



Road Safety in Delhi:

A Critical Analysis of the Role of Public Institutions

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List of Acronyms

ACP	-	Assistant Commissioner of Police
BAC	-	Blood Alcohol Concentration
CRRI	-	Central Road Research Institute
DCB	-	Delhi Cantonment Board
DDA	-	Delhi Development Authority
DMRC	-	Delhi Metro Rail Corporation
DSIIDC	-	Delhi State Industrial and Infrastructure Development Corporation Ltd.
DTC	-	Delhi Transport Corporation
DTP	-	Delhi Traffic Police
DUMTA	-	Delhi Urban Mass Transit Authority
I&FC	-	Irrigation & Flood Control
ICT	-	Information & Communication Technology
IRTAD	-	International Traffic Safety Data and Analysis Group
MCD	-	Municipal Corporation of Delhi
MHA	-	Ministry of Home Affairs
MORTH	-	Ministry of Road Transport and Highways
MOUD	-	Ministry of Urban Development
NCRB	-	National Crime Records Bureau
NCTD	-	National Capital Territory of Delhi
NDMC	-	New Delhi Municipal Council
NH	-	National Highways
NHAI	-	National Highway Authority of India

NMV	-	Non-Motorized Vehicle
NSRC	-	National Road Safety Council
PWD	-	Public Works Department
RSC	-	Road Safety Cell
RTI	-	Right To Information
UMTA	-	Unified Metropolitan Transport Authority
WHO	-	World Health Organisation

Abstract

Road accident is one of the major man made tragedies, killing millions of people across the world every year. The situation is quite alarming in the developing countries, experiencing increasing motorisation, without adequate institutional mechanism to combat the problem. Even within these developing countries, the vulnerable road users comprising pedestrians, bicyclists and two-wheeler riders are the worst affected.

Experiences of some of the successful countries in improving road safety have shown that the road accidents are preventable to an extent, subject to concerted efforts by the government at the highest level. It is also necessary to bring all stakeholders on board to carry out the task effectively.

Situation in case of India is quite grim, where more than 100,000 people are killed and many more get seriously injured in these accidents every year. In Delhi, the Capital city of India, though there has been some declining trend in the number of fatalities on account of these accidents during the last three years, the situation is far from satisfactory. There is an urgent need to take necessary steps for improving road safety environment of the city. For this purpose, necessary institutional mechanisms need to be evolved by bringing major stakeholders on board so that right policies are framed to save the lives of thousands of people. There is enough scope to learn from the experiences of the developed countries in this field.

Key Words: *road safety, road accidents, road traffic fatalities, enforcement, transport, motor vehicle.*

CHAPTER- 1

INTRODUCTION

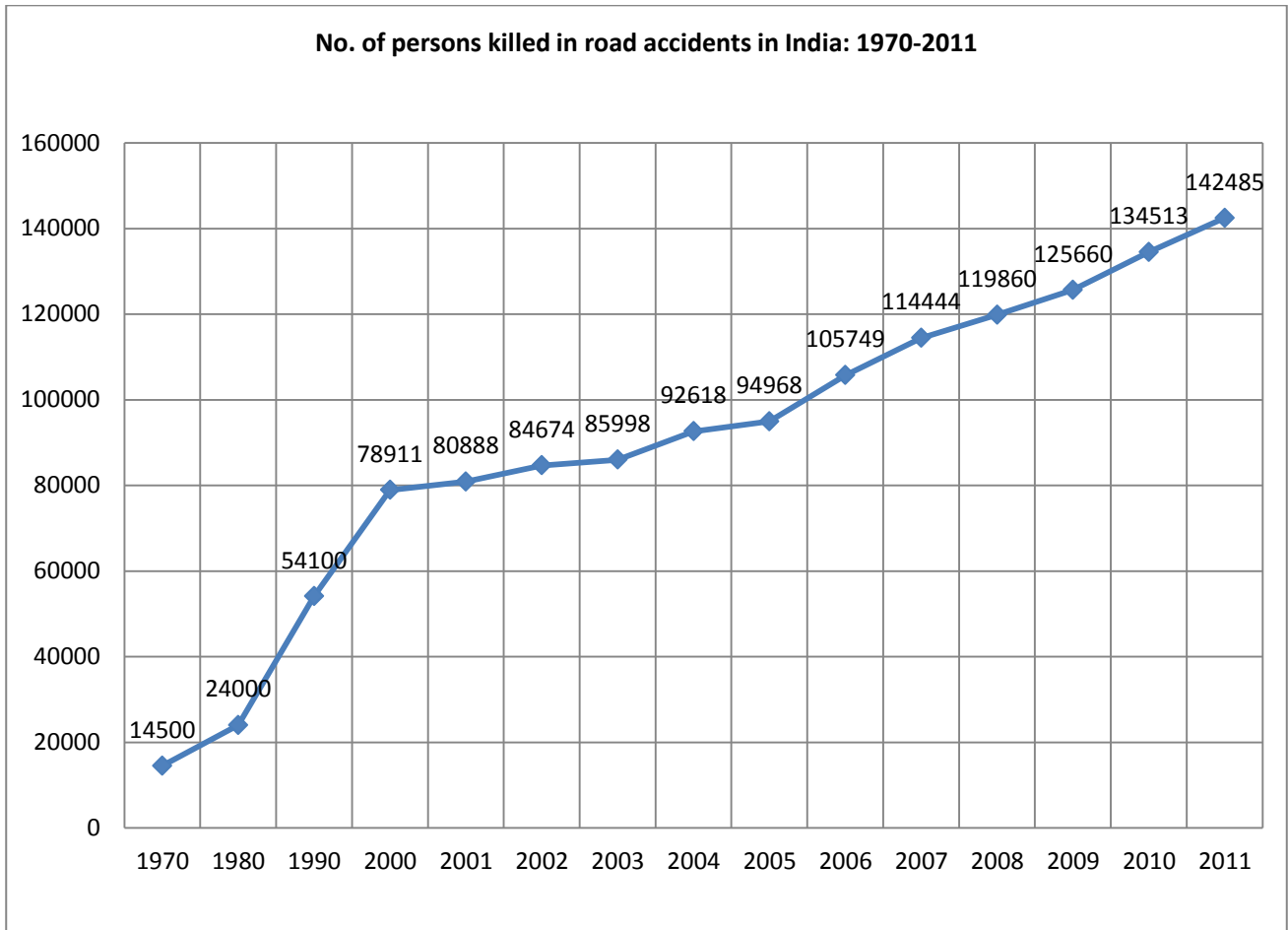
1.1 Research Background

Road transport sector plays a vital role in the development of a country. Ironically, this sector is also the most unsafe, responsible for deaths and injuries of millions of people, especially the young working population, throughout the world. 'Road travel brings society benefits, but the price society is paying for it is very high' (WHO, 2004; 6). As per WHO (2013) report, 1.24 million people were killed and 20 to 50 million sustained injuries on the world's roads in 2010. Efforts made by some of the developed countries like Sweden, Netherland and Denmark in the recent past have shown positive results in reducing the road accidents. It has been estimated that there will be about 30% decline in the mortality due to road accidents in the developed countries by the year 2020 (WHO,2004;5). This reflects that road accidents are preventable to an extent, subject to concerted efforts by the all concerned agencies. The situation is more critical in the case of middle income (developing) countries experiencing increasing motorisation. Their annual road traffic fatality rate is 20.1 per 100,000 populations, in comparison with high-income (developed) countries with fatality rate of 8.7 per 100,000 populations (WHO, 2013). As per the report published by WHO(2009), over 90% of the world's road traffic fatalities occur in low and middle- income countries, which have only 48% of the world's registered motor vehicles. Further, it has also been predicted that the road traffic deaths will increase on average by over 80% in low and middle-income countries and decline by almost 30% in high-income countries (Koptis and Crooper, 2003; WHO, 2004).There has been increasing concern at the international level to reduce the menace of road accidents in the developing countries by improving road safety. Acknowledging the concern, the World Health Organisation (WHO) dedicated World Health Day 2004 to the issue of road safety. Subsequently, the United Nations also passed a resolution declaring 2011-2020 as UN Decade of Action for Road Safety, urging the Member Nations to take adequate steps to improve road safety.

1.2 Problem Statement

In case of India, the situation is quite alarming. As per the report published by the Ministry of Road Transport and Highways (MORTH) (2013), a total number of 138,258 persons were killed in road accidents in the year 2012 in India. Though there have been some decline in the number of road traffic fatalities in the year 2012 in comparison with the figures of 2011, the situation is still very grim as the fatalities on this account has increased about 9.5 times between 1970 to 2011 (Chart 1).

Chart 1



(Source: Road Accidents In India: 2012, MORTH, 2013)

However, in case of Delhi there has been some improvement in the road safety environment, as the numbers of fatalities have shown a declining trend consistently during the last three years, despite increase in the number of inhabitants and registered motor vehicle in the city (Table 1).

Table 1

No. of persons killed in road accidents in Delhi: 2008-2012

Year	Total No. of road accidents	Total No. of persons killed	No. of accidents per 10,000 vehicles	No. of persons killed per 10,000 vehicles	No. of persons killed per hundred thousand population
2008	8,435	2,039	14.3	3.5	12.3
2009	7,516	2,325	11.9	3.7	13.3
2010	7,260	2,153	10.8	3.2	12
2011	7,281	2,065	10.1	2.9	12.3
2012	6,937	1,866	9.3	2.5	9.8

(Source: Road Accidents in India: 2012, MORTH, 2013)

As per the Annual Press Conference Report of Delhi Police for the year 2012, strict enforcement of traffic laws, especially relating to drunken driving, driving two-wheelers without helmet, over speeding and driving four-wheeled vehicle without wearing seat belts during the last few years have significantly contributed in the decline in road traffic fatalities in Delhi (Delhi Police, 2013).

1.3 Research Question

Keeping in view the research background, my investigation is aimed at:

How traffic fatalities reduced in Delhi during the last three years?

To carry out the investigation, I have focussed on the following issues:-

- a) Which institutional arrangements facilitated decline in traffic fatalities in Delhi?
- b) What are the major policy interventions, affecting road safety in Delhi?
- a) What are the challenges for a sustainable road safety environment in Delhi?
- b) Are there some good policy practices available on road safety in the developed countries? If so, what can Delhi learn from these policies?

To explore the institutional arrangements, which directly or indirectly affect road safety in Delhi, the role of the concerned Central Ministries/Agencies (Delhi Traffic Police under M/o Home Affairs, M/o Urban Development, Road Transport and Highways as well as State Government's agencies (Transport Department, Municipal Bodies) were analysed to see what initiatives have been taken by these institutions in the recent past in this direction. How these agencies coordinate and cooperate with each other on the issue of road safety? What are the linkages (vertical as well as horizontal) between these institutions/ agencies? Which are the missing links? What are the challenges before these agencies to strengthen road safety environment in Delhi? How this issue is being handled at agency level in some of the countries with successful road safety strategies? Which of these strategies/ approaches can be adopted in case of Delhi within the framework/ concept of 'governance', where the issue of coordination between the different organisations in pursuit of common goals become crucial?

1.4 Policy Relevance

The increasing fatalities and injuries due to road traffic accidents have become a major development problem, a serious public health and social equity issue.

Development Issue: Road accidents take an enormous toll on individual's family and the national economy as a whole. During the year 2011, about 51.9% of the road accidents victims in India were from the age group 25- 65 years i.e. the wage earning age group and often the breadwinners of the families (MORTH,2012). The loss of the family member(s) not only causes everlasting psychological trauma, but often results in economic catastrophe for the family, jeopardising their future well-being as well. The estimated cost on this account in the low- and middle income countries is between 1-2% of their gross national product, estimated at over US \$ 100 billion (WHO, 2004). 'The total cost to the economies of low- and middle-income countries, estimated at US\$ 65 billion, is more than the total amount of development assistance these countries receive annually'(Jacobs et al , 2000, as cited in Nantulya & Reich, 2003).

A study conducted by the Planning Commission of India in 2002 estimated the social cost of road accidents at Rs. 55,000 crore annually (at year 2000 price), which constitute about 3% of the GDP(MORTH,2007).

Public Health Issue: As per WHO report, road accidents are the eighth leading cause of the death globally, and it will become fifth leading cause of death by 2030 if urgent attention is not given for improving road safety (WHO, 2013). It has serious consequences for the low and middle income countries, where over 90% of deaths related to road traffic accidents occur. These accidents place a huge strain on the already woefully inadequate public health system in these countries (WHO, 2009). According to Gururaj (2008), nearly 10-30% of hospital registrations in India are due to road traffic injuries. Even this figure is an underestimation of the magnitude of the problem as the poor people in many parts of the rural India have no access to the hospital facilities.

Social Equity Issue: Road traffic accidents have a disproportionate impact on the poor vulnerable section of the society. These people have less access to the resources and also less influence over policy decisions. As per WHO, half of the world's traffic related deaths occur amongst the

motorcyclists (23%), pedestrians (22%) and cyclists (5%), primarily belonging to the vulnerable group of the society (WHO, 2013). 'Globally, poorer population groups bear a disproportionate burden of avoidable morbidity and mortality from road traffic injuries. The distribution of road traffic injuries is generally influenced by socioeconomic factors. Poor countries bear a disproportionate burden of injuries and fatalities, and within countries, poor people account for a disproportionate portion of the ill health due to road traffic injuries' (Nantulya & Reich, 2003;13).

In case of India, two- three wheelers accounted for the highest share in accidents (30.6%), while the pedestrians and cyclists, primarily from the lower strata of the society were involved in about 7% of the road accidents (MORTH, 2013). In case of Delhi, two-wheelers accounted for about 26% of the fatalities, while 31% of the pedestrians and cyclists were killed in the road accidents during the year 2012 (NCRB, 2013).

The current state of affairs strongly demands a well thought and implementable public policy initiative to curb the menace of road traffic accidents so that it does not become an obstacle in development by putting unnecessary strain on our limited resources. It also draws our attention to the plight of most vulnerable sections of road users, comprising pedestrians, bicyclists and two-wheeler users, whose voices remain unheard by the policy makers. Reduction in road traffic fatalities can contribute to the attainment of the Millennium Development Goals that aim to halve extreme poverty and significantly reduce child mortality (WHO, 2004).

1.5 Research Objective

My research objective is to find out ways in which the public institutions and policy initiatives can contribute in improving road safety environment in Delhi. In this endeavour my research will focus on the lessons we can learn from the success of the leading countries in the field of road safety, where long drawn, painstaking efforts have resulted in building and strengthening of viable public institutions, which is imperative for the success of any policy initiative in this field.

1.6 Scope and Limitations

The nature of road traffic and its consequences are determined by the policy decisions of multiple agencies operating in this field, besides the action of different categories of road users. The scope of this paper is limited to analyse the role of major public agencies/institutions, as they lay the basic foundation for any successful road safety policy in the long run. The paper also analyses the role played by the public institutions in case of two successful countries in road safety, so as to learn some lessons from their experience.

The research is primarily based on secondary data collected from various government documents. Most of them were available on the official website of these Departments. Some of the latest accidents related data, traffic rules enforcement related figures and information relating to policy interventions have been obtained from Delhi Police and Transport Department, Govt. of Delhi, through Right To Information (RTI) Act. Besides, the information relating to recent policy initiatives were also compiled from the interviews of the Officers from the Ministries of Road Transport and Highways, Ministry of Urban Development, Delhi Traffic Police and Transport Department, Government of NCT, Delhi. However, the common men were not interviewed as the

focus of the research was to explore the issue from institutional perspective. Information on some of the parameters like fatalities per vehicle-kilometre travelled, number of people killed due to over speeding, etc. was not available. The data also suffers from the problem of under reporting. Gururaj (2008) in his study in Bangalore concluded that the number of deaths resulting from road accident may be reasonably reliable, but the figures regarding injuries are grossly underestimated. While comparing the data from police report to that of hospital report he found that in case of deaths about 5% of cases were not reported to the police, while percentage of such underreporting was about 50% in case of injuries (Gururaj, 2008). Similarly, the report published by the Planning Commission, Government of India highlighted this problem of underreporting of road accidents. It estimated the ratio of underreporting of deaths: serious injuries: minor injuries in the ratio of 1:15:70 (Planning Commission, 2001). Nantulya and Reich (2003) in their study have also pointed out the problems associated with data quality, especially in case of developing countries. Different agencies use different methods for data collection with regard to population denominators, registered vehicles, road traffic accidents and other variables. These inconsistencies often affect the interpretation and the conclusion drawn after analysis. However, despite these limitations, some broad conclusions can be drawn on the basis of the available data (Nantulya and Reich, 2003).

In this paper, my analysis is based on fatality data as they are more reliable than data relating to injuries.

1.7 Methodology and Data Collection

The research is based on the analysis of data and other information gathered primarily from the following sources:

- I. **Data collected through secondary sources:** The data relating to number of road accidents, causes of these accidents, types of vehicles involved, age profile of the victims at all India level as well as Delhi have been collected from the official websites of various government departments. Besides, data relating to action taken by Delhi Traffic Police while enforcing the traffic rules, like imposition of penalties, number of prosecution; data relating to strength of Delhi Traffic Police, road network and population of Delhi; information relating to measures taken for improving road safety by different government departments at national and state level were obtained from related department either through RTI or by personally visiting the department.
- II. **Data collected through semi-structured interview:** some of the key resource persons in Delhi Traffic Police, who are directly responsible for traffic management and road safety in Delhi were interviewed to ascertain their views regarding road safety environment in Delhi and the challenges they face in improving the same. The officers from Transport Department at national and state level were also interviewed as these institutions have a major role in policy making for road traffic and safety management. In addition, one of the Officers from Ministry of Urban Development (MOUD) was also interviewed, keeping in view the fact that MOUD is actively involved in transport management policy for Delhi.

- III. **Literature Review:** Literatures available on the improvement of road safety at both national and international were reviewed in order to analyse the entire issue in a proper perspective. Focus was on the conceptual framework used at international level to understand the complexities in the road safety in a holistic way. Besides, the literature on the experience of enforcement of traffic related rules in improvement of road safety in the developed countries were also reviewed.

1.8 Structure of Paper

Research background and the justification for conducting the research have been given in Chapter 1 of this paper. Chapter 2 comprises of theoretical concepts and literature review pertaining to road safety. In Chapter 3 analysis of data relating to traffic fatalities in Delhi during the last five years and the role of enforcement agency and contribution of Delhi Metro Rail in improving road safety environment in Delhi, have been undertaken. Chapter 4 contains the analysis of the role of major stakeholders in the field of road safety. Chapter 5 deals with the experiences of two developed countries i.e. Sweden and The Netherlands in improving road safety environment. Chapter 6 consists of conclusion and policy recommendations.

1.9 Meaning of the Frequently Used Terminologies

- i. **Fatalities per 10,000 vehicles:** relative figure showing ratio of fatalities and motor vehicle. However, it ignores non- motorized transport and other indicators of exposure.
- ii. **Fatalities per 100,000 population:** shows the impact of road traffic accidents on population. This is the primary measures for international road-safety comparisons as they are the most appropriate measures to show the total harm resulting from road crashes (Sivak & Tsimhoni, 2008).
- iii. **Road traffic fatality:** any person killed immediately or dying within 30 days as a result of an injury accident (WHO, 2004)
- iv. **Blood Alcohol Concentration (BAC) Limit:** refers to the maximum amount of alcohol that is legally acceptable in the blood of a driver on the road-i.e. the blood alcohol above which a driver may be punished by law.

CHAPTER-2

Road Safety: Concepts, Approaches and Literature Review

2.1 Approaches and Concepts in Road Safety

The increasing motorisation has also led to increase in the number of road accidents throughout the world, killing millions of people every year. This has drawn the attention of a large number of scholars from different fields i.e. engineering, medical sciences, psychology, policy, law and management to find out factors contributing to such accidents and measures to combat the same. As a result, a large number of scientific researches, literatures and policy documents, using different concepts and approaches emerged in this field, especially in the developed countries.

In the beginning it was viewed that the person behind the wheel was primarily responsible for the accidents. As such, the focus was on correcting his/ her behaviour (Bliss and Breen, 2012). Gradually, with more systematic and scientific research in this field it was realised that though human error may trigger such accident, but may not necessarily be the underlying cause. With scientific and systematic research, it emerged that human behaviour is not only the result of individual's knowledge and skills, but is also shaped by the overall environment, external to him/her, in which it takes place -the design and layout of the road, the nature of vehicle, the traffic laws and their enforcement or lack of enforcement, etc. (WHO, 2009). Accordingly, a series of preventive measures, encompassing the areas of road design and layout, vehicle design and various traffic laws were enacted and enforced for improving road safety environment. Gradually, it was realised that effectiveness of these interventions itself depends on the prevailing institutional arrangements under which these operates. Further, it was also realised that road transport system is the product of interaction between various institutions, operating independently, with different priorities and goals at hand. Therefore, it was necessary to bring these institutions at a common platform to realise the goal of improving road safety. This lead to the emergence of 'systems approach', focussing attention on all inter-related elements i.e. from defining the roles and responsibilities of different institutions to evolving suitable interventions and setting goals. Road safety management can be viewed as a production processes with three inter- related elements: institutional management functions, interventions and results. Focus must be paid to all these elements and their linkages for improving road safety performance in a country. If institutional mechanism are overlooked, the desired results cannot be achieved (World Bank, 2009).

My analysis is based on institutional approach to the road safety. I have focussed on analysing existing institutional arrangements in Delhi for improving road safety i.e. what are the existing institutional arrangements for improving road safety in Delhi? What are the mechanism for coordination and cooperation among these institutions? Whether these institutions supplement each other in improving road safety environment? What are the institutional arrangements adapted by the countries with successful road safety records? What lessons can be learned from the experiences of these countries?

I have also analysed some of the issues relating to existing policy interventions, especially relating to traffic management strategies in place and enforcement of laws relating to traffic violations by Delhi Police to improve road safety environment. This aspect is quite significant as many of the studies and reports have pointed out that non-enforcement of traffic laws is one of the major impediments in improving road safety (Jacobs and Sayer, 1983; Dandona et al, 2005; Menon et al, 2008; Grimm and Treibich, 2012).

However, it would be pertinent here to present a brief sketch of the various concepts and approaches widely used in the study of road safety. Although the paper is based on institutional approach, but the elements of safe system approach have also been considered, wherever necessary.

2.2 Focus on Driver's Behaviour

In the 1950s and 1960s, rapid motorisation in the developed countries also escalated the number of road accidents and related injuries and deaths (Bliss and Breen, 2012). Person behind the wheel was considered as the prime reason for the accident. Therefore, most of the policies placed considerable emphasis on improving driver's behaviour by formulating legislative regulations and penalties for improving the same (ibid). Other factors contributing to road traffic accidents, like design and layout of the road, vehicle design, etc. were not given adequate attention for improving road safety. This also helped the concerned agencies to evade any responsibility for these accidents. 'Placing the onus of blame on the road traffic accident victim acted as a major impediment to the appropriate authorities fully embracing their responsibilities for a safer road traffic system' (Rumar, 1999 as cited in WHO, 2009). The result was establishment of dispersed, uncoordinated and poorly resourced institutional units for improving road safety (Trinca, et al, 1988).

2.3 System Intervention Approach

Under this approach, the scope for interventions was broadened, encompassing various elements of the road transport system. Areas like road infrastructure, its layout and design, vehicle design and different measures to improve the behaviour of different categories of road users were systematically studied and suitable interventions at different levels were developed. This approach received a major fillip as a result of the pioneering work of William Haddon Jr., an American epidemiologist in this field. He developed a systematic framework for understanding the different types of interventions required for improving road safety, based on a disease model in medical science, comprising infrastructure, vehicles and users in the pre- crash, crash and post- crash

stages/ phases (Haddon Jr., 1968). The model so developed, known as “Haddon Matrix Model” is illustrated below (Figure 1).

Figure 1

The Haddon Matrix Model.

PHASE		FACTORS		
		HUMAN	VEHICLES AND EQUIPMENT	ENVIRONMENT
Pre-crash	Crash prevention	Information Attitudes Impairment Police enforcement	Roadworthiness Lighting Braking Handling Speed management	Road design and road layout Speed limits Pedestrian facilities
Crash	Injury prevention during the crash	Use of restraints Impairment	Occupant restraints during the crash Other safety devices Crash-protective design	Crash-protective roadside objects
Post-crash	Life sustaining	First-aid skill Access to medics	Ease of access Fire risk	Rescue facilities Congestion

(Source: World report on traffic injury prevention, WHO, 2004).

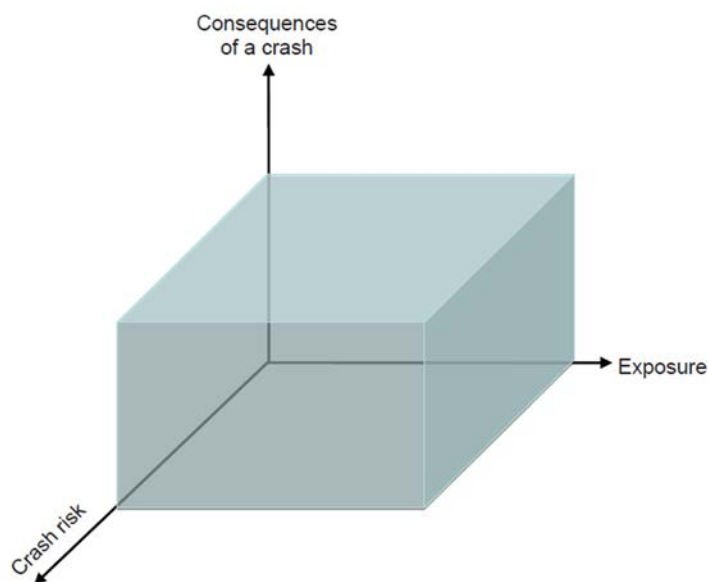
As a result, various strategies were developed to improve road safety with the aim – to reduce exposure to risks, prevent road accidents from occurring, and reduce the severity of injury in the event of crash and to reduce the consequences of injury through improved post- collision care. However, the focus was still on interventions and not on the institutions and the institutional mechanism in which these strategies and their effectiveness were embedded.

2.4 Total Harm Concept

Another approach used in understanding the complexities involved with road traffic accidents, suitable counter- measures to combat the same was developed by Thulin and Nilsson in 1994(Sivak and Tsimhoni,2008). According to this approach, total harm is conceptualised as a product of exposure, risk and consequences (Figure 2).

$$\text{Total Harm} = \text{exposure} \times \text{risk} \times \text{consequences}$$

Figure 2



(Source: Sivak and Tsimhoni, 2008)

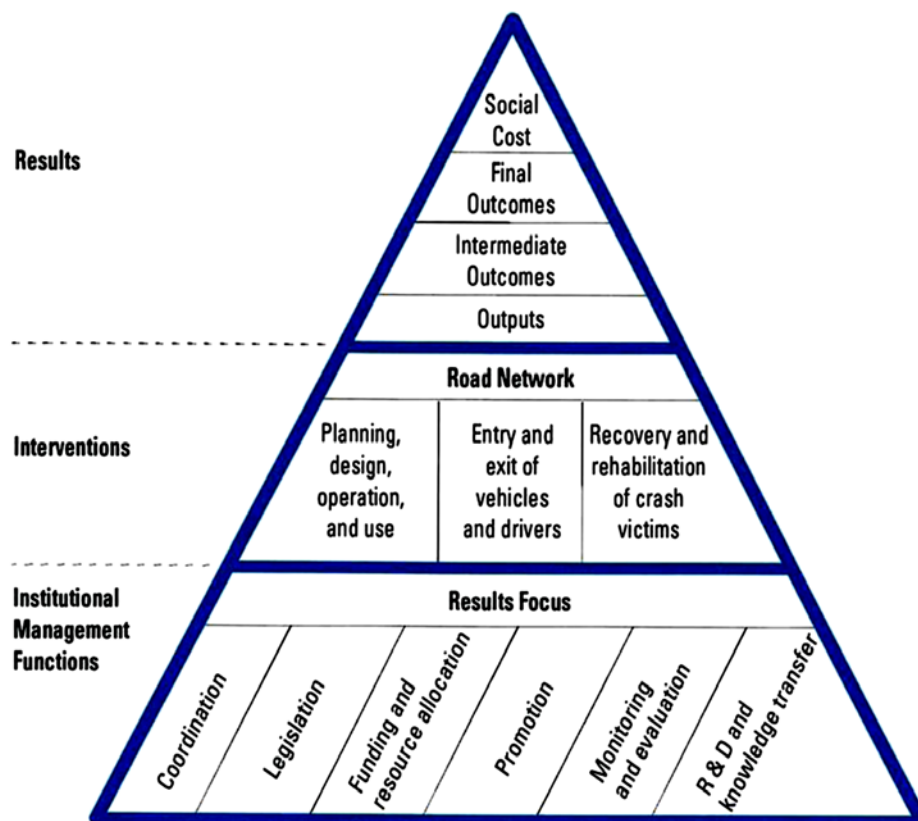
Intervention at any level i.e. to reduce exposure or risk or the consequences of the accidents will determine the volume of the 'total harm' in a given environment. Intervention should be based on the ability to bring about change in any of these elements to improve road safety.

2.5 Safe System Approach

'Safe System' is the most comprehensive approach developed in the field of road safety. It has emerged as a result of culmination of knowledge generated through various researches carried out in this field from different perspectives: economic development, public health, human behaviour, social equity, institutional management and sustainable development perspectives. Improving road

safety is viewed as an on- going process within the overall management system comprising institutional management functions, suitable interventions and the final outcome/ results (Bliss and Breen,2012). It was realised that success of any intervention depends on effective collaboration from other agencies. For instance, the laws pertaining to seat-belts or speed limits cannot be successful in absence of their effective enforcement (Luoma and Sivak, 2012). Hence the focus shifted from system intervention to develop an integrated, system approach for improvement of road safety. The overall framework of the system approach is illustrated below in Figure 3 .

Figure 3



Source: Bliss and Breen, building on the frameworks of Land Transport Safety Authority, 2000; Wegman, 2001; Koornstra et al, 2002; Bliss, 2004.

The basic objective of this approach is to develop sustainable transportation system, based on combination of available transportation system, while optimizing the trade-offs among the safety, environmental, economic and social consequences. 'A *Safe System* is dedicated to the elimination of deaths and injuries that undermine the sustainability of road transport networks and the communities they serve. Its focus on safer and reduced speeds harmonizes with other efforts to reduce local air pollution, greenhouse gases and energy consumption. And its priority to afford protection to all road users is inclusive of the most vulnerable at-risk groups such as pedestrians, young and old, cyclists and motorcyclists' (World Bank, 2009; XVI).

The institutional management functions forms the base of the system. It primarily comprises government institutions, but also recognises the role of private sector and civil society. One of the basic tenets of the institutional management is coordination among the various agencies/institutions which can contribute in improving road safety environment.

2.6 Role of the Government

Role of the government is very crucial in development of multi-sectoral institutional capacity for improving road safety. According to Wesemann (2001), the issue of improving road safety cannot be left at the mercy of free- market mechanism, as there is no substitute for government intervention in providing road safety. Trinca et al (1988) while analysing the role of the government have found that in many countries institutional arrangements for traffic safety were fragmented. There was absence of a lead agency, with institutional accountability and responsibility for road safety (Trinca et al., 1988). Similarly, Bliss in his study has also pointed out at the problem of weak safety management capacity in the low and middle- income countries as a barrier to improving road safety (Bliss, 2004 as cited in World Bank, 2009). Koornstra (2007), while projecting the trends in road traffic fatalities has observed that lack of sufficient political priority and ineffective road safety measures are the major obstacles in improving road safety environment in the low and middle income countries. Sivak and Louma (2012) in their study of road safety management in the BRIC countries have observed that none of these countries has a single lead agency in the government responsible for improving road safety. In this paper, my endeavour will be to analyse the role of the existing institutional mechanism for improving road safety environment in Delhi.

Highlighting the role of institutions in achieving the desired goals, North (1990) has shown their crucial role in shaping the path for economic growth in British- North American and Spanish- Latin American countries. According to North, the function of institutions is to provide certainty in human interaction, which is accomplished by the norms and rules and their effective enforcement. Institutions influence the cost of exchange and the consequential benefits for the society (North, 1971). Therefore, it is imperative to have such institutional arrangements, which facilitate socially beneficial consequences. Further, North has pointed out that, it is easier to alter secondary institutional arrangements at a much lower cost than changing the fundamental institutional

arrangements. Incremental changes in such secondary institutional arrangements, in the long-run, will alter the fundamental intuitional arrangements (North, 1971).

However, according to Lee and Kim (2009), both institutions and policies can help, but differently for different groups of countries, in accomplishment of their desired goals. They have cited the case of China and Post-1991 India, where major policy initiatives led to economic growth in both the countries.

According to Streeck and Thelen (2005), institutions are not fixed and rigid, rather they are in flux, continuously created and recreated by the varying interests and commitments on the part of wide range of actors. Institutions cannot be treated as rigid hardware of social life. Institutional change can be generated as a result of policy initiatives as well as in the course of implementation and enactment of an institution (Streeck & Thelen, 2005).

The above outlined perspectives have been taken into view, while analysing the role of various agencies in the road safety and the recommendations made thereto.

2.7 Literature Review- Indian Context

There are number of researches focussing on the issue of road safety in India. It has been recognised that unlike the developed countries, the road transport sector scenario is somewhat different in India. India is experiencing increasing individual modes of transport, heterogeneous traffic mix, and rapid addition of high speed vehicles without adequate road infrastructure and proper segregation of traffic for different road users (Mohan, 2002b). Increasing speed, non-use of helmet, seat-belt, drinking and driving, poor visibility, failure to enforce safety laws and poor trauma care are some of the factors recognised for higher accidents and fatality rates on Indian roads.

Highlighting the need for traffic law enforcement, Jacobs and Sayer (1983) have pointed out that lack of awareness of traffic rules is one of the major factors of low standard of road- user behaviour in the developing countries. O' Neill and Mohan (2002) have advocated for strict enforcement of traffic safety laws for changing road user behaviour and establishment of national and regional road safety agencies for improvement in road safety. Similarly, Dandona et al (2005) in their study of traffic law enforcement in Hyderabad, India have advocated the need to enhance the traffic law enforcement activity of the police to make it more visible. Gururaj (2008) has argued that there are scientific evidences from high income countries regarding effectiveness of interventions such as use of helmets, preventing drinking and driving, speed control and use of seat belts in improving road safety. While analysing the age and gender variations in trend of road traffic fatalities in the city of Manipal, India, Kanchan et al (2010) have stressed on the need to re-evaluate the effectiveness and impact of on-going preventive activities by the public authorities. According to these authors, road accidents are preventable by strict enforcement of traffic laws and public awareness. Grimm and Treibich (2012) in their study of road traffic crashes fatalities in India have observed that increase in motorisation coupled with urbanisation are the general drivers of road traffic fatalities across Indian states. Further, they have emphasised the need of strict enforcement of traffic rules for reduction in road traffic fatalities.

In her case study of transport system in Delhi, Tiwari (2002) observed that the existing transport infrastructure does not meet the needs of the poor, whom she has referred as 'transport poor'. They are primarily dependent on non-motorized modes of transportation and constitute high share of public transport usage. They are the victims of road traffic accidents; though do not contribute to the same (Tiwari, 2002). In her another paper, Tiwari (2011) continued to analyse the prevailing urban transport system in India from social equity perspective. She has advocated for providing better and safer environment to the "Most Vulnerable Categories" of road users, comprising pedestrians, cyclists and two-wheeler riders. According to her, the focus should be on promoting use of non- motorised vehicles, improving public transport, safer speed limits, and segregated facilities for NMVs and introduction of traffic calming measure for speed management. She has also stressed for setting up of Road Safety & Traffic Management Board, both at National as well as state level. Menon et al. (2008) have pointed out that there is less emphasis on the safety of vulnerable road users- pedestrians, bicyclists and two-wheeler riders. They have suggested formulation of road traffic policies viz. pedestrian – friendly paths, separate lanes for heavy and light motor vehicles and strict implementation of traffic rules and regulations to enhance road safety. In another work Mohan (2008) has highlighted the road traffic accidents in India as a public health problem. He has also pointed out at the neglect of public policies beneficial for majority, like strengthening of public transport system. He has advocated for focus on the safety of pedestrians, bicyclists and motorcyclists, speed control and prevention of driving under the influence of alcohol. Badami (2009) in his article has pointed out the issue of faulty urban transport planning as the major factor for most of the problems, like congestion, environmental pollution, increasing traffic deaths on Indian roads. According to him, the present urban transport policy has severely compromised accessibility and safety for walking and space for other non-motorised modes. This has resulted in more traffic fatalities for these vulnerable categories. ' It is precisely because of the lack of pedestrians (and cyclists) infrastructure and facilities, and therefore the inability to walk and cycle safely, that such an overwhelming proportion of traffic fatalities is accounted for these two modes' (Badami,2009;45).

Mohan (2011), while analysing the road traffic fatality data in Asian countries has observed that the issue of unreliable road accident data is a major problem for identification of risk factors, which in turn create difficulties in formulating suitable counter measures. Despite these limitations, he has suggested strict enforcement of traffic rules, especially relating to speed limits, drinking and driving, with combination of technological aid and policing. He has also advocated for establishing National Road Safety Board at the national level to set policy and research agenda.

CHAPTER - 3

Road Safety in Delhi: An Analysis

3.1 Delhi - Introduction

Delhi, the Capital city of India, is also known as National Capital Territory of Delhi (NCTD) in administrative parlance. It is situated in the northern part of India, 160 km. south of Himalayas and spread over an area of 1483 sq. Kms. (Directorate of Economics & Statistics, 2012). It shares borders with two other Indian states- Haryana in north, west and south and Uttar Pradesh in east. The river Yamuna, a tributary of river Ganges forms the eastern boundary of the city.

The city has a unique position in governance by being the capital city of the country and a State in its own right, with elected members of the Legislature. At one hand it is the city where the policies for governing the country as a whole is being debated and evolved, while on the other hand it is functioning as a separate state, with its own jurisdictions, formulating and implementing various policies for meeting the aspirations of its local population. With the growing economy, the population of the city has also exploded during the last few decades, putting enormous pressure on the government in creating necessary infrastructure for meeting the basic requirements of various public services. Migration from the neighbouring states on a daily basis as well as on permanent basis is a regular feature. A large number of population continuously migrating in from far off places, especially from relatively poorer states in search of livelihood have worsened the situation.

To govern such a huge and complex population is a very daunting task for the state as well as the national government, which also has jurisdiction over a number of issues.

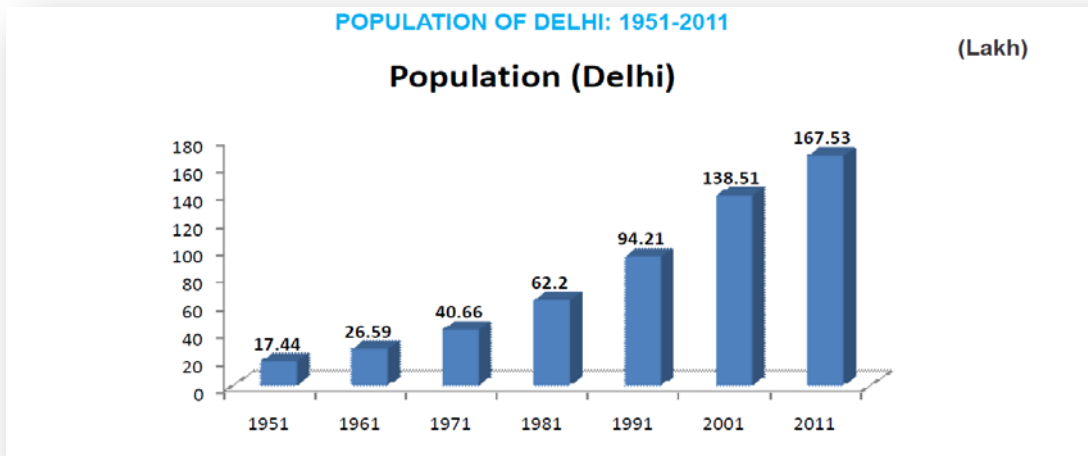
This context poses a major challenge to the road transport sector, which is functioning as the vital link for sustainable development of the city. Though the government is trying to build more road network and related infrastructure and better public transport system, but it has not been able to keep pace with the increasing demand of mobility. As a result there has been a rapid increase in the personalised motor vehicles in the city from 3,375,153 in 2000-01 to 7,452,985 in 2011-12(Planning Department, 2013). Similarly, the city has also experienced growth in the non-motorised vehicle (comprising mainly hand- driven rickshaw and cycle rickshaw trolley) segment from 163,343 in 2002-03 to 207,587 in 2010-11(ibid). These ever-increasing fast and slow moving vehicles, sharing the same shrinking road space has resulted in terrible traffic jams and more pollution. Another major pitfall of the chaotic development is large number of road accidents in the city, which during the last three years has though declined, but still remains high in comparison with other developed cities of the world.

For holistic understanding of the complexities involved in road transport management and its impact on the road safety environment of the city, a contextual backdrop of the city's demographic, socio- economic and administrative profile, is given below.

3.2 Demographic Profile

Delhi is one of the fastest growing cities in the country. The population of the city has increased from 1.74 million in 1951 to 16.75 million in 2011 i.e. about ten times in the last sixty years (Planning Department, 2013). Delhi's population increased at the rate of 2.09% per annum during the last decade which was higher than the national average rate of 0.33% per annum. Delhi accounts for about 0.05% of India's geographical area, but it has 1.38 % of the nation's population. About 97.5% of the population live in urban areas, while the rest 2.5% in the rural areas (ibid). The population growth of Delhi during the last sixty years is depicted in Table 2.

Table 2



(Source: Economic Survey of Delhi, 2012-13)

3.3 Economic Profile

Delhi has a strong and vibrant economy, with per capita income of Rs. 2.01 lakhs (\$3278; 1\$= Rs.61) in 2012-13. This is three times higher than the national average and second highest in the country (Planning Department, 2013). The Gross State Domestic Product (GSDP) has recorded a growth rate of 18.84% during the year 2011-12(ibid). However, the higher rate of economic growth and per capita income hides the dismal reality of slums and unauthorised colonies in the city, where the people lead a very tough life to make their ends meet. As reported by the Planning Commission (2009), 64.5 per cent of Delhi’s population was living in Jhuggi Jhopri (JJ) clusters, slum designated areas and unauthorised colonies in 2004. ‘Delhi presents a picture of extra- ordinary affluence at some places and utter deprivation in some other areas, which is more of the latter’ (Planning Commission, 2009; 67).

3.4 Road Network

Delhi has a strong road network to cater the need of mobility of both people and goods. The total length of the roads in Delhi increased from 28,508 Km in 2000-01 to 32,663 Km. (increase of 14.22%) in the year 2011(Table 3).There are multiple of organisations/ agencies functioning at local and national level responsible of maintenance/ upgrading of these roads in the State - MCD, NDMC, DCB under Ministry of Defence and National Highways Authority of India (NHAI), under Ministry of Road Transport and Highways for maintenance of five National Highways (NHs) i.e. NH-1, NH-2, NH-10, NH-8 and NH-24 passing through NCTD.

Table 3
Growth of road network in Delhi: 1980-2011

Sl. No.	Agency	1980-81	1990-91	2000-01	2005-06	2008	2009	2010	2011
1	MCD	12,129	18,673	24,885	27,139	27,139	27,139	27,139	27,139
2	NDMC	1,191	1,289	1,299	1,550	1,290	1,290	1,290	1,290
3	PWD								
	a NH	302	324	388	182	182	356	356	360
	b Others	570	1,135	1,792	2,168	2,230	2,270	2,300	2,400
4	Others (i/c DCB, DSII DC, I&FC, DDA)	124	143	144	326	1,290	1,357	1,357	1,474
	Total	14,316	21,564	28,508	31,365	32,131	32,412	32,442	32,663

(Source: Economic Survey of Delhi, 2012-13)

3.5 Transport Sector

There has been a rapid growth in motor vehicle population in Delhi during the last decade (Table 4).

Table 4
Growth of motor vehicle in Delhi: 2000-2012

Sl. No.	Details	Number of vehicles		Growth Rate (Per cent)	
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		1999-2000	2011-2012	Per cent	Annual compound
1	Cars and Jeeps	873,443	2,347,276 (31.49%)	168.74	7.9
2	Motorcycle and Scooters	2,077,586	4,654,706 (62.45%)	124.04	6.4
3	Ambulance	1,421	2,589 (0.03%)	82.2	4.72
4	Auto Rickshaws	70,145	88,216 (1.18%)	25.76	1.78
5	Taxis	8,545	68,965 (0.92%)	707.08	17.43
6	Buses	15,514	34,251 (0.45%)	120.77	6.28
7	Other Passenger Vehicles	5,613	23,214 (0.31%)	313.58	11.54
8	Tractors	4,590	5,558 (0.07%)	21.08	1.48
9	Goods Vehicles(All Types)	100,929	223,534 (2.99%)	121.48	6.31
10	Others	5,779	4,676 (0.06%)	-19.09	-1.62
	Total	3,163,565	7,452,985 (100%)	135.59	6.81

(Source: Economic Survey of Delhi, 2012-13)

The numbers of motor vehicles have increased from 3,163,565 in the year 1999-2000 to 7,452,985 in the year 2011-2012, with decadal growth rate of 135.59% and annual compounded growth rate of 6.81%. The personalised motor vehicle segment comprising four wheelers (cars and jeeps) and two wheelers (scooters and motor cycle) increased at the rate of 168.74% and 124.04% respectively. These two segments of motor vehicles constitute about 94% of the total motor vehicles on the road. Interestingly, the number of two-wheelers is almost double in comparison to the number of four wheelers on the road. However the actual number of motor vehicles may be 20-30% lower, as registration procedure do not remove many of the out-of-service vehicles from the record (Mohan, et al, 2009).

3.6 Public Transport in Delhi

Delhi's public transport system is predominantly based on buses run by Delhi Transport Corporation (DTC), functioning under the control of State Government. It is further augmented by private bus services running as per the rules/ regulations of the State government. There are about 34,251 buses of DTC and private buses are plying on Delhi's road (Planning Department, 2013). The buses constitute less than one per cent of the total number of motor vehicles, but cater about fifty per cent of the travel need of the people (Tiwari, and Jain, 2011).

Delhi Metro Rail is being managed by Delhi Metro Rail Corporation (DMRC), presently operating on the network of 190 kms. with average ridership of 2.5 million people per day (Delhi Metro Rail Corporation Ltd., 2013; Economic Times, 2013).

However, the increasing trends in the number of personalised vehicles reflect that the public transport has not been able to cater the need of mobility of the people at large. This has put enormous pressure on the road infrastructure, which has seen a growth of only 14.22% during the last decade. 'Public transport systems have not been able to keep pace with the rapid and substantial increases in demand over the past few decades. Bus services in particular have deteriorated, and their relative output has been further reduced as passengers have turned to personalized modes and intermediate public transport' (Singh, 2005).

3.7 Road Traffic Scenario in Delhi

'... Driving on Delhi's roads is a nightmare for any sane person' (Delhi Traffic Police, 2013a). The above message from the Commissioner of Police, Delhi conveys a lot about the prevailing road safety environment in the city of Delhi. The problem of sharing of same road space by the slow and fast, heavy and light vehicles; encroachment on footpaths, non-availability of proper facilities for pedestrian crossings, limited parking space, ill-maintained road infrastructure, traffic signals etc. However, there has been some silver lining amidst the grim scenario. The data published by MORTH, and NCRB (MORTH, 2013; NCRB, 2013) reveal that the road traffic fatalities have shown a declining trend during the last three consecutive years in Delhi (Table 1).

From the data given in Table 1 above, it may be seen that the total number of road accident fatalities came down from 2,325 in the year 2009 to 2153 in 2010, which further declined to 2,065 in the year 2011 and finally it touched an all-time low to 1,866 in the year 2012, recording 19.74% decline in comparison with the fatalities of 2009. Similarly, the fatality rate per 10,000 vehicles has also declined from 3.5 in the year 2008 to 2.5 in the year 2012. The fatality rate per hundred thousand population, which is considered a better parameter to assess road safety environment, (though is showing a fluctuating trend for this period) has also declined from 13.3 in the year 2009 to 9.8 in the year 2012. This is quite remarkable in comparison with the trends at all India level for road accident fatalities, which has increased every year since 2002 till 2011. For the first time it has declined in the year 2012. This is a positive sign, but not the time to cheer as the fatality rate (per 100,000 population) is still very high in comparison with some of the developed countries in the world, with higher level of motorisation than Delhi (Discussed in detail in Chapter 5).

3.8 Road Users Killed in Accidents

The available data on different categories of road users killed in these accidents in Delhi shows that the pedestrians, two-wheeler riders and bicyclists accounted for about 60-70% of the total fatalities during the years 2011-2012 (Table 5).

Table 5

Number and share of road accident deaths by various modes of transport

Year	Truck/ Lorry	Bus	Tempo/ Van	Jeep	Car	Three Wheeler	Two Wheeler	Bicycle	Pedestrian	Others	Total
2011	141	92	89	19	186	64	642	76	603	195	2107
2012	131	65	99	12	205	67	489	78	501	219	1866

(Source: NCRB, 2011 and 2012)

The larger proportion of these categories of road users in the total traffic fatalities reflects varied aspects of governance, especially urban transport management, policies relating to development of road and allied infrastructure, besides the issues relating to enforcement of various traffic related laws in the city (Agarwal,2006; Ahmad et al,2013; Badami,2009; Menon et al, 2008;Tiwari,2002).

3.8 Traffic Laws and Enforcement

Enforcement of traffic related laws is vital for road safety. There are numbers of studies which have shown that strict enforcement of the traffic laws has significantly improved the road safety environment (Jacobs and Sayer, 1983; Redelmeier et al, 2003; Dandona et al, 2005; Menon et al, 2008; Grimm and Treibich, 2012). Like any other developed country, there are ample numbers of traffic laws to prevent road accidents in Delhi. In this regard, Motor Vehicle Act, 1988, Central Motor Vehicles Rules, 1989, Delhi Motor Vehicles Rules, 1989 and Rules of Road Regulations, 1989 prescribe various provisions for safe movement of motor vehicles on roads, including penalties in case of their violation. There are 75 different types of offences for which penalties can be imposed (Delhi Traffic Police, 2013b).

In Delhi, powers to enforce provisions relating to motor vehicles movement have been entrusted with two agencies, (i) Delhi Traffic Police, and (ii) Enforcement Wing of Transport Department, Government of NCT, Delhi. Since the major role is assigned to Delhi Traffic Police, I have focussed on the action taken by Delhi Traffic Police for enforcing these laws during the last five years. I have also analysed in brief the effects of introduction of Delhi Metro Rail service as a public transport system in improving the situation.

3.10 Delhi Traffic Police (DTP)

DTP, a branch of Delhi Police is the main agency entrusted with powers and responsibilities to ensure compliance with various traffic laws in Delhi. Unlike other States in India, where the police is under administrative control of the State Government, Delhi Police functions under the

administrative control of Ministry of Home Affairs, a Central Ministry because Delhi also serves as the Capital City of the country, having distinct administrative and security requirements.

From the data obtained from Computer Branch of DTP, it is apparent that there has been an increase in the numbers of prosecutions against different types of traffic violations (Table 6).

Table 6

Total No. of Traffic Prosecution: 2008-2012

Year	2008	2009	2010	2011	2012
Total Prosecution	2,732,496	3,448,592	2,606,011	3,051,505	3,298,827

(Source: Computer Branch, Delhi Traffic Police)

The total number of recorded traffic offences increased from 2,732,496 in 2008 to 3,298,827 in the year 2012, with an increase of about 20% in prosecution rate. Though a traffic rule violation has some direct or indirect bearing on the road safety environment, however there are some specific areas in which violations have greater chances of road accidents and fatalities thereto, e.g. over speeding, drunken driving, driving two-wheeler without helmet, driving four-wheeler without wearing seat-belt. I have focussed my analysis in these four areas, their effect on road safety and action taken by DTP for enforcement of related laws in these areas. Table 7 below provides an empirical proof regarding increase in the number of prosecution in these four traffic laws violations in Delhi.

Table 7

No. of prosecution for over-speed, seat-belts, drunken driving & helmet: 2008-12

Year	Offences			
	over-speed	seat-belts	drunken driving	helmet
2008	189,622	158,932	8,296	191,612
2009	222,659	134,494	12,784	255,686
2010	143,242	69,860	11,388	207,474
2011	44,618	224,368	18,073	331,463
2012	261,377	319,640	25,678	341,686

(Source: Computer Branch, Delhi Traffic Police; Annual Press Conference, 2012, Delhi Police)

3.11 Speed and Road Traffic Fatalities

Speed has direct bearing on both crash risk and its consequences. ‘ For a car occupants in a crash with an impact speed of 80 Km./h, the likelihood of death is 20 times what it would have been at an impact speed of 32 Km./h’ (WHO,2009;77). Similarly, the probability of a pedestrian being killed increases by eight times in case the speed of the car is increased from 30 Km./h to 50 Km./h (Mackay Ashton SJ as cited in WHO,2009).

From the records made available by the Computer Branch of DTP as well as Annual Press Conference of Delhi Police, 2012 (Delhi Police,2013), it can be seen that the number of prosecution cases against over speeding have increased from 189,622 in the year 2008 to 261,377 in the year 2012(Table 8 above). Though there is no separate data being maintained by DTP regarding number of road traffic fatalities on account of over speeding, but it can be argued safely that increase in prosecution has a positive bearing on drivers' behaviour to comply with the rules. This in turn contributes in improving road safety environment.

3.12 Drunken Driving and Road Traffic Fatalities

Alcohol is one of the major factors for traffic accidents (Evans, 1991).The crash risk increases exponentially with increasing blood alcohol concentration (Aberg, 1998). According to Velmurugan et al (2013), drunken drivers involved in road accidents occurring between 10.00 PM and 1.00 AM influences the serious injuries more than the non-injury related road accidents.

From the available data from DTP, it is observed that the number of prosecution in case of drunken driving increased from 8,296 in the year 2008 to 25,678 in the year 2012 i.e. about 300% jump in the number of prosecution during this period (Table 7 above). This has contributed in improving road safety environment in the city as there has been a significant decline in the number of fatal accidents involving drunken driving i.e. from 12 in 2010 to 6 in 2012 (MHA, 2013a).

3.13 Helmet and Road Traffic Fatalities

In case of two-wheeler users, head injuries due non-use of standard crash helmet is the major cause of fatality. As per the WHO Report (2009), use of standard helmet is the most successful way to prevent fatal accidents among the two-wheeler users. It reduces chance of fatal and serious injuries by between 20% and 45 % (Servadee F. et al as cited in WHO, 2009). In a study of crash victims admitted to neurosurgery ward in Delhi, it was found that the persons who used helmet received less severe injuries in comparison to non-users (Mishra et al, 1984). In an another study analysing the pattern of fatal head injuries due to vehicular accidents in Mangalore, it was found that in case of fatal head injuries among the two-wheeler users, most of them were not wearing helmet(Menon et al,2008).

With regard to action taken by DTP against non-use of helmet, it is observed that the number of prosecution cases have increased during the last five years, i.e. from 1,91,612 in 2008 to 3,41,686 in 2012 (Table 7). This has contributed in reducing the number of road accident fatalities involving two-wheelers, which has declined from 642 in 2011 to 489 in 2012 (Table 5).

3.14 Seat-Belts and Road Traffic Fatalities

Failure to use seat-belts is a major factor for fatal injuries among the vehicle occupants in case of an accident. Crash researches in various countries have found that rates of seat-belts being worn were substantially lower in fatal collision than the general average rate (WHO, 2009). According to Eluru and Bhat (2007), seat belt use reflects safety conscious driving attitude, which is equally important in reducing the likelihood of a fatal injury.

From the available records on the number of prosecution for violation of provision regarding use of seat-belts, it is seen that the prosecution rate has almost doubled in five years from 1,58,932 in 2008 to 3,19,640 in 2012 (Table 7). If the strict enforcement drive continues on a sustainable way, it will definitely increase the compliance of the law in the long run, which in turn, will save some precious lives. In a case study of the effect of use of seat-belts and fatality reduction in Delhi, Mohan (2009) found that the use of seat –belts might have resulted in saving 11-15 lives per year in Delhi.

There have been concerted efforts on the part of DTP to strictly enforce the traffic rules, especially in the areas of speed control, drunken driving, use of helmet and seat belts, which are very crucial in shaping the road safety environment in the city. According to Beenstock and Gafni (2000), the high rate of police enforcement contributes in reducing the rate of road accidents.

Besides the action taken by the DTP, the improvement in the public transport system with the introduction of “Metro Rail” in Delhi since 2002 has also contributed in decline in the number of road traffic fatalities. At present it has operational network of about 190 Kms., with 142 stations of which 32 are underground (Planning Department, 2013). Daily average ridership is of about 2.5 million people (Economic Times, 8th September, 2013). Public transport accounts for lower vehicular pollution and fatalities than personal motorized modes’ (Badami and Haider, 2007). As per the study carried out by CRRI in 2009, based on the metro ridership of 0.85 million passenger (in 2009), it has been estimated that the introduction of metro rail has resulted in an average of 57,953 vehicles off the road each day and reduced 51 fatal accidents across the metro corridor (Sharma et al, 2013). Delhi Metro provides an alternate and comfortable mode of transport to a large number of people in Delhi. Besides reducing travel time, it has also contributed in reducing number of road accidents and atmospheric pollution (Murty et al, 2006).

3.15 Challenges and Constraints of Delhi Traffic Police

Though there has been a concerted effort on the part of DTP to increase enforcement of traffic rules, there are many challenges and constraints to carry out this task effectively. From the available literature/ reports on this issue and after interview with Additional Commissioner of Police (Traffic) and ACP (Road Safety Cell), DTP, the following main challenges and constraints have emerged:-

- a) **Limited Organisational Strength:** The sanctioned strength of Delhi Police Force as on 01.01.2012 was 81,468 (BPR&D, 2012). Out of these 81,468 personnel, about 6,000 personnel are deployed in Traffic Police Branch, which constitute about 7% of the total strength (Computer Branch, Delhi Traffic Police, 2013). The number of personnel in traffic department has not increased in proportion to the rapid increase in the number of vehicles on the road. The number of vehicles per traffic police personnel was 440 in 2004, which increased to 1351 in 2007. It has been telling upon the capacity of DTP in enforcing traffic rules effectively (BPR&D, 2008). Adding to the problem, are thousands of vehicles entering Delhi’s roads from neighbouring States, further worsening the situation.

- b) **Presence of Mixed Traffic on Roads:** presence of vehicles of all shapes and size as well as varying speeds is a common feature on Delhi's road. This poses a major challenge before DTP in regulating and managing smooth flow of traffic.
- c) **Limited Use of ICT:** Although the use of ICT is gradually increasing in traffic management, enforcement of traffic rules and increasing road safety awareness among the citizens, yet the situation is far from satisfactory. As per the report published in a local daily (Hindustan Times, 2013), DTP is planning to procure and install cameras to check traffic laws violations.
- d) **Lack of Cooperation from Other Agencies:** This is one of the very crucial areas in which DTP is facing major constraints in improving road safety environment in the city. DTP receives very little cooperation from other agencies, including the civic agencies responsible for maintenance of roads, footpaths, construction and maintenance of sub-ways, water logging problem and so on. Addl. Commissioner of Police (Traffic), Delhi pointed out that these agencies' cooperation is very crucial for improving road safety environment in the city. Besides, there are policy issues pertaining to various Central Ministry/ Departments, State Govt. Departments, like strict provisions for issuance of driving license, increase in the quantum of penalty (MORTH), road designs, availability of public transport system, parking space for the vehicles, design of the vehicles, fitness regimes for different categories of motor vehicles which have a significant bearing on the overall road safety environment in the city. According to him, constant and concerted efforts from all concerned agencies are urgently required on this issue. However, at present there is very little coordination among these agencies and that too on ad hoc basis, primarily for crisis management. There is no single agency which can effectively monitor and coordinate the activities of these agencies with the objective of promoting road safety in Delhi. Citing an example of lack of coordination at ground/ functional level, ACP (RSC), DTP pointed out that in case of any emergent situation (like clearing the road, removing the fallen live electrical wires from the road, etc.), immediate response and support required from the concerned civic agencies(especially at night) is very difficult. According to him, there is a definite need for collaboration among the concerned agencies, not only at the higher level, but also at the functional level to tackle day to day small but crucial issues on priority.

The issues pertaining to the role of major agencies, action taken by these agencies to improve road safety, the coordination mechanism, etc. will be analysed in the next chapter.

CHAPTER-4

Agencies and their Responsibilities for Road Transport and Safety in Delhi

4.1 Agencies Engaged in Road Transport and Safety

In order to manage and regulate the smooth flow of different categories of motor vehicles (both high and low speed) on roads and also to strengthen road safety environment in Delhi, a number of agencies functioning under the administrative control of both Central and State Government, formulate and ensure implementation of necessary policies and programmes. While deliberating on the issues and challenges involved in management of road transport in National Capital Region, the Parliamentary Standing Committee on Transport, Tourism & Culture in its 198th Report have observed that there are 27 agencies/ authorities involved in regulation and management of transport system in Delhi (Standing Committee on Transport, Tourism & Culture, 2013).

In this paper, I have focussed on the role of three major agencies at the national level i.e. (i) Delhi Police, under Ministry of Home Affairs; (ii) Ministry of Urban Development; and (iii) Ministry of Road Transport & Highways, as their policy initiatives have direct bearing on the road safety environment in the city. Further, I have briefly examined the roles of some of the provincial and local level agencies, whose action also influence the road safety scenario. The main agencies performing these roles, along with their areas of jurisdiction are given in Table 8

Table 8

Agencies and their role in road transport and safety: Delhi

Central Government		State Government	
Agency	Responsibility	Agency	Responsibility
Delhi Police (Ministry of Home Affairs)	Matters relating to law and order; enforcement of traffic laws, road safety	Transport Department	Registration and inspection of motor vehicles, issuing of driving licences, fixing motor vehicle tax rates, enforcement of rules relating to plying of motor vehicle, regulation of operations of bus services
Ministry of Urban Development	Matters relating to land use and planning, urban transport and planning	Public Works Department	Construction and repairs of roads, traffic lights, flyovers, underway,
Ministry of Road Transport & Highways	Rules for safe movement of motor vehicles, road safety, maintenance of NHs	Local Municipality/Board (MCD, NDMC and DCB)	Construction and maintenance of roads, traffic lights, licensing and control of non- motorised vehicles

—	—	Delhi Transport Corporation	Operation of intra- city and inter-city bus services
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4.2 Role of Major Agencies

In order to appreciate the issues relating to prevailing road safety environment in Delhi in a holistic manner, it would be appropriate to explore and analyse the functions of these agencies in brief.

4.2.1 Ministry of Road Transport & Highways: is the key Central Ministry responsible for enactment of legislations for safe movement of motor vehicle throughout the country. It is also empowered with framing policies for promoting road safety at national level. This exercise is being carried out through Motor Vehicle Act, 1988 and the Central Motor Vehicle Rules, 1989. The Government of NCTD is empowered to frame its own rules, in consonance with the provisions of these two central enactments.

4.2.1(a) National Road Safety Council (NRSC): NSRC is an apex body at national level, functioning under the administrative control of MORTH. Besides the Minister for the Road Transport & Highways, Minister in-charge of Road Transport of all States and Union Territories (UTs), Director General of Police of all States/UTs, representatives from different related Central Ministries, Civil Society Organisations, other Government institutions related to road construction, road safety and insurance, representatives from automobile manufactures' associations, transport operators' associations are the members of this council. The function of this council is to advise the government on all matters pertaining to road safety. However, NRSC is an advisory Body and its recommendations are not binding either on the State Governments or on any Central Agencies. 'The NRSC does not have adequate statutory backing, budgetary resources or the mandate to be an effective organisation for executing road safety plans in a mission mode' (Committee on Road Safety and Traffic Management, 2007; 14).

4.2.1 (b) National Highway Authority of India (NHAI): functioning under the control of MORTH, is responsible for development, maintenance and management of National Highways (NHs), passing through different states across the country. The total length of road network under the control of NHAI is about 71,772 Km. (MORTH, 2012). Although NH constitute about only 1.7% of the total road network in the country, it carries about 40% of the total road traffic (ibid). Five NHs pass through Delhi, with approximate length of 360 Km. (Table 3 above).

4.2.2 Ministry of Urban Development (MOUD): MOUD is the nodal Ministry at the National level for broad policy formulation and monitoring of programmes in the areas of urban development and urban water supply and sanitation. It also handles matters relating to planning and coordination of urban transport. The Ministry has come out with a National Urban Transport Policy in 2006 with objectives to ensure easily accessible, safe, affordable, quick, comfortable, reliable and sustainable mobility for all (MOUD, 2013). In case of Delhi, it has direct responsibility for land use planning and development, which is being performed by Delhi Development Authority (DDA). According to

Wegman (2004), land use planning can have a major influence on both mobility and safety (Wegman, 2004). Besides, MOUD is also actively involved in the matter of urban transport management in Delhi.

4.2.2 (a) Delhi Metro Rail Corporation (DMRC): It was set up in 1995, with equity participation from Government of India (MOUD) and Government of National Capital Territory of Delhi for implementation and operation of Delhi Mass Rapid Transit System. At present it has operational network of about 190 Kms., with 142 stations of which 32 are underground (Economic Survey of Delhi, 2013).

4.2.3 Delhi Police

Delhi Police functions under the administrative control of Central Ministry i.e. Ministry of Home Affairs. The priorities of Delhi Police are maintenance of law and order and prevention of crime in the city.

The Traffic Wing of Delhi Police is entrusted with the responsibilities to provide safe and smooth flow of traffic. It has the prime responsibility to enforce traffic rules and regulations effectively. It is also entrusted with the task of promoting road safety in Delhi.

4.2.4 Transport Department, Government of NCT, Delhi

It is responsible for providing an efficient public transport system for the city. It is also entrusted with the task of registration of motor vehicles, issuance of driving licences, issue of permits for buses and other modes of transport, fixing fares for different modes of transport, etc.

The Transport Department has an 'Enforcement Wing', responsible for enforcing various provisions of Motor Vehicles Act, 1988 and Rules made thereunder. However, unlike Delhi Traffic Police, it has limited manpower. Hence, it has focussed enforcement areas, which can be enforced only by the officers of Motor Vehicles Department. 'Of the staff strength of 193 personnel, 150 are deployed in about 30 teams of 5 officials each. These teams are deployed in the field with specific instructions to focus on particular type of vehicles or offences' (Standing Committee on Transport, Tourism & Culture, 2013; 19).

4.2.5 Public Works Department (PWD), Government of NCT, Delhi

PWD is the main agency of Government of NCTD, engaged in planning, designing, construction and maintenance of Government assets as well as infrastructure development and maintenance. It is also responsible for development and maintenance of roads, bridges, flyovers, footpaths, subways, etc. within its areas of jurisdiction (Public Works Department, 2013).

4.2.6 Local Municipal Bodies

NCTD has five local bodies i.e. (i) New Delhi Municipal Council; (ii) Delhi Cantonment Board; (iii) South Delhi Municipal Corporation; (iv) North Delhi Municipal Corporation; and (v) East Delhi Municipal Corporation, responsible for providing necessary civic facilities for the areas under their jurisdiction (Ahmad et al, 2013). These local bodies have their elected head, [except in the case of

NDMC] and they take decisions independently. These agencies are responsible for construction and maintenance of roads, maintenance of traffic lights, etc. in their respective jurisdiction. They are also responsible for licensing of non- motorised vehicles.

4.3 Analysis of the Role of Agencies

4.3.1 Multiplicity of Agencies

From the above discussion of roles and responsibilities of various agencies in the road transport sector as discussed above, it is amply clear that there are numbers of agencies involved in this sector. Some of them are functioning under the administrative control of Central Government, others under the State Government as well as locally elected Bodies. There is overlapping and duplicity in their areas of work. As a result, it becomes very easy for these agencies to blame other agencies for any failure on their part, instead of owning the responsibility for prevailing chaos on roads of Delhi in general and poor road safety environment in particular. In a similar vein, Planning Commission has observed, 'Thus there is the Government of India, the Government of NCTD, the Municipal Corporation of Delhi, the New Delhi Municipal Committee, the Cantonment Board, the Delhi Development Authority and other agencies under the Government of India and the Government of NCTD all working within the same geographical area. They are all very powerful legal entities. Frequently, situations arise in which, it seems, a function/task is to be performed by more than one agency. Moreover, developmental activities need inputs from many of these bodies that are independent. The public agencies operating in the NCTD find themselves seriously constrained in implementing their programmes/projects as consultation with and concurrence of a large number of bodies becomes unavoidable. The citizen is confused about the agency that should be approached for a particular service or grievance. It also enables the agencies to pass the buck to other agencies for failure or inefficient or ineffective implementation of programmes' (Planning Commission, 2009; 32).

4.3.2 Coordination Mechanism

There is a weak of coordination mechanism, both at the policy formulation and implementation level amongst the agencies in the road transport sector in NCTD, which undermines road safety issues. MORTH has initiated a proposal to set up " National Road Safety and Traffic Management Board"; MOUD is advocating for setting up of Unified Metropolitan Transport Authority (UMTA), for planning, coordination, and management of public transport system in Delhi; Government of NCTD has proposed to set up Delhi Urban Mass Transit Authority (DUMTA), for managing all transport related issues in Delhi. These initiatives by different agencies at national and state level indicate that there is lack of formal coordination among the various stakeholders to address the problems associated with road transport sector in general and road safety in particular in Delhi. Echoing the

same view, the Parliamentary Standing Committee on Transport, Tourism and Culture in its 198th Report made the following observation:

‘The Committee finds that as far as Delhi is concerned, while planning is with the Union Ministry of Urban Development, management of traffic is with the Delhi Police, which is under the Union Ministry of Home Affairs, NCT Transport Department is responsible for issuing licenses and registering vehicles under the Motor Vehicle Acts and Rules. From planning to enforcement each Ministry/Department perform its duties exclusively without having any formal coordination between them’ (Standing Committee on Transport, Tourism & Culture, 2013; 21).

Another classic example of the lack of coordination and understanding is development of Metro Rail and BRT projects for Delhi, which have been developed as competing policy initiatives of different intellectual camps in the city (Ahmad et al, 2013).

Similar situation prevails in the road sector and various utility services providers, whose activities impinge upon the road infrastructure facilities, which is necessary for smooth flow of traffic as well as road safety. Raising concern over this issue, Planning Commission (2009) observed that there are multiple agencies responsible for construction and maintenance of roads, bridges and flyovers in Delhi. However, there is very little coordination among them. Further, there is no coordination among the different utility providers digging up the roads for laying sewage, water supply and cables. As a result, quite often the roads are dug up and excavated materials are heaped on the roads, causing obstruction to the traffic flow and also danger for plying of motor vehicles. ‘Fundamentally, the factors causing deterioration in the transport system of metropolitan Delhi are, multi-agency planning and implementation, inter-agency interests and conflicts, lack of a strong will to improve the public transport system, lack of land use-transport integration, and, above all, a non-existent public transport culture’ (Planning Commission,2009;144).

4.3.3 Lead Agency: Unspecified

The fundamental role of road transport is to provide cheap and efficient mobility. The agencies functioning in this sector primarily concern with formulating and implementing policies to meet the above objective. The issues pertaining to traffic safety do not get the attention it deserves. According to Trinca et al (1988), the traffic safety is relatively small consideration in the transport planning and management. Expressing similar views in case of India, the Committee on Road Safety and Traffic Management (2007) has observed that the role of key agencies in improving road safety is peripheral as it is not a priority area in their agenda.

Delhi Traffic Police is the main agency entrusted with the task for road safety in Delhi. DTP is a part of Delhi Police, whose main role is to maintain law and order and prevent crime in the city. Delhi Police is primarily an enforcement agency, working under the administrative control of a Central Ministry i.e. Ministry of Home Affairs (MHA). MHA has a number of responsibilities at the national level- like, issues pertaining to internal security, maintenance of Centre- State relation, border management, disaster management, etc. (MHA,2013b). The issue of road safety in Delhi does not figure out in its priority areas. The depleting strength of Traffic Police in comparison with increasing number of motor vehicle in the city of Delhi, as discussed in Chapter 3 (Para 3.15 a)

indicates that traffic management though important, yet is not given the attention it deserves. In an interview of ACP (Road Safety), DTP concurred on the issue under consideration.

MORTH is another agency, though at national level, which is directly concerned with the issue of road safety, for the entire country, including Delhi. However, the priorities of MORTH are manifold like, construction and maintenance of National Highways, formulating broad policies relating to road transport sector, environmental issues, automotive norms and making arrangements for movement of vehicular traffic with neighbouring countries (MORTH, 2012). The issues pertaining to road safety often takes a back seat. For instance, MORTH initiated a proposal for amendments in the provisions of Motor Vehicles Act, 1988 in 2007. The proposed amendments also cover the issues like, enhancement of penalties for various traffic offences, compensation to road victims, which are crucial from road safety perspective. However, the proposal has not received the approval of the competent authority (MORTH, 2013). Similarly, a proposal for creation of “National Road Safety and Traffic Management Board” was mooted in 2010, in line with the recommendations of the report of the Committee on Road Safety and Traffic Management submitted in 2007. However, the same has not yet been finalised. During the course of an interview Director (Road Safety), MORTH acknowledged that at times these proposals lose their priority amidst other urgent issues.

MOUD is primarily concerned with framing policies and providing financial assistance to the State Governments for planned development of urban areas and urban water supply and sanitation. It is also the nodal ministry for planning and coordination of Urban Transport matters at the central level (MOUD, 2013). It assists States’ in strengthening public transport system in the urban areas. In Delhi, MOUD is the major partner of the State Government for operation of Metro Rail. Though these activities contribute in improving road safety, but are not sufficient enough to address the problem in a holistic way.

The local Municipal Bodies primarily focus on the issues like, water supply, garbage disposal, and only secondarily on the issues related to improvement of road and allied infrastructure, which are very crucial from road safety point of view.

4.4.4 Authority at Local Level

Another area of concern is the limited authority of local the local bodies in planning and management of the road transport sector of the city (Agarwal, 2006). Emergent from the discussion above is the significant role of national and state level agencies in decision making in the road transport sector. Ideally, the locally elected bodies should have greater say in the policy making. These bodies are not only well-versed with the complexities at the ground level, but at the same time directly responsible to the citizen for their action. However, they have limited financial resources and administrative capacities, (unlike the national or the state level agencies) to undertake this task. The problems get further compounded by the fact that there are five local, but independent agencies, with very little linkages, functioning in Delhi. Their roles have great bearing in removing the bottlenecks in the road transport sector as well as in the area of road safety. Issues like encroachment on roads, placing of hoardings, clearing of pedestrians pathways, provision of street lights and lights for the sub-ways, proper maintenance of drainage system, especially during

the rainy seasons not only affect the smooth flow of traffic, but sometimes also create dangerous situations for driving, thus compromising the safety of the pedestrians as well. The crucial role of these local civic agencies in promoting road safety in Delhi was also acknowledged by Additional Commissioner of Police (Traffic) during interview.

CHAPTER- 5

Best Practices in Road Safety: The Netherlands and Sweden

5.1 Best Practices in Road Safety

Reports published at international levels (WHO, 2004; 2009; 2013 and World Bank, 2009) have predicted increase in the road traffic fatalities in the future, especially in the developing countries, experiencing increasing motorization. However, these Reports have also presented the case of some developed countries- like, Sweden, The Netherlands, Australia, New Zealand and United Kingdom- which have managed to reduce fatalities through concerted efforts. The success experienced by Sweden and The Netherlands compared to India, in improving road safety, on different parameters of safety can be gleaned from the Table 9 given below.

Table 9
Fatality rates in Sweden, The Netherlands and India

Country	Sweden				The Netherlands				India			
	1980	1990	2010	2010 % change over 1980	1980	1990	2010	2010 % change over 1980	1980	1990	2010	2010 % change over 1980
No. of vehicles/ 1000 population	330	507	584	76% (+)	333	390	563	69% (+)	7	23	108	1442% (+)
No. of fatalities	848	772	266	68% (-)	1996	1376	537	73% (-)	24,000	54,100	1,34,513	460% (+)
No. of fatalities/ 10,000 vehicles	2.5	1.2	0.5	80% (-)	4.3	2.4	0.7	83% (-)	53.1	28.2	10.5	80% (-)
No. of fatalities/ 100,000 population	10.2	9.1	2.8	72% (-)	14.2	9.2	3.6	74% (-)	3.6	6.5	11.4	216% (+)

(Sources: IRTAD, 2013 and MORTH, 2013)

The data given in Table 9 shows that Sweden and The Netherlands, despite higher level of motorisation in comparison with India have managed to reduce road accident fatalities in absolute numbers as well as on different yardsticks for measuring the prevailing road safety environment i.e. fatalities per 10,000 vehicles and 100,000 population, over the years. Though there has been decline in the fatalities per 10,000 motor vehicle in India, this does not necessarily indicate improvement in the road safety environment. According to Koptis and Cropper (2005), fatality rate per motor vehicle always decreases with the increase in per-capita availability of motor vehicles (Koptis and Cropper, 2005 as cited in Mohan et al, 2009).

Both these countries are relatively better placed in terms of economic development and simultaneously are very small in size and population in comparison with India. Though economic development may provide sufficient resources for undertaking various interventions, but may not be enough to improve the road safety environment in the country, which requires concerted efforts on the parts of major stakeholders, especially from the public institutions. As pointed out by Wegman (2005), road safety improvements are not happening automatically, but are the result of continuous and deliberate efforts made in this direction. This can also be inferred from the fact that even among the developed countries the road traffic fatality rate varies to a great extent with countries like Sweden and the Netherlands having the fatality rate of 3.0 and 3.9 respectively, while USA and France having the fatality rate of 11.4 and 6.8 respectively (Table 10)

Table 10

Fatality rate per 100,000 population in Developed Countries

(Base Year: 2010)

Sl. No.	Country	GNI per Capita (In US \$)	Road Traffic Deaths per 100,000 population
1	Australia	46,200	6.1
2	Austria	46,920	6.6
3	Belgium	46,920	6.6
4	Canada	43,250	6.8
5	France	42,190	6.4
6	Netherlands	48,920	3.9
7	Sweden	50,580	3.0
8	USA	47,350	11.4

(Source: Global Status Report on Road Safety, WHO, 2013)

Given the scenario, it will be interesting to find out the efforts made by these countries in improving the road safety environment, especially their policy initiatives and institutional arrangements. In their recent reports World Bank (2009) and WHO (2004, 2009, 2013) have also advised the developing countries to learn lessons from these countries, especially in the area of building sound institutional mechanisms, with focus on setting long-term goals, identifying lead agency, ensuring coordination among stakeholders and setting different targets, to improve road safety environment in a sustainable way. The aim of this chapter is to explore the institutional arrangements of these two countries on the four parameters mentioned above.

5.2 Road Safety: The Netherlands

The Netherlands: Key Facts (2011)

Area-	41,528 Sq. Km.
Population-	16.7 million
Kilometre of Public Road-	117,430
No. of vehicles/1000 inhabitants	567
Total police reported deaths-	661
Road Deaths per 100,000 of population-	4.0

(Source: IRTAD, Road Safety Annual Report, 2013)

The Netherlands is one of the most successful countries in road safety performance. It has a long history of developing systematic road safety management policies by involving major stakeholders at every stage. As a result, the number of road traffic fatalities started declining since 1970. It declined from 1,996 in 1980 to 537 in 2010, representing a decline of about 73%. Similarly, the fatality rate per hundred thousand populations also declined sharply during the said period from 14.2 to 3.6, recording a decline of 74% (IRTAD, 2013). The declining trend in absolute number of road fatalities is shown in Table 9 above.

For a comprehensive understanding of evolution of successful road safety policy, the policy initiatives and the institutional arrangements supporting these initiatives as highlighted in varied literature/documents (Koornstra,2002; Weegman,2003;WHO,2004;2009;2013;WB,2009;IRTAD,2013) are discussed below.

5.2.1 Vision for Road Safety: The Dutch Parliament played a crucial, leading role in setting the vision for road safety in the country. The vision is based on the concept of “Sustainable Safety”, which was first deliberated at length among the various stakeholders, and finally placed before the Parliament for detailed discussion and approval. It is the cornerstone of Dutch transport and traffic policies (World Bank, 2009). It takes into consideration ‘Human Limitations’, both in terms of ‘Human Error’ and ‘Human Tolerance’. Human beings are prone to commit mistakes and have a physical limit to absorb/tolerate consequences of collision, the outcome these mistakes. Therefore, the emphasis is to frame such policies which could minimize human error as well as the impact of the collision in cases where it occurs despite such efforts. According to Wegman and Aarts (2006), this has posed a big challenge for the policy makers as they have to systematically and consistently strive for framing such policies which gradually adjust the present traffic system to the requirements of human error and human tolerance. ‘It will be necessary to make Many Small Steps forward (so called incremental change) and decision- making procedure will have to be agreed upon in order to set these Many Small Steps by Many (independent) stakeholders in the right direction, and to involve efficiency consideration’ (Wegman,2004;8).

5.2.2 Lead Agency: The Ministry of Infrastructure and the Environment (Directorate General Mobility- Roads and Traffic Safety Section) is the lead agency for road safety in the Netherlands (IRTAD, 2013; 314). It is responsible for enacting legislation, funding, setting and monitoring targets, research and development and knowledge transfer to the regional and local governments in the area of road safety. It has in-house capacity for research and performance appraisal of the various road safety strategies at regular intervals.

As per WHO (2009) report, the Ministry has a comprehensive framework for monitoring and evaluation of road safety outcomes, which is delivered by its agencies, assisted by a wide range of organisations.

5.2.3 Coordination Mechanism: There exist well- established institutional mechanism, which ensures coordination/collaboration among the stakeholders, right from the stage of evolving appropriate policies and strategies, till the execution and monitoring and evaluating the effectiveness of these strategies in a systematic and scientific basis. The Ministry of Infrastructure and the Environment ensures this coordination at both vertical and horizontal level. Vertical coordination is carried out at European, national, regional and local level and the horizontal coordination across central government agencies (WHO, 2009).

5.2.4 Result Focus: In The Netherlands, target-setting began way back in 1983 within the context of the first national road safety plan. It is based on an in-depth analysis and forecasting of trends and modelling of different scenarios and in consultation with representatives of national, regional and local authorities. Finally, it is presented before the Parliament for approval. The Netherlands’ ‘Road Safety Strategic Plan 2008-2020’ stipulates no more than 500 fatalities and 10,600 serious injuries by 2020(IRTAD, 2013).

The above institutional arrangements enabled the Dutch government to take some pragmatic policy initiatives since 1984- (i) a National Road Safety Plan(1984),stipulating targets for lesser deaths and hospitalisation; (ii) Decentralisation Agreement (1994), specifying the areas for coordination with regional agencies; (iii) a Five- Year Start –Up Programme (1997), entering into contractual agreement with regional agencies to meet targets for road safety; and (iv) Mobility Memorandum (2005), splitting the national targets into regional and metropolitan areas targets, for reducing road traffic crashes in the country (WHO,2009).

5.3 Road Safety: Sweden

Sweden: Key Facts (2011)

Area-	449,964 Sq. Km.
Population-	9.4 million
Kilometre of Public Road-	215,000
No. of vehicles/1000 inhabitants -	597
Total police reported deaths-	319
Road Deaths per 100,000 of population-	3.4

(Source: IRTAD, Road Safety Annual Report, 2013)

Sweden has the best road safety record in the world. ‘Sweden has a long tradition in road safety work and is a global leader. Road safety is a national priority. Sweden’s aim is to create a well- developed, extensive and long-term sustainable transport system that enables safe and secure accessibility and eliminates the risk of fatal and serious road crashes’ (World Bank,2009;229). According to Koornstra et al (2002), traffic safety in Sweden got attention as early as September, 1967, when there was a change from left to right hand traffic. ‘The period around the change meant a re-education of population, a re-construction of the road network and new vehicles for public transport’ (Koornstra et al, 2002; 9). Road Safety Office was established in 1968, which was later merged with the Swedish Road Administration (SRA) in 1993 (World Bank, 2009; 229).

From the available reports, it has been found that despite increasing motorisation, Sweden has been successful in reducing the road traffic fatalities during the last few decades. The number of people killed in road traffic accidents reduced from 848 in 1980 to 266 in 2010, i.e. a decline of 68%. Similarly, the fatality rate per 100,000 population also dropped from 10.2 in 1980 to 2.8 in 2010, experiencing a decline of 72% (IRTAD, 2013).

There were a number of interventions taken at different levels (National, regional, local) and in different sectors (road design, motor vehicle safety, legislation and enforcement), which contributed in improving road safety environment in the country gradually. However, the success of these interventions were itself determined by the types of institutions set-up, their coordination with each other, the role of the political leadership and so on. According to Bliss and Breen (2012), the prevailing institutional capacity and their management functions directly effects outcome of any intervention for improving road safety.

5.3.1 Vision for Road Safety: Sweden’s road safety policy is based on the philosophy of “Vision Zero”, which was approved by the Swedish Parliament in 1997(Koornstra et al, 2002; 9). Its ultimate goal is to build such a traffic structure/system in which no one is killed or seriously injured as a result of a traffic accident. ‘Vision Zero entails a shift in the road safety planning paradigm. Instead of starting from an existing problem situation, Vision Zero departs from an absolute state of the future- safe road traffic’ (Belin et al, 2012; 177-178). In this approach, the emphasis shifted from improving the ability of the road users to cope with an imperfect system to build roads, motor vehicles and other transport services in such a way which enables the road users to tolerate the impact of an accident. In this regard, it recognizes responsibilities on the part of all stakeholders i.e. service providers, law enforcement agencies and the road users to cooperate with each other for strengthening the road safety environment in the country (Koornstra et al, 2002). ‘The Swedish Parliament’s decision on

Vision Zero transformed this scientific foundation into a public policy that has guided the design of the entire road transport system in Sweden in recent years' (Belin et al,2012;177).

5.3.2 Lead Agency: The SRA is the lead agency, responsible for road safety in Sweden. ' While the Ministry of Industry, Employment and Communications has legal responsibility for national road safety, the Swedish Road Administration (SRA) is the national authority assigned the overall sectoral responsibility for entire road transport system' (World Bank,2009;229). SRA has in-house capacity to review road safety performance, formulates proposals for follow-up action, in collaboration with other government agencies. It was responsible for introducing the concept of Vision Zero, which also facilitated it in establishing better communication with Parliamentarians and other decision –makers in the area of road safety.

5.3.3 Coordination Mechanism: Sweden has a long tradition of powerful local government, with considerable degree of autonomy and power to levy taxes. These local governments, comprising 290 municipalities and 20 country councils are responsible for promoting road safety in their respective areas of jurisdiction (IRTAD, 2013). However, they work in tandem with national government's policy of Vision Zero. At the national level, within SRA there are three organisations- (i) Director General's Advisory Council on Road Safety; (ii) National Coordination Assembly; and (iii) National Road Safety Assembly, which ensure horizontal coordination among the different stakeholders for promoting road safety (World Bank, 2009). SRA is also responsible for maintenance of road infrastructure for the entire country. SRA has seven regional offices, which enter into agreements with local municipalities for specific action for achieving national road safety goal. For this purpose, sufficient funds and necessary equipment are also provided to the local bodies to enable them to carry out their tasks effectively.

5.3.4 Result Focus: Sweden's long term goal under Vision Zero is that no one should be killed or seriously injured in road accidents. Besides this long term goal, SRA also sets up intermediate targets, both with regard to number of fatalities and serious injuries and with regard to various interventions for improving road safety. Sweden has an interim target for the year 2020, which initially projected a reduction in fatalities by 50% between 2007 and 2020. However, these targets and their indicators are constantly monitored and revised to keep it as relevant as possible (IRTAD, 2013). In addition, the intermediate outcome targets for different strategies on various identifiable and measurable parameters like, increasing the use of seat-belts, reducing speed limits on urban road networks, reducing the cases of drinking and driving, installation of more automatic speed cameras, etc. are set up so as to enable the agencies to assess the results of interventions in an objective terms.

The above description brings out the following important dimensions of the policy initiatives and institutional arrangements in Sweden and the Netherlands in the area of road safety.

- i. The road safety policies in both the Netherlands and Sweden have evolved over several decades of concerted efforts of the lead agency at the national level.
- ii. In both the cases political leadership have played a crucial role in setting the vision/goal of the road safety policy i.e. " Sustainable Safety" in case of the Netherlands and "Vision Zero" in Sweden. Both these vision/goals were debated and approved by the respective Parliament, which not only gave impetus for formulating concrete strategies and policies, but also made available the necessary resources for implementing these policies.

- iii. Their road safety vision i.e. “Sustainable Safety” and “Vision Zero”, do not accept road accidents as an unavoidable side effect of road transport system. Instead, it acknowledges that it is the transport system which needs to be arranged in such a way that people can travel without the risks of fatalities or serious injuries.
- iv. There are well-established institutional mechanism, identifying the roles and responsibilities of the major stakeholders and coordination mechanism for sharing responsibilities in implementing various interventions.
- v. The targets regarding outcome are not only clearly projected but are constantly monitored at each level, i.e. local, regional and national. In both the countries, the major stakeholders are consulted at various stages of policy formulation and its implementation. Targets are fixed not only for reducing the fatality or serious injuries, but also for different interventions like for increasing the use of seat-belts, fitting the new vehicles with anti-alcohol lock, speed limits on different categories of roads and so on. Targets are revised from time to time, as interim targets are also projected.

CHAPTER-6

Conclusion and Recommendations

6.1 Conclusion

The road traffic fatalities have declined in Delhi in the last three years. The efforts made by the enforcement agency i.e. DTP have contributed in this decline. Besides, the introduction of Delhi Metro as a convenient alternative mode of public transport system has also made a difference, with average daily ridership of about 2.5 million people. However, the situation is far below the satisfaction as the fatality rate per 100,000 population is still very high in Delhi (9.8 in 2012) in comparison with countries like Sweden (3.4 in 2011) and the Netherlands (4.0 in 2011).

The research has shown that although different agencies involved in road transport sector are taking some steps in their own domain, but there is no coordination and integration in their efforts, to improve road safety and transport management in Delhi. The concerned decision makers are spread across different institutions with very little or no effective coordination among them. Road safety requires multi-sectoral approach, which in turn depends on integration of the efforts of major stakeholders in this direction. However, the integrated policy-making cannot succeed, if the decision makers spread across different institutions fail to cooperate effectively (Hull, 2005).

Experiences of Sweden and The Netherlands have shown that the institutional ownership and accountability for results are must for a successful road safety performance. In case of Delhi,

there is no lead agency/organisation entrusted with responsibilities as well as powers to formulate policies and to ensure coordination among different agencies for road safety. DTP is the main agency vested with responsibilities for improving the overall road safety environment in the city. However, it has no mandate to formulate policies and to ensure coordination among the various agencies. The latest attempt of the Delhi government to constitute a Task Force, comprising members of civic and road owning agencies to be led by Additional Commissioner of Police(Traffic), to resolve the traffic related problems (Hindustan Times, 28th September,2013), is a small step in the right direction. This primarily concerns the execution of policy and not about policy decision-making, which is a separate area altogether. The experience from the two countries as discussed in this paper has shown that policy decisions were primarily framed by the agencies at the national level. Thereafter, the executing agencies at regional level were taken on board for implementing the same, through entering into formal agreement. DTP's limited role is enforcement of traffic rules and not for making any policy decision regarding improvement of road safety environment in Delhi. In such a scenario, there is a vacuum in policy making in this area, as far as NCTD is concerned.

Another area of concern is that the state political leadership has no direct say in the functioning of DTP, which is main agency responsible for the road safety in Delhi. DTP is under the administrative control of a Central Ministry i.e. Ministry of Home Affairs. The state leadership generally abstain itself from taking any major policy initiatives in the area of road safety.

The paper also reflects that a successful road safety policy invariably warrants initiatives at the national level, as there are number of issues in the road transport sector like regulations for movement of motor vehicles, issuance of driving license, fitness and safety issues, construction and maintenance of major roads, enactment of various legislations in the area of road safety, including penalties for traffic laws violations, etc. which are under the purview of the central agencies. In addition, these vehicles are plying on the roads cutting across all states, which necessitate the involvement of the central Ministry in policy formulation. The experience from the two countries have also shown that the major policy decisions like, setting goals and objective, targets and ensuring coordination among the various agencies have successfully been undertaken by the national level agencies. Therefore, any suggestion for improvement in the road safety for Delhi would also require deliberation for necessary changes at the central level.

The objective and goals for road safety in case of Delhi are rather very general and not specific, as in the case of the Netherlands and Sweden. There are no long-term or short-term targets for improving road safety. Target setting helps in formulation of specific plans and also in fixing responsibilities on the part of various stakeholders to take suitable action to achieve the goal. It also helps in assessing the success of different interventions objectively. 'Targets indicate that the government is committed to reducing the road toll and is likely to support proposed policy and legislative changes and allocate sufficient resources to safety programmes' (Transport Research Centre and International Transport Forum, 2008 ;10).

The success stories of Sweden and The Netherlands have also reflected that road safety policy requires constant attention at the national and regional levels, by the major stakeholders, to achieve the desired goal.

6.2 Recommendations

In light of the analysis made in this paper, following recommendations are made for improving road safety environment in Delhi:-

- (i) There is a need to actively associate political leadership at both national as well as state level in setting the objectives and goals for improving road safety environment in the country, including Delhi. The 'National Road Safety Council' (NRSC), a statutory body set up under Section 215 of the Motor Vehicles Act, 1988 by MORTH provides the necessary platform for this purpose. NSRC is headed by Minister for Transport at national level and is represented by the Ministers for Transport from all States and Union Territories of the country. At present, it is functioning merely as an advisory body and its recommendations are not binding. Necessary provisions be made in the Motor Vehicles Act, 1988, so that its recommendations become binding on other concerned agencies. Besides, the NRSC should also be entrusted with the responsibilities to set the objectives and goals at the national and the targets for improving road safety both at the national and the state level.
- (ii) The 'Road Safety and Traffic Management Board', as suggested by the Committee on Road Safety and Traffic Management (2007) should be set up at the earliest. In addition to the roles, as stipulated by the Committee, the proposed Board should also be responsible for the following :-
 - a) It shall assist NRSC in setting both long and short term targets for reducing road accident in the country. For this purpose it shall provide necessary input/ feedback to NRSC at regular intervals.
 - b) The Board shall be responsible to implement the recommendations of NRSC by formulating necessary strategies and entering into formal agreement with the other agencies at the national level as well as provincial level for implementation of the strategies.

As informed by Director (Road Safety) MORTH, in an interview, the proposal is at a very advanced stage of approval of the competent authority. This needs to be expedited, while incorporating the suggestions made above, as the Committee had submitted its report way back in the year 2007.

- (iii) Similarly, a State level 'Road Safety Council' be set up in Delhi, under the Chairmanship of Minister for Transport, Government of NCTD. The representatives from DTP, local municipal bodies, civic agencies, transport department, government of NCTD, agencies involved in construction and maintenance of roads, transport operators associations, Civil Society and NGOs working in the area of road safety should be the members of this Council. The Council should be the focal point for interaction with the national as well as state level agencies for the issues relating to road safety. The Council shall identify the major problems in the area of road safety and formulate strategies for overcoming the same. It should devise strategies to promote public awareness to improve road users'

behaviour. It should be responsible for implementing the recommendations of the NRSC and have sufficient authority for regulating and coordinating the activities of various agencies at the state level.

- (iv) Multiplicity of authority is a major constraint in development of integrated transport system as well as related infrastructure in Delhi. Presently, different agencies are operating different transport services in Delhi. For example, bus transport services are managed by Delhi Transport Corporation, while the private bus services are regulated by Transport Department, Government of NCTD, a separate agency. Delhi Metro Rail is operated by Delhi Metro Rail Corporation, another separate entity. The taxis and auto-rickshaws are operated by private operators, while the movement of non-motorized vehicles are regulated by the local municipal bodies. The problem gets further complicated by the fact a number of agencies responsible for creating and maintaining roads and related infrastructure are not under the administrative control of Delhi government. There is a need to set up a 'Unified Mass Transit Authority' for Delhi, which can integrate all transport and traffic related issues at a higher level, through comprehensive planning and regulation for development of an efficient user friendly public transport system. The issues pertaining to sharing of road space among different road user groups, strengthening the road safety environment of the city should be the back bone for evolving any policy initiative.

The proposed 'Authority' should be chaired by the Chief Minister of NCTD, with high level representatives from Transport Department, Government of NCTD, DDA, MCD, NDMC, experts from the field of transport planning, Civil Society and NGO in the area of road safety as members. One of the most critical area and bone of contention would be the issue of powers to be vested with this 'Authority'. Keeping in view the fact that a large number of central agencies are directly involved in planning for the development of Delhi, including its transport system, it is high time that the matter be looked into and resolved by a 'Group of Minister' of the Government of India, in a time-bound manner, as also suggested by the Parliamentary Standing Committee on Transport, Tourism and Culture (Standing Committee on Transport, Tourism & Culture, 2013).

- (v) Analysis in this paper has brought out that strict enforcement of traffic rules has potential to improve road safety environment. This is supported by a number of studies, both at national and international level, as reflected in this paper. Hence, it is imperative to take some urgent steps to strengthen the capacity of the enforcement agency i.e. DTP in case of Delhi. For this, following recommendations are made:-
- a. The strength of DTP needs to be augmented at the earliest. This will enable them to increase their visibility on roads, which is necessary for Delhi, as enforcement is still carried out through physical visibility, and very less reliance on modern technology, like road side camera and well-functioning traffic light system. In an attempt to find out the causes of road traffic fatalities in India, Grimm and Treibich (2012) have concluded that increased enforcement of road traffic rules have the potential to lower the road traffic fatality rate.

- b. The quantum of fines for different traffic rules violations need to be enhanced. Most of these fines were prescribed in the year 1988 i.e. about 25 five years ago, under various provisions of the Motor Vehicles Act, 1988. In most of the cases, penalty is of Rs. 100 (\$1.5) for traffic rules violations (Delhi Traffic Police, 2013a), which is not an effective deterrent in preventing the road users from intentionally violating traffic rules. According to Additional Commissioner of Police (Traffic), Delhi Police, the quantum of these penalties need to be enhanced to make it more effective in serving its purpose. As per the report published in a local daily (Hindustan Times, 2013), stiffer fines increased the compliance with rules by the three- wheeler drivers. This further strengthened the case for increase in the quantum of fines.
 - c. The use of ICT in traffic rules enforcement needs to be increased, especially in the areas of checking over-speeding, drunken driving and monitoring of traffic violations by habitual violators. In another report published in the same daily on the same date mentioned above, it has been reported that e-challan system (an electronically generated ticket for traffic violation) has helped DTP in identifying repeated offenders and taking necessary action against them.
- (vi) Devising specific intervention strategies for combating the factors responsible for the road accident in Delhi is must for improvement of road safety. However, the intervention strategies can be formulated only on the basis of high quality reliable data on road accidents which is missing in case of India. As pointed out by Mohan (2009), the quality of the road accidents data, its recording and classification are very poor. In such a situation effectiveness of any intervention strategies becomes uncertain. “High quality data on road accidents enhance the process of identifying safety problems and also make the task of formulating different strategies easier” (World Bank, 2009). In this direction the road accident data collection system as adopted in case of the State of Tamilnadu (India), in collaboration with World Bank i.e. Road Accident Data Management System (RADMS) should be followed by every State, including Delhi to enable the agency to formulate necessary strategies in this area. RADMS records the details of each accident, geographically map accidents, identifies accident prone spots and displays crash types. This is helping the Police, Transport and Road Authority to analyse the road accidents more scientifically, and enabling them to plan and implement remedial measures (MORTH, 2012).

References

- Åberg, L., 1998. Traffic rules and traffic safety. *Safety Science*, 29(3), 205-215.
- Agarwal, O. P., 2006. Urban Transport. India Infrastructure Report, 106-128.
- Ahmad, S., Balaban, O., Doll, C. N., Dreyfus, M., 2013. Delhi revisited. *Cities*, 641-653.
- Badami, M. G., 2009. Urban transport policy as if people and the environment mattered: Pedestrian accessibility the first step. *Economic and Political Weekly*, 43-51.
- Badami, M. G., Haider, M., 2007. An analysis of public bus transit performance in Indian cities. *Transportation Research Part A: Policy and Practice*, 41(10), 961-981.
- Beenstock, M., Gafni, D., 2000. Globalization in road safety: explaining the downward trend in road accident rates in a single country (Israel). *Journal of Accident Analysis and Prevention* Vol. 32(1), 71–84.
- Bliss, T., Breen, J., 2012. Meeting the management challenges of the Decade of Action for Road Safety. *IATSS research*, 35(2), 48-55.

Bureau of Police Research & Development [BPR&D], 2008. Comprehensive proposal for strengthening of Delhi Police-views of BPR&D (Available at <http://www.bprd.nic.in> , accessed on 18/09/2013).

Bureau of Police Research & Development [BPR&D], 2012. Data on Police Organisations in India, As on January 1, 2012. (Available at <http://www.bprd.nic.in> , accessed on 17/09/2013).

Committee on Road Safety and Traffic Management, 2007. Ministry of Road Transport and Highways, Government of India, New Delhi (Available at <http://www.morth.nic.in>).

Dandona, R., Kumar, G.A., Dandona, L., 2005. Traffic law enforcement in Hyderabad, India. *International Journal of Injury Control and Safety Promotion*, Vol. 12 (3), 167-176.

Delhi Metro Rail Corporation Ltd., 2013. (Available at official website of DMRC Ltd. <http://www.delhimetrorail.com>)

Delhi Police, 2013. Annual Review-2012 (Available at <http://www.delhipolice.nic.in>; accessed on 5th May, 2013).

Delhi Traffic Police, 2013a. Message from Commissioner of Police Delhi (Available at <http://www.delhitrafficpolice.nic.in>).

Delhi Traffic Police, 2013b.(Available at Official website of DTP, <http://www.delhitrafficpolice.nic.in>).

Directorate of Economics & Statistics, 2012. Delhi Statistical Hand Book 2012. Government of NCT of Delhi, India (Available at <http://www.des.delhi.gov.in>).

Economic Survey of Delhi, 2012-2013. Government of NCT of Delhi, India (Available at <http://www.delhi.gov.in>).

Economic Times, 2013. (Local English daily, dated 20th August, 2013, available at www.economictimes.indiatimes.com).

Eluru, N., Bhat, C. R., 2007. A joint econometric analysis of seat belt use and crash-related injury severity. *Accident Analysis & Prevention*, 39(5), 1037-1049.

Evans, L., 1991. *Traffic safety and the driver*. Science Serving Society.

Garg, N., Hyder, A., 2006. Exploring the relationship between development and road traffic injuries: a case study from India. *European Journal of Public Health*, Vol.16, 487-49.

Grimm, M., Treibich, C., 2012. Determinants of Road Traffic Crash Fatalities across Indian States. Working Paper No.531. International Institute of Social Studies, The Hague, The Netherlands (Available at <http://www.iss.nl>).

Gururaj, G., 2008. Road traffic deaths, injuries and disabilities in India: Current scenario. *The National Medical Journal of India*, Vol. 21, No.1, 14-20.

Haddon Jr, W., 1968. The changing approach to the epidemiology, prevention, and amelioration of trauma: the transition to approaches etiologically rather than descriptively based. *American Journal of Public Health and the Nations Health*, 58(8), 1431-1438.

Hindustan Times, 2013. (Local English daily, dated 6th September, 2013 and 11th November, 2013 available at www.hindustantimes.com)

Hull, A., 2005. Integrated transport planning in the UK: From concept to reality. *Journal of Transport Geography*, 13(4), 318-328.

International Traffic Safety Data and Analysis Group [IRTAD], 2013. Road Safety Annual Report 2013. OECD, 2013.

Jacobs, G. D., Sayer, I., 1983. Road accidents in developing countries. *Accident Analysis & Prevention*, Vol.15 (5), 337-353.

Kanchan, T., Menezes, R.G., Bakkannavan, S. M., 2010. Age and Gender variations in trend of road traffic fatalities in Manipal, India. *Journal of Medicine, Science and the Law*, Vol.50, 192-196.

Koornstra, M., Lynam, D., & Nilsson, G., 2002. *SUNflower: a comparative study of the development of road*. SWOV, Leidschendam.

Koornstra, M. J., 2007. Prediction of traffic fatalities and prospects for mobility becoming sustainable-safe. *Sadhana*, 32(4), 365-395.

Lee, K., Kim, B. Y., 2009. Both institutions and policies matter but differently for different income groups of countries: determinants of long-run economic growth revisited. *World Development*, 37(3), pp-533-549.

Luoma, J., Sivak, M., 2012. Road-Safety Management in Brazil, Russia, India, and China. Report No. UMTRI-2012-1, Transport Research Institute, The University of Michigan, U.S.A.

Menon, A., Pai, V. K., Rajeev, A., 2008. Pattern of fatal head injuries due to vehicular accidents in Mangalore. *Journal of Forensic and Legal Medicine*, 15(2), 75-77.

Ministry of Home Affairs, 2013a. Lok Sabha Unstarred Question No.2377, answered on 12th March, 2013 (Available at <http://mha1.nic.in/par2013/par2013-pdfs/ls-120313/2377.pdf>).

Ministry of Home Affairs, 2013b. Annual Report, 2012-13. Government of India, New Delhi (Available at <http://www.mha.nic.in>).

Ministry of Road Transport and Highways [MORTH], 2012. Annual Report, 2011-2012. Government of India, New Delhi (Available at <http://www.morth.nic.in>).

Ministry of Road Transport and Highways, 2013. Road Accidents in India- 2012. Ministry of Road Transport and Highways, Transport Research Wing, New Delhi (Available at <http://www.morth.nic.in>).

- Ministry of Urban Development [MOUD], 2013. Annual Report, 2012-13. Government of India, New Delhi (Available at <http://www.moud.gov.in>).
- Mishra, B. K., Banerji, A. K., Mohan, D., 1984. Two-wheeler injuries in Delhi, India: a study of crash victims hospitalized in a neuro-surgery ward. *Accident Analysis & Prevention*, 16(5), 407-416.
- Mohan, D., 2002a. Traffic Safety and health in Indian cities. *Journal of Transport and Infrastructure*, Vol. 9(1), 79-94.
- Mohan, D., 2002b. Road Safety in less motorized environments: future concerns. *International Journal of Epidemiology*, 2002, Vol. 31, 527-532.
- Mohan, D., 2004. Road Ahead – Traffic injuries and fatalities in India. Transportation Research and Injury Prevention Programme, Indian Institute of Technology, Delhi, 1-30.
- Mohan, D., 2008. Road traffic injuries: a stocktaking. *Best Practice & Research Clinical Rheumatology*, 22(4), 725-739.
- Mohan, D. (2009). Seat belt law and road traffic injuries in Delhi, India. In *Proceedings of the Eastern Asia Society for Transportation Studies* (Vol. 7).
- Mohan, D., Tsimhoni, O., Sivak, M., & Flannagan, M. J., 2009. Road safety in India: challenges and opportunities. Transportation Research Institute, University of Michigan.
- Mohan, D., 2011. Analysis of road traffic fatality data for Asia. *J East Asia Soc Transp Stud*, Vol.9, 1786-1795.
- Murty, M. N., Dhavala, K. K., Ghosh, M., Singh, R., 2006. Social Cost- Benefit Analysis of Delhi Metro. Institute of Economic Growth, Delhi, India. (Available at <http://mpra.ub.uni-muenchen.de/1658/>).
- Nantulya, V. M., Reich M. R., 2003. Equity dimensions of road traffic injuries in low- and middle-income countries. *Journal of Injury Control and Safety Promotion*, Vol.10, 13-20.
- National Crime Records Bureau [NCRB], 2013. Accidental Deaths and Suicide in India 2012 (Available at <http://ncrb.gov.in>).
- North, D.C., 1971. Institutional Change and Economic Growth. *The Journal of Economic History*, Vol.31 (1), 118-125.
- North, D.C., 1990. Institutions, Institutional Change and Economic Performance. Cambridge University Press, New York.
- O' Neill, B., Mohan, D., 2002. Reducing motor vehicle crash deaths and injuries in newly motorising countries. *British Medical Journal*, Vol. 324, 1142-45.
- Planning Commission, 2001. Report of the Working Group on Road Accidents, Injury Prevention and Control. Planning Commission, Government of India, New Delhi
- Planning Commission, 2009. Delhi Development Report. Planning Commission, Government of India. Academic Foundation, New Delhi.

Planning Department, 2013. Economic Survey of Delhi 2012-13. Government of NCT of Delhi, India (Available at <http://www.delhi.gov.in>).

Public Works Department, 2013.(Available at Official website www.delhi.gov.in/wps/wcm/connect/Lib_PWD/pwd/home).

Pucher, J., Korattyswaropam, N., Mittal, N., Ittyerah, N., 2005. Urban Transport crisis in India. *Journal of Transport Policy*, Vol.12 (3), 185-198.

Redelmeier, D. A., Tibshirani, R. J., Evans, L., 2003. Traffic-law enforcement and risk of death from motor-vehicle crashes: case-crossover study. *The Lancet*, 361(9376), 2177-2182.

Report of the Committee on Road Safety and Traffic Management, 2007. Ministry of Road Transport and Highways. Government of India, New Delhi (Available at <http://www.morth.nic.in>).

Singh, S.K., 2005. Review of Urban Transportation in India. *Public Journal of Transportation*, Vol.8 (1), 79-97.

Sivak, M., Tsimhoni, O., 2008. Improving traffic safety: Conceptual considerations for successful action. *Journal of Safety Research*, 39(5), 453-457.

Standing Committee on Transport, Tourism & Culture, 2013. 198th Report on 'Management of Road Transport in National Capital Region: Issues and Challenges'. Parliament of India. Rajya Sabha (Available on <http://rajyasabha.nic.in> , accessed on 16/09/2013).

Streeck, W., Thelen, K., 2005. Introduction: Institutional change in advanced political economies. *Beyond continuity: Institutional change in advanced political economies*, 1-39.

Thulin, H., Nilsson, G., 1994. Road traffic, exposure, injury risks and injury consequences for different travel modes and age groups. *VTI rapport*, 390.

Tiwari, G., 2002. Urban transport priorities: meeting the challenge of socio-economic diversity in cities, a case study of Delhi, India. *Cities*, 19(2), 95-103.

Tiwari, G., 2011. Key mobility challenges in Indian cities. International Transport Forum Discussion Paper No.2011-18. International Transport Forum.

Tiwari, G., Jain, D., 2012. Accessibility and safety indicators for all road users: case study Delhi BRT. *Journal of Transport Geography*, 22, 87-95.

Transport Research Centre, International Transport Forum, 2008. *Towards Zero: Ambitious Road Safety Targets and the Safe System Approach*. OECD Publishing.

Trinca, G., Johnston, B., Campbell, F., Haight, P., Knight, M., Mackay, J., McLean, E., Petrucelli, 1988. Reducing traffic injury- A global challenge. Royal Australian College of Surgeons, Melbourne.

Velmurugan, S., Padma, S., Madhu, E., Anuradha, S., Gangopadhyay, S., 2013. A study of factors influencing the severity of road crashes involving drunk drivers and non drunk drivers. *Research in Transportation Economics*, 38(1), 78-83.

Wegman, F., 2004. *Fewer crashes and fewer casualties by safer roads*. SWOV Institute for Road Safety Research.

Wegman, F., & Aarts, L., 2006. *Advancing sustainable safety*. Leidschendam: SWOV Institute for Road Safety Research.

Wesemann, P., 2001. Economic evaluation of road safety measures; European Conference of Ministers of Transport, Round Table, No. 117, OECD Publishing.

World Bank, 2009. *Implementing the recommendations of the World Report on Road Traffic Injury Prevention, Country Guidelines for the Conduct of Road Safety Management Capacity Reviews and the Specifications of Lead Agency Reforms, Investment Strategies and Safe System Projects*. World Bank Global Safety Facility, Washington DC.

World Health Organisation, 2004. *World report on road traffic injury prevention*, WHO, Geneva.

World Health Organization, 2009. *Global Status Report on Road Safety- Time for Action*, WHO, Geneva.

World Health Organization, 2013. *Global status report on road safety 2013: supporting a decade of action*. WHO, Geneva.