



RIGHT OF WAY

AN ASSESSMENT OF SAFETY AND ACCESSIBILITY OF ROADS IN INDIAN CITIES

A Centre for Science and Environment briefing paper



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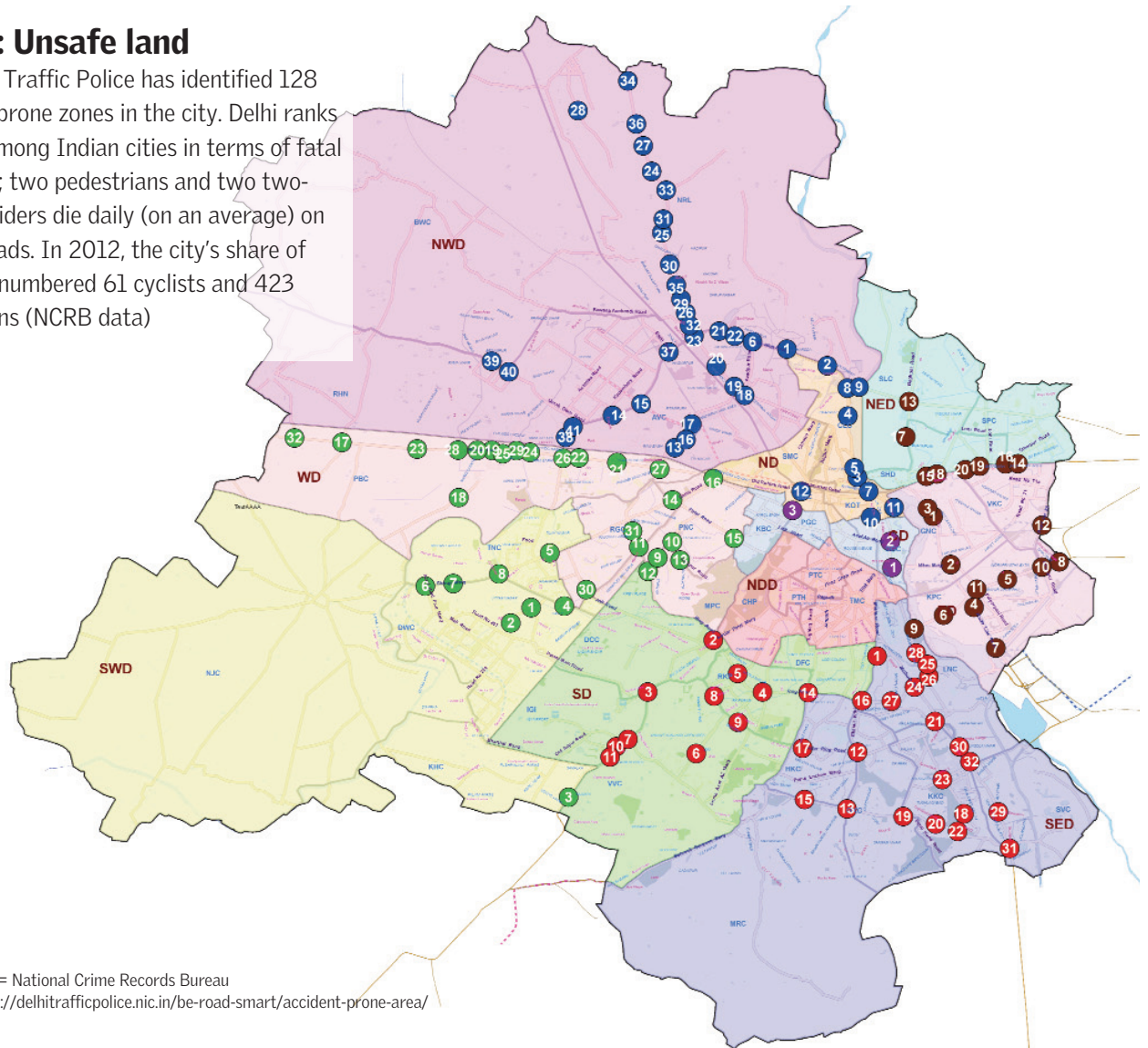
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Map 1: Unsafe land

The Delhi Traffic Police has identified 128 accident-prone zones in the city. Delhi ranks highest among Indian cities in terms of fatal accidents; two pedestrians and two two-wheeler riders die daily (on an average) on Delhi's roads. In 2012, the city's share of fatalities numbered 61 cyclists and 423 pedestrians (NCRB data)



Note: NCRB= National Crime Records Bureau
Source: <http://delhitrafficpolice.nic.in/be-road-smart/accident-prone-area/>

- **Central Delhi:** 1. ITO/IP Flyover 2. Rajghat 3. Faiz Road Crossing/Idgah
- **East & North-east Delhi:** 1. Geeta Colony Flyover 2. Shakarpur Chungi 3. Shamshan Ghat Geeta Colony 4. Akshardham Mandir 5. East Vinod Nagar/Mv li Red Light 6. Khel Gaon 7. Mayur Vihar Extension 8. Murga Mandi Flyover 9. Nizamuddin Yamuna Bridge 10. Underpass Ghazipur Red Light 11. Underpass Patparganj 12. Anand Vihar ISBT 13. Khajoori Chowk 14. Dilshad Garden 15. Dharampura Red Light 16. MS Park Metro Station 17. Pusta New Usmanpur 18. Seelampur T-point 19. Shahdara Flyover 20. Shyam Lal College
- **New Delhi & North-west Delhi:** 1. Burari Chowk 2. Gandhi Vihar Bus Stand 3. ISBT K Gate 4. Majnu Ka Tila 5. Monastery Ring Road 6. Mukand Pur Chowk 7. Nigam Bodh Ghat 8. Wazirabad 9. Wazirabad Pull 10. Kabootar Market 11. Vijay Ghat 12. DCM Chowk 13. Britannia Chowk 14. Deepali Chowk 15. Madhuban Chowk 16. Shakurpur Red Light 17. Wazirpur Depot 18. Azadpur Bus Terminal 19. Azadpur Chowk 20. Azadpur Sabzi Mandi 21. Bhalswa Chowk 22. Jahangirpuri Bus Stand 23. Mukharba Chowk 24. Bakoli Bus Stand 25. Budhpur Ganda Nala/Hanuman Mandir Budhpur 26. CNG Pump Sanjay Gandhi T-point 27. Khampur Village 28. Lala Harishchander Hospital 29. Libaspur Bus Stand 30. Nangli Budhpur Village/Mohan Vilas Farmhouse 31. Sai Baba Mandir 32. SGT Nagar 33. Shani Mandir 34. Singhu Border 35. Swaroop Nagar 36. Tikri Khurd Bus Stand 37. Haider Pur 38. Mongol Puri Flyover 39. Rama Vihar 40. Sec 23 Petrol Pump 41. West Enclave Red Light
- **South & South-east Delhi:** 1. Shamshan Ghat Barapulla 2. Dhaula Kuan 3. Sanjay T-point 4. Hyatt Hotel 5. Moti Bagh Flyover 6. Ambience Mall 7. Mahipalpur Flyover 8. Malai Mandir 9. Munirka 10. Radisson Hotel 11. Shiv Murti 12. Chirag Delhi Flyover 13. Khanpur T-point 14. AllIMS 15. DC Office 16. Moolchand 17. Panchsheel Flyover 18. ESI Hospital, Anand Mai Marg 19. Hamdard Ngr Red Light 20. Kaya Maya Hospital 21. Modi Mill Flyover 22. Okhla More 23. Roundabout Okhla Estate 24. Ashram Chowk 25. Barapulla Ring Road 26. DND Flyover 27. Lajpat Nagar 28. Sarai Kale Khan 29. Ali Village 30. Harkesh Nagar 31. Jaitpur More 32. Sarita Vihar Flyover
- **West & South-west Delhi:** 1. Dada Dev Hospital 2. Power House Mahavir Enclave 3. Rajokri Flyover 4. Dabri Flyover 5. Janakpuri East 6. Kakrola Dwarka More 7. Nawada Village 8. Uttam Nagar Metro Station 9. Kapoor Hospital 10. Loha Mandi 11. Maya Puri Chowk 12. Naraina 13. Pusa Gate Inder Puri 14. Moti Nagar Flyover 15. Roundabout Pusa 16. Zakhira Flyover 17. Ghewra More 18. Karan Vatika Nihal Vihar 19. Kirari More 20. Krishna Garden 21. Madi Pur Metro Station 22. Paschim Vihar Metro Station 23. Mundka Metro Station 24. Nangloi DTC Depot 25. Pani Ki Tanki 26. Peera Garhi Chowk 27. Punjabi Bagh Chowk 28. Rajdhani Park 29. Surajmal Metro Station 30. Gate No 3 Tihar Jail 31. Gurudwara Raja Garden 32. Tikri Village

Walk, cycle, and public transport will not work if people are not safe, are injured or die while accessing jobs, educational services, markets, recreation and a range of daily chores. Road injuries and deaths have recorded an unacceptable increase in Indian cities. An astounding number of walkers, cyclists, public transport users and poor people meet a similar harsh fate on roads.

This has spurred Centre for Science and Environment (CSE) to assess the accident risk in Indian cities, investigate accident hotspots in Delhi and carry out a safety audit of selected streets of Delhi to identify the factors contributing to unsafe roads. This has helped assess policy gaps to understand the solutions and the way forward. This assessment has become necessary at a time when Delhi and other cities face the daunting challenge of increasing the share of public transport along with walking and cycling for clean air and public health, and reduce fuel guzzling and climate impacts.

This analysis has exposed how fatal road accidents have increased phenomenally because Indian cities are prioritising high speed roads for vehicles instead of safe access for all road users. This needs to be reversed to create well designed space for walkers and cyclists, allow safe crossing at grade, reduce friction with high speed vehicles, calm and slow down traffic, give priority to walkers and cyclists and public transport users in the road design, and make penalty and deterrent more stringent for a zero tolerance policy for accidents.

DEATH TOLL 2012

In some other Indian cities

KOLKATA

34 cyclists
276 walkers

MUMBAI

28 cyclists
264 walkers

VIJAYWADA

23 cyclists
207 walkers

NAGPUR

30 cyclists
123 walkers

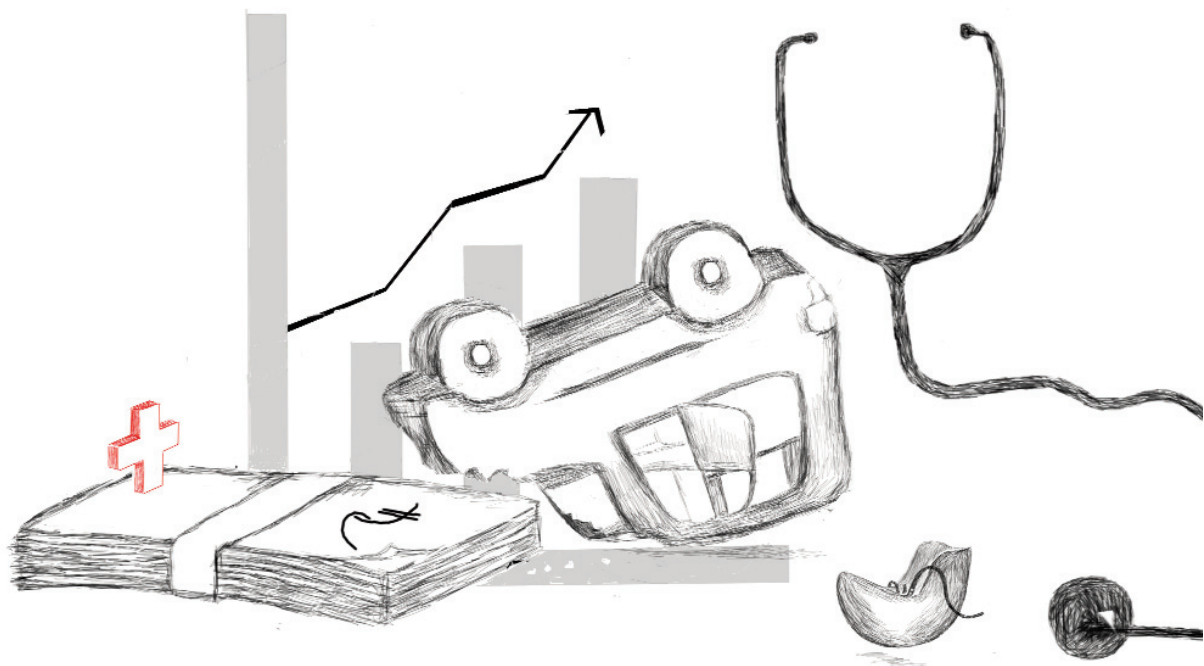
CHENNAI

58 cyclists
103 walkers

A. Road injury and public health

The World Health Organization (WHO) now classifies disability, unproductive life years, and premature deaths related to road injuries as a significant health impact of motorisation. The recent estimates of Global Burden of Disease (GBD), a report brought out jointly by a group of international organisations including the WHO, has changed the way health impacts of motorisation are conventionally understood, by including deaths and illnesses from road accidents as well as air pollution within its ambit. Both are the impacts of rapid motorisation (*see Graph 1: Disease burden, motorisation and road accidents*). The GBD report ranks road injuries as the world's eighth leading cause of death and the number one killer of young people aged 15 to 24. If deaths due to road injuries and air pollution from vehicles are combined, then they exceed the tally from HIV, tuberculosis or malaria.

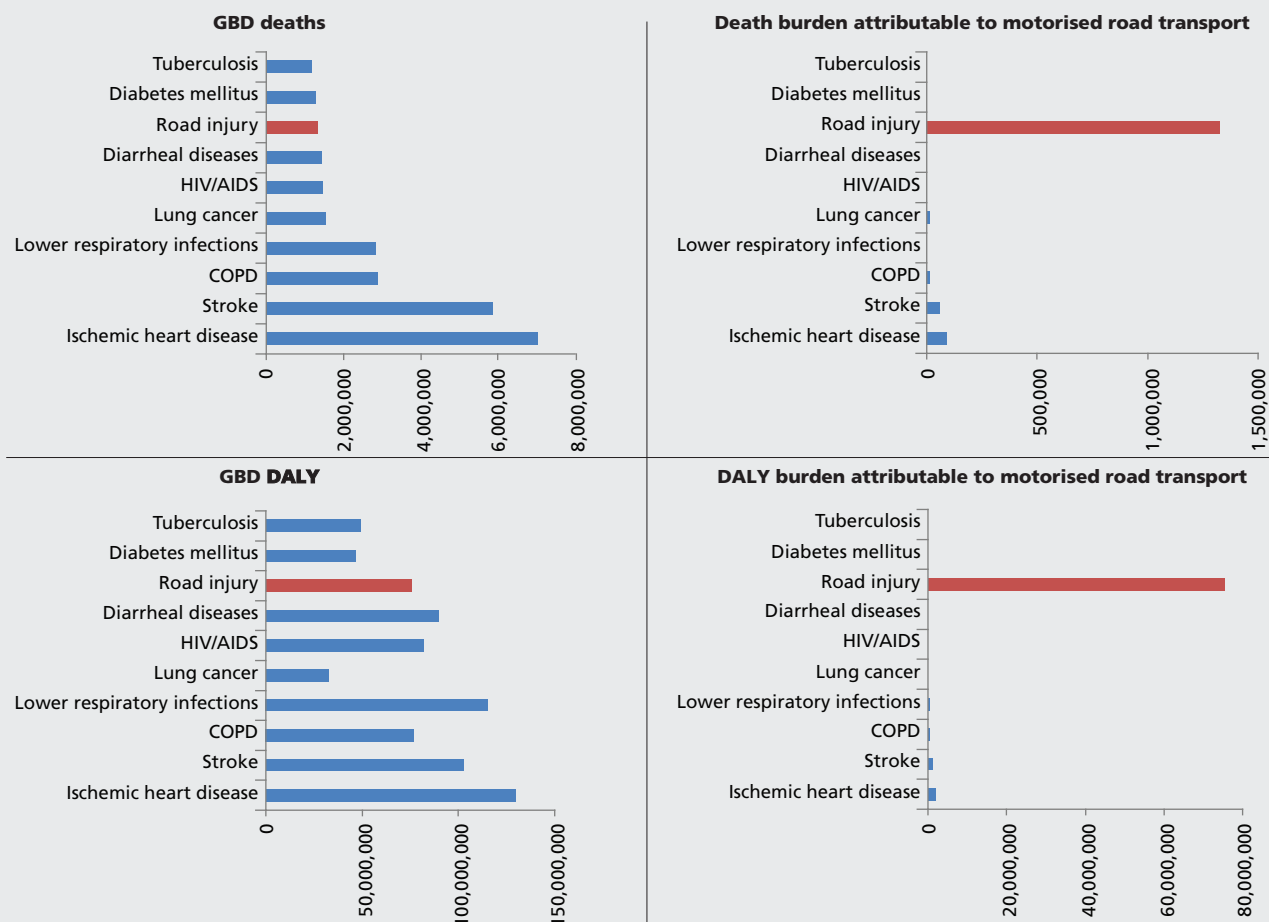
Globally, there has been significant increase in healthy years lost due to road injuries and outdoor air pollution between 1990 and 2010. When the rate of healthy years lost due to injuries and air pollution from motorised road transport in 2010 is added, the damage is overwhelming (*see Graph 2: Change in burden of disease from air pollution and road injuries*).



JUHI JHA / CSE

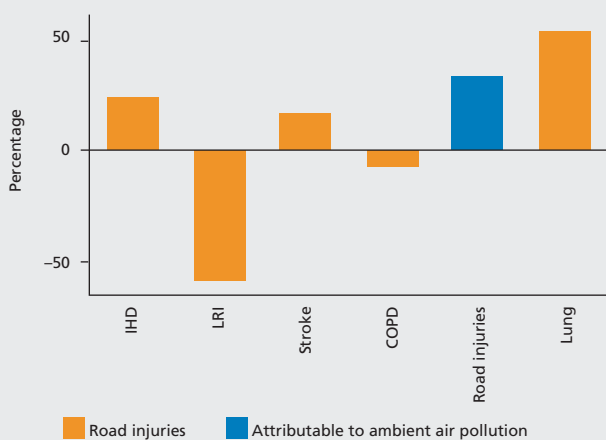
Graph 1: Disease burden, motorisation and road accidents

The death and DALY burden of motorised road transport rides way above other causes

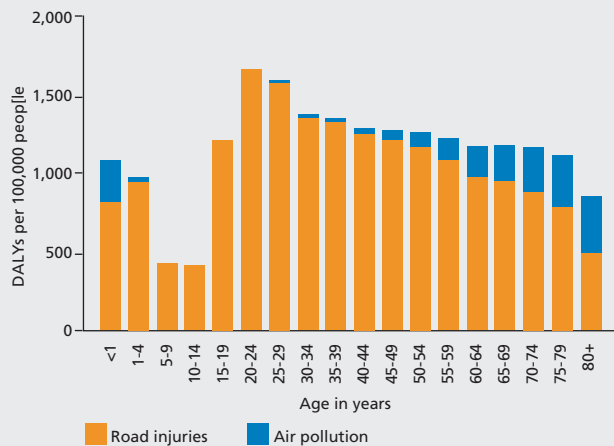


Graph 2: Change in burden of disease from air pollution and road injuries

Global shift in healthy years lost due to road injuries and outdoor air pollution, 1990-2010



Rate of health years lost to injuries and air pollution from motorised road transport, 2010



Notes: GBD= Global Burden of Disease, COPD= Chronic Obstructive Pulmonary Disease, DALY= Disability Adjusted Life Years, IHD= Ischemic Heart Disease, LRI= Lower Respiratory Infections.
Sources for graphs 1 & 2: Global Road Safety Facility, The World Bank; University of Washington, *Transport for Health: The Global Burden of Disease from Motorised Road Transport*, Seattle, WA, Washington DC, 2014

B. Chilling statistics

Explosive trend in Indian cities: According to the Union ministry of road transport and highways, close to 500,000 road accidents were reported in the year 2012. As much as 11 per cent of the global road injury deaths occur annually in India alone. These numbers are equal to wiping out close to 40 per cent equivalent population of a nation like Maldives. India also displays a very disturbing trend — over the last two decades, while the total number of accidents and injury shows only a small downward dip, fatalities have increased very sharply, from 18 per cent in 2003 to 25 per cent in 2012. More people are dying now as cities allow vehicles to have more speed on roads, while depriving people of safe access to these same roads (*see Graph 3: Road accidents and consequences*).

Fatalities go up
2003 18%
2012 25%

Accident rates rising in smaller cities: Highly motorised cities like Mumbai, Chennai, Delhi and Bengaluru top the list with the highest numbers of injuries and deaths as recorded by the Union ministry of road transport and highways. Mumbai has the highest number of all types of accidents, while Delhi records largest number of fatal accidents among all cities. Studies now indicate that smaller cities that have newly built highways, show increasing vehicle conflict and accident risks — Lucknow, Vadodara and Agra are some examples (*see Graph 4: Cities on killer roads and Table 1: Fatal tally*).

Delhi tops: Delhi ranks the highest in terms of fatal accidents and in number of pedestrians and cyclists falling victim to road crashes. The total number of accidents in 2013 was 9 per cent higher than the 2012 level. The ministry's report titled *Road Accidents in India 2012*, shows that on an average, about five road accident deaths occur every day, which includes two pedestrians and two two-wheeler riders. Every week, two cyclists and one car rider dies in Delhi (*see Graph 5: A dubious trend in Delhi*). In 2014 (till the month of May), road accidents had claimed 325 lives during the night and 332 lives in the day time. Violation of rules is rampant — with 329,000 cases of signal jumps, over 14,000 cases of drunken driving and 45,158 cases of overspeeding being reported. Chennai, which follows Delhi in road accident deaths, reports 25 per cent less fatalities.

Table 1: Fatal tally

Cities and their dead; Delhi tops the list of fatalities

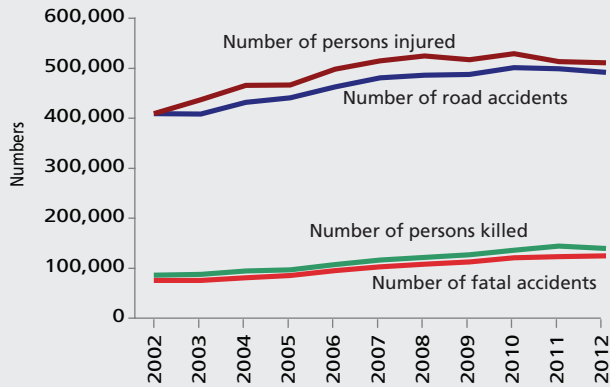
	No of persons killed (approximation)
Delhi	1800s
Chennai	1400s
Bengaluru	700s
Kanpur, Patna	500s
Kolkata, Lucknow, Mumbai, Hyderabad, Indore, Meerut, Agra, Allahabad, Pune	400s
Jaipur, Vizag, Ghaziabad, Vijaywada, Raipur, Mallapuram, Jodhpur, Bhopal	300s
Nagpur, Jabalpur, Coimbatore, Ludhiana, Ahmedabad, Faridabad, Gwalior, Surat, Asansol, Durgapur, Varanasi, Kollam	200s
Aurangabad, Jamshedpur, Khozikode, Vadodara, Thiruvananthapuram, Nasik, Rajkot, Kochi, Thiruchirapalli, Chandigarh, Madurai, Thricchur, Kota	100s
Amritsar, Kannur, Srinagar, Dhanbad	50-90

Source: *Road Accidents in India 2012*, ministry of road transport and highways (MORTH), Government of India, New Delhi

Young and productive people at maximum risk: Nationally, the young population (till 24 years) constitutes 40 per cent of the victims, other than motor vehicle drivers (*see Graph 6: How old?*). In 2012, about 5,879 children in the age group 0-14 years and about 26,709 young adults in the age group 15-24 years were victims of road accidents. The most affected victims other than

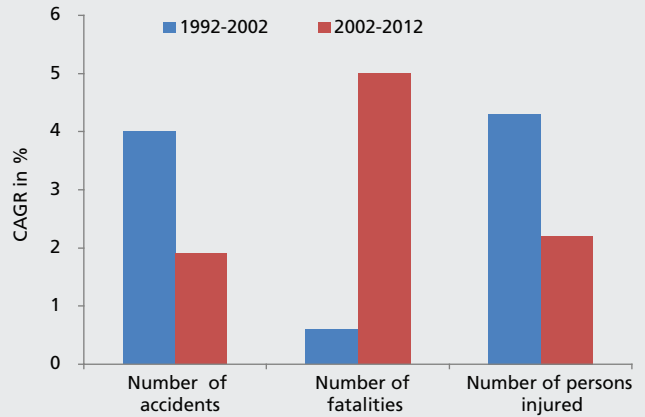
Graph 3: Road accidents and consequences

A. Trends — India



Source: Road Accidents in India 2012, MORTH, Government of India, New Delhi

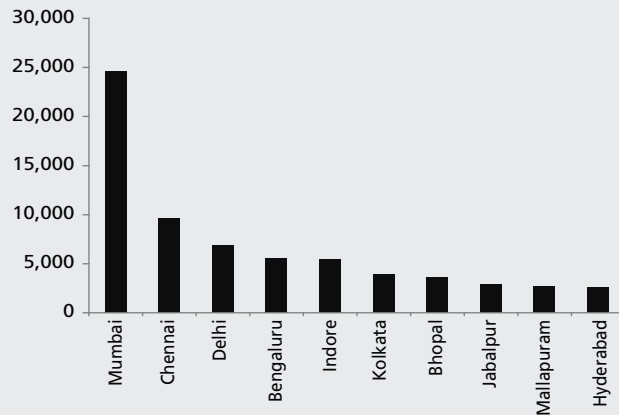
B. Decadal growth rates



Note: CAGR= Compound Annual Growth Rate

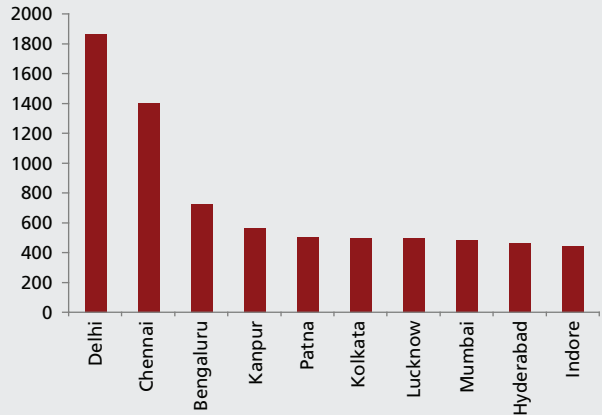
Graph 4: Cities on killer roads

A. Total number of accidents



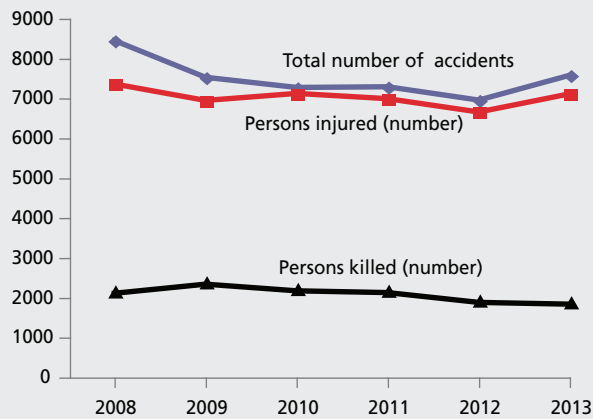
Source: Road Accidents in India 2012, MORTH, Government of India, New Delhi

B. Total number of persons killed



Graph 5: A dubious trend in Delhi

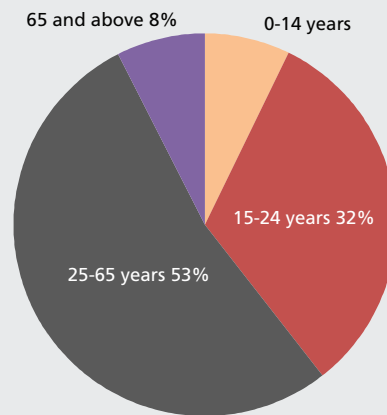
Nine per cent hike in total number of accidents in 2013 compared to 2012



Source: <http://delhitrafficpolice.nic.in/about-us/statistics/>

Graph 6: How old?

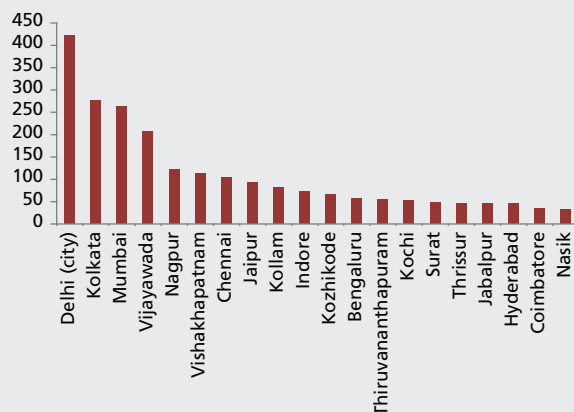
Age profile of road accident victims (other than drivers) in India



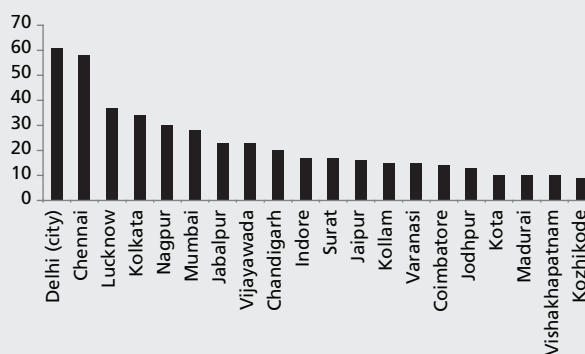
Source: Road Accidents in India 2012, MORTH, Government of India, New Delhi.

Graph 7: Walker and cyclist deaths in Indian cities, 2012

A. Pedestrian road accident deaths



B. Cyclists road accident deaths



Source: National Crimes Records Bureau report 2012, <http://ncrb.nic.in/CD-ADSI-2012/table-1.8.pdf>

Walkers as victims in Delhi

44%

2006-2009

8,503 killed

51% walkers

drivers were those in their most productive phase of life — 25-65 years. As much as 53 per cent of the victims fell in this bracket. The economic, societal and emotional cost of this is enormous.

Walkers and cyclists most vulnerable: Globally, walkers and cyclists together make up a quarter of the road injury and death victims. In India, the national database on pedestrians and cyclists is very poor, but data from individual cities shows very high risk. In Delhi, the share of pedestrians falling victims to road crashes is as high as 44 per cent — the highest among key metro cities. According to an IIT study, 51 per cent of the 8,503 fatalities in 2006 to 2009 were pedestrians. Among motorised vehicles, two-wheelers are the most vulnerable (*see Graph 7: Walker and cyclist deaths in Indian cities*).

Evidence from AIIMS Trauma Centre points to grievous public health impact:

At the trauma centre of the All India Institute of Medical Sciences (AIIMS) in Delhi, which can handle only 15,000 cases, almost 60,000 are reported every year, with a 10 per cent annual increase. Approximately 5,000 cases require major operations. Of the total cases reported for injuries, head injuries account for 40 per cent while orthopaedic and torso injuries are 30 per cent. In cases of brain injuries, there is only 40 per cent chance of recovery. Most of the pedestrians who are brought to the trauma centre belong to the lower socio-economic strata.

Amit Gupta, additional professor of trauma surgery at the centre, says that about 31 per cent of the cases brought to the trauma centre are in the age group of 21-30, followed by those in the age group of 31-40 (about 19 per cent). Of all the victims, as much as 28 per cent are pedestrians. Cyclists and car victims make up 9 per cent each. Two-wheeled motorcycle riders constitute the biggest group among the victims, and one of the major reasons for this is that they do not wear helmets. While 63 per cent of those driving two-wheelers wear helmets, as many as 86 per cent of the pillion riders do not.

C. Delhi trends

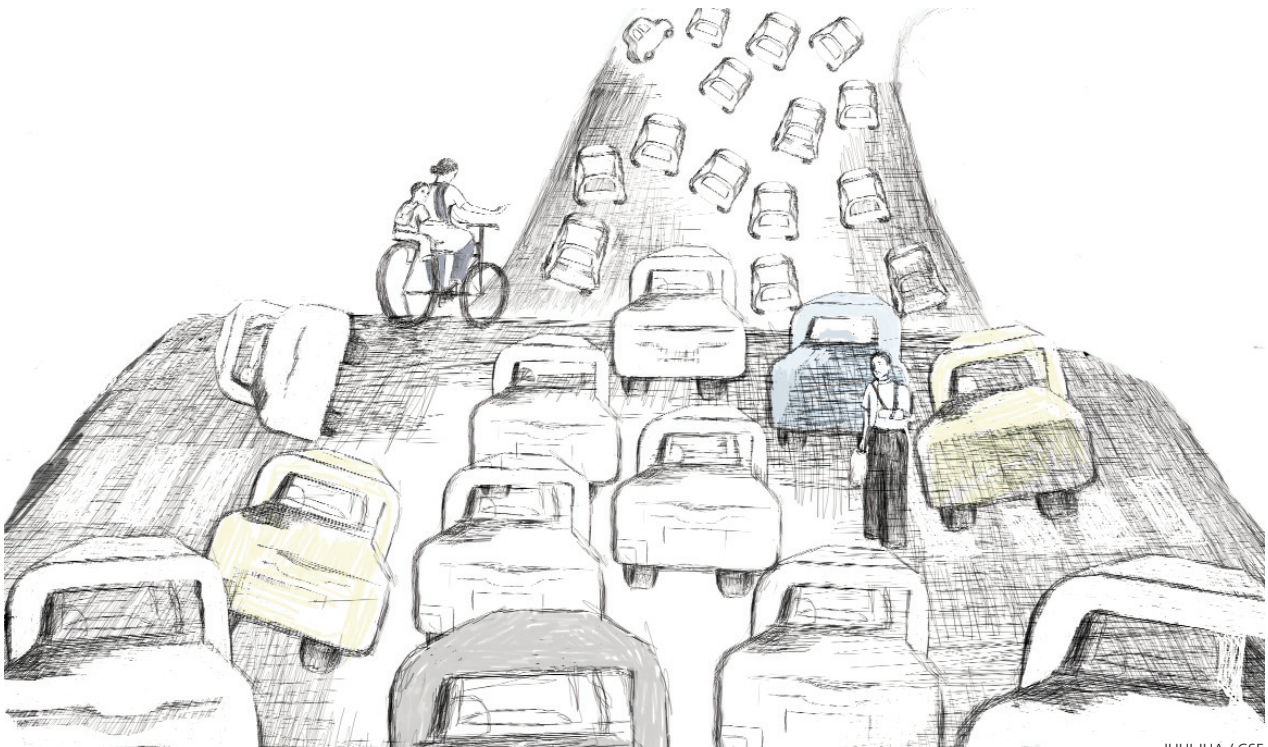
CSE has reviewed city's 128 accident-prone zones, as identified by the traffic police in Delhi (see *Map 1 on page 4: Unsafe land*). These areas record three or more fatal accidents or 10 or more total accidents within a 500-metre (m) diameter. The review has helped to understand the factors that contribute to accident risk in different sites.

The results: The key spots include Narela, Punjabi Bagh, Civil Lines, Kalyanpuri, Shahdara, Model Town, Kalkaji, Lajpat Nagar and Ashok Vihar. Together, these areas record 60 per cent of the total accidents in Delhi. Other prominent hotspots include Vasant Vihar, Rohini, Hauz Khas, Sarita Vihar, Patel Nagar, Greater Kailash, Delhi Cantt, R K Puram etc (see *Graph 8: Geographical spread of accident-prone zones*).

Killer roads: A majority of the accidents occur on signal-free arterial roads. Only eight roads: the Ring Road, Outer Ring Road, GT Karnal Road, Rohtak Road, GT Road, NH-24, NH-8 and Mathura Road, account for about three-fourth of the total accidents in Delhi. Nearly 20 per cent of all accidents occur on the Ring Road, 14 and 12 per cent on Outer Ring Road and GTK Road, respectively. Of the total accidents recorded on accident-prone roads, 33 per cent are fatal (see *Graph 9: Deadly roads*).

Fatalities on accident-prone roads

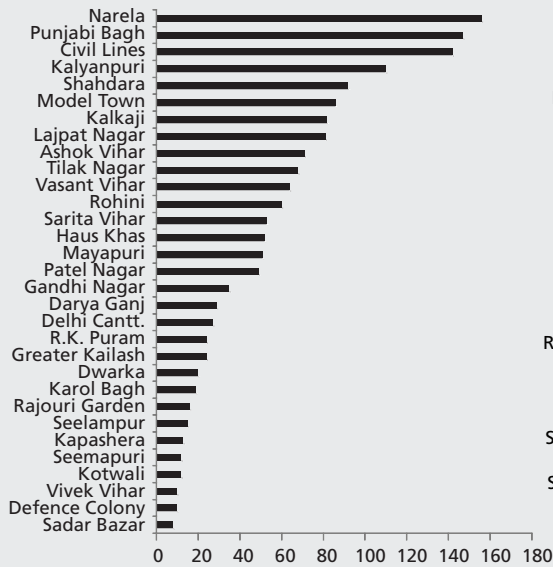
33% of the
total accidents



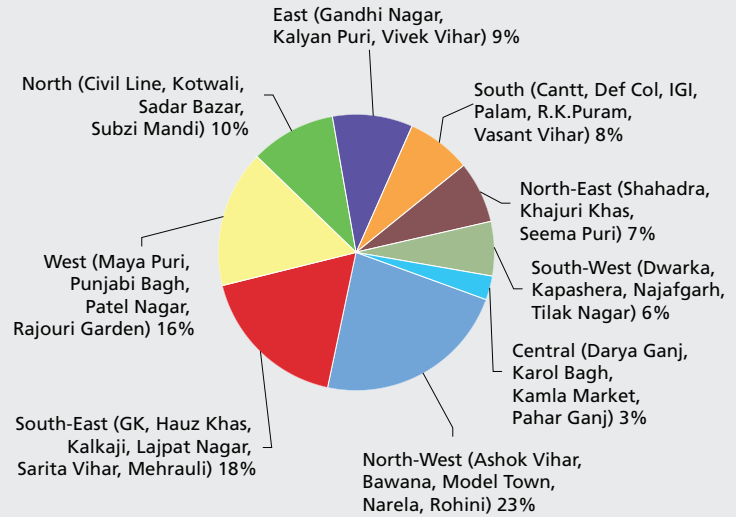
JUHI JHA / CSE

Graph 8: Geographical spread of accident-prone zones

A: Number of total accidents in different traffic



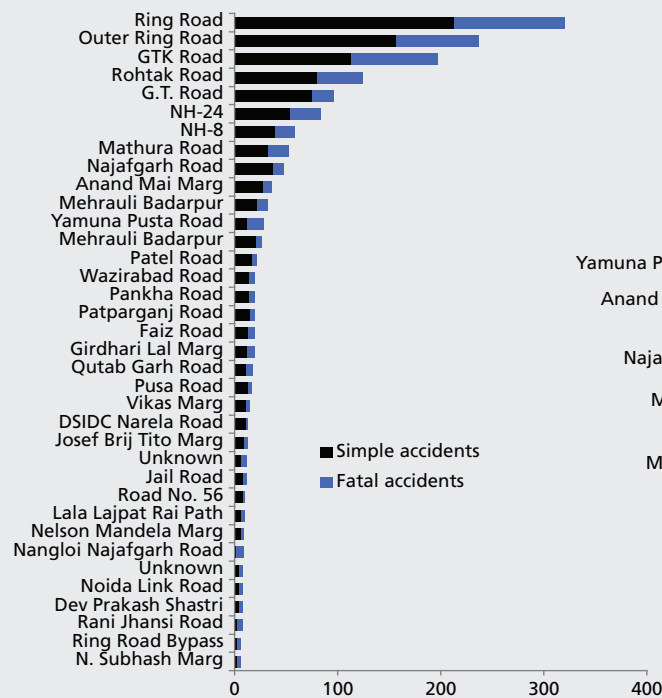
B: Percentage of accidents in different districts management circles



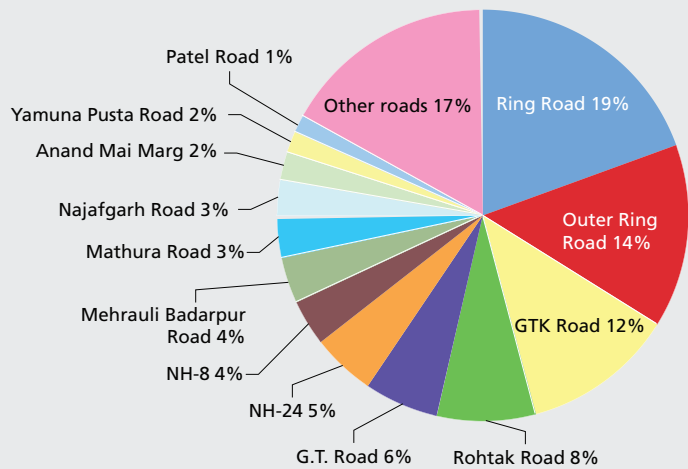
Source: Based on data shared by Delhi Traffic Police

Graph 9: Deadly roads

A: Number of total accidents on different roads — fatal and simple



B: Delhi's roads — share of total accidents



Source: Based on data shared by Delhi Traffic Police

D. The most vulnerable

The review of 128 accident-prone spots in Delhi shows that most accidents occur near flyovers and intersections; more than 40 per cent happen close to flyovers and 30 per cent at unsafe crossings and junctions (*see Graph 10: Designed to damage*). Substantial numbers of accident hotspots also occur near public transport hubs. This shows that the nature of road design has significant bearing on accident risk, with built environment enhancing the risk.

Of the total hotspots identified near flyovers, about 27 per cent are on the Ring Road, 17 on GT Karnal Road, 13 on Outer Ring Road and 6 per cent on Mathura Road. It is important to note that the eight key arterial roads that record nearly 75 per cent of all deaths, have been designed as high speed corridors. These roads have received the maximum attention and resources from the government — including widening for six-eight lanes, flyovers to allow seamless travel for vehicles, subway crossings and foot overbridges to prevent people from crossing on the surface and obstructing traffic flow, and closing of medians to allow vehicles to move uninterrupted. These features have turned these arterial roads into death traps. Especially deadly are the places where the flyovers begin, where traffic merges at full speed. These include the flyovers at Dhaula Kuan, AIIMS, Sarita Vihar, Mahipalpur, Rajokri, Akshardham, Dabri, ITO/IP and Moti Bagh (*see Graph 11 : Flyovers are high risk zones*).

The Transport Research and Injury Prevention Programme (TRIPP) of the Indian Institute of Technology, Delhi has studied the AIIMS flyover. It has found that after the construction of the flyover, the speed of vehicles increased by 21.5 per cent, 22.6 per cent, 15 per cent and 31.6 per cent respectively for heavy vehicles, cars, three-wheelers and two-wheelers. Increased speed shortened the time gap at every stage of crossing. The probability of pedestrian fatality with a specific vehicle group increased 67 per cent, 100 per cent, 100 per cent, and 200 per cent, respectively. Nearly 22 per cent of pedestrians continued to choose high risk crossing at grade, despite the presence of a pedestrian underpass (*see Graph 12: Faster and deadlier*).

No accident hotspots in Lutyens' Delhi: Central Delhi — built around rotary, largely four-lane roads and with nearly no flyovers — shows the least number of accidents. Even though the design of the rotaries are older and can be improved to reduce vehicle friction and encourage safer passage for cyclists, this has proved to be more preventive than the high speed corridors.

Maximum accidents occur at night and early morning: As much as 50 per cent of accidents occur at night, and 33 per cent between 6 PM and 12 AM. This only reinforces the fact that any road condition that allows the vehicles to increase speed enhances accident risk.

Many hotspots near bus and Metro stations — these compromise safe access to public transport: It is very disturbing that the access paths to public transport

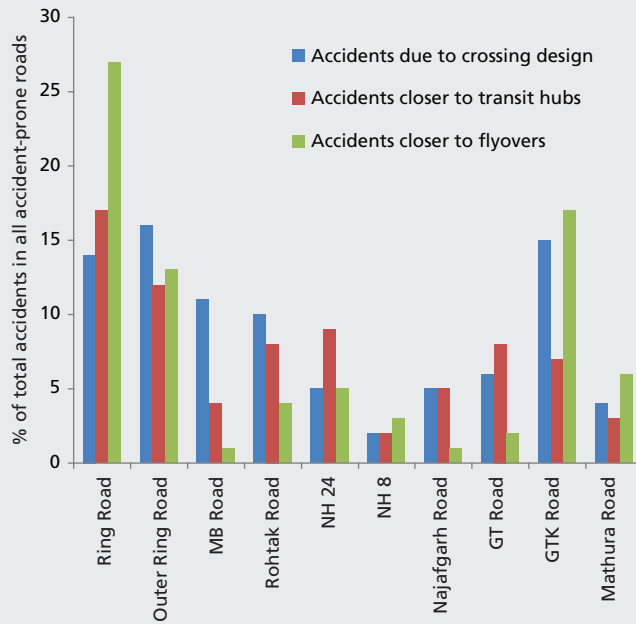
8 key arterial roads

All designed as high speed corridors

75% of all deaths on these roads

Graph 10: Designed to damage

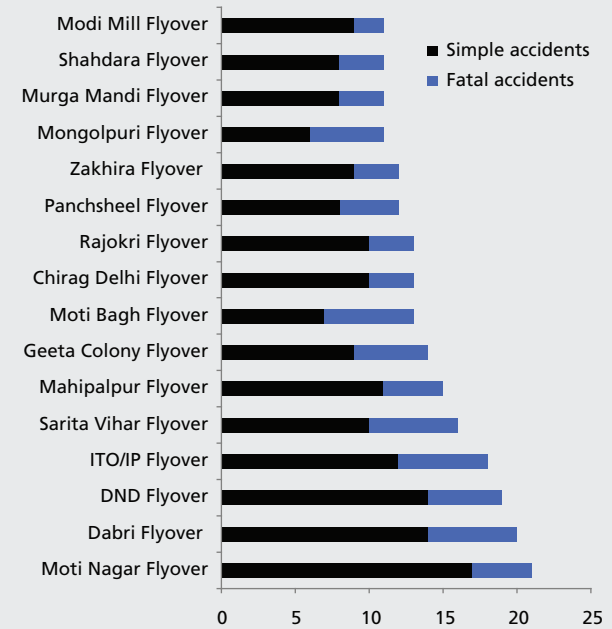
Accidents occurring due to road design



Source: CSE analysis of accident data provided by Delhi Traffic Police

Graph 11: Flyovers are high risk zones

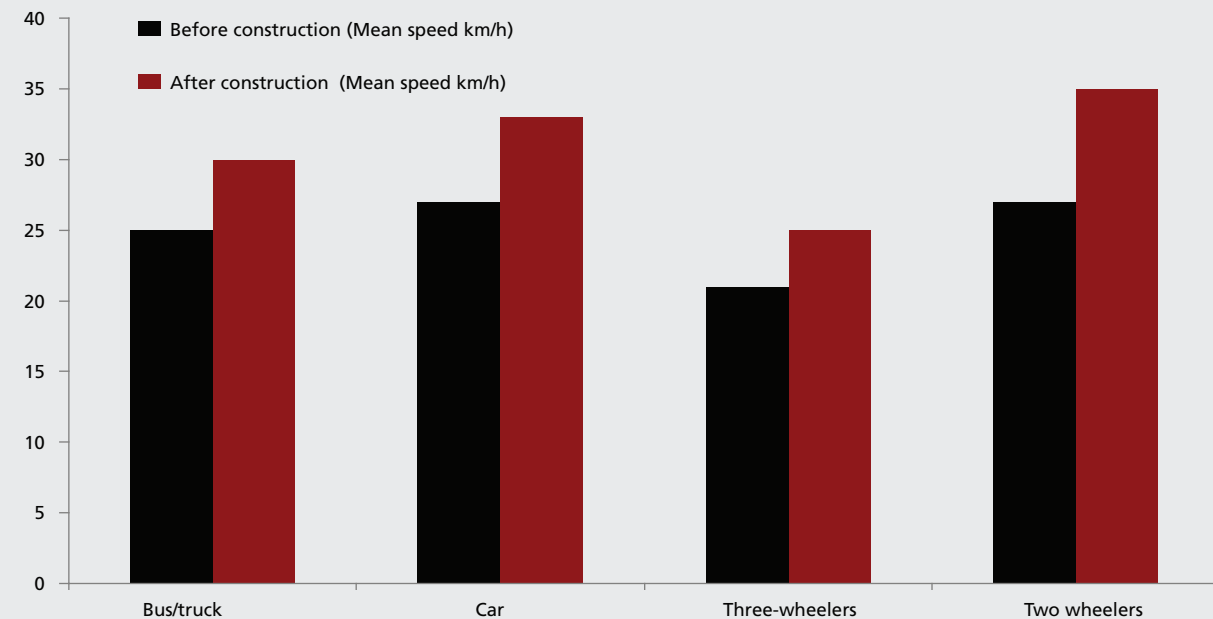
Flyovers increase speed and high accident risk



Source: Delhi Traffic Police

Graph 12: Faster and deadlier

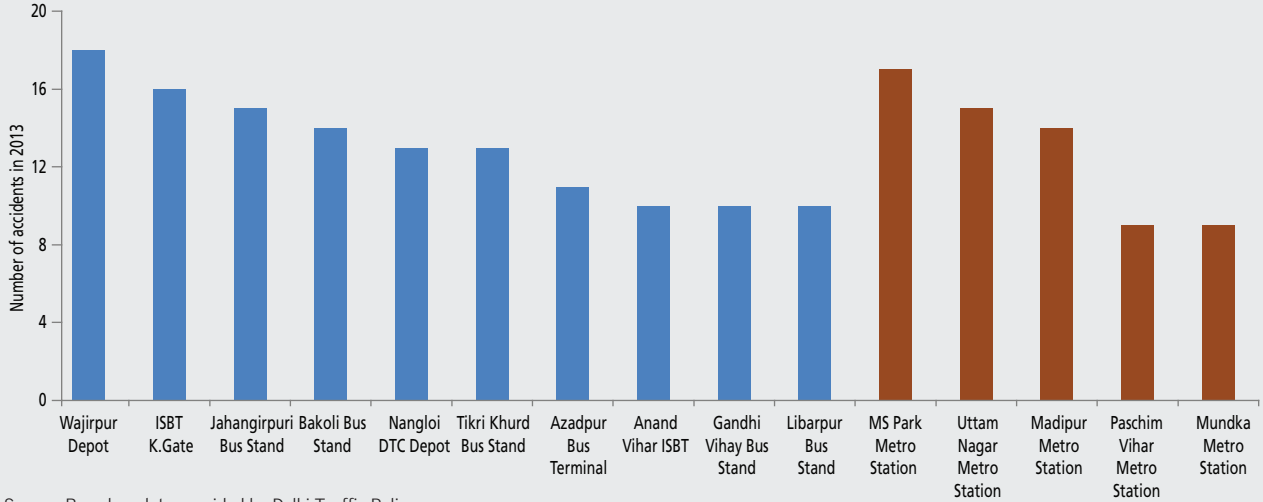
Change in speed of vehicles after the construction of the AIIMS flyover



Source: G Tiwari, Transport Research and Injury Prevention Programme, IIT Delhi, 2013

Graph 13: Accidents near public transport nodes

Access to bus and Metro stations are also unsafe

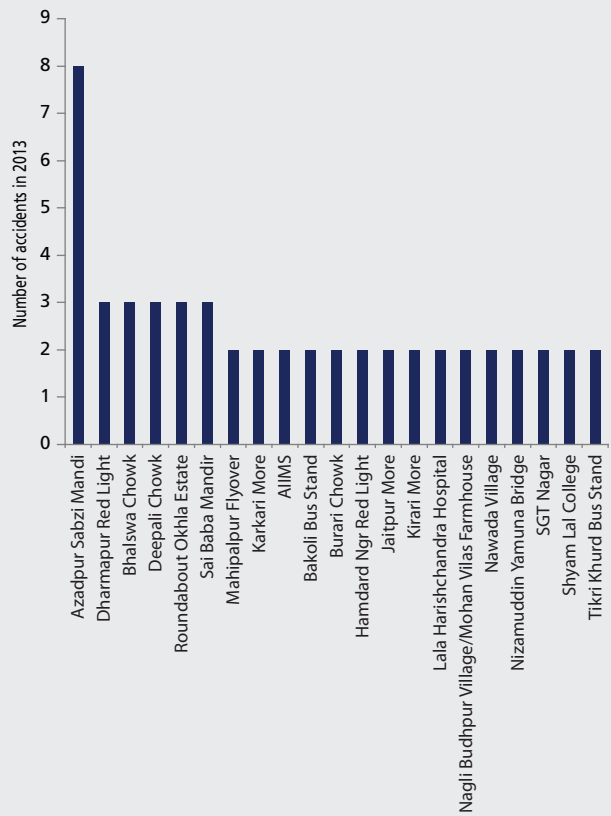
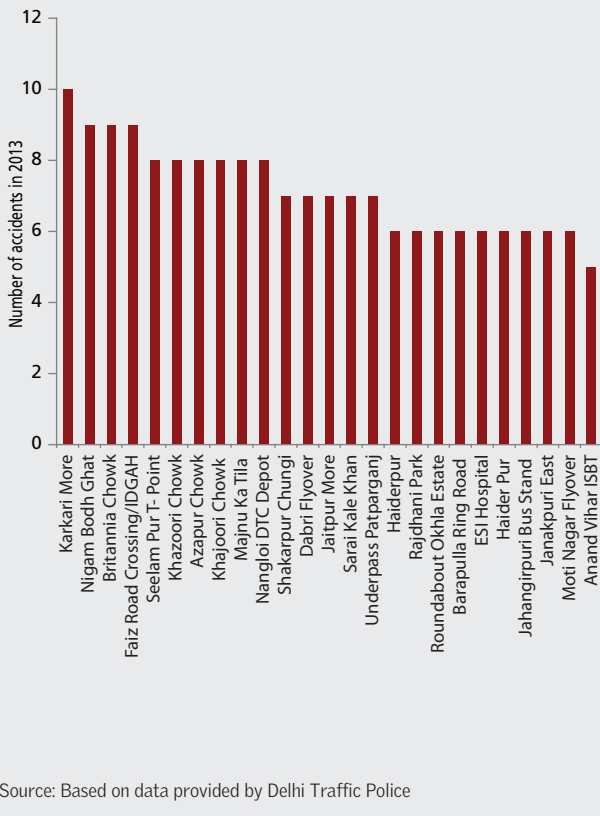


Source: Based on data provided by Delhi Traffic Police

Graph 14: Dare to walk and cycle on Delhi's roads?

A. Key pedestrian accident spots

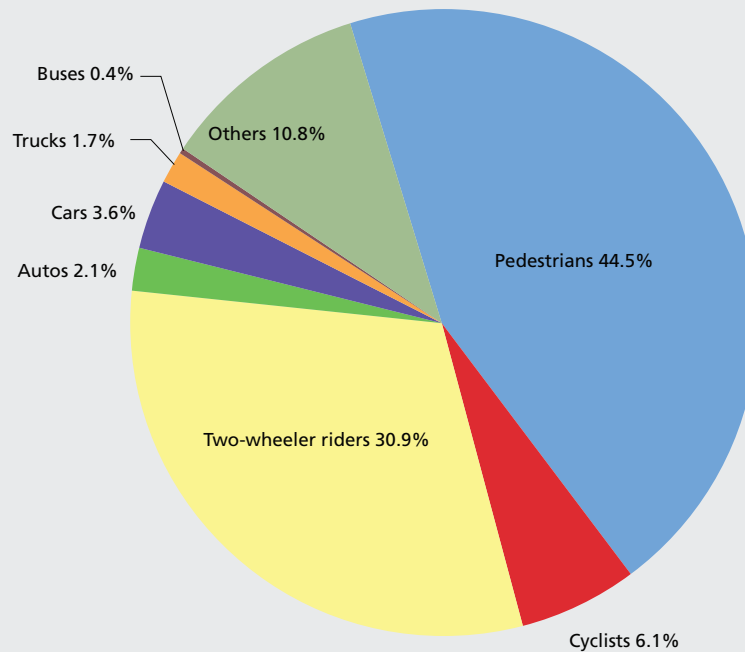
B. Key cyclist accident spots



Source: Based on data provided by Delhi Traffic Police

Graph 15: Who is vulnerable in Delhi?

Pedestrians and cyclists make up 50 per cent of the total victims



Source: *Road Accidents in India 2012*, MORTH, Government of India, New Delhi

1.3-4 times hike in pedestrian accidents in areas near public transport nodes, markets etc

nodes including bus depots, bus stations, bus terminals and Metro stations show high incidence of accidents. Some of the notorious stretches are near ISBT gate, Anand Vihar ISBT, Pashchim Vihar Metro Station, Uttam Nagar Metro Station, Jahangirpuri bus stand, etc. Ten bus stops listed as accident spots account for 8 per cent of the total accidents, and include the Kashmere Gate and Wazirpur stops. Among the Metro stations, those at Mansarovar Park, Uttam Nagar and Madipur are the major accident spots. This is a serious matter in view of the fact that lack of safety in accessing public transport can compromise public transport usage (see *Graph 13: Accidents near public transport nodes*).

High pedestrian accidents: In 2013, 56 zones for pedestrian accidents were identified by the traffic police; 21 such hotspots have been identified for cyclist accidents. Areas near public transport nodes, major markets and low income locations are where there has been an increase in pedestrian accidents. In some locations, the numbers have increased by 1.3 to four times during 2012 and 2013 (see *Graph 14: Dare to walk and cycle on Delhi's roads?*). Some key accident spots, especially vulnerable for pedestrians, include Karkari More, Nigam Bodh Ghat, Britannia Chowk and Faiz Road Crossing; for cyclists, the stretches include Azadpur Subzi Mandi, Dharampura Red Light, Bhalswa Chowk and Deepali Chowk. According to the *Street Design Guideline* document of the UTTIPEC (Unified Traffic and Transportation Infrastructure (Planning and Engineering) Centre of the Delhi Development Authority), 40 per cent of the

total road length of Delhi has no sidewalks. Not surprising then, that 44 per cent of Delhi's accident victims are pedestrians (*see Graph 15: Who is vulnerable in Delhi?*).

Increase in bicycle accidents: Twelve accident-prone zones were identified by the traffic police for cyclist victims in 2012; in 2013, newer locations have come up. The zones especially vulnerable for cyclists include Azadpur Sabzi Mandi, Shyamlal College, Nizamuddin Yamuna Bridge, Mahipalpur Flyover and Bhalsawa Chowk. This is a very serious concern as Delhi has the highest number of cyclists in the country and the second largest number of walkers. In stretches like Uttam Nagar and Subhash Nagar on Shivaji Marg, and Jyoti Nagar East on Loni Road, cycles and cycle rickshaws outnumber cars. According to the *Street Design Guideline* document, cycle lanes in Delhi are almost negligible.

Notorious crossings: About 24 per cent of the total accidents happen at crossings/junctions. Accidents happen on roads without properly designed junctions, or where provisions for crossing are missing. According to traffic police data, 26 junctions are listed as accident hotspots. A CSE re-analysis of all the accident spots showed that crossing and junction-related problems could be contributing to 30 per cent of the total accidents. Some key hotspots are Burari Chowk, Seelampur T-point and Ashram Chowk which recorded 25, 25 and 22 accidents, respectively. Other hotspots are Faiz Road Crossing, Punjabi Bagh Chowk, Azadpur Chowk, Britannia Chowk, Okhla Estate Roundabout and Mukandpur Chowk.

Urban villages do not generate motorised traffic but suffer the most: Poor infrastructure near low income neighbourhoods increases modal conflict and friction considerably. Some of the notorious accident hotspots are near Ali Village, Shakarpur Chungi etc, with a total share of 10 per cent. These areas that are close to high speed arterial roads have very high footfalls but very low level of protection.

Foot overbridges and subways do not work: There is a growing tendency to remove people from the road while making signal-free corridors: by building foot overbridges and subways for crossing. But the traffic police's own review of overbridges indicates that this has actually increased the safety risk, as people prefer to cross on roads, where it is convenient to cross. This forced eviction of people from the surface may help lower accident rates (as has been the case near Anand Vihar Bus Station), but such an approach will also limit sustainable modes like walking, cycling and public transport usage. In Anand Vihar, wide roads (nearly eight-lane) have been built. This is very difficult to cross amidst high speed traffic in one signal phase and therefore, increases the accident risk. Road design will have to give primacy to pedestrians and public transport users. Otherwise, a large number of zero pollution walk and cycling trips within a short radius will convert to motorised trips.

40%
Delhi road
length with no
sidewalks

E. Best practices

According to the WHO, the middle-income countries have the highest annual road traffic fatality rate at 20.1 per lakh of population; the rate is 18.3 per lakh of population in low-income countries. The lowest fatality rate is in high-income countries at 8.7 per lakh of population (*see Graph 16: World road traffic deaths*).

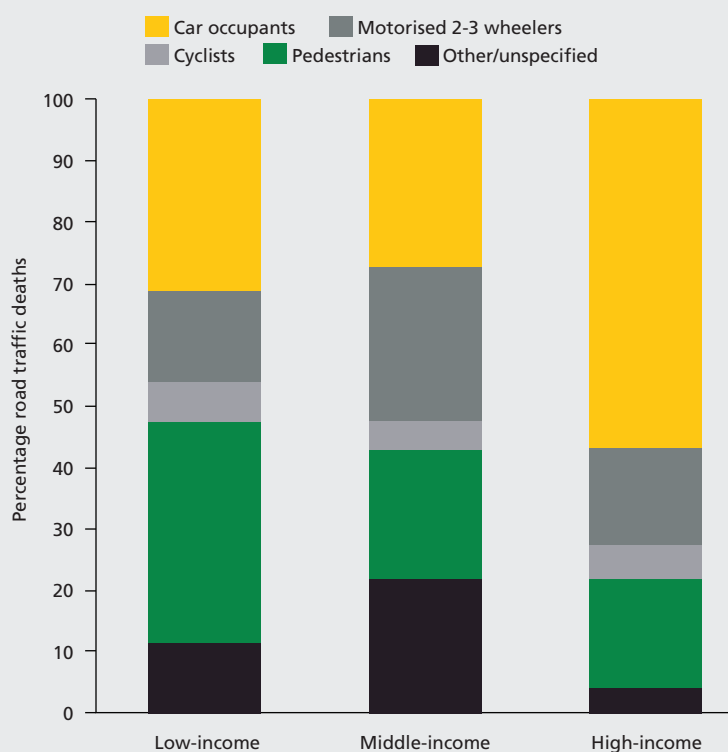
Developed and developing countries are not directly comparable as they have different levels of motorisation, travel practices, land use patterns and urban design of sprawls. The WHO database indicates that if more motorists are dying in developed countries, there are more pedestrians dying in developing countries: the logic is that developing countries have more walking and cycling trips. A 2013 study carried out by D Mohan of TRIPPS, of the Indian Institute of Technology, Delhi shows that the difference in income levels between countries cannot explain fully why rich nations have lower accident rates. Even in the Western world, road transport injury rates vary among cities with similar incomes and populations by a factor of three-five because of urban and road design. Cities with higher proportion of wide streets and low density road network have much higher fatality rates compared to more compact cities. This is an important lesson for Indian cities.

Globally, countries are moving towards a zero tolerance policy on accidents and transforming urban and road design for safety. Many Western European and high-income countries in the Asia-Pacific region have reduced their burdens dramatically. Japan reduced its disease burden from road injuries by 42 per cent between 1990 and 2010, and Sweden lowered its burden by 30 per cent. Case studies of interventions, policies, regulations and institutional capacities to deliver them in these high-achieving countries could help elucidate key lessons that other nations can follow.

Sweden has a Vision Zero road safety policy that prioritises safety over speed. The policy promotes low urban speed limits, pedestrian zones and barriers to separate cars from bikes. It has proposed a speed limit of 30 km/hour. Some engineering interventions have been made like building 1,500 km of '2+1' roads where each lane of traffic takes turns to use a middle lane for overtaking. This has helped save 145 lives and created 12,600 safer crossings. Coupled with strict policing, these

Graph 16: World road traffic deaths

A quarter of these occur among pedestrians and cyclists



Source: WHO 2013, Global status report on road safety 2013, World Health Organization

measures have halved the number of pedestrian deaths over the past five years. Sweden has also integrated the guidelines for traffic safety and crime prevention under the Traffic for an Attractive City (TRAST). Swedish police guidelines include safety audit guidelines as well.

The Netherlands has a Sustainable Safety Vision policy that has led to implementation of effective road safety measures. Infrastructure measures alone have reduced the number of fatalities by 30 per cent.

In several **Europe Union** countries, the focus is on slowing down traffic, separation of vulnerable people from motorised traffic, awareness campaigns, more safe pedestrian crossings, and effective fines for violation of pedestrian spaces. In the EU, fines are prescribed by law, either as a part of a Road Traffic Act, or as subject of a special legislative provision. Some countries allow police officers to decide the actual amount of the fine according to the specificity of the traffic situation. In Finland, Sweden, Norway and Switzerland, the amount of the fine is a function of the net income of the offender.

In Paris (**France**), the city mayor has announced a maximum speed limit of 30 km/hour on all streets of the city.

United Kingdom: Careless driving can be fined up to UK £100 and points are added on to the license. There is a proposal from the department of transport to restrict motorists to a speed of 15 mph, a fine of UK £100, and three penalty points for overtaking cyclists. This is for a few cities where cycle flows are high.

Germany: A computerised point system for traffic violations is in place. One can incur up to three points if the offence endangers traffic safety. Once there are eight demerit points, the licence is revoked. To get it back, the motorist needs to pass a physical and mental status examination.

USA: In California, a new traffic law will be implemented from September 2014. It aims to reduce high rates of bicycle accidents, injuries and fatalities across the state. Motorists will be required to keep at least a three-foot distance from bicycle riders as they pass them on the road. In New York, from October 2014, the default speed limit is being lowered to 25 mile per hour (mph) from 30 mph. This is part of mayor Bill de Blasio's 'Vision Zero' traffic safety plan to reduce pedestrian fatalities, and includes speed bumps, improved road design, and new cameras to catch rule-breakers and penalise them.

Other cities: In London, the Road Traffic Reduction Act allows authorities to reduce traffic levels or their rate of growth in targeted areas for lowering congestion and improving air quality. San Francisco has enforced a Better Street Policy. New York City is promoting pedestrian infrastructure. In Auckland, the Land Transport (Road Users) Rule stops motorists from stopping or parking on a footpath and pedestrians have to be given right of the way.

These instances are only indicative of the way other governments have taken accident risk reduction seriously to implement measures to protect people.

20.1
per lakh of
population: the
annual road
traffic fatality
rate in
middle-income
countries

F. The CSE audit

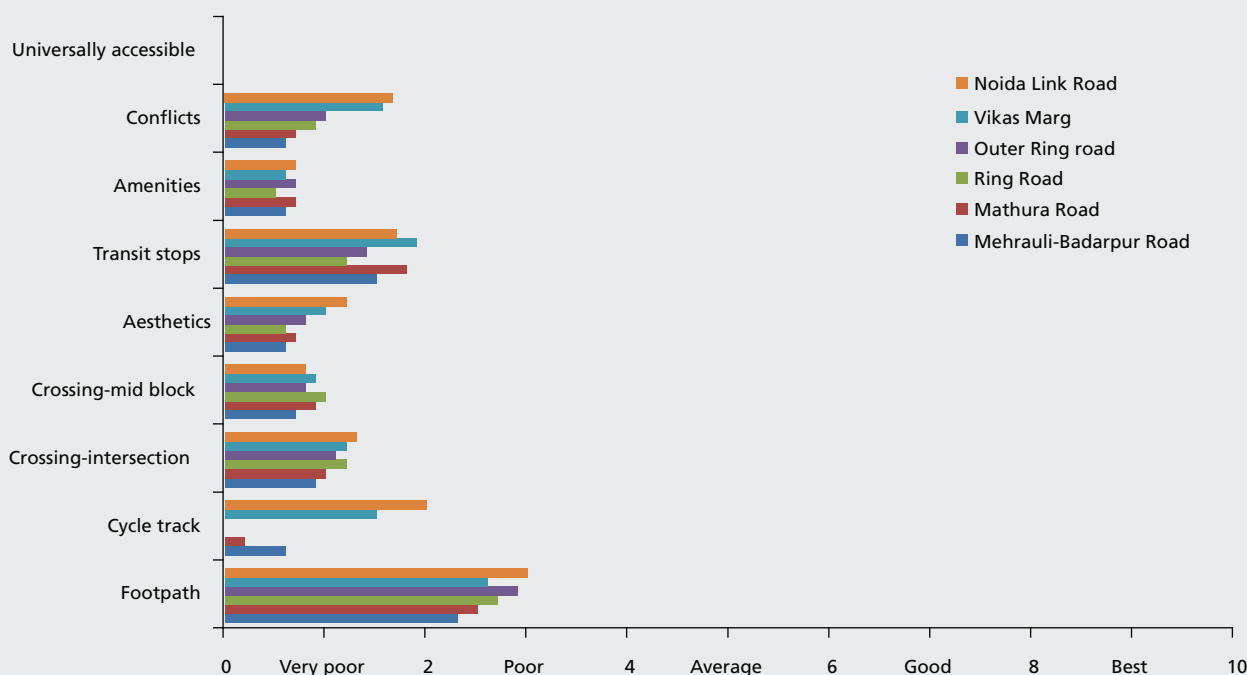
From the accident hotspot data shared by the Delhi Traffic Police, CSE selected stretches from six arterial roads (*see list: Selected roads and stretches*) that are considered the most dangerous for pedestrians and cyclists. A safety audit was carried out in these segments to understand the existing problems. Out of these six arterial roads, one road segments was studied in detail to suggest design solutions to improve safety, convenience, aesthetics and overall attractiveness and well-being.

Together, the stretches selected by CSE cover approximately 27 km. CSE reviewed various methods that are available globally for street audits and ranking and derived an appropriate method for a rapid assessment. The technique for assessing the walking environment included reviewing, auditing and rating the existing infrastructure and accessibility features on selected corridors. This assessment was based on quantitative and qualitative indicators that also allowed a room for discretion of the assessor and users.

The audit was carried out in accordance with a checklist of parameters prepared by CSE; this checklist was based on the street design guidelines of UTTIPEC. These guidelines are expected to be followed by the city authorities, but are not mandatory. The audit identified deficiencies and maintenance concerns, and proposed solutions.

Graph 17: Ranking of road segments based on the safety audit

None of the roads scored 'good' under any of the parameters



Source: CSE

To carry out the safety audit, eight criteria were considered:

- Engineering and design features of footpaths and cycle tracks (height, width, material, continuity, segregation from carriageway, obstructions, and lighting)
- Crossing-intersection and mid-section (signal time, signage, markings, continuity/barrier-free access and traffic calming measures)
- Encroachments/impediments on footpaths (permanent or temporary structures and parking)
- Design features for transit/bus stop/shelter (height, boarding/alighting time, clear width and crossing facility)
- Amenities (toilets, vendor spaces, trees, lighting and seating)
- Conflicts (between buses, motor vehicles, non-motorised transport (NMT), pedestrians etc)
- Safety features (lighting, dead width and public spaces)
- Aesthetics (design qualities of street furnitures/features)

The process: The CSE team did the surveys with the help of volunteers. Detailed maps and checklists were used for scoring. Field surveyors rated the selected road stretches on a scale of 1 to 10 for each indicator in every section. Each road/corridor was divided into segments for scoring. The scoring for each segment was done on the basis of the infrastructure available and its comparison with the existing standards. The scoring for each ‘assessment parameter’ was done in two parts — design according to the standards, and the existing situation in a given segment.

The score: The final score of each segment in each component was multiplied with the segment length. The score of the component was derived by adding the scores of all the segments and then dividing it with the total length. This process gave the scores for each corridor for each component, and where they stood with respect to safety and accessibility of cyclists and pedestrians. The scores were assigned to quantify the problems and indicate the variability on a scale. The review of the corridors was based on the auditing.

This was supplemented by a perception survey to assess how pedestrians, cyclists and public transport users feel about the walking conditions and overall environmental conditions. CSE also took into account user perceptions on personal safety and availability and quality of infrastructure to evaluate ranking of each component and rating of the corridors.

The ugliest of all: The ranking of all the road segments show that for all parameters, all roads scored from ‘very poor’ to ‘poor’. None of the corridors featured in the ‘average’, ‘good’, or ‘best’ classes (*see Graph 17: Ranking of road segments*). For the criteria on footpaths, some roads hit the second lowest rank of ‘poor’. This brings out how dismal the state of affairs is.

SELECTED ROADS AND STRETCHES

- Mehrauli-Badarpur Road (Khanpur T-point to Hamdard Nagar T-point)
- Mathura Road (Harkesh Nagar to Badarpur Extension)
- Ring Road (Maharani Bagh to Moolchand Crossing)
- Outer Ring road (Mukarba Chowk Flyover to Wazirabad Intersection)
- Vikas Marg (Indraprastha Marg Crossing to Shakarpur More)
- Noida Link road (Laxmi Nagar Metro Station to Gurjar Samrat Mir Bhoj Marg Intersection)

The findings

Footpaths and cycle paths

- Footpaths are available in around 55 per cent of the total length surveyed, while only 10 per cent have cycle tracks.
- The width of a footpath (according to the Street Design Guidelines) should be a minimum of 1.8 m: only 10-15 per cent of the total road stretch surveyed meet this norm.
- The kerb height (norm is 150 millimetre or mm) is unacceptable along all the roads, except at some locations along Vikas Marg. Only five per cent of the total length has a kerb height that meets the standard.
- None of the corridors have a continuous footpath.
- Most footpaths are found to be not even 1 m wide (the required width is a minimum of 2 m).
- Only the Noida Link Road and Vikas Marg have reasonable lengths of cycle tracks, while Mathura Road and Mehrauli-Badarpur (MB) Road have cycle tracks only for 300-400 m.
- Most of the cycle tracks are not even accessible, and most of the sidewalks are severely obstructed both temporarily and permanently. Spaces have been taken up by illegal and unplanned markets, hawkers, and for parking.

FOOTPATH: MEHRAULI-BADARPUR AND MATHURA ROAD

The pedestrian count is more than 10-15 per cent of the total vehicles on these roads. The footpaths are discontinuous and in poor condition. The width of the sidewalks varies between 1-3 m. The kerb height along the MB Road differs every 200 m. Near Khanpur T-point, the kerb height is 150 mm over a distance of about 150 m, before rising further to 250 mm. From Khanpur to the Jal Board office, the kerb height varies between 250 to 400 mm, while the kerb height near Batra Hospital on the same road goes up to 800 mm, making it almost inaccessible and unusable for pedestrians (see *photo A*).

CYCLETRACK: THE NOIDA LINK ROAD

The longest stretch of this cycle path is about 2 km. The width of the cycle track varies from 1.5 to 3.5 m, and it gives a clear view of the road to the cyclist. The cycle track near the Akshardham Temple runs along the flyover, hence the slope is steep. Cyclists tend to use the flyover and not the track. For most part, there is no activity along the road and the tracks are secluded, making them unsafe (see *photo B*).



Access to public transport

- Accessibility to public transport nodes is poor in almost all the corridors.
- Bus stops are located on footpaths, as there is no clear multi-function zone.
- The height of the base of the bus stop does not match with the base of the bus, so people tend to wait on the road; buses stop in the middle of the road, or at the foot of flyovers making it unsafe for bus users.
- Roads with more public transport users have less bus stops. Low income neighbourhoods have high usage of public transport, but the transit stops along the roads that border these neighbourhoods have limited infrastructure to accommodate all the people at the bus stops. This is the case at Sangam Vihar and Khanpur (MB Road), Aali village (Mathura Road), Jahangirpuri (Outer Ring Road) and Shakarpur More (Vikas Marg).
- According to the UTTIPEC guidelines, the bus stops should be equipped with amenities such as public toilets, seating areas, kiosks, route maps and have adequate lighting, but all the transit stops in the six locations score very poor in these aspects. The amenities are negligible; even the size of the bus box is inadequate to accommodate the people using bus services. On the MB Road, there are a few bus stops which have toilets close to them, but these facilities are unclean and ill-maintained.
- None of the bus stops are equipped with ramps, making it difficult for the disabled to access them.
- There are many locations with no bus shelters and the passengers have to stand in the middle of the road to board the bus. On the other hand, there are a few locations with well-designed public transport infrastructure, but there is no one to use it!

BUS STOP: THE RING ROAD (NEAR NEHRU NAGAR AND LAJPAT NAGAR)

The bus stops are located close to the foot of the flyover. Buses tend to drop passengers at the foot, exposing them to high friction with vehicles.

People try to cross amidst high speed traffic on the surface. The footpaths are quite high, making it impossible for passengers to access them. To board buses, people do not stand at the bus stop but in the middle of the road. The facilities are not at all disabled-friendly (see photos C and D).



Crossing facilities

- None of the intersections is designed with raised table-top crossings or pelican signals for convenient crossings. None of the corridors have mid-section crossings.
- Crossings are given either in the form of foot overbridges or subways; medians are usually blocked with high railings. Only 15 per cent of the total corridors studied has visible zebra crossings.
- An opinion survey shows 90 per cent of walkers and cyclists prefer crossing on the ground as foot overbridges and subways increase the travel distance and are inconvenient.
- On the other hand, foot overbridges and subways with ramps attract motorised vehicles for crossing.

CROSSING FACILITIES: THE OUTER RING, RING AND MB ROADS

Foot overbridges and subways have been provided for crossing on these roads. But this has not helped as most people, the differently abled and elderly in particular, prefer to cross at grade as climbing these facilities is difficult for them. Also, using the foot overbridges increases walk time by three-four times than that in normal surface crossings. Pedestrians avoid subways as they are not well-lit and increase the distance.

Subways and foot overbridges with ramps are easy targets for motorised vehicles. Motorised two-wheelers enter them illegally and negotiate them, endangering lives.

The crossings are equally dangerous. In most parts of these roads, at-grade surface crossing is barred. There is no limit on vehicular speeds at the places from where people can cross. Zebra crossings are barely visible at junctions, especially on the Ring Roads. Intersections along Mathura Road, MB Road and Vikas Marg have zebra crossings available only at 10-15 per cent of the total stretch (see photos E-H).



Environmental conditions

- All the corridors score poor on this count.
- There are a few public toilets along the MB Road, Noida Link Road and Vikas Marg, but these remain locked or are unusable. As for the rest, there are no amenities provided along their bus stops and footpaths — no places to rest, public toilets, or designated spots for hawkers.
- There are no facilities for women.
- Walking and cycling infrastructure and bus stops are ill-maintained, unclean and badly lit (making them unsafe in the night).
- There is no provision for shaded footpaths in this city which faces seven months of harsh summer. About 90 per cent of the footpaths along all corridors surveyed have no concentrated lighting or shade.
- Footpaths all along the segments are along the boundary walls with setbacks, making them unsafe and vulnerable to crime.
- Parking on footpaths is a menace, especially along Mathura Road, MB Road and Vikas Marg. Around 50 per cent of each of these roads' footpaths are encroached by parking.
- Aesthetics are unappealing. Footpaths along Mathura Road, MB Road and Vikas Marg are broken and in insanitary conditions. Construction debris occupy footpaths. At Khanpur, along the MB Road, a garbage dump spills over the footpaths (*see photos I-L*).



Universal accessibility

- The infrastructure in all the corridors is not designed keeping the disabled in mind: in fact, all the corridors score '0' in this aspect.
- None of the road stretches in the given corridors have footpaths with adequate height and there is no provision of ramps
- There are no auditory signals at any of the intersections
- The tactile paving provided on the footpaths have no relevance as they begin in the middle of the footpath and end abruptly anywhere
- No provision of ramps has been provided on bus stops for physically challenged and visually impaired

UNIVERSAL ACCESSIBILITY: BLIND TO THE PLIGHT OF THE DISABLED

It is important to note the definition of 'disabled' here: in the urban commuting context, 'being disabled' goes beyond just being physically challenged. In this context, disabled-friendly design is a universal need, as factors such as health conditions, ageing, the need to carry heavy weights or infants etc can lead to obstruction in mobility.

Disabled people cannot access footpaths that are higher than 300 mm and without ramps. As there are no raised table-top crossings and the medians are blocked, this makes them vulnerable to accidents while crossing. Most bus stops do not have ramps or tactile paving. Tactile paving that exists along some portions of the Ring Road, Mathura Road and Vikas Marg do not lead the user anywhere as they are put in a haphazardly manner. There is no provision of auditory signals on any corridor.

Anjlee Aggarwal of Samarthyam, a Delhi-based NGO working on disabled-friendly infrastructure, says a few initiatives have been taken in Delhi to make pavements disabled-friendly, but there is no continuity in the network for disabled people to feel safe (see photos M-N).



Change is possible: CSE redesigns

Centre for Science and Environment has demonstrated how by changing design and reorganising street activities, roads can be transformed for zero accidents.

CSE has done a detailed design of one segment of the MB Road to provide an alternative street design for optimum use of road space. For this purpose, two stretches have been considered: from Hamdard crossing to Vayusenabad and from Vayusenabad to Khanpur crossing.

CSE has based its redesign on the UTTIPEC street design guidelines as these guidelines are expected to become the law for approval of any road project. It is expected that these guidelines will notified under the Delhi Development Act and mandated in the Delhi Master Plan to make their compliance a legal requirement.

These guidelines have been used for the conceptual design of the proposed street changes. This includes all street components to ensure safety of pedestrians and cyclists, smooth movement of traffic, ease of alighting/boarding buses and intermediate transport along with amenities for all road users. Fundamentally, this has segregated space for road users, reorganised street activities, provided more safe crossing facilities at grade, removed encroachments, provided space for key services of para-transit, and provided spaces for legal parking, vendors, bus stops, etc.

The design demonstrates that the reorganisation of activities and better design can actually free up substantial spaces that are otherwise not available for any use. In fact, the proposal envisages freeing up as much as 7,000 sq m that can be improved for streetscaping and creating pedestrian plazas, food courts and vending areas, with overall improvement in environmental conditions (*see Chapter G: Change is possible*).

G: Change is possible

Redesign of pilot corridor on MB Road

In its proposal (*see diagrams in the pages that follow*), Centre for Science and Environment (CSE) has demonstrated that by changing the design and reorganising street activities, roads can be transformed into zero accident zones. CSE has done a detailed redesign of one segment of Mehrauli-Badarpur (MB) Road to provide an alternate street design for optimum use of road space. For this purpose, two stretches have been considered: (a) from Hamdard crossing to Vayusenabad and (b) from Vayusenabad to Khanpur crossing.

Barriers to accessibility on these stretches: some snapshots

The stretch between Khanpur and Hamdard T-junctions is about 2.5 km in length, and it hosts multiple activities. It is flanked by institutional and educational centres on one side, and the low income neighbourhood of Sangam Vihar, the Air Force campus, and Khanpur on the other side. This generates enormous pedestrian and cycling traffic as well as high footfalls at bus stops. A safety audit of this stretch has highlighted the following problems, which have been kept in view while redesigning the selected stretch:

Footpaths: Only 40-50 per cent of this stretch has footpaths. These are of narrow width ranging from 1-2 m and heights ranging from 150-800 mm. These footpaths have no continuity. In most places, they are broken and too high for people to climb. They do not have ramps for the convenience of people with disabilities. The height of the footpaths near Batra Hospital and Hamdard University is as high as 900 mm, making it very difficult for people to access it.

Cycletracks: The cycletrack is only 200 m long near Hamdard University. It is mostly encroached by motorcycles. The stretch after the Jamia Hamdard junction is not used at all, as the surroundings are not safe enough for walkers and cyclists. The stretch does not have public amenities like toilets or sitting benches for road users. There is no designated space for cycle parking. Tracks are not maintained and cleaned and are full of garbage dumps.

Transit stops: Bus stops are not adequately designed to meet the needs of commuters, who are numerous here. Most of the road space is occupied by parked cars. Hawkers have not been given adequate legal space. Near Batra Hospital, the bus stops are located on footpaths at a height of 900 mm, making them practically inaccessible. People stand in the middle of the road to board the buses. This increases friction with other modes and therefore, the accident risk. Legal parking spaces have not been created for cars, cycles or auto-rickshaws. The service road between Batra Hospital and Hamdard Nagar is choked with illegal parking. The stretch from Khanpur T-point to Vayusenabad is in a similar condition, with bus stops located on high footpaths and people waiting for buses on the carriageway.

Crossings: The junctions and crossings are poorly designed. There are no traffic calming measures at junctions. The slip roads allow free turns to vehicles making them unfavorable for cyclists and walkers. There is no provision of safe crossing for cycle users.

There are two foot overbridges near Sangam Vihar and the Hamdard campus. These overbridges force people to climb and walk much more than they would if they crossed the road at grade. High railings bar people from crossing where they need to cross. This leads to lot of unprotected crossing and increases the accident risk.

CSE's design solution

Centre for Science and Environment has piloted a design for the targeted stretches on this road to demonstrate that change is possible. The new conceptual design takes into account the key elements of UTTIPEC Street Design Guidelines which is the guiding legal document for road infrastructure in the city (*see Box: Highlights from the Street Design Guidelines considered for the study*).

Conceptual redesign

The new conceptual design has followed some fundamental principles. It has segregated space for road users as much as possible, reorganised street activities, provided more safe crossing facilities at grade; removed encroachments, provided space for key services of para-transit, provided legal parking, vendors, bus stops, etc; and freed up spaces to improve streetscaping and to create plazas and improved overall environmental conditions.

In doing so, the width of the carriageway has been kept the same and rest of the space has been reorganised to accommodate the maximum features. The width of the footpaths has been kept at 2 m with a height 150 mm along the corridor from Hamdard Nagar T-junction to Vayusenabad; for the rest of the corridor till Khanput T-junction, the width is up to 2.5 m. The 2.5 m-wide cycletrack can be provided only till Vayusenabad. In the rest of the corridor, there is space available. Traffic calming and slow speed are needed to keep cyclists safe in mixed traffic.

In the new scheme of things, proper signages and lighting have been provided for the cycletrack and footpaths. The height has been maintained at 150 mm to make it safe and convenient for people. Special consideration has been given to safe crossings for pedestrians, by providing a mid-block table top and crossings after every 250 m. The intersections have been designed keeping walkers and cyclists in mind, and refuge islands have been provided. The provision of crossings every 250 m makes foot overbridges redundant.

It is proposed that the crossing near the Indo-Tibetan Border Police base be shifted behind Sangam Vihar to allow vehicles to turn easily and avoid congestion. But the bus stops have been retained, though they can be better equipped with more seating spaces and public utilities for both men and women.

One of the key benefits of this conceptual rethink and reorganisation of street activities is freeing up of about 7,000 sq m of space between Hamdard Nagar T-junction and Vayusenabad. This offers the opportunity to create pedestrian plazas, organise hawking and vending etc while improving overall accessibility, safety and aesthetics.

HIGHLIGHTS FROM THE STREET DESIGN GUIDELINES CONSIDERED FOR THE STUDY

While creating the new conceptual design of the stretch from Hamdard T-junction to Khanpur on Mehrauli-Badarpur Road, CSE has kept in view the following parameters from the UTTIPEC guidelines:

- Complete segregation of pedestrian and cycle paths on all arterial and sub-arterial streets for safe movement on road and across the intersection.
- Surface-level safe crossing (preferably every 200-250 m) at mid-block section with appropriate signals (pelican/blinkers etc).
- All standard signages (informative/cautionary/warning etc) for all road users in and around intersections with clear view for pedestrian/cycle/motor vehicle to be installed by removing all other non-traffic signboards/ad boards etc.
- All other components/physical features for regulating the traffic like signals, streetlight poles etc to be removed (accommodating/relocating trees to the extent possible) for a clear obstruction-free walkway/footpath; all these can be relocated to the multi-function zone.
- All standard road markings (zebra/cycle crossing strip along the zebra at all the legs of an intersection, stop lines, weaving section-changing lane, directionals etc).
- All standard signals with clear visibility and timer for motorists and pedestrians/cyclists for safe crossing of pedestrians/cyclists and also to facilitate motorists to switch off their engines and save fuel.
- Traffic calming strips at all approaching signal points on intersections/mid-sections and major merging/diverging points and entry/exit points of flyovers, with visible precautionary/warning signs for lowering of speeds at 20 kmph (if the speed limit is > 50 kmph).
- All standard street lights at intersections, mid-sections, pedestrian/cycle corridors and bus stops: lux level for the carriageway and walk/cycleways.
- All existing parked vehicles either occupying footpaths and/or carriageway to be removed for reclaiming streets for movement of all vehicles and road users, including the elderly, disabled and children.
- On-street and off-street parking sites to be demarcated for providing short- and long-term provisions for parking as part of the street design along with appropriate pricing, management and enforcement, but only after ensuring provision of footpaths, cycletracks and multi-function zone as per standards and also clear/smooth movement space on carriageway with clear lane markings all along the road.
- Heights of all footpaths along both sides of the road to be a maximum of 150 mm as per the guidelines, including the bus stop height, to maintain continuity of smooth pedestrian movement. However, ramps with standard disabled-friendly slope should be provided in all existing bus stops that are higher.
- Bus stops/bus boxes to be clearly marked with a bus lane at least 50 m on both sides of bus stops for buses to dock on the defined bus box to facilitate easy boarding/alighting and to allow general traffic to move on the carriageway.
- Multi-function zone to be provided as per the guidelines to accommodate all essential physical features on the road including bus stops, on-street parking, cycle parking, toilets etc. At least 0.5 m strip and/or bollards must be there between footpaths, cycle tracks and carriageways to prevent misuse by car parking.
- Boundary walls to be removed or made transparent all along the street or active street edges by providing/allowing vending stalls/zones all along the walls in the immediate vicinity of bus stops/stations etc to ensure 'eyes on the street' for women's safety.
- Synchronisation of signals along corridors for safe mid-section surface crossings for pedestrians/cyclists.
- More direct pedestrian/cycle access: colony to colony and colony to bus stops.
- Network and parking plan: area-level integrated plan for organised parking spaces and more cycling/pedestrian spaces.

H. Whither policy?

A rapid review of existing policies and legislations in India indicates that the legal framework to address the problem of road safety and vulnerability of pedestrians and cyclists is very weak. The legal mandate is fragmented across departments, ministries and between Central and state governments. However, there are provisions in existing laws and policies which, if harmonised and effectively implemented, can help protect the vulnerable.

Yet safety mitigation is a much larger issue that requires interventions ranging from safety regulations for vehicles and users, protection of public and pedestrian spaces to protect other road users, and road and urban design guidelines to make infrastructure safe for people to use. But there is no single umbrella legislation that addresses all these requirements comprehensively. The provisions are splintered and partial and do not make up the whole solution. It is, therefore, important to look at the jigsaw of policies and legislations piece by piece to understand the current status and the way forward.

National policies

At the national level, policies of the Union ministry of road transport and highways and Union ministry of urban development have a bearing on road safety. In addition to this, the Indian Penal Code addresses the penalty and punishment for road accidents. All of them have their limitations and challenges that need immediate remedy.

The National Urban Transport Policy

Needs teeth: The National Urban Transport Policy (NUTP), administered by the Union ministry for urban development, addresses the requirements and safety of walkers and cyclists. But it does not have strong legal teeth for compliance. The ministry must ensure that all transport infrastructure projects that are funded and planned under its aegis have explicit provisions for reducing dangers in built environment. This can be done through design features, enforcement mechanisms, stringent policies for penalty and deterrence, and mandatory safety audits.

Under its Jawaharlal Nehru National Urban Renewal Mission (JNNURM) programme, the ministry is expected to give priority to the construction of cycletracks and pedestrian paths in all cities and also support the construction of safe pedestrian crossings at busy intersections and high traffic corridors.¹ But this has seen very limited application. This scheme is now under review. But it is important that the future central funding mechanism for transport projects is linked with road safety, safe infrastructure, road users' rights, and with action plans and timelines.

The National Urban Transport Policy will have to be strengthened to intergrate safety requirements for transport infrastructure from the perspective of road users, and safety audits in its guidance for the state governments and ensure that these requirements are enforced. The policy has to explicitly recognise the bearing of road engineering and urban design on the safety of all road users and provide for solutions. But the ministry has not focused on this.

NUTP
must realise
that road
design is the
key to road
safety

MVA

has the norms
and rules, but
these are not
enforced

The Motor Vehicles Act 1988 and Rules (1989)

Needs effective enforcement, stringency and strong deterrence: This is the key national legislation that makes rules for safety of motor vehicles and its use, safety enforcement and deterrence for accidents. It is administered by the Union ministry of road transport and highways. However, this Act and the Rules are largely oriented towards motorists' safety, and cover issues such as vehicle safety guidelines, use of protective gears, seat belt provision, helmets etc. They also focus on strategies for sane and controlled driving by limiting speed and putting deterrents on dangerous driving, drunken driving, etc. But even this is not well enforced.

All state governments are guided by the procedures laid down in the Central Motor Vehicles Act 1988 and Rules 1989 and the State Motor Vehicle Rules. Various sections of the Act deal with speed limits, driving at excessive speed and dangerously, safety measures for drivers and pillion riders and protective headgear. The Central government can make rules for motor vehicles and trailers and include speed governors; safety belts, handle bars or motorcycles, auto-dippers and other equipment's essential for safety of drivers, passengers and other road users; and standards of the components used in the vehicle as inbuilt safety devices. This can set speed limit and bar a person from leaving the vehicle in dangerous position. This Act essentially deals with the power of the licensing authority that can disqualify a person from holding a driving license or revoke such license.

Rules for pedestrian protection not enforced: It is important to note that though this legislation is oriented more towards motorists' safety and is not explicitly designed to protect all road users, there are still some provisions in the Act that accord passive protection to pedestrians. For instance, this Act bars motorists from entering pedestrian space (footpaths or pavements). It states that no person in charge of a motor vehicle will park vehicle in such a position that it obstructs public place and cause danger and casue undue inconvenience. This is a powerful provision that can be immediately leveraged to protect pedestrian space. But unfortunately, this is rarely enforced.

Weak penalty: Increasingly, the discussion is veering towards the need for effective penalty and deterrent to move towards a zero tolerance policy. Most provisions of the MV Act provide powers to fix penalties, but most of them relate to compoundable offences; this means the offending vehicle can be freed after the payment of a fine. Only provisions like 'Punishment relating to accidents' under section 187 of the Act relate to non-compoundable offences and the offenders are taken to court. Moreover, the fine under the current provision, fixed way back in 1988, can be as low as Rs 100.

There is a range of penal action. The mechanism of enforcement also differs. Under Section 183 on speeding, an offender cannot be convicted solely on the evidence of one witness unless validated and recorded by a mechanical device. In Delhi, over-speeding has a compoundable penalty of Rs 360 and a subsequent compounding amount of Rs 900. This needs to be made five times higher. Racing is a compoundable offence with a penalty of only Rs 450.

Section 184 on dangerous driving attracts penalty and imprisonment, but it is ineffective without cameras and speed detectors. In Delhi, driving dangerously is also a compoundable offence with a penalty of Rs 900 in the first

offence; the subsequent amount is Rs 1,800. Violation of stop line and traffic signal is a compoundable offence with a fine of Rs 90, with a subsequent compounding amount of Rs 270.

Clause 187 provides for punishments relating to accidents: these could be imprisonment or fine or both. These may be extended to three months, or with fine which may extend to Rs 500, or with both. If the person has been previously convicted of an offence under this section, the punishment is imprisonment for a term which may extend to six months, or a fine which may extend to Rs 1,000, or both. In Delhi, this is a non-compoundable offence and the perpetrator is taken to court.

Anil Shukla, additional commissioner, Delhi Traffic Police, says only enforcement in terms of challans will not help as the system will get overburdened with an enormous number of non-compliances. For example, a camera-based drive to stop overspeeding for a month in only one junction near Pragati Maidan in Delhi had led to booking of more than a lakh of violators. These numbers are beyond the capacity of the existing legal system for prosecution. The challenge, therefore, is not only about enforcement; it is also about having strong deterrent and collective will in the society, which demands much stronger preventive action.

More specific strategies are being looked into to address overspeeding on highways. Harman Sidhu, of the Chandigarh-based Arrive Safe Foundation, has moved the Punjab and Haryana High Court to take action against 185 liquor shops on a stretch of 295 km along national highway-1 (NH-1) to prevent drunken driving. The High Court has ordered that these shops should not be accessible or visible from the highways.

The Motor Vehicles (Amendment) Bill to amend the Act enhances penalties for offences, and provides different penalties for first and subsequent violations. Overall, an attempt has been made to propose revision of the penalty in the MVA (*see Table 2: Proposed changes to MVA to make penalties more stringent*). But this has not been passed.

The Bill changes the method of awarding compensation for motor accident claims. If the fault of the driver is to be established, the claim is decided by the civil court or the Motor Accident Claims Tribunal. If the claimant does not seek to establish the fault of the driver, compensation shall be based on the victim's income and age.

This is now being redrafted. The key focus areas include re-drafting of law and amendments; stricter enforcement of laws and rules; improved safety mechanism in cars; cutting down on human intervention and more reliance on IT-based systems; installation of CCTV cameras at all traffic signals; repeated offender licenses to be suspended/cancelled; redesigning of heavy vehicles; and centralising data to check misuse of driving licenses. Public transport vehicles plying in all the cities with over 10-lakh population will be fitted with advanced GPS tracking system.

The Central Motor Vehicle Act also requires serious overhaul for more effective enforcement of safety rules and also protection of other road users.

National Road Safety Policy 2010

Make it legally enforceable: To address road safety concerns, the government has introduced the National Road Safety Policy. The Union cabinet approved the policy based on the recommendations of the S Sundar committee report on March 1,

Bill
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Table 2: Proposed changes to MVA 1988

The aim is to make penalties more stringent

	Motor Vehicles Act, 1988	Motor Vehicles (Amendment) Bill
Offences where fine has been stipulated	Fines range from Rs 100 to Rs 5,000	Fines have been enhanced to range between Rs 500 to Rs 20,000
Other violations of the Act	Maximum fine of Rs 300	Fine has been increased to Rs 1,000 (for initial offences) and Rs 5,000 (for subsequent offences)
Rash and negligent driving	Offence is not recognised under the MVA. Penalty under Section 279 and 304A of the IPC applies	Recognises this offence and imposes a fine, as well as payment of compensation to victims
Compensation for motor vehicle accidents	Without establishing the fault of the driver: fixed compensation of Rs 25,000 (death), Rs 12,000 (permanent disablement) Establishing the fault of the driver: calculated according to the Second Schedule, based on victim's age and income Interest: Not specified in the Act	Without establishing the fault of the driver: calculated according to the amended Second Schedule, based on victim's age and income Establishing the fault of the driver: awarded by the court or the Motor Vehicles Tribunal Interest: simple interest up to 2 per cent per annum from the date of the claim

Source: http://www.prsindia.org/uploads/media/1182409102/LB_Motor%20Vehicles%20Amendment%20Bill,%202007.pdf

2010
The National Road Safety Policy came into being, under which a Fund has been proposed to fund road safety activities

2010. For its implementation, the government is expected to set up a National Road Safety Board and a National Road Safety Fund to finance road activities.

The key strategies listed in the Policy include road safety information database, safe road infrastructure, safe vehicles, safe drivers, safety of vulnerable road users, road traffic safety education and training, enforcement of safety laws, emergency medical services for road accidents, IT application for road safety, human resource development and research for road safety, safer vehicles, enabling legal, institutional and financial environment for road safety and awareness about road safety issues.

With regard to safety of road users, it states that the design and construction of all road facilities (rural and urban) will take into account the needs of non-motorised transport and the vulnerable and physically challenged in an appropriate manner. The government will seek to disseminate 'best practices' in this regard to town planners, architects, and highway and traffic engineers.

If the legal framework and fund is finalised, the implementation of safety measures can get a legal compliance system. The National Road Safety and Traffic Management Board Bill 2010 was cleared by the Rajya Sabha, but not the Lok Sabha. This is expected to address the current weaknesses, especially those related to penalties in the Central MV Rules. This has also proposed a National Road Safety Traffic Management Board to oversee road safety and traffic management in India. This must be expedited.

India Penal Code (IPC), 1860

Road accident is a crime and attracts police action under the Indian Penal Code (IPC), 1860. The police in the states are responsible for enforcing the IPC. The sections of the IPC that deal with road accident cases are 279, 304A, 336, 337 and 338. These sections impose penalties or imprisonment as the case may be for causing death by negligence, endangering life or personal safety of others, and causing hurt and grievous hurt. Most of the offences are bailable. Section 283 of the IPC deals with danger or obstruction in public way and imposes a Rs 200 fine.

There is a strong demand now to make the punishment and penalty related to accident offences stringent. For instance, rash and negligent driving on a public way should be made punishable with imprisonment for a term which may extend to six months, or with a fine which may extend to Rs 1,000, or with both. For causing death by negligence or causing grievous hurt by endangering life, the offender should be punished with imprisonment for a term which may extend to two years, or with a fine, or with both. The degree of stringency of penal action needs to be reviewed to ensure effectiveness.

Maneesh Chaudhary, senior superintendent of police of the Chandigarh Traffic Police, points out that the section which is evoked for motor vehicles accidents is Section 304 A, which makes it a bailable offence. The person is given bail on the spot if s/he has one surety available with her/him. The fine is a mere Rs 500. Thus, killing someone entitles the offender to a bail within a day or on the spot.

Even though the technology for surveillance and internet-based compliance is expected to gain ground in future, there is still a strong view the current system of challans and catching violators on roads with mechanical aids must continue as this puts psychological and social pressure on violators. However, there is also an opinion that internet-based surveillance and improvement of vehicle database can enable more effective action on violators. But its usefulness is still limited as often, addresses and contact details of drivers are not available with the officials. There is also a view, as Dinesh Mohan of IIT Delhi propounds, that only increasing the fiscal penalty will not work as a majority of drivers in buses, two-wheelers and cars are from low income classes. Therefore, linking penal action with cancellation of drivers' license, barring them from driving etc can work better. At the same time, there has to be a strong focus on rigorous training coupled with incentives for safe driving.

However, the nature and severity of penal action and its enforcement under the IPC needs a review and reform.

Implement existing laws effectively

Several laws and policies thus govern road safety requirements today. Though they are not fully adequate, there are several provisions in existing laws that provide enough leeway to take effective action and to protect the infrastructure for walkers and cyclists. But these are not implemented in the right spirit and with effective deterrents.

The MV Act 1988 (Section 138) provides power to state governments to make rules including "...prohibiting the use of footpaths or pavements by motor vehicles; ...prevention of danger, injury or annoyance to the public or any person, or of danger or injury to property or of obstruction to traffic...", among others. It is left to the discretion of the state government to make rules on prohibition.

IPC
treats road accidents as a crime and attracts punishment and penalties, but these need to be made more stringent

MVA allows state governments to make rules to stop motor vehicles from using pedestrian pathways

Section 122 of the same Act says that one cannot leave a vehicle in a position that can cause danger, obstruction or undue convenience. It says: “No person in charge of a motor vehicle shall cause or allow the vehicle or any trailer to be abandoned or to remain at rest on any public place in such a position or in such a condition or in such circumstances as to cause or likely to cause danger, obstruction or undue inconvenience to other users of the public place or to the passengers.” While the Act empowers in spirit, it is unclear which authority will enforce this provision.

The Central Motor Vehicle Rules (CMVR) 1989, in its Rule 15, says motorists must act correctly at pedestrian crossings which are not regulated by traffic lights or traffic police, by giving preference to persons crossing the road. It also lays down that they must regulate speed to suit varying road and traffic conditions; anticipate the actions of pedestrians, drivers of other vehicles and cyclists; and show courtesy and consideration for the safety and convenience of other road users.

Similarly, the IPC 1860 provides for danger or obstruction in public way or line of navigation (Section 283). Accordingly, ‘whoever, by doing any act, or by omitting to take order with any property in his possession or under his charge, causes danger, obstruction or injury to any person in any public way or public line of navigation, shall be punished with fine which may extend to Rs 200’. The penalty is very low, but this provision can be effectively used to protect pedestrians and cyclists.

The Rules of the Road Regulations, 1989 include right of way for pedestrians at uncontrolled pedestrian crossings; motorists are not allowed to drive on or park on footpaths or tracks. While approaching a road junction or pedestrian crossing, a motorist must slow down and stop at stop lines. But these provisions are not used effectively to remove encroachments and protect road users. It prevents parking on pedestrian pathways.

Clearly, effective implementation of current legal provisions can make a lot of difference.

Street design standards and guidelines need legal back-up for mandatory implementation

The weakest link in the current laws is the lack of stringent legal framework to enable mandatory implementation of pedestrian- and cycle-friendly road design. All road construction agencies follow the Indian Roads Congress (IRC) guidelines. These guidelines have been revised in 2011 to make them more appropriate and sensitive towards vulnerable road users like walkers and cyclists. But these guidelines are mostly voluntary and can be bypassed or implemented partially unless codified in the specific agreement with the construction agency.

If the Road Safety Policy, Safety Board and Fund come into force at the Central level, then these design guidelines can be legally mandated. The Union ministry of road transport and highways needs to look into this immediately.

The IRC guidelines have now recommended that pedestrian facilities should be planned in an integrated manner so as to ensure a continuous pedestrian flow and reduce pedestrian conflicts with vehicular traffic to the minimum. A number of engineering solutions to improve the quality of the pedestrian network have been included. These take into account the needs of children, families with young children, elderly persons, persons

with disabilities and people carrying heavy luggage for continuity, comfort and safety.

The revised guidelines have improved the specific design standards for pedestrian facilities that include guidelines for footpaths, kerbs, continuity and consistency, tactile pavers, level changes, pedestrian crossings, ramps and steps, elevators/lifts, multi-functional zones, street furniture, bollards, wash-rooms and toilets, school zone improvements, pedestrian facilities at parking spots, pedestrian facilities at transit areas etc.

For instance, the guidelines have set improved norms for footpath surfaces to make them stable, firm, and slippage-resistant. They say footpath widths should be wide enough to accommodate pedestrian flow; obstructions should be removed to give a clear walkway to the pedestrian; informal commercial activities of informal sector must be integrated in the overall design of the footpath facility by providing space for them. The footpaths must to be segregated from roads, where fast moving vehicles ply. They have focused on safety and security to provide for adequate street lighting and police patrolling during the night time and sufficient activities in the surrounding areas to ensure safety. They have asked for climate-friendly features, pedestrian-friendly street furniture and improved walk environment.

The guidelines stress on road safety audit and pedestrian facility audits. These can help in reducing the number and severity of clashes by identifying safety issues and correcting them before projects are implemented.

Even though road building agencies are expected to follow these guidelines these are never implemented in totality and a great part of the design standards related to complete street design for improved accessibility for walkers and cyclists and universal access are ignored. It has, therefore, become necessary to mandate complete street design according to the improved guidelines.

At the city level, Delhi has taken the lead to adopt street design guidelines. In 2009, the governing body of the UTTIPEC had approved the Street Design Guidelines. This focuses on mobility and accessibility, safety and comfort, and ecology. This requires design to create 'eyes on the street' by removing setbacks and boundary walls and building to the edge of the street, to allow people from inside to look out on to the pavement, thus discouraging misbehavior, shady corners, etc.

Even though extensive and comprehensive guidelines have been created for Delhi, most of these are not implemented. It has therefore become necessary to make its holistic implementation mandatory by notifying the guidelines under the Delhi Development Act and make them a part of the Master Plan.

This will also require a lot of awareness raising and capacity building among the road building agencies. Sarvagaya Srivastava, chief executive engineer Public Works Department, Delhi says: "The PWD is an implementing agency and responsible for all engineering aspects. There has been a paradigm shift now as earlier the requirement of the footpaths was all need-based. But now design has to be done by taking a holistic view and looking at every requirement and users; things are changing." The PWD is trying to implement changes, but a multiplicity of agencies delays the projects.

Thus, immediate intervention is needed to create a holistic and integrated framework to take into all aspects of road safety to eliminate 'danger' from roads for all road users.

**All
road
construction
agencies follow
the Indian
Roads Congress
guidelines**

I. The way forward

The only way Indian cities can avert a serious mobility and pollution crisis is by scaling up public transport along with walking and cycling. The Delhi Master Plan, for instance, has set the target of increasing the share of public transport to 80 per cent by 2020 (from the current share of 40 per cent). Several other cities have set similar targets. This would be possible only if walking and cycling are also scaled up to improve safe access to buses, Metro stations and other destination points. Almost every public transport trip begins and ends as a walk trip. Even a 50 per cent increase in public transport ridership will increase the demand for walking and will need significant expansion of walking infrastructure. Moreover, safe infrastructure for walking and cycling can help to convert large number of short-distance motorised trips into walking and cycling trips and reduce air pollution and carbon footprints enormously.

Unfortunately, the obsession with high speed, seamless, signal-free travel for motorised vehicles through flyovers, expressways and elevated roads is increasing safety risk and disrupting the direct shortest routes of walkers and cyclists. This is increasing distances and travel time for people and exposing them to very high traffic friction and accidents.

Car parking and other encroachments are taking away space from people, exposing them to unsafe conditions. This can adversely affect public transport usage. It is a matter of concern that road engineering interventions once made cannot be changed easily — but it can permanently decide the design of the network and influence travel choices and safety of people. The time to act is now.

It is clear, that policies now need to focus not only on injury reduction, but also on reducing the danger that is being built into road infrastructure by design.

Reform the Motor Vehicles Act (MVA) and Rules for stringent penalty, reduce speed limit in cities to 30-40 km/hour and make penalties more stringent to achieve zero fatalities. The Motor Vehicles Act and Rules focus on vehicle safety, seatbelt and helmet requirements, and speeding and drunk-driving laws. This can work effectively only with strong deterrence and stringent penalties. Align with global best practices, reduce the average traffic speed to 30-40 km/hour to reduce speed differential between different modes and the severity of the friction, and make penalties more stringent.

Strictly enforce the existing provisions of the Central MVA that bar parking and obstruction on pavements: The Act already has a provision that bars vehicles from being parked in public spaces. Enforce these clauses to protect walk space and crossings. Make all forms of encroachment on footpaths (including parking, extension of private gardens etc) punishable by law. This can be implemented immediately by invoking the provisions of the MVA.

Notify the improved guidelines of the Indian Road Congress under a national act to make it mandatory across the country: This is needed urgently to legally mandate improved guidelines for street and road network development in a holistic manner. This should be backed by a comprehensive road safety act addressing the safety of all road users, including the vulnerable ones such as pedestrians and cyclists. Similarly, notify the UTTIPEC street design guidelines under the Delhi Development Act to make them mandatory. This should be included in the Delhi Master Plan and be made the basis of approval of all road network projects.

Introduce comprehensive road safety act to protect all road users: This act should holistically address the issues of enforcement of safe road design, protection of space of vulnerable groups, safe driving and penal action.

Pre- and post-construction road safety audits of roads must be made mandatory for all city-based road projects. This practice is currently in vogue for highway projects, especially those that are funded by multilateral banks. This provision should be developed and mandated for city roads as well.

Public transport plans must include pedestrian plans for multimodal integration. All cities are poised to scale up public transport plans and systems. This is an opportunity to integrate public transport with safe walking and cycling access.

Improve traffic surveillance and technology aids. Massive investments have been planned in Delhi as well as in several other countries in this area. These will have to be effectively deployed to integrate with surveillance of traffic violations.

Enhance the capacity of enforcement agencies. Enforcement and implementation agencies do not have adequate professional skills related to risk prevention and road design (to derisk cities). This will require training and awareness for skill building.

Implement measures to reduce automobile dependence. The ultimate solution lies not only in designing roads and cities for making roads safe and reducing vehicle miles traveled, but also for taking additional measures to reduce automobile dependence.

References

- Anon 2013, Global Status Report on Road Safety 2013: Supporting a decade of action , World Health Organization, Luxembourg
- Anon 2013, Road Accidents in India 2012 , Ministry of Road Transport and Highways, Government of India, New Delhi
- Anon 2013, Accidental Deaths and Suicides in India 2012 , National Crime Records Bureau, Ministry of Home Affairs, Government of India, New Delhi
- M. C. Mishra 2014, Director, All India Institute of Medical Sciences, New Delhi, May 26, personal communication
- Geetam Tiwari 2014, Planning and Designing Transport Systems to Ensure Safe Travel for Women , International Transport Forum, Organisation for Economic Co-operation and Development
- Anon 2006, National Urban Transport Policy , Ministry of Urban Development, Government of India
- The Central Motor Vehicles Act, 1988 and Rules 1989, Ministry of Road Transport and Highways, Government of India
- The Motor Vehicles (Amendment) Bill 2012, Ministry of Road Transport and Highways, Government of India
- The India Penal Code, 1860
- The Rules of the Road Regulations, 1989
- National Road Safety Policy 2010, Ministry of Road Transport and Highways, Government of India
- Street Design guidelines, UTTIPEC, Delhi Development Authority
- Dinesh Mohan edited, 2013, Safety, Sustainability, and Future Urban Transport, IIT Delhi, Eicher
- New York Times, 2014, Matthew Chayes, NYC re-engineers traffic to prepare for 25 mph limit. July 20



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