

ROAD SAFETY SCENARIO IN INDIA AND PROPOSED ACTION PLAN

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ABSTRACT

Fatalities in road accidents in India constitute 8-10 per cent of global road deaths. This phenomenon is like a silent disaster happening every day and it is worse than any other natural or man-made disaster. India has introduced a major road development programme to make travel faster, but the safety outcomes are not satisfactory due to deficiencies in engineering, education and enforcement (the three E's of traffic engineering and safety management). The characteristics of the accidents and their causal analysis suggest poor discipline in road use coupled with poor enforcement as the main causes of this situation. A more comprehensive road safety programme needs to be undertaken to improve the current situation. Considering the magnitude of the problem, a road safety action plan is suggested and the proposed initiatives are discussed. The contribution of the India chapter of the International Road Federation to the cause of road safety is also highlighted.

Keywords: road accidents in India, road safety action

INTRODUCTION

Road fatality rates in India are probably among the highest and out of 1.25 million deaths worldwide every year, 8-10 per cent (about 115,000) of all road deaths are in India. With the rising purchasing power of average Indians, motorized vehicle ownership is growing at a fast pace and, in some cities, vehicle ownership has reached a level comparable to that of the developed countries. The poor and inadequate public transport services in cities, particularly the non-metropolitan cities, have compelled many residents to use private modes more often than should have been necessary. As a result, the use of private modes for work trips is very high. The World Health Organization (WHO, 2004) has estimated that fatalities per 100,000 population in the developing world will grow from 13.3 in 2000 to 19.0 in 2020, while in the developed world during the same period, they will decline from 11.8 to 7.8. It may be mentioned that India had 10.1 fatalities per 100,000 population in 2007.

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Safety is supposed to be built into the road traffic system by traffic engineering practices, but traffic engineering has yet to find its due importance in road system development and operation in India. The giant road development programme being undertaken in India is grossly deficient in traffic engineering. The aim of engineering is to provide the most scientific design to make the roadway safe for all users and to provide a forgiving road. The other critical dimension of the road safety problem in India is the poor public education regarding road safety. Education is a long-term matter which needs to be inculcated in all road users from childhood in order for them to possess good road senses and to remain responsible to others while using the road. Similarly, enforcement is another dimension where a legal system is required to be introduced to penalize the violators of traffic rules so as to act as a deterrent. Of course, in these efforts, economic rationality has to be considered while ensuring appropriate safeguards for preserving the safety environment.

The road system and the traffic operations in India are deficient in safety management. One of the reasons for this situation is that there is very little opportunity to learn from the past mistakes. The accident records are supposed to provide the best clue about what has been deficient in the road, vehicle and user systems to explain the causes of accidents and to develop remedial measures. This aspect of the road safety management system is poor in India, with untrained police officers collecting only incomplete records of fatal accidents and always stating the road user's fault as the cause of the accident. In a road environment where the road design (engineering), knowledge of traffic rules (education) and traffic control and policing (enforcement) are not satisfactory, the cause of the accident can also be the driver's fault. In a deficient road and traffic environment, causes are mainly linked to poor road geometry and poor traffic control aggravated by poor traffic sense.

This paper describes the huge road development programme being undertaken in India and its safety implications. While the magnitude of the problem is discussed, the nature of the road safety problem and basic issues are also analysed. Road safety initiatives introduced in the past and those that are ongoing and being contemplated by the government are also discussed, along with the mission of the India chapter of the International Road Federation (IRF) to achieve targeted reductions in road fatalities. A road safety action plan has been proposed using engineering, education and enforcement (the three E's of traffic engineering and safety management), including enforcement.

STATUS OF ROAD DEVELOPMENT

India has a road network of an estimated 3.3 million km, which carries nearly 65 per cent of freight and 85 per cent of passenger traffic. The road traffic is estimated to be growing at an annual rate of 7-10 per cent, while the vehicle population is growing at a rate of 12 per cent per year. Road length by category of roads is shown in table 1. The national highways in the country account for only 2 per cent of the total road network, but they carry over 40 per cent of the total road traffic.

Table 1. Road network in India

Category of road	Length in km
National highways/expressways	66 754
State highways	128 000
Major and other district roads	470 000
Rural roads	2 650 000
Total road network	3 314 754

Source: India, Department of Road Transport & Highways, *Annual Report 2007-2008*.

The Government is implementing a massive National Highways Development Project (NHDP) in the country in seven phases to increase the capacity by 54,450 km of national highways (NH) by widening them to 4-6 lanes. The National Highways Authority of India (NHAI) is entrusted with the implementation of NHDP. Phase I and II of NHDP, comprising 14,000 km, are almost complete, while the other phases are in various stages of implementation. These improved high-speed roads are spread out over the whole country and include 1,000 km of expressways and 700 km of bypasses in congested areas.

II. SAFETY HAZARDS ON INDIAN ROADS

Road traffic accidents constitute 32 per cent of all accidental deaths in India. An account of accidental deaths in the country with special reference to traffic accidents is given in table 2.

Table 2. Accidental deaths in India

Year	Deaths due to natural disasters	Deaths due to unnatural accidents*		
		Total	Traffic accidents (road, rail, air, etc.)	Road accidents
1998	22 762	235 647	93 996	79 919
1999	27 506	244 412	99 541	81 996
2000	17 366	238 517	98 038	78 911
2001	36 651	234 368	99 516	80 888
2002	16 723	243 394	101 958	84 674
2003	14 954	244 671	102 951	85 998
2004	18 937	258 326	111 794	92 618
2005	22 415	271 760	118 265	94 968
2006	21 502	293 302	131 652	105 749
2007	25 153	315 641	140 560	114 444

Source: Central Bureau of Health Intelligence and Ministry of Road Transport and Highways, India.

* Major causes of unnatural accidents other than traffic accidents include the collapse of structures, drowning, explosions, fire, firearms, stampede, suffocation, being killed by animals and other similar causes.

The dominance of road transport will continue in India as it has in the rest of the world. The share of the movement of both passengers and goods is expected to increase further in the coming years with the full implementation of the current road development programme being undertaken in the country. Most of this high-speed road development programme is expected to be completed by 2015. Without complementary developments in other transport subsectors, the road safety problem could become worse. Table 3 shows the number of fatalities and injuries due to road accidents and the corresponding vehicle population from 1970 to 2007.

Table 3. Road accident statistics of India

Year	Total no. of road accidents	Total no. of persons killed	Total no. of persons injured	Total no. of registered motor vehicles (1 000)	No. of accidents per 10 000 vehicles	No. of persons killed per 10 000 vehicles	No. of accidents per 100 000 population	No. of persons killed per 100 000 population
1970	114 100	14 500	70 100	1 401	814.42	103.50	21.20	2.70
1980	153 200	24 000	109 100	4 521	338.86	53.09	22.80	3.60
1990	282 600	54 100	244 100	19 152	147.56	28.25	33.80	6.50
2000	391 449	78 911	399 300	48 857	80.12	16.15	38.60	7.80
2001	405 637	80 888	405 200	54 991	73.76	14.71	39.30	7.80
2002	407 497	84 674	408 700	58 924	69.16	14.37	38.80	8.10
2003	406 726	85 998	435 100	67 007	60.70	12.83	38.10	8.10
2004	429 910	92 618	464 600	72 718	59.12	12.74	39.80	8.60
2005	439 255	94 968	465 282	81 502	53.90	11.65	39.90	8.60
2006	460 920	105 749	496 481	89 618	51.40	11.79	41.40	9.50
2007	479 216	114 444	513 340	98 000*	48.90*	11.67*	42.40	10.10

Source: <http://morth.nic.in>; Transport Research Wing, Ministry of Road Transport and Highways, *Road Accidents in India 2007*.

* Estimated.

A. Scale of the problem

Table 3 shows that currently about 115,000 people are killed and another 0.5 million are injured in road traffic accidents per year. These numbers are conservative estimates, however, as some motor vehicle accidents are not reported to avoid lengthy and coercive adjudication problems. It is estimated that the country loses around 750 billion rupees (Rs) (\$17 billion) per year due to road traffic accidents, which is 2-3 per cent of the gross domestic product (GDP). Casualties due to traffic accidents (which occur only one or two at a time) attract less attention than other less frequent types of natural or unnatural disasters. Table 4 compares road fatalities with many contemporary natural and man-made disasters, which are literally dwarfed by the road accident-related deaths and injuries every year. Road accidents can easily be called a silent disaster and a national mission is needed to mitigate the menace of this sociotechnical problem, just as any other epidemic requires. They are a menace with complex causes

and, therefore, a very professional comprehensive approach is needed to combat them (Sikdar, 2005).

Table 4. Comparison of casualties caused by road accidents and other disasters

Disaster (natural and man-made)	Deaths	Injuries
Bhopal gas tragedy, India, 2-3 December 1984	20 000	530 000
Latur (Killari) earthquake, India, 30 September 1993	9 000	20 000
Orissa super-cyclone, India, 29-30 October 1999	20 000	NA
World Trade Centre (9/11), USA, 11 September 2001	3 000+	NA
Bhuj (Kuchch) earthquake, India, 26 January 2001	13 800	166 800
Asian tsunami, many countries, 26 December 2004	245 000	1 000 000
Sichuan earthquake, China, 12 May, 2008	90 000	375 000
Road accidents (India), 2007	115 000 per year	> 0.5 million per year

Source: Compiled by the authors.

An estimated 0.8 billion motor vehicles are in use worldwide and India has only 100 million of those vehicles, according to the number of motor vehicles registered in 2007. About 70 per cent of the vehicle population of India is the most vulnerable (in terms of safety of operation)—two-wheelers. In comparison to the developed world, India has a low vehicle ownership rate. However, the demand for road travel is growing faster than the average income of the population or the rate of growth of GDP. Inadequate road safety provisions and poor travelling conditions (operational control and road use behaviour) have created a high level of risk in road travel. Consequently, the fatality rate per 10,000 vehicles in India is 15-20 times higher than that of developed countries. A World Bank study (2002) identified poor safety outcomes as one of the significant transport sector deficiencies in India.

The mixed traffic conditions on Indian roads is often said to be responsible for the high accident rate. The mix of the vehicle fleet in India has been changing over the last 50 years. While the share of the two-wheeler population grew considerably during the 1980s and 1990s, it has been on the decline since 2000; the population of cars, however, is increasing very quickly. The changing mix of vehicles over the decades is shown in table 5.

**Table 5. Trends of motor vehicle growth in India
(Thousands; (Percentage))**

Vehicle type	1951	1981	1991	2001	2011*	2021*
Two-wheelers	27 (8.8)	2 618 (48.6)	14 200 (66.4)	38 556 (70.1)	84 480 (64.0)	160 524 (54.6)
Car, jeep and taxi	159 (52.0)	1 160 (21.5)	2 954 (13.8)	7 058 (12.8)	26 400 (20.0)	95 256 (32.4)
Buses	34 (11.1)	162 (3)	331 (1.6)	634 (1.2)	1 320 (1)	2 940 (1)
Goods vehicles	82 (26.8)	554 (10.3)	1 356 (6.3)	2 948 (5.4)	8 052 (6.1)	19 698 (6.7)
Others	4 (1.3)	897 (16.6)	2 533 (11.9)	5 795 (10.5)	10 560 (8)	14 994 (5.1)
Total	306	5 391	21 374	54 991	132 000	294 000
	(100)	(100)	(100)	(100)	(100)	(100)

Source: <http://morth.nic.in>.

Note: Figures in parentheses show percentages of the total for that year.

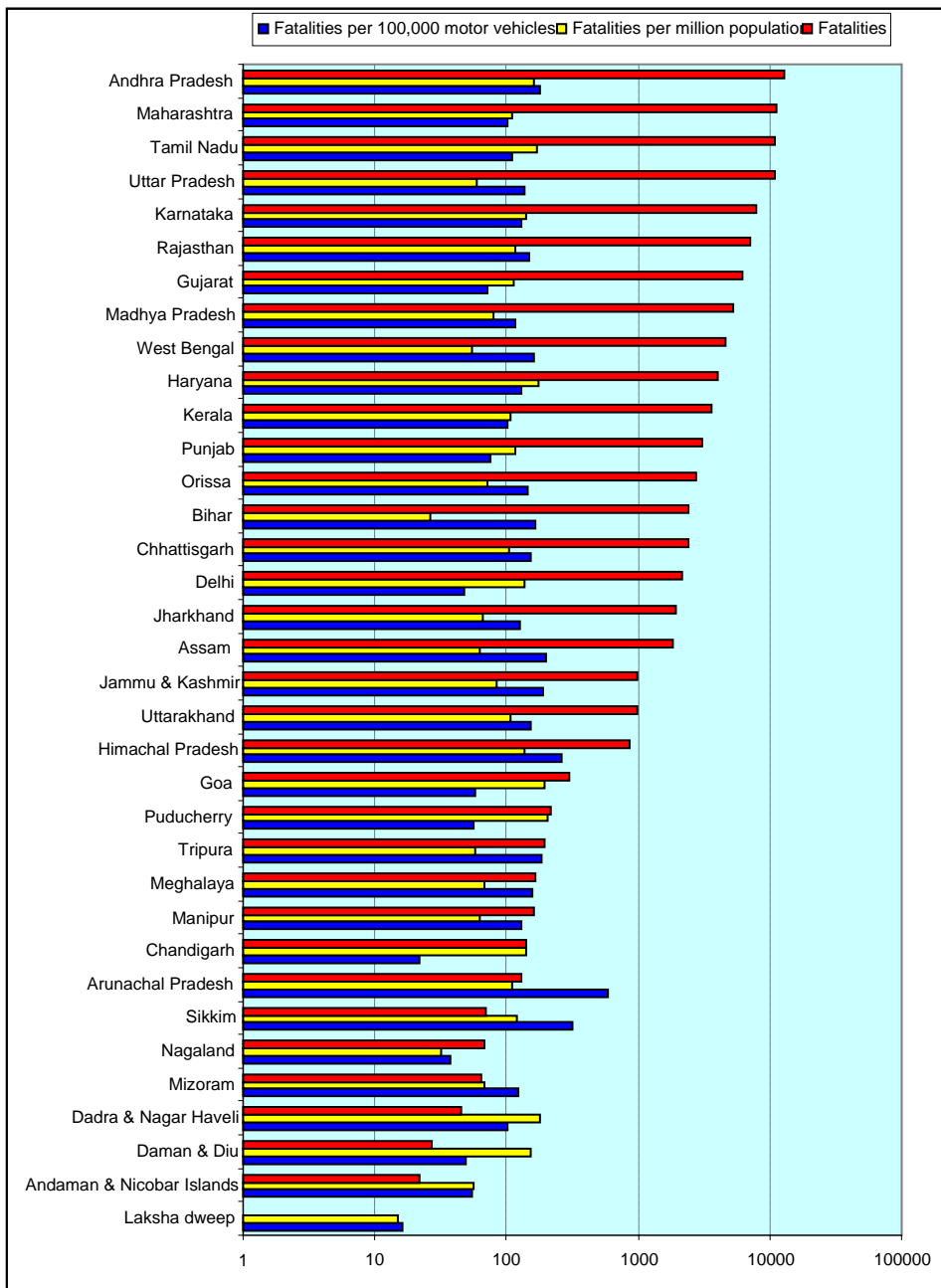
* Projection based on transport demand.

The number of accidents is generally related to traffic flow levels (i.e. exposure). This relationship is hard to establish in the Indian context, however, as the density of traffic is still very low except in major metropolitan cities. Rather, the deficiencies in engineering design and poor management of roads and traffic are mostly to blame for this problem. These deficiencies are the primary causes of this man-made disaster that wipes out a large number of people every year, equivalent to the population of a medium-sized city.

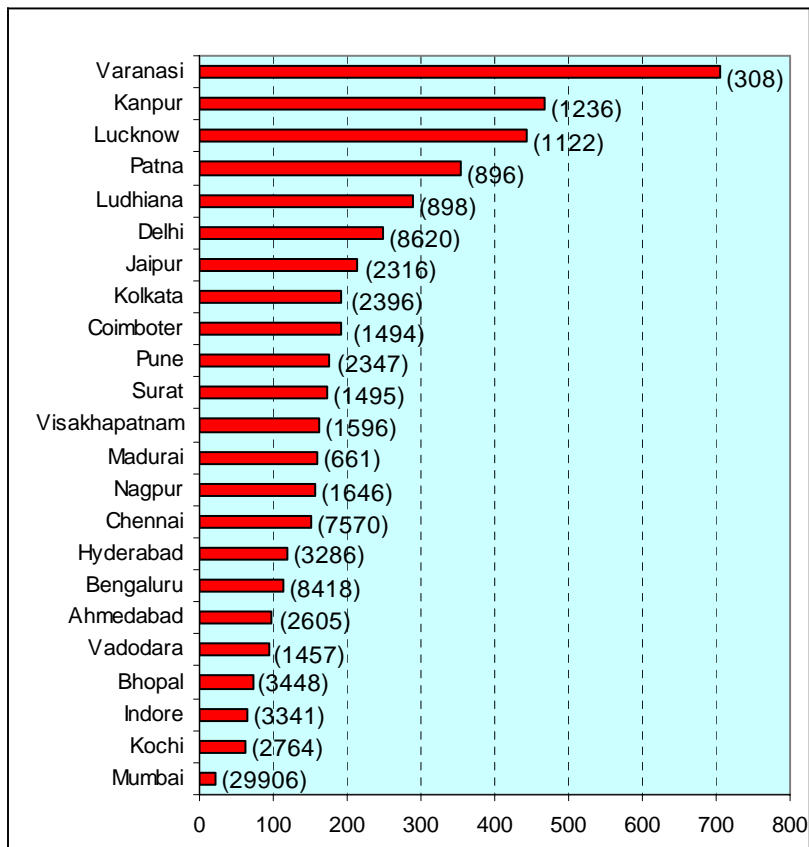
Depending on the vehicle population, road density, terrain, etc., the road accident deaths in various states of India are different. Interestingly, the number of fatalities per million population and per 100,000 motor vehicles for the majority of states in India hover around a value of 100 (as shown in figure 1). Based on total fatalities, three distinct groups of states emerge: (i) states with fatalities of over 5,000 (8 states); (ii) states with fatalities between 500 and 5,000 (13 states); and (iii) states with fatalities below 500 (14 states and Union Territories). The first group of eight states contributes 68 per cent of all road fatalities.

The accident data for selected cities in India reveal that four metropolitan cities (Delhi, Chennai, Mumbai and Bengaluru) except Kolkata contribute 61 per cent of road accidents in the selected cities, which is about 11 per cent of total accidents in the country. As shown in figure 2, Mumbai, with the highest number of accidents, has the lowest accident severity, while Varanasi, which has the lowest number of accidents, has the highest accident severity.

Figure 1. Road traffic fatalities per population and motor vehicles for states of India, 2006



Source: Transport Research Wing, Ministry of Road Transport & Highways, *Road Accidents in India 2007*.

Figure 2. Road traffic accident severity for select cities in India, 2007

Source: Transport Research Wing, Ministry of Road Transport & Highways, *Road Accidents in India 2007*.

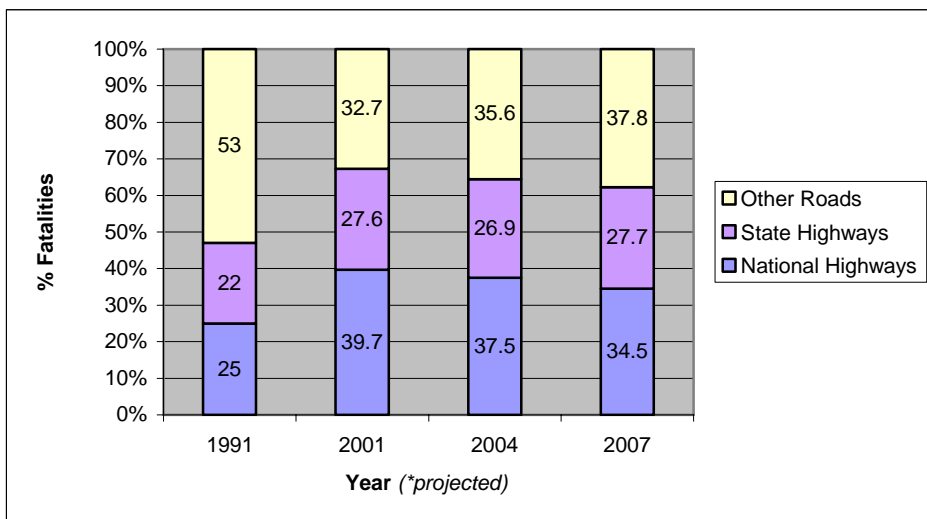
Note: Accident severity is the number of fatalities per 1,000 accidents; values in parentheses are the number of road accidents.

B. Causes and characteristics of road accidents

The main constraint in making the road network safe is that the high-speed roads are also not free from mixed traffic and they are not fully access-controlled. The slow traffic is not segregated to service roads or provided with separate lanes. Expressways are being built with full access control, but there are only a few hundred kilometres of them so far. About two thirds of the total fatalities in India occur on highways, while in such states as Haryana and Bihar, the share is as high as 82 per cent and 98 per cent, respectively. Over the last decade, the national highways and state highways (SH) have

seen dramatic improvements (although not the entire network of NH and SH) in terms of capacity (by widening to four lanes) and riding quality. Thus, the shares of fatalities on NH, SH and other roads show a changing pattern over the years, as can be seen in figure 3. The actual number of fatalities, however, is growing unabated for all types of roads.

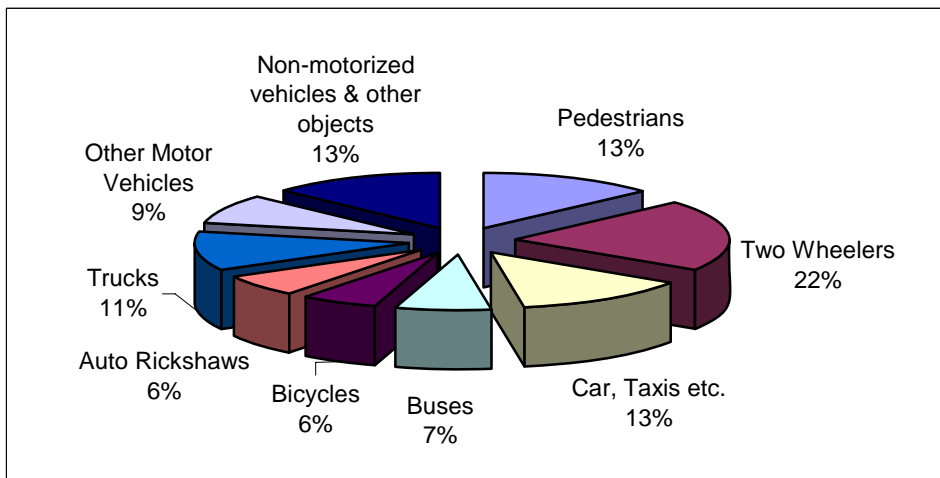
Figure 3. Share of fatalities on different types of roads



Source: Transport Research Wing, Ministry of Road Transport & Highways, *Road Accidents in India 2007*.

A conservative estimate of the ratio between deaths, major injuries and minor injuries is 1:15:70, from the pattern observed in most countries (World Report on Road Traffic Injury Prevention, 2004). Thus, even for the present lower proportion of high-speed roads, for 115,000 fatalities in road accidents, the estimates for serious and minor injuries would be 1,500,000 and 7,500,000, respectively. There is no uniform system for accident data collection and analysis followed by state and city authorities, which makes all of the available data largely unusable. Accident data are collected by the police for the adjudication of claims and for crime records, not for accident investigations. Thus, the real causes related to the accidents never get revealed for any correction or improvement focusing on road safety. The data available from the metropolitan cities indicate that 60-80 per cent of all reported fatalities are to the vulnerable road users (VRU) and in some cases, this percentage is as high as 75-90 per cent, while on non-urban roads the share of VRU in fatalities is about 50 per cent. Figure 4 shows the share of fatalities to road users in India.

Figure 4. Share of fatalities in road accidents by type of motor vehicle user/occupant (2007) in India



Source: Transport Research Wing, Ministry of Road Transport & Highways, *Road Accidents in India 2007*.

Some of the major causes of road accidents in India are:

- Absence of an inspection and maintenance regime to ensure the roadworthiness of vehicles
- Poor discipline of road users linked to level of education
- Lack of safety provisions in roads as well as poor operation and maintenance
- Primitive traffic management and poor levels of enforcement
- Mixed traffic (slow traffic sharing the same right-of-way as fast traffic).

A study sponsored by the Ministry of Road Transport and Highways revealed that about 19 per cent of fatal accidents on four-lane divided highways were head-on collisions, while pedestrians and bicycles were involved in 35 per cent of fatal accidents (Mohan et al., 2009). These findings indicate the need for stricter enforcement of traffic regulations on highways and an awareness drive for VRUs to change their behaviour.

III. ROAD SAFETY INITIATIVES IN INDIA

A. Past initiatives

Every road project has an allocation of 2 per cent of the project cost for safety. In reality, however, this budget has been used as a contingency for different purposes. Other unstructured initiatives implemented in an unplanned way and resources distributed thinly out of a small budget have not produced the desired results. The Commission for Global Road Safety (CGRS) has made a candid recommendation for an allocation of 10 per cent of the project fund for road safety features (CGRS, 2009), which deserves careful consideration.

The major initiatives of the government for safety improvement have been in the following areas:

- Road engineering through NHAI and state public work departments (PWD)
- Enforcement of traffic laws through state police
- Education and training: sporadic campaigns in print and television media, and driver training programmes through NGOs
- Accident relief: NH accident relief service and trauma care centres have been established in some areas
- Road safety audit: selected sections of NH and expressway sections have been subjected to audits, but not in all stages of development and very few of audit recommendations have been implemented
- Funding: there has been low level of funding, with Rs 520 million (\$11 million) in one year (2007-2008)
- A national road safety policy was formulated at the beginning of the decade, but it has not yet been adopted

B. Ongoing initiatives

In spite of all the initiatives taken so far, the road safety situation in the country has not changed. The reason for this has been identified as the absence of an institutional set-up with implementation and enforcement teeth. The Apex Committee formed by the Government of India to address road safety has recommended wide-ranging actions, including the enactment of a national road safety and traffic management act to ameliorate the safety problems. The Committee has also recommended the creation of a national road safety board with sweeping powers on various aspects of road safety

which can be implemented through state-level boards. The recommendations include:

- (a) Road-related measures—designing, setting standards and conducting audits
- (b) Vehicle-related measures—prescribing safety features
- (c) Road safety research—institutional linkages and training
- (d) Traffic laws related to operations and management
- (e) Capacity-building
- (f) Road user behavioural changes through public awareness and education
- (g) Medical care and rehabilitation
- (h) Other functions of liaison with national and international agencies on road safety

The enactment of the law has yet to take place. The concern of the government for road safety is now visible, however. The National Highways Authority of India is aiming to take up a road safety improvement programme with multilateral funding at the national level (for the NHDP) in order to chart a new course for road safety in the country.

C. Initiatives of the India chapter of IRF

The India chapter of IRF has taken up road safety as its mission. After three successive regional conferences on the objective of enhancing road safety through better planning, design, construction and operation of highways, the 2009 conference will address accident prevention through road safety measures. Its call for a drastic reduction in road fatalities by 50 per cent in three years is being objectively targeted through planned efforts of all of the government and private agencies involved in the development and management of roads and highways. The India chapter of IRF is also working with some of the build-operate-transfer entrepreneurs to create examples of best practices in the provision of built-in safety of the highest standards, which will meet the requirements of all road users. While advocating a mandatory road safety audit (RSA) for all new roads or their upgrades, the India chapter of IRF has also recommended various ways and means to make VRUs visible in traffic streams. It has also addressed the government and automobile manufacturers concerning the mandatory provision of in-vehicle safety devices similar to those available in the developed world, and the deployment of appropriate intelligent transport system (ITS) devices to assist in enforcement.

IV. ROAD SAFETY ACTION PLAN

On the basis of the current status of road safety in India, it is clear that a national mission is required to improve road safety. It would not be possible to reverse the growing trend of road accident casualties by any short-cut or piecemeal approach. This mission must have highly ambitious and time-bound targets, championed by the highest political echelon.

It has been observed through the audit carried out along sections of NH that some unsafe road user behaviours are the fallout of unsafe or inconvenient provisions by design and operations. At the same time, it was observed that road users with higher awareness levels also showed poor road use behaviour in the absence of enforcement measures. The objectives of the high-speed multi-lane highway for faster travel will be defeated if the dangers of using such roads in an incorrect way are not understood.

A. Safety audit

Safety is to be achieved by enhancing the safety capability of each of the elements of the road-vehicle-road user system. While vehicle and roadway safety can be enhanced by engineering improvements, road user behaviour appears to be a very vast and diffused problem, which can be addressed through public education. The vehicle safety (in new vehicles) has improved significantly in recent years. The engineering safety of the road is to be pursued uniformly through road safety audits. Audits of road user behaviour are never carried out, yet they are the weakest link in the process. A behavioural audit can reveal many issues which may vary by types of road user. Usually, RSAs do not cover behavioural audits that need to be addressed.

Road safety audit

A considerable amount of resources can be deployed with the aim of reducing accidents by improving the geometries and operational conditions of the roads. This can be achieved by a road safety specialist performing an independent check on the safety elements. The specialist, after systematic examination, can comment on the safety aspects of the road. RSA appears to be an ideal technology for improving road safety in India. As basic and accurate data on accidents have yet to be collected, preventive measures through prescriptions of RSA can help in a significant way by reducing accident occurrences due to faulty road geometrics and design.

Behavioural audit

The behaviour of road users is a very important dimension of the road safety problem, especially in India. With a low level of literacy and an

even poorer knowledge of road safety, the public at large is extremely vulnerable to traffic exposure. High-speed traffic, which is otherwise legitimate for the more rapid movement of people and goods across the country, has posed a serious problem for the population and activities located close to the national highways and other high-speed roads which do not have access control. A proper road use behaviour audit can identify all the incorrect behaviours of the road users that are incompatible with modern roads, and they need to be targeted through a road safety campaign. The high-speed roads being built under NHDP pass through many villages and towns, and they create ribbon developments, which obviously cause the frequent and unsafe exposure of the inhabitants of these villages and towns to the dangers of high-speed traffic.

The incorrect behaviours might be due either to a lack of knowledge of traffic and general safety rules or to defiant behaviour regarding the rules. For example, not responding to a warning sign by a driver might be due to not understanding the meaning of the sign or to overconfidence. A survey on national highways in India (NHAI, 2008) resulted in the following important findings on non-compliance with safety requirements:

- Vehicles travel in the wrong direction (in the opposite carriageway) for a short stretch to avoid travelling the extra distance to take a U-turn at the next median opening
- Due to long hours of continuous driving without adequate rest, truck drivers feel drowsy while driving
- Women in veils and burkas are vulnerable on the road due to their limited vision
- Small children unaccompanied by adults are vulnerable, as they may exercise poor judgment
- Groups of cyclists or pedestrians walking along the road are highly vulnerable to high-speed traffic
- Road users do not use safety devices such as helmets and seat belts
- Overloading is common in vehicles carrying both passengers and goods

B. Public education-cum-publicity campaign

All unsafe behaviours should be addressed through public education campaigns. The campaign may use different mediums and be sustained over a long period of time. The frequency and intensity of the campaign seems to have a significant effect on the correction or modification of behaviours, as seen in the NHDP corridors (NHAI, 2008). As the younger population has

more reception and absorption capacity and is more likely to be moulded to safer behaviours, school curricula need to be extended to include wider coverage of social behaviour relevant to road safety. Where such contents have already been included, their effectiveness may be evaluated. Unstructured publicity for social issues carried out in a sporadic manner has no impact; only the institutionalization of the road safety education campaign can make a difference. The extensive network of schools and colleges can provide an excellent basis for establishing a road safety cell (RSC) in each of these institutions to spread the road safety messages through campaigns and various other related activities. A coordinating mechanism, such as a road safety monitor (RSM), will be required to lead the activities; it can be developed at the grass roots level to champion the cause through a bottom-up approach, as the National Service Scheme (NSS) and the National Cadet Corps (NCC) were.

C. Enforcement campaign

An enforcement campaign is an important part of any road safety action plan. It should be initiated by setting up a mechanism in liaison with the road agencies (PWD, NHAI and municipal corporations), police officials and local village administrations to enforce safe road use practices. The enforcement campaign can be designed to target the following:

- Encroachments, if any, which can be dangerous for safe traffic movements should be removed
- Parked or stopped vehicles on the highway or urban roads (at unsafe locations) are to be promptly approached for immediate removal
- Speed limits can be set based on the adjoining land use, especially in populated areas, and enforced by the police
- Blood alcohol concentration (BAC) limit enforcement is very important in the reduction of alcohol-related road accidents
- Helmet and seat belt enforcements have a salutary effect in the reduction of injuries; enforcement should be stricter
- Stricter enforcement is called for to prevent talking on mobile phones while driving and even while crossing the road as pedestrian

The concept of citizen policing to supplement the efforts of traffic police force will significantly enhance the enforcement of capacity. While traffic police cannot be deployed everywhere, alternative policing arrangements can be made available at any location. A large network of

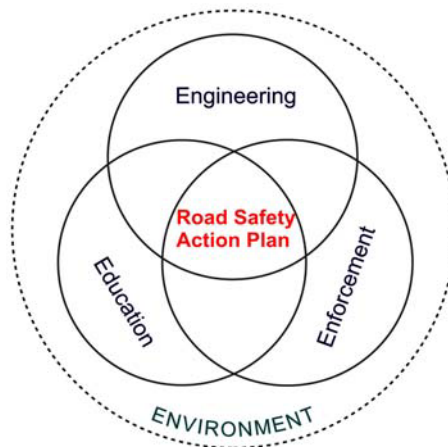
competent people (voluntarily enrolled citizens) with knowledge and training in traffic laws and enforcement systems can provide a wonderful service.

All road safety enforcement campaigns are to be taken up in coordination with a public education campaign, as the probability of behavioural change is high when the road users perceive that there is a higher chance of being detected. This campaign is to be aimed at increasing public knowledge about the traffic rules and raising awareness of increased enforcement.

D. Institutionalized effort

A well-designed road safety programme involving all of the 3 E's can bring about the desired change in the safety situation. A framework for such a programme for a typical highway corridor must be comprehensive, as shown in figure 5.

Figure 5. A conceptual framework for a road safety action plan



A realistic change in terms of a reduction in deaths and injuries is possible through a series of multi-pronged actions taken by a safety board or authority through the development and implementation of a comprehensive national road safety programme (NRSP) with the following components:

- (i) Road safety monitoring and evaluation programme;
- (ii) Institutional and capacity-building programme;
- (iii) Road safety demonstration and awareness programme, which may include the following:
 - Black-spot treatment programme

- Vehicle inspection and testing programme
- Driver training and testing programme
- Road safety audit and safety inspection
- Safety enforcement programme
- Road user education and awareness programme
- School road safety education programme
- Road accident emergency medical services programme

F. Mobilization of resources

Due to the poor safety records of the roads, the Government may create a dedicated fund to support the financing of road safety. The proposed national level road safety board is likely to have a separate budget exclusively targeted to safety outcomes. The problem has assumed such a dimension that resources from the Government alone may not be sufficient.

Additional resources may be tapped from insurance companies, automobile companies and oil giants, which can easily change the scale and speed of road safety-related activities in the country. For example, a small percentage from the compulsory third-party insurance premium for all motor vehicles can be collected in a central road safety fund for the provision of required safety features on every road. However, it is not only the shortage of the fund which has created the crisis. It is also the limited human resources and research facilities for dealing with road safety problems, which need to be addressed.

CONCLUSION

The massive road development programme of NHDP being undertaken in India is bringing huge benefits to the nation in terms of faster road travel. However, the road accident record in India is among the worst in the world, with an estimated 125,000 fatalities every year. With less than 1 per cent of the world's vehicle population, India accounts for 6 per cent of the world's road accidents and 10 per cent of the world's road fatalities. The rapid growth in vehicle ownership is closely following the highly ambitious road development plans. With plans for developing more than 50,000 km of high-speed roads without access control and adequate safety provisions and with poor road use behaviour, the consequent safety hazard is likely to be a potential threat to the entire country on the scale of an epidemic. The traffic engineering and basic enforcement and operation measures on non-urban roads in India are found to be grossly deficient and are considered to be the primary causes of accidents.

In order to mitigate the high level of risk to which the population with poor or little knowledge of road safety and safe behaviours are exposed, a

systematic action programme is required and should be undertaken as a national mission. A structured and targeted public education campaign to modify road user behaviour has to be an important component of the programme. It has also been observed that the frequency and intensity of the campaign has long-term impacts on knowledge and behaviour.

The safety initiatives in India in the past lacked objectivity and, therefore, could not make a great difference in safety outcomes. An action plan has been suggested with various ingredients from the three E's to remove the engineering deficiencies and modify road use behaviour. The Apex Committee recommendation that there should be a dedicated fund and an executive agency, such as a board, to implement time-bound targeted road safety projects is sound, as these measures can provide the necessary institutional set-up at the national and state levels. The proposed comprehensive action plan, along with the initiatives of the IRF India chapter, is likely to make a difference.

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