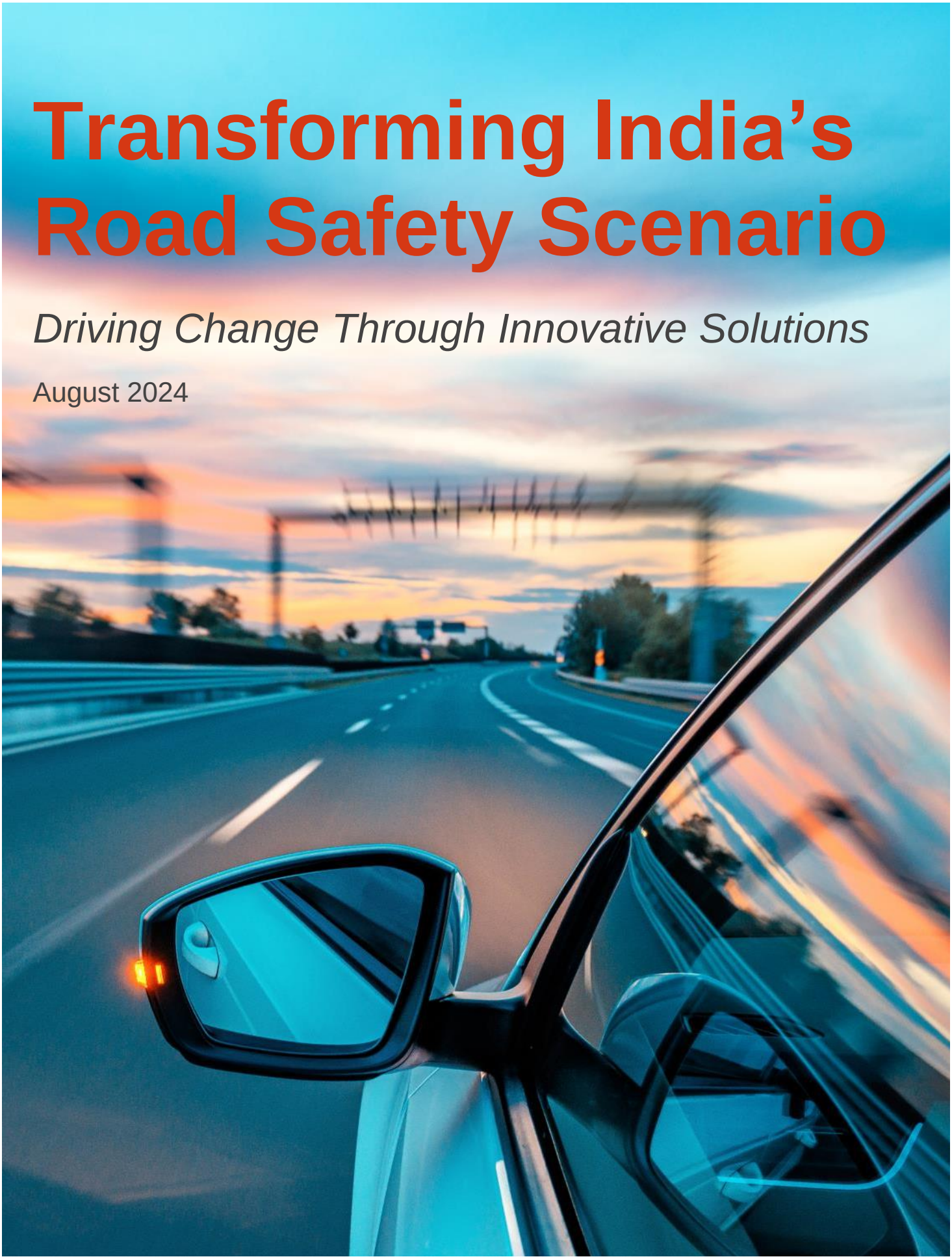
FICCI

CRISIL
An S&P Global Company

Transforming India's Road Safety Scenario

Driving Change Through Innovative Solutions

August 2024



Contents

Foreword-FICCI **4**

Message from CRISIL **5**

Executive Summary **6**

Introduction **8**

Understanding road safety dynamics 9

Where are we going wrong? 11

Case Studies – Evolving Road Safety Dynamics in India **12**

State best practices 12

Corridor-based best practices/demonstrations 13

City and network-based best practices 15

Initiatives by industry 16

Role of Stakeholders **19**

Collaboration is the need of the hour 19

Role of automotive, technology and transportation industries 20

Role of government 21

Role of civil society 22

Recommendations/ Framework/ Action Plan **24**

Road Safety Pillars- Interventions and Implementation 24

Framework for road safety interventions 27

Priority action areas 28

Road safety action plan – need of the hour 30

Speed control – reducing accidents and fatalities by 70% 33

Foreword-FICCI



Mr Ramashankar Pandey

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FICCI Sub-Committee on Road Safety,

Director (NE), Paracoat Products Ltd & Social Defence Fellow (IAF-Nudge),

National Institute of Social Defence, Ministry of Social Justice and Empowerment, GOI

I am happy to share with you the FICCI-CRISIL Knowledge Report on *'Collaborative Approaches to Improving Road Safety in India: The Role of Stakeholders',* unveiled at 6th Edition of FICCI Road Safety Awards & Conclave 2024 organised by the Federation of Indian Chambers of Commerce and Industry.

India stands at a crucial juncture in its journey towards becoming a global economic powerhouse. Productivity and safety of our workforce is essential to reach the vision of a *Viksit Bharat@2047*. As our nation's infrastructure rapidly expands, it is certainly essential to ensure safety of our productive workforce, specially while commuting on the vast network of more than 63.3 lac kilometres of Indian roads, only second to the road network length of the United States.

The sobering statistics of road accidents and fatalities remind us that progress cannot merely be measured by the length of our highways but by the safety of those who travel on them. Millions of us use roads every day and more than 461 families don't get back their people home, day after day. Road deaths remain the biggest cause of unnatural death for Indians, and mostly young.

Road crashes account for 1.35 million lives lost globally each year, with 93% of these fatalities occurring in low- and middle-income countries like India. In 2021, the National Crime Records Bureau reported over 155,600 fatalities on Indian roads. Vulnerable groups such as pedestrians, cyclists, and two-wheeler drivers make up nearly 54% of all fatalities and serious injuries, with 69% of fatalities affecting those aged 18 to 45. These numbers are concerning. These are the productive, young population of India!

The disproportionate impact of road crash deaths and injuries on this economically productive segment of the population negatively affects productivity and, in turn, hampers the GDP growth rate.

The FICCI-CRISIL Knowledge Report delves into the critical role of stakeholders – government bodies, private sector players, civil society organisations, and individuals – in fostering a safer road environment. It highlights that road safety is not just the responsibility of one entity but a shared commitment. From implementing stricter regulations & improving road infrastructure to enhancing driver education and fostering a culture of safety, every stakeholder has a role to play in reducing road accidents and saving lives.

As we move forward, let this report serve as a call for action by all stakeholders. The insights and recommendations herein are not just guidelines but imperatives and best practices. By working together, we can create a safer, more responsible, and resilient road network that supports our nation's growth while safeguarding its most valuable resource — its people.

I hope you will find this report useful. We welcome your suggestions and feedback.

Message from CRISIL



Ashutosh Bhandari

Sr Practice Leader & Director,

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CRISIL - Market Intelligence and Analytics

India records the highest number of road accident fatalities in the world — a dubious distinction, given the adverse socio-economic ramifications these accidents have. More disheartening is the fact that most of these deaths are preventable as through safe system approach. An analysis of the accidents suggests that over speeding, substandard infrastructure in terms of blackspot & post-crash facilities and insufficient safety features in vehicles/ unsafe vehicles etc. are the key reasons for the fatalities.

Road accidents have a debilitating impact on individual lives and families. Unfortunately, the number of pedestrians, cyclists and motorcyclists (usually hailing from low- and middle-income groups) who die in accidents is disproportionately high — more than 60%. What this also means is that so many households may have lost their breadwinners and ended up in poverty. On top of this, these families may also have had to borrow money to meet the medical expenses, eventually leading them into a debt trap.

To understand and rectify the factors leading to these accidents, all states need to devise and implement an advanced and comprehensive road safety action plan/ framework. Considering the magnitude/ seriousness of the issue, a national level road accidents data management centre must be immediately established in consultation with the states. Given that over speeding is a major cause of accidents, speed control systems and technology-based solutions are the need of the hour. Driving tests and skill training for drivers, especially those driving commercial vehicles, must be upgraded with advanced technology. For infrastructure developers and designers, crash proof infrastructure must be mandated as one of the KPIs.

FICCI and CRISIL have come together to chalk out a strategy to improve road safety in India. This report is the outcome of our deliberations and in-depth analyses. It emphasises on the role of stakeholders, focused use of technology, continuous skill improvement, better infrastructure with minimum blackspots, robust golden-hour care and targeted awareness campaign through collaborations between all stakeholders.

It is our hope that this report will give rise to meaningful discussions and result in focussed interventions to reduce road accident fatalities in India by 50% by 2030. The 6th edition of road safety award and conclave, which seeks to facilitate collaboration and knowledge sharing, is a step in that direction.



Executive Summary

Roads make a vital contribution to our country's economy, serving as the lifeline that links cities, towns and villages, fostering economic integration. They facilitate the movement of people and goods across states, which enables trade and commerce. In recent decades, the road infrastructure in our country has expanded at an unprecedented pace, mirroring our rapid economic growth and progress.

Thus, as we build more and better roads, it becomes our shared responsibility to keep them safe. However, despite noteworthy efforts on road safety, there has been an increase in the number of accidents and fatalities, which inflict human suffering and have a detrimental effect on economic growth. As per an estimate, road accidents set the gross domestic product (GDP) back by 3.14%[1], amounting to a loss of around Rs 5 lakh crore annually.

The 2020 UN General Assembly resolution on 'Improving Global Road Safety' reaffirmed the world's commitment to the UN's 2030 Agenda for Sustainable

[1] *PIB: Road Accidents- MoRTH*

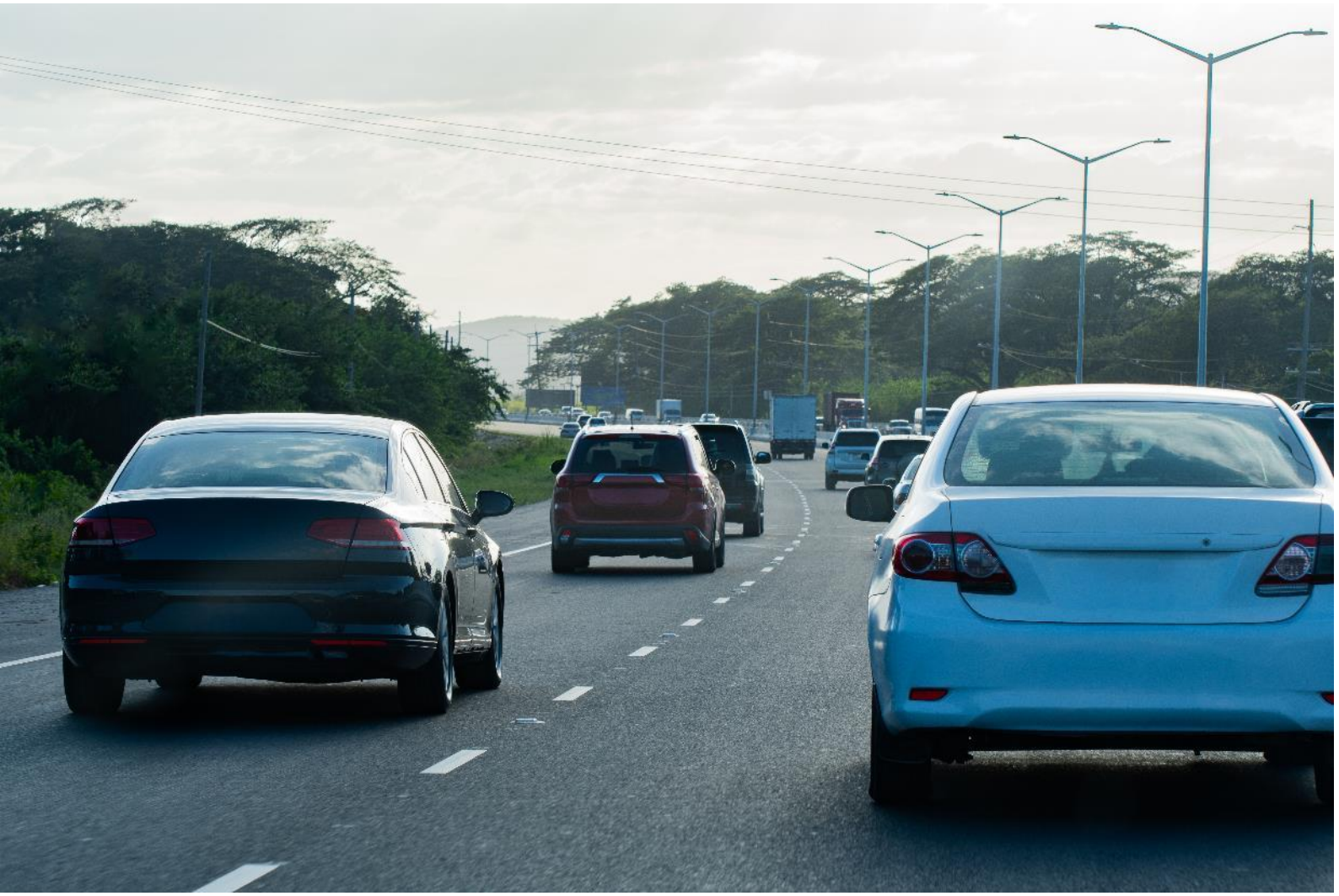
Development and declared 2021-2030 the 'Second Decade of Action for Road Safety'. It targets reducing the number of road traffic deaths and injuries by at least 50% by 2030. India has a big role to play in this global commitment.

As we delve into the causes of road accidents in our country, we discover many of these are preventable. Human error, in particular, plays a significant role in these tragedies and warrants immediate redressal. Over speeding, fatigue, negligence in wearing helmets or seatbelts and inadequate driving skills form the bulk of reasons behind avoidable accidents. Addressing these aspects through a collaborative multi-pronged approach and by correcting road design flaws can contribute significantly to improving road safety in India.

The following steps could go a long way in combating the severity of road accidents and minimising fatalities:

- Unlocking latest road safety technologies to identify and control speeding vehicles ((Speed calming systems, over speeding violation alert, IoT based automatic speed control system & automatic speed adjust system etc.), assess driver behaviour and prepare advanced training modules
- Promoting the use of advanced driver assistant systems (ADAS) with anti-collision devices, and driver fatigue and distraction monitoring system especially for commercial vehicles.
- Use of tech-based solutions like Geographic Information Systems (GIS) to capture road traffic crash data, i.e. 'where' accidents repeatedly occur and combine analyses with map-based visualisation to identify areas of concern and enable government agencies to address them
- Dedicated Road Safety Fund at central as well as state level, must be mobilized and spent effectively by formulating innovative programmes for road safety.
- Auditing 'high fatality' corridors for engineering and design faults using technology and converting them into 'zero fatality' zones
- Installing robust post-crash care systems, i.e. improving response efficiency and ensuring easy access to trauma centres
- Collaboration between industry, government and civil society
- Robust driving training facilities and testing systems accessible to all
- Creation of a National Safety Index
- Creation and implementation of state road safety action plans along with a corridor- focused approach

Through this report, we hope that the case studies/analysis and recommendations/framework, it presents, will lead to a cross-functional knowledge exchange and collaborative action, and seek synergies towards improved policies, practices and more informed initiatives by stakeholders, in turn, improving road safety plans and outcomes.



Introduction

In 2022, road accidents claimed the lives of about 168,491 people in India—or one every four minutes—according to data from Ministry of Road Transport & Highways (MoRTH). Thus, by the time you finish reading this report, road accidents would have claimed at least 18 lives in India in a single hour.

The personal, social and economic consequences of this are staggering. Data from the MoRTH shows crash costs amount to 3.14% of the GDP.

The resultant injury and loss of lives are also a huge burden on India's demographic dividend and have a tangible impact on living standards and economic productivity. Almost half of all road accident victims are 18-45 years old, implying a loss in the most productive years.

The poor are the worst hit, considering pedestrians and two-wheeler, both account for more than half of road accident deaths (64%) in the country. These represent lower income strata of the society, which have the least protection in terms of adequate medical and social safety. Thus, the burden of an accident is borne not only by the victims but also their households and families—and, thereby, the economy.

Therefore, as a signatory to the 2020 Stockholm Declaration, India aims to halve the rate of road crashes and deaths by 2030.

Understanding road safety dynamics

Road safety is also one of the biggest public health concerns in India. It is imperative for the health and prosperity of the country as much as individuals. In addition to pedestrians, motorcyclists and motorists, the issue concerns unauthorised vendors and others who encroach roads.

According to a 2022 report by MoRTH, the five key causes of road accident-related deaths are speeding (71.2%), driving on the wrong side (5.4%), bypassing traffic signals (0.9%), using mobile phones while driving (2.0%) and drunk driving (2.5%). Increased enforcement by authorities and better education about road safety can help limit these tragedies.

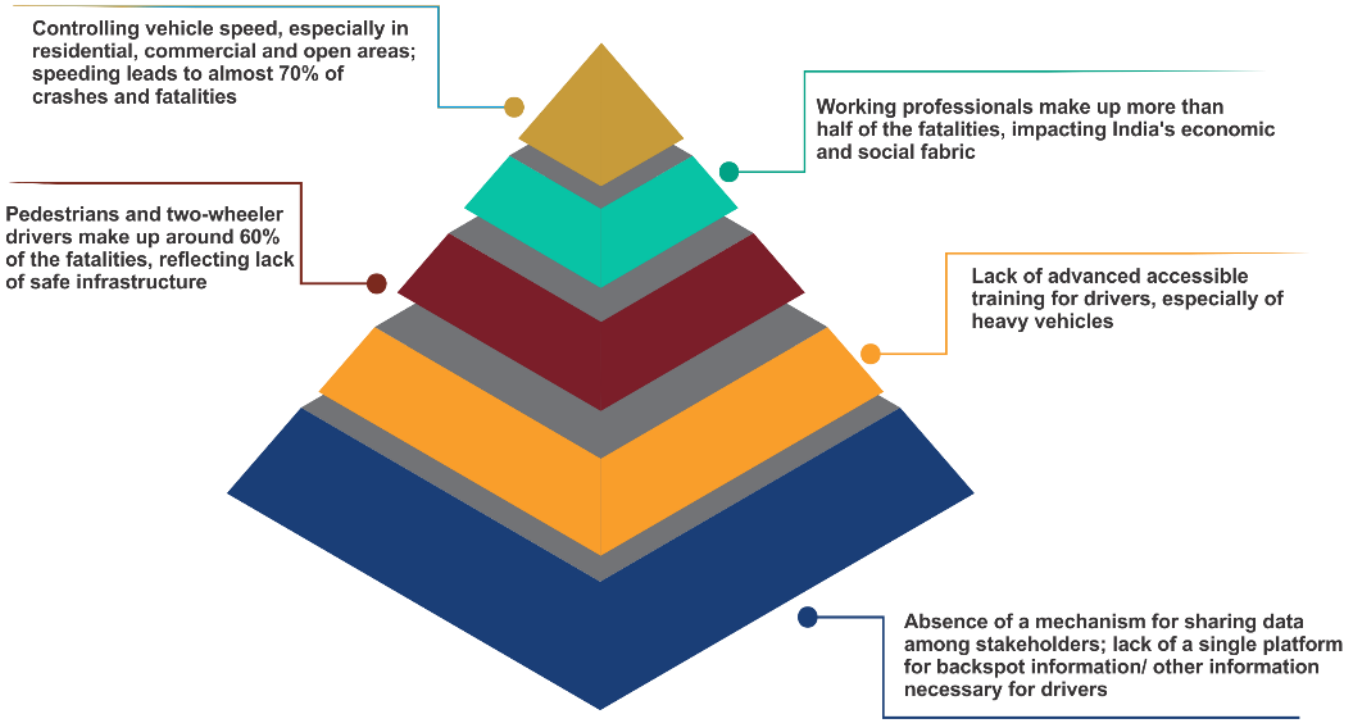
On the other hand, accidents due to road conditions are mainly attributed to straight roads (67%) and curved roads/potholes/steep grade together accounts for (13.8%). Thus, there is an urgent need to improve road engineering by using speed calmers, speed breakers, efficient road design and planning.

Two-wheelers contributed the most to accident deaths (44.5%), followed by pedestrians (19.5%), which indicates the need for safety regulations based on the category of road users.

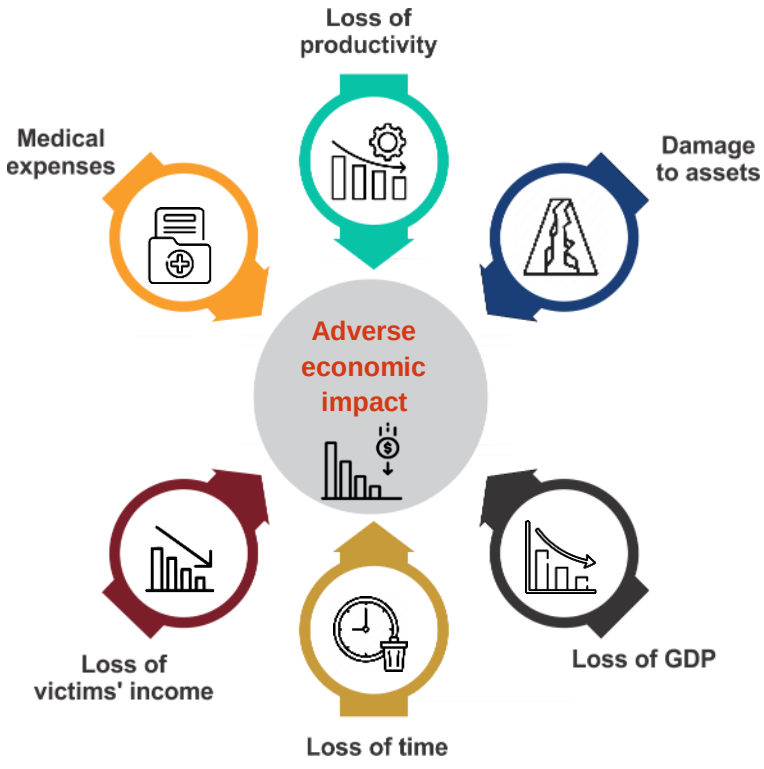
Description	Accidents	Fatalities	Injuries
Total accidents (2022)	4,61,312	1,68,491	4,44,366
Road category- National Highway	1,51997	61,038 (36.22%)	1,44,352
Road category- state highways	1,06,682	41,012 (24.3%)	1,06,485
Road category- other roads	2,02,633	66,441 (39.4%)	1,92,529
Nature of accident – hit and run	67,387	30,486 (18.1%)	54,726
Nature of accident – hit from back	98,668	32,907 (19.5%)	95,241
Nature of accident – head-on collision	77,886	26,413 (15.7%)	83,580
Traffic violation (speeding)	3,33,323	1,19,904 (71.2%)	3,22,795
Road feature (straight)	3,09,247	1,11,815 (66.3%)	2,97,694
Road feature (curved)	54,593	20,573 (12.2)	55,866

Note: Percentage is with respect to the total fatalities

Challenges



Negative Economic Impact



Where are we going wrong?

Road safety has always been a complex and multifaceted issue. Despite many interventions and initiatives by the industry, government and society, decadal trends show an increase in road accidents and fatalities. The number of vehicles has almost tripled compared to the pace of roads developed, which is cause for alarm. Further, new challenges emerging over the next decade will require innovative solutions.

1. Multimodal transport: By 2036, 600 million people will inhabit cities, representing 40% of the population. Thus, demand for mobility will exceed the capacity of most current systems. Despite the potential benefits of multimodal transport, especially last-mile connectivity, India would need to ensure vulnerable road users are equally protected
2. The increasing proportion of vulnerable road users (pedestrians, cyclists and two wheelers) deaths observed over the past decade is cause for concern given the lack of safe road infrastructure for these group
3. Purchases of vehicles/two-wheelers are increasing at a rapid pace, yet many new vehicles do not meet the bare minimum safety standards. To reduce costs, manufacturers can skip integration of life-saving technologies in newer models sold in countries where regulations are weak or non-existent
4. Lack of an appropriate safety routine and speeding cause around 70% of the fatalities, while drunken driving, failure to use helmets and seatbelts and distracted driving (stress, use of mobile phone) account for other accident-related deaths. Even after so many interventions, campaign and enforcement drives, Speed management remains one of the main concerning challenges being faced around the world and calls for a long-term, multidisciplinary response. The speed at which a vehicle travels directly influences the risk of a crash as well as the severity of injuries sustained, and the likelihood of death resulting from that crash. Reducing vehicle speed in high-impact zones, where the road user mix includes a high volume of vulnerable road users (such as pedestrians and cyclists (urban areas) or at junctions/intersections etc. is especially important



Case Studies – Evolving Road Safety Dynamics in India

State best practices

Showcasing select practices undertaken by state authorities to improve the road safety ecosystem

1. Project SuVahak, Odisha

The first-of-its-kind state-level Heavy Motor Vehicle (HMV) driver training programme launched in Odisha to improve road safety and driver skills. The project aims to provide drivers with job opportunities in India and abroad. Training is conducted at Institutes of Driving Training and Research (IDTRs) in Odisha. Currently, four IDTRs are operational in the state, located in Chhatia, Bonai, Berhampur and Keonjhar.

Most road accidents are caused due to human error, which is preventable. Therefore, proper training for drivers is essential. *Drivers trained under Project SuVahak have so far maintained a zero-accident record.*

Corridor-based best practices/demonstrations

Showcasing select practices undertaken by major road corridors to improve the road safety ecosystem[2].

1. Belgaum-Yaragatti Highway (SH-20) Safe Corridor Demonstration Project (SCDP)

The 62-km Belgaum-Yaragatti highway saw 179 crashes and 50 deaths in 2015. Interventions across the 4Es of road safety[3] were implemented on the stretch, which resulted in a 54% reduction in deaths between 2015 and 2018.

Development, customisation and high-level monitoring of post-crash care: The Karnataka government's health department focused on strengthening the entire chain of post-crash care, i.e. on-site care, in-hospital care and patient referrals. A *network-based communication system was established between the police and the health department* to provide guidance and simultaneous updates to both the caller and the relevant agency. On-ground data was gathered to create a tailored implementation plan, and it was monitored at the highest level via a state-level monitoring body, which included the project director, the state health secretary, the director of health services and key members.

***Institutional strengthening and improved coordination between departments via regular meetings focused on corridor interventions*:** Under Karnataka State Highway Improvement Project II, institutions linked to the road sector were strengthened with a detailed plan of action. *The plan was a major reason for the decline in crash deaths on the Belgaum-Yaragatti Corridor*. Such plans are instrumental for the smooth implementation of a project without compromising safety. They should be developed for road safety projects of a similar scale in other states.

2. Old Mumbai-Pune Highway (NH-48)

The 111-km stretch of the Old Mumbai-Pune Highway witnessed a large number of road crash fatalities, i.e. approximately six times higher than the road crash deaths per km witnessed on national highways in the country. Interventions across the 4Es were implemented on the stretch, which resulted in a 61% reduction in deaths between 2018 and 2021.

Crash Vulnerability Audits (CVAs) - Highway stretches can be audited at least once a year in depth based on the 4Es of road safety to identify safety issues and recommend appropriate measures. Typically, safety initiatives are confined to an assessment of the quality of road engineering. To this effect, *states can train road safety auditors in comprehensive and regular auditing techniques that also study concerns such as the availability and quality of emergency care and police enforcement*. This will allow informed and targeted interventions to be taken up to reduce the number of road crashes.

Prioritising high-fatality zones over black spots: The common approach on black spots tends to rely heavily on historical crash data at a specific spot on the road. Conversely, under CVAs, projects involve regular analysis of crashes and the causes behind the deaths on a 5-kilometer-long stretch designated as a high-fatality zone. This is based on triangulation of FIR data, speed data, traffic volume and black spot data to name a few. Further, *the "black spot" analysis includes not only the location, but also the 500-m stretch around the location*. Therefore, state governments should prioritise a larger stretch of road and audit and deploy corrective measures on it. This will ensure black spots as well as nearby areas are made safer.

[2] *Road Safety Good Practices in India, Report by Ministry of Road Transport & Highways, Government of India*
[3] *Ministry of Road Transport & Highways, Government of India initiative to reduce road fatalities and injuries - 4Es of Road Safety i.e. Engineering, Enforcement, Education and Emergency Care.*

Conducting tactical urbanism for unsafe intersections on highways - Tactical urbanism refers to the deployment of low-cost and temporary interventions such as cones and barriers to reallocate the road space on a spot (could be a high-fatality stretch or intersection) to protect pedestrians and non-motorised transport users from fast-moving vehicles and also reduce speeds. This will improve the overall safety of the zone or intersection.

3. Yashwantrao Chavan Mumbai-Pune Expressway

The 94.5 km stretch of the Mumbai-Pune Expressway witnessed 159 deaths per 100 km in 2016, which was higher than the national average of deaths on national highways i.e. about 50 deaths per 100 km. Interventions across the 4Es were implemented on the stretch, which resulted in a 40% reduction in deaths between 2016 and 2022.

Strategic positioning of enforcement and emergency care resources: Highway or expressway patrolling vehicles and ambulances can be suitably positioned near black spots and other crash-prone sites. *As opposed to evenly distributing patrolling vehicles, police vehicles were deployed at high-fatality zones on the expressway to enable quick action in the event of a crash*. This also improved regular patrolling aimed at preventing illegal and unauthorised driving. Ambulances were optimised, upgraded and similarly positioned to provide quick emergency medical care.

State governments can position medical transport, and first response vehicles based on the same mechanism to ensure critical resources are positioned as per needs. Further, the movement of such vehicles can be tracked using GIS and the recorded data can guide future procurement, allocations and improvements in the delivery of emergency services.

City and network-based best practices

Showcasing select practices undertaken by cities to improve the road safety ecosystem[4]

1. KERALA Kerala's Sabarimala Safe Zone

The Sabarimala safe zone comprises the roads connecting to the Sabarimala temple. Interventions implemented across the 4Es in the zone resulted in zero deaths for two consecutive years (2019-2021).

Developing a robust enforcement model – The model can be leveraged to improve road safety in areas where road engineering and road user expertise have limited effect. Without significant engineering work, the project managed to eliminate road crashes in Sabarimala between 2019 and 2021. Constant patrolling and coordination via control rooms were clubbed with electronic enforcement.

Capacity building for emergency care: The burden of road crash seemed to arise mainly from delay in emergency care and rescue work, due to congestion. This was caused due to a lack of rapid access repair services and prompt bystander care. To increase the capacity of emergency care in the zone, police officials and local medical facilities took on the responsibility of rendering emergency care and breakdown assistance to resolve congestion. The state thus managed to enhance the emergency care on the stretch, which was one of the factors of zero road crash deaths. Such capacity-building measures can be deployed in zones with limited access to emergency care and huge congestion.

2. Tamil Nadu's Hub-and-Spoke model

In 2017, Tamil Nadu witnessed 17,918 deaths, which increased to 18,392 in 2018. Interventions across the 4E's implemented in the state led to reduced deaths between 2018 and 2022 (2.8% reduction in deaths).

Involving high-ranking officials in road safety bodies - The institutional setup and operations under the state road safety projects can greatly benefit from the leadership of high-rank officials, such as at the level of a principal secretary.

Hub-and-Spoke model – The model comprises spokes, which are centres providing first aid to accident victims, while hubs facilitate a more elaborate or definitive care to the victim. The classification is based on a feasibility analysis that mapped the hubs to their spokes based on "assured referral linkages". The same allowed trauma care centres to be designated as Level 1, 2 and 3 (Level 1 centres providing the highest level of care).

[4] *Road Safety Good Practices in India, Report by Ministry of Road Transport and Highways, Government of India*

Initiatives by industry

1. Automated Driving Test Track project (ADTTs)



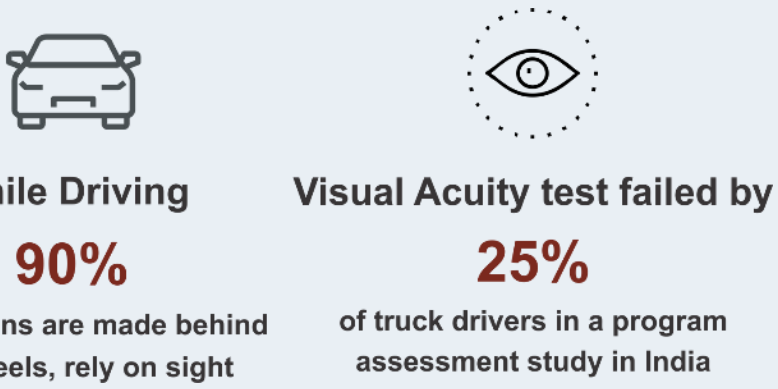
The process for granting driving licenses lays the foundation for road safety, since it contributes to the quality of drivers and road safety awareness. *Maruti Suzuki* is working to improve road safety since decades and has taken significant strides to strengthen the process of driving test required for obtaining a license through its ADTTs.

The project, executed under the public private partnership (PPP) model with the state transport departments, aligned with the centralised Drivers of Motor Vehicles Rules. Maruti Suzuki has constructed automated scientifically designed test tracks and uses the latest technologies to evaluate driving skills required for obtaining a driving license. The tracks assess crucial driving skills on scientifically laid tracks, including reverse parallel parking, overtaking, traffic junction navigation and gradient tests for four-wheelers. Two-wheeler applicants undergo tests, such as navigating a serpentine track, emergency braking and balancing strip. The smartphone-based Harnessing Auto Mobile for Safety solution is jointly developed by *Maruti Suzuki's Institute of Driving and Traffic Research* (IDTR) and Microsoft Research India to provide a safe, automated and transparent driving license test process.



2. See to be Safe initiative

VisionSpring Foundation's See to Be Safe initiative is aimed at screening commercial drivers and allied transport workers across India to enhance road safety, improve occupational health and boost economic productivity. By ensuring that drivers have a clear and healthy vision, the initiative focuses on reducing the risk of accidents caused by poor eyesight, especially for those who spend long hours driving. Regular vision screenings help identify and correct vision problems among transport workers, contributing to their overall health and wellbeing, and improving their work performance and quality of life.

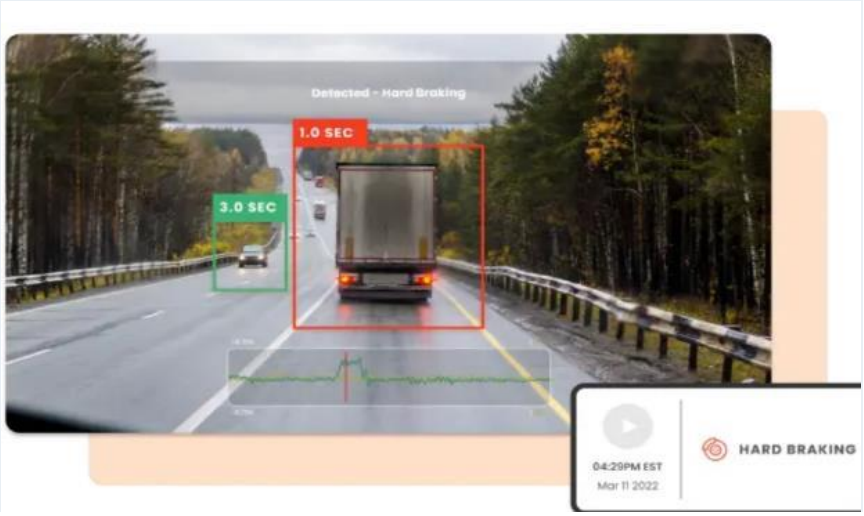


In addition, the initiative raises awareness about the importance of eye health through educational campaigns and workshops, informing drivers about the availability of affordable vision care solutions. By collaborating with various stakeholders, including transport companies, government agencies and healthcare providers, *VisionSpring Foundation* ensures the widespread reach and sustainability of the programme.

3. Driver monitoring and driving score technology using AI and ML

The initiative by *Netradyne* is focused on addressing human error in real time using computer-vision artificial intelligence (AI) technology. Several fleet organisations adopting the technology have reported drastic reduction in road accidents by more than 50%, within a few quarters of deployment.

The initiative provides advanced fleet safety solutions, solving global road and driver safety problems using vast AI and machine learning (ML) capabilities that are built into an Internet of Things (IoT) device. By leveraging advanced algorithms and sensors, the systems can detect various risky behaviour, including over-speeding, distraction and fatigue. Through timely alerts, personalised coaching and actionable insights, drivers and fleet managers can make informed decisions, ultimately fostering a safer driving environment.



Some key tangible outcomes are the real-time analysis of driver behaviour and provision of actionable feedback,

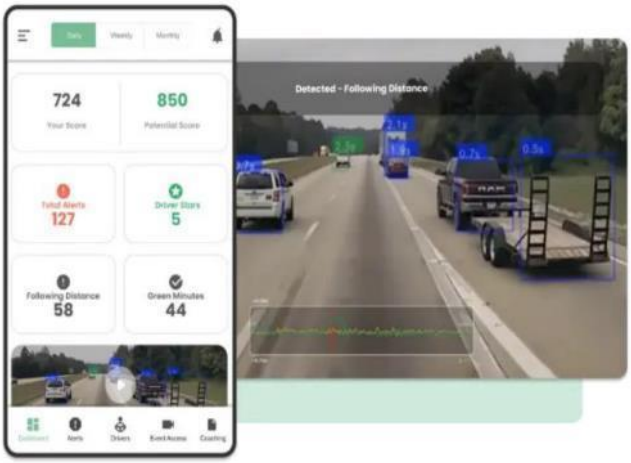
enabling companies to proactively identify and address risky behaviour, leading to 50% reduction in accidents within a few quarters of implementation.

A global petroleum company based in India reported an 80% decrease in incidents/violations. Writer Safeguard, a Hitachi group cash management company, reported a reduction of 74% in driver drowsiness and 38% in distracted driving instances within a year of deployment of the technology.

The overall driving score data shows that an improvement of 300 points (on a scale of 1,000) in driving score brings down the accident rate by 55%.

Additionally, defensive driving habits led to optimised fleet operations and reduced fuel consumption, which positively impacts the environment, with less carbon emissions.

4. Speed Calming System (SCS)



Sekura successfully developed an industry-first AI/ML-based road safety Speed Calming System (SCS), which uses principles based on behavioural science to improve traffic safety. The SCS detects various traffic violations common in India and displays the violator's vehicle registration number (VRN) on an electronic signboard. This encourages immediate corrective action and fosters sustainable positive behavioural changes in drivers, leading to orderly traffic.

The SCS includes two overhead gantries positioned ~300m apart on the approach to accident-prone locations (grey/black spots). The gantries feature violation detection and electronic display systems.

Based on the gravity of violation, colour-coded display of speed/VRN on relevant variable messaging system (VMS) heightens the impact on both violators and compliant road users alike, triggering a sustainable behavioural change well before reaching accident-prone locations. While the traditional system focuses on punitive measures such as fines, which are effective only if the violator survives the violation-led accident, the SCS promotes lasting behavioural change without relying solely on penalties. It retains the capability to provide evidence for enforcement when needed.

5. Electronic stability and tail guard systems in trucks

Vehicle rollovers are also one of the reasons of road accidents claiming thousands of human lives. Electronic Stability System (ESC) helps in enhancing the stability of truck trailers and prevents rollover in case of harsh cornering, hard braking and over-speeding. It detects the sudden shift in the centre of gravity of the truck and automatically applies brakes, slowing it down and prevents it from losing control. Globally, almost 30% accidents occur due to reversing. Hence, a tail guarding system helps to eliminate a blind spot at the rear of a truck by installation of proximity sensors. The sensors automatically stop the vehicle and prevent any reverse collision with man/machine.

DP World is the first corporate in the Indian automotive industry to have adopted these technological advancements by mass procurement of 46 such trucks.



Role of Stakeholders

India's rapid motorisation and urbanisation have brought about a significant increase in road traffic. The road safety landscape is marked by complex challenges, including congestion, inadequate infrastructure and lack of awareness. The country accounts for ~11% of global road accident fatalities, with over ~1.5 lakh deaths annually (World Bank Data). Addressing this requires a comprehensive and collaborative approach involving the automotive industry, government and civil society. The road safety problem involves three components - the human, vehicle and road infrastructure.

Road safety impacts a wide range of stakeholders, including the government, business community, civil society and public. It is a combined health, socioeconomic and infrastructural burden. The stakeholders work independently to accomplish the goal of creating safer roads, users and vehicles. However, this individual effort has not helped reduce road crashes and fatalities. The issue demands a multilateral approach towards road safety where multiple sectors collaborate with a unified vision to make roads safer. The World Health Organization has set a target of reducing global road traffic deaths by 50% by 2030, a goal that can only be achieved through a multi-pronged approach involving the collaboration of industry, government and civil society.

Collaboration is the need of the hour

The challenges of road safety in India require a united front, which can help leverage collective strengths to create a safer and more sustainable transportation ecosystem, create comprehensive strategies to tackle

challenges and enable a safer environment for all road users. This report serves as a clarion call for all stakeholders to jointly recognise that only through collaborative efforts we can effectively address the complex and pressing issues of road safety in India.

The following actions are recommended for a successful collaboration:

- Comprehensive approach: Emphasise on the necessity of a comprehensive approach that combines industry innovation, government regulation and civil society engagement to address road safety challenges holistically
- Shared resources: Illustrate how collaboration allows for the pooling of resources, leading to more efficient and impactful road safety interventions
- Expertise exchange: Highlight the importance of sharing expertise and best practices among the automotive industry, government and civil society to formulate effective strategies

Role of automotive, technology and transportation industries

The Indian automotive, technology and transportation industries can significantly contribute to road safety through innovations in vehicle design, advanced safety features and sustainable mobility solutions. The automotive industry plays a crucial role in road safety by designing and manufacturing safer vehicles. Automakers are now incorporating features, such as anti-lock braking systems (ABS), airbags and electronic stability control (ESC) to enhance vehicle safety and minimise the severity of accidents. Additionally, the industry can contribute to research and development of ADAS and autonomous vehicles, which hold the potential to further reduce road accidents.

The industry could play a vital role in combating road safety issues through various interventions, such as:

- Developing safer vehicles: Automobile manufacturers can develop safer vehicles by implementing advanced safety features, such as airbags, ABS and ESC, supporting road safety research
- Companies can support research into road safety issues, such as the development of new safety technologies and the study of human factors contributing to road accidents
- Enforcing road safety policies within their organisations: Companies can enforce road safety policies within their own organisations by imparting training to employees on safe driving practices and implementing strict disciplinary measures for traffic violations
- Collaborating with the government: The industries must collaborate with the government to develop and implement effective road safety policies and programmes
- Corporate social responsibility (CSR): Many industries in India have embraced CSR to contribute to the welfare of the society. Several companies allocate resources to conduct road safety awareness programmes, education campaigns and infrastructure development. These initiatives aim to instil a sense of responsibility among citizens and promote behaviour conducive to road safety
- Training and skill development: Certain industries, particularly those involved in transportation and logistics, recognise the importance of imparting training and skills to drivers. Training programmes focusing on defensive driving, adherence to traffic rules and handling emergencies are essential components of industry-led initiatives to promote road safety

The industries could play a vital role in reducing road accidents in India and making the roads safer for all. A few notable interventions, which the industries could encourage and support in the road safety scenario are:

- Encourage more industries to adopt comprehensive road safety policies as part of their CSR initiatives.
- Promote the use of emerging technologies, such as AI and IoT, for smart traffic management and accident prevention.
- Facilitate knowledge-sharing platforms for industries to exchange best practices in road safety.
- Strengthen government-industry partnerships for the development and maintenance of safer road infrastructure.
- Actively participate in the current Initiatives of the MoRTH, such as:

Automated testing stations: Transport vehicles must be issued fitness certificates, depending on their roadworthiness, as per Rule 62 of the Central Motor Vehicle Rules. The Motor Vehicles (Amendment) Act, 2019, mandates that fitness testing of all on-road vehicles be done only at automated vehicle testing centres. There is, thus, a need to set up such facilities across the country.

Registered vehicle scrapping facilities: The Vehicle Scrappage Policy, 2021, focuses on phasing out old and unfit vehicles, de-registering private cars older than 20 years and commercial vehicles older than 15 years. Vehicle owners will be given certain benefits (tax rebate) for scrapping old vehicles.

Smart City Mobility Plan: This plan aims to develop smart transportation solutions for urban areas, including intelligent traffic management systems, integrated public transportation and non-motorised transport options.

Road safety engineering measures: Implementation of engineering measures to enhance road safety, including the identification and rectification of black spots (accident-prone areas) on highways.

Road safety audits: Conducting audits of road projects at different stages of planning and design to identify and address potential safety hazards.

The Integrated Road Accident Database (iRAP) / e-Detailed Accident Report (eDAR) project is an initiative of the MoRTH funded by the World Bank. Its main objective is to develop iRAD and enrich the road accident database by analysing information from across the country through data analytics. The proposed system would have a Monitoring & Reporting Dashboard and an Analytics Dashboard for easy understanding, helping apex authorities make forecasts to formulate new policies and strategies. The project aims to achieve ‘Safe Roads for All’ in India.

Role of government

The government bears the primary responsibility for creating and maintaining safe road infrastructure. This includes designing roads with adequate safety features, such as clear lane markings, proper signage and pedestrian-friendly crossings. Additionally, the government must prioritise maintenance of roads and ensure they are in good condition to minimise the risk of accidents caused by potholes or other defects.

The government also regulates design standards and fitness testing of vehicles and is responsible for creating and enforcing road safety laws and regulations. This includes setting speed limits and implementing seat belt and drunk driving laws.

Central and state governments both play crucial roles in improving road safety. The central government provides overarching policy guidelines, while states are responsible for implementing these within their respective jurisdictions.

Role of central government

Policy formulation and legislation: Evaluating existing road safety laws and enforcement mechanisms, emphasising the need for stricter implementation and penalties. The central government, through MoRTH, formulates national road safety policies and enacts laws to regulate traffic and road safety. The Motor Vehicles Act, 1988, is the primary legislation governing road safety in India and the act was further amended in 2019 with a focus on improving road safety.

Developing and maintaining road infrastructure: Discussing ongoing and planned government initiatives related to road infrastructure development and their impact on safety. The MoRTH is responsible for constructing and maintaining national highways, which form a significant portion of the country's road network. It ensures that these highways meet safety standards and incorporates road safety features like proper signage, markings and road surface conditions.

Funding and technical assistance: The central government provides the states financial assistance to implement road safety initiatives, such as infrastructure improvement, advanced traffic management and public awareness campaigns. It also provides technical expertise and support to state governments for developing and implementing road safety programmes.

Research and development: The central government promotes research and development in road safety through various institutions and organisations. This includes research on road design, vehicle safety, traffic management systems and human behaviour.

International collaboration: The central government engages with international organisations and other countries to share best practices and adopt global standards for road safety. It also participates in initiatives like the United Nations Decade of Action for Road Safety 2011-2020 & 2021-2030.

Role of state government

Implementation of road safety policies: State governments are responsible for implementing national road safety policies and enforcing traffic regulations within their jurisdictions. They oversee the construction and maintenance of roads, traffic signals and signage.

Driver education and licensing: State governments are responsible for driver training and issuing driving licences. They also implement measures to improve driver behaviour and reduce traffic violations.

Traffic management and enforcement: State governments manage traffic flow through traffic police, signals and intelligent transportation systems. They also enforce traffic laws and impose penalties for violations.

Trauma care services: State governments are responsible for providing adequate trauma care facilities and emergency medical services for road accident victims. They also promote road safety awareness among healthcare professionals.

The central and state governments play complementary roles in improving road safety. The central government provides the overall framework and support, while states implement specific measures and initiatives at the local level. Effective collaboration and coordination between the two levels of government are essential to reduce road accidents and save lives.

Role of civil society

Civil society organisations play a vital role in raising public awareness of road safety and advocating for policy changes. They can conduct public awareness campaigns, organise road safety workshops and seminars and engage with communities to promote safe road behaviour. Additionally, civil society can act as watchdogs, monitoring government initiatives and advocating for stricter enforcement of traffic rules. Non-governmental organisations (NGOs) and community groups can also work with industry and government to develop and implement effective road safety interventions.

Benefits of collaboration

Effective collaboration between industry, government and civil society requires a sharing of resources and expertise. Industry can provide technical expertise and financial resources to support research and development in road safety technologies. The government can share data on road crashes, enforcement capabilities, traffic patterns and regulatory framework to inform industry's efforts and guide policy decisions. Civil society organisations can provide insights into community needs and perspectives, ensuring that initiatives are tailored to local contexts. This helps in more effective policy implementation, improved infrastructure, and enhanced public awareness.

A collaborative approach that fosters open communication, knowledge/data sharing, innovation and shared responsibility is essential for creating a safer and more sustainable transportation system.

Several successful collaborations have demonstrated the power of a multistakeholder approach to road safety.

For example, the Global Road Safety Partnership (GRSP) brings together governments, industry, NGOs and international organisations to promote road safety worldwide. The GRSP has developed several successful initiatives, including the Safe Roads to School campaign and the Decade of Action for Road Safety.

Key Note

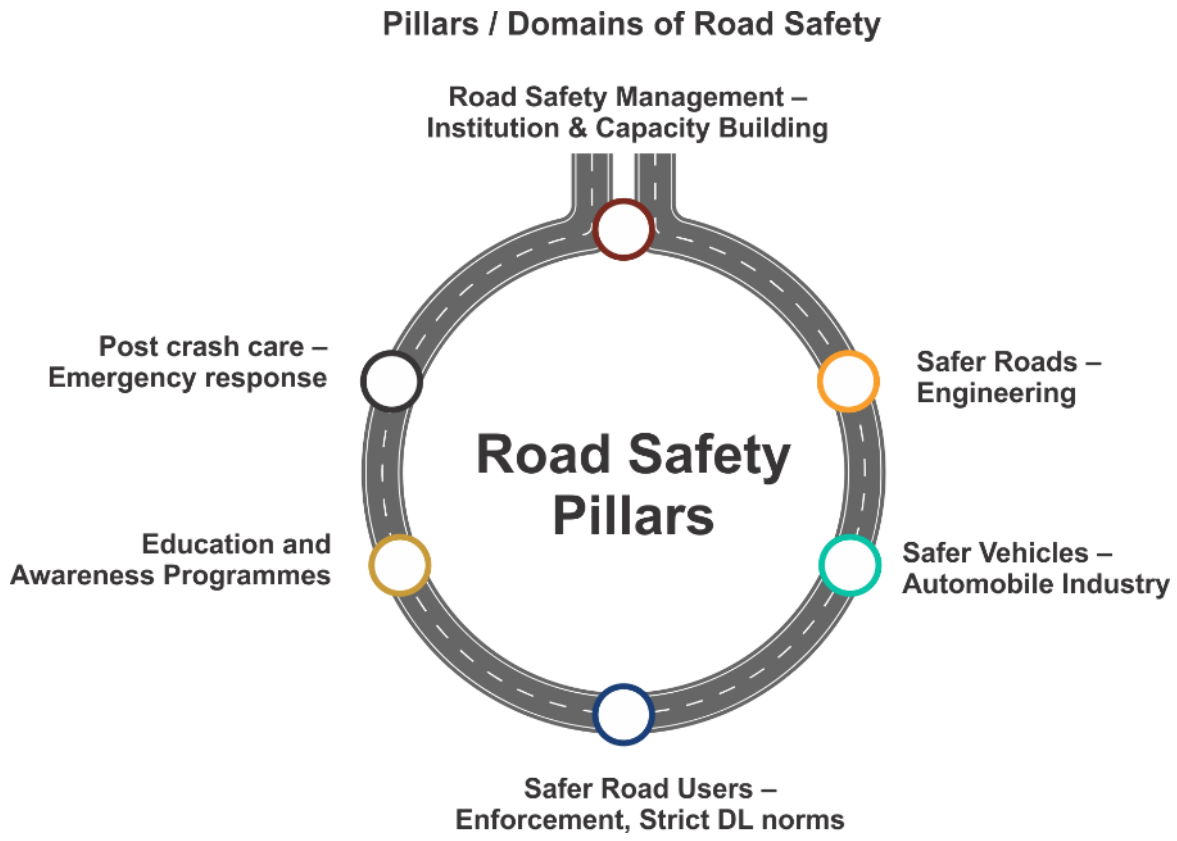
The role of industry in promoting road safety in India is multifaceted, encompassing CSR, technological innovation, training and collaborative efforts. As industries continue to recognise their responsibility in creating safer roads, it is crucial to sustain and expand these initiatives to address the complex challenges posed by road safety in the country. Through concerted efforts, industry stakeholders can contribute significantly to reducing road accidents and fostering a safer transportation environment.





Recommendations/ Framework/ Action Plan

Road Safety Pillars- Interventions and Implementation



To create an ecosystem for the implementation of the above-mentioned pillars of road safety considered by various national & international organisation, various interventions are required to implement and halve the number of accidents in India. These six pillars would yield results through a holistic, bottom-up approach, wherein:

- The issue would be first identified
- It would then be backed by data and quantified
- The data received would be analysed
- The outcome would be comprehensively discussed with stakeholders and a solution would be drafted
- With funds allocated, the solution would be implemented and monitored

Major Interventions required

- Unlocking the potential of technology
- Encouraging the use of new technologies such as AI, IoT, and GPS to check speeding, seat belt and helmet use, drowsiness and fatigue of drivers and provide real-time alerts to drivers and enforcement agencies
- The driver's behaviour, which is a subjective matter, can be tracked using AI and IoT and converted on a real-time basis into a Safe Driving Score (SDS)
- Mandating an SDS for every driving licence (DL) holder can be a game changer for road safety. Incentive schemes to encourage an SDS by linking it with all road-and vehicle-related permits
- Collaborate approach of all stakeholders and continuous monitoring and discussion on challenges and solutions through unified platform

Anti-collision/ Speed-control devices in vehicles

Installing ADAS in vehicles with features like collision prevention sensors/ lane departure warning systems/automatic speed adjust/ IoT based speed control

Enforcement

Tech-based automated enforcement system: The enforcement system needs to be automated, comprising speed cameras, incident detection cameras, redlight violation detection and automatic number plate recognition (ANPR) systems, IoT and real-time detection of violations and issuance of automated penalty challans.

However, the problem with an automated system is not the availability of technology, but of funds. The equipment and software of automated enforcement systems is expensive and requires skilled manpower for operation. Since most Indian cities/municipalities don't have enough financial resources, this requires innovative public-private partnerships.

Infrastructure

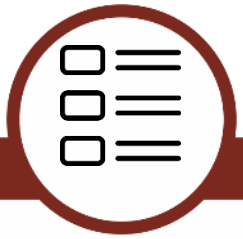
Sensor and location-based apps to provide drivers advance alerts of black spots, potholes and poor roads conditions

Auditing of high fatality corridors for engineering and design faults using technology and then converting them into zero-fatality corridors.

Emergency care

E-call buttons in vehicles, QR code-based stickers or mobile apps can map trauma centres/hospitals and create a database to provide quick emergency care during the golden hour in case of accidents.

Further, a national safety index/ road safety action plan could raise accountability and competition and drive states to undertake road safety initiatives effectively.



Need for a National Safety Index

A ranking system must be put in place to recognise the overall safety fabric of states, metropolitan cities or national highways. The ranking parameters could include the quality of roads, use of technology, number of fatalities, new initiatives (campaigns undertaken, collaboration with industry, driver unions, rectification of black spots, 24x7 surveillance and patrolling).

Further, the index could be used to provide incentives for funding proposals of states. It could be also used as a benchmarking tool and an input to assess other infrastructure rankings (such as the Sustainable Development Goal India Index). Hence, the index would encourage competition among states. Investors could also use the index as a tool for investments in the states.



Need for Road Safety Action Plans

There is a need to formulate and professionally manage state road safety action plans to implement Vision Zero in road accidents with ambitious goals and targeted safety outcomes.

An action plan is a strategic way to prioritise safety improvements and justify investment decisions. It helps communicate more clearly with stakeholders and access funding opportunities. The benefits of developing a local road safety plan (LRSP) include promoting road safety awareness, developing lasting partnerships that may benefit future projects, instilling or enhancing a sense of collaboration among different disciplines and assisting local agencies to better leverage funding.

Framework for road safety interventions

S. No	Pillars	Action areas				
1	Capacity building	Implementation of road safety action plans (RSAPs)	Use of automated driving test track-based testing for DL/ crash prevention course	Accessible advanced driving training based on DL for type of vehicle	Training on adaptation of modern technologies for all drivers, especially for commercial drivers	Psychometric test/ vision improvement/ portal for learning from analysis of accidents/ best practices
2	Engineering	Black spots/ intersections/ high impact zones re-design and construction.	Creation of no parking zones/ installing required road signage	Setting up of crash barriers/ impact absorb design	Continuous monitoring of potholes/ infrastructure maintenance	Separate lanes for VRUs, cycle tracks etc.,
3	Safe vehicles	Speed limiting (speed control) devices/ alarm systems/ intelligent IoT based intervention systems	High safety standards for vehicles irrespective the segment	Research/ innovation on safety of vehicles, on the basis of post-crash analysis	Driving assistance implements based on AI, assistance on accident prevention	Electronic stability system (ESC) and tail guarding system in trucks and other ADAS features
4	Safe road users/ enforcement	Training of officials for active patrolling	Installation of IoT-based Advanced Traffic Management Systems (ATMS)	Use of speed violation devices/ ANPR/ dynamic speed control system	Ensuring implementation of all rules and regulations	Focused approach on data collection management system/ safety audits/ post-crash investigations
5	Awareness	To start from schools, embedding road safety concerns since childhood	Nationwide programmes on overall road safety scenario	State-level programmes based on local issues or specific highway/ zone	Awareness by local officers based on kind of accidents in a particular zone (micromanaged targeted intervention)	National conclaves/ radio shows/ podcasts/ digital space/ continuous study of scenario/ sharing of best practices and learning from worst
6	Emergency care	Use of hub & spoke model for post-crash response	Robust first responder training and availability of support kits at tolls and high impact zones	Identification of high impact zones/ regular eye testing and health check-ups for drivers	Robust management at golden hour – reducing response time	Mandatory life-saving training to all the stakeholders

Priority action areas



Below is an overview of the interventions required (short- and long-term plans) based on the different roles of the stakeholders

Stakeholder	Immediate intervention required	Long term – holistic approach
Government	1. Identify black spots 2. Implement technology-based monitoring – data collection/ analytics 3. Develop a micromanaged system – high-impact zones/ corridors to be rectified/ corrected in terms of engineering measures/ monitoring measures/ speed limit interventions 4. Revise driver licensing system oriented towards high-speed corridor driving in mixed traffic conditions, with advanced-level training and test	1. Develop a state road safety action plan 2. Develop a national safety index 3. Develop a robust last-mile transportation system 4. Conduct prolonged and targeted road safety workshops/ seminars and training
Private/ industry	1. Mandate speed limiting and control devices 2. Enhance safety features of vehicles, especially commercial vehicles 3. Implement a driver monitoring system for commercial vehicles	1. Facilitate knowledge-sharing platforms to exchange best practices in road safety 2. Promote use of emerging technologies such as artificial intelligence and IoT for smart traffic management and accident prevention, such as Netradyne Driver.i– this has helped many organisations reduce accidents to half[5]
Both government and private	1. Conduct road safety audits 2. Conduct awareness and training programmes	1. Integrate data and share data with each other for better management of rules and regulations on roads (integration of road data of both the government and private players in terms of sharing CCTV footage, etc., via digital intervention on a single platform)

5 Netradyne press release

Road safety action plan – need of the hour

There is an urgent need for state governments to develop a road safety action plan (RSAP). The action plan would not only provide a strategic roadmap to prioritise safety improvements but also allow state governments to access funding and justify investment decisions to the stakeholders.

RSAPs can help in promoting road safety awareness, creating lasting partnerships that may benefit future projects, facilitating or enhancing collaboration among different disciplines, and assisting local agencies to better leverage funding.

The long-term benefits of a successful road safety strategy are as follows:

Reduced deaths and serious injuries of commuters and the public in general: Implementation of RSAPs can reduce the number of fatalities/ injuries in traffic crashes

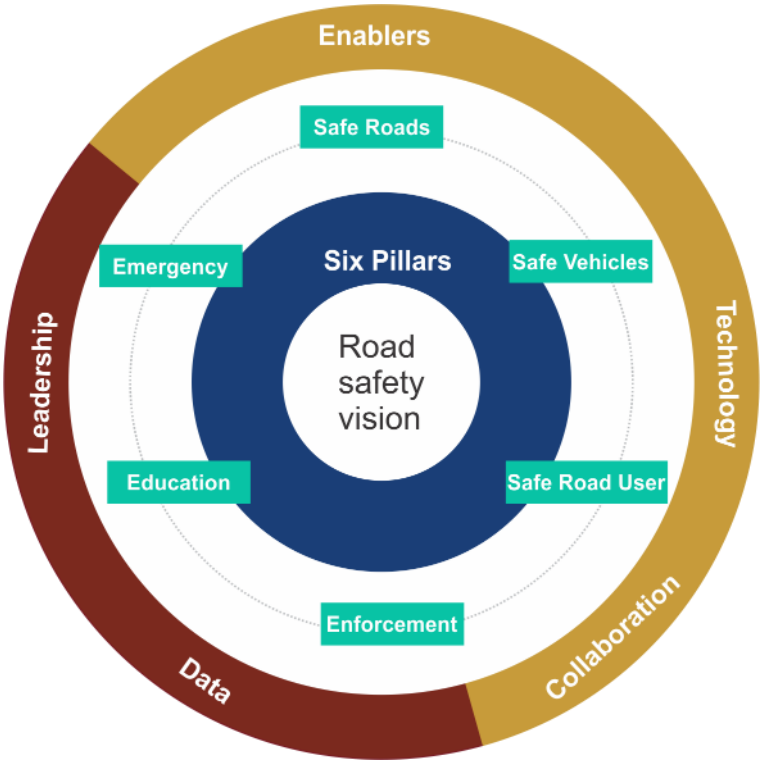
Improved health and well-being: By making roads safer, RSAPs can improve traffic flow, reduce congestion, minimise vehicular emissions, and improve overall health and well-being of individuals

Reduced costs: Cost savings can be realised from reduced loss of personnel, time off-duty (injured), damage to equipment, and collateral damage to public highways and people

Increased economic productivity: By reducing the number of traffic crashes, RSAPs can help increase economic productivity through a reduction in lost productivity due to injuries and fatalities

Improved quality of life: RSAPs can help improve the quality of life for everyone by making roads safer

Six pillars of the strategy framework underpin the RSAP.



The Six pillars of road safety action plan

Safe roads

Developing safety guidelines, standards for implementation of road projects as per IRC, and other governing standards, rules and procurement guidelines

Coordinating with central and state road agencies and police departments for necessary road improvement strategies

Ensuring building and maintenance of highways and key roads as per standards

Improving the design of roads and intersections, which can include making roads wider, adding more lanes, and installing traffic-calming measures such as speed bumps and chicanes

Extending technical and financial support to the concerned agencies

Safe vehicles

Developing new technologies that can help prevent accidents, such as collision avoidance systems

Requiring manufacturers to use safer materials in the construction of vehicles, such as those less likely to catch fire or explode

Encouraging the development of public transportation systems that can reduce the need for people to drive

Periodically monitoring vehicles through automated and tamper-proof vehicle inspection and testing centres

Safe road users

Educating road users about the importance of safe behaviour, which can include teaching them about the dangers of speeding, distracted driving, and driving under the influence of alcohol or drugs

Enforcing traffic laws, which can help deter people from breaking the law and putting themselves and others at risk

Providing better public transportation options, which can help reduce the number of people who need to drive and can make it easier for people to get around without a car

Deploying automated driver testing centres with an elaborate and stringent vehicle driving licence issuance system

Enforcement

Strengthening law enforcement measures to discourage traffic violations and ensure compliance with traffic rules and regulations

Increasing police presence, conducting regular patrols, and enforcing strict penalties for speeding, drunk driving and other traffic offences

Implementing automated traffic enforcement systems, such as speed cameras and red-light cameras

Promote public awareness and education

Launching public awareness campaigns to educate citizens about safe driving practices, pedestrian safety and the importance of road rules

Conducting targeted educational programmes in schools, colleges and workplaces to promote responsible road behaviour

Collaborating with community organisations, NGOs and media outlets to disseminate road safety messages effectively

Enhance emergency response systems

Strengthening emergency response systems by improving coordination among emergency services, hospitals and law enforcement agencies

Conducting training programmes for emergency personnel to enhance their skills in handling road accident victims effectively



Speed control – reducing accidents and fatalities by 70%

In the United States, more than half of deadly road accidents happen because of over-speeding. In the European Union as well, more than 50% of road accidents are due to over-speeding. In India, where roads can be tricky, over-speeding leads to more than 70% of road accidents, posing the greatest challenge to the country's road safety.

Over-speeding is a major problem globally, necessitating solutions such as vehicle over-speed control system to make roads safer. Overcoming this challenge requires a holistic approach, including all types of interventions.

Speed management on Indian roads

- Advanced driver training and qualifying tests
- Mapping of behavioural aspects of drivers
- Use of technology to curb speeding (to penalise drivers as well as automatically control a vehicle's speed)
- Rectification of black spots on a regular basis
- Robust monitoring of high-impact zones
- Vehicle health monitoring/ promoting awareness about regulations



A research report[6] has indicated that the death risk is about 4-5 times higher in collisions between a car and a pedestrian/road worker on foot at 50 km/h compared to the same type of collisions at 30 km/h. Considering this, there is a strong recommendation to reduce speed in urban areas.

To estimate the expected change in the number of crashes, two empirical models have been used – the power model and the exponential model (which considers the initial speed). The power model provides a good representation of the relationship between speed and crash risk and is easy to apply. As a rule of thumb, it shows that a 10% increase in mean speed leads to a 20% increase in all injury crashes, a 40% increase in fatal and serious crashes, and a 40% increase in fatal crashes. Accordingly, a 10% decrease in mean speed leads to a 20% decrease in injury crashes and a 40% decrease in fatal crashes. This means that even small changes in driving speeds can have a substantial effect on road safety.

To decrease road trauma, i.e., fatalities and injuries, interventions are required to reduce speed on roads and to reduce differences in speed.

Section control (using measurement of average speed over a section of road to detect a driver's failure to comply with the speed limit there) is a relatively new measure, which appears to be very effective in not only reducing speed but also contributing to more homogenised traffic flow and increased traffic capacity resulting from reduced

6 Speed and Crash Risk, Research Report, International Traffic Safety Data and Analysis Group (IRTAD), published by the International Transport Forum, 2018. The International Transport Forum is an intergovernmental organisation with 59 member countries. It is politically autonomous and administratively integrated with the OECD.

variability in vehicle speed. It has also been shown that speed cameras tend to reduce the severe speeding offences to a larger extent than mean speed.

Interventions required to reduce speed and significantly decrease fatalities:

Speed control/ monitoring system in vehicles

The combination of advanced driver-assistance system (ADAS) and navigation system can be used for real-time speed monitoring. The navigation system can continuously provide real-time data inputs to the ADAS for controlling the vehicle speed based on the inputs.

Automatic speed adjustment

If the vehicle exceeds the speed limit, the ADAS overrides the vehicle's manual settings and adjusts its speed to the maximum permissible limit.

IoT-based automatic vehicle speed control system

Unlike regular speed detectors, which simply identify instances of excessive speed, this system uses advanced radio frequency (RF) sensors and intelligent control technology. It not only detects speeding but also takes immediate action by wirelessly communicating with the vehicle's onboard systems to automatically regulate its speed. The system uses a radio frequency identification (RFID) module to control the speed of the vehicle. The RFID receiver should be installed inside the vehicle, and the RF transmitter is put at the start and end of the prohibited regions. The system then compares and keeps track of the speed. When a vehicle's speed exceeds the allowed limit, it automatically adjusts its speed to fit the zone7.

The system can be a solution in high-risk and high-density areas such as schools, hospitals and crossings. In the area-based speed control of vehicles using RF transmitter and receiver modules, the transmitter is installed in defined areas where the speed limit of the vehicle must be controlled. The transmitter will transmit a signal, and the receiver should be installed within the vehicle for speed controlling purposes. Whenever the vehicle enters the mapped area, the speed of the vehicle is decreased to cutoff speed and kept constant until the vehicle leaves that area.

Speed calming system (SCS) – behavioural change

The system uses behavioural science principles to improve traffic safety. The SCS detects various traffic violations common in India and displays the violator's vehicle registration number (VRN) on an electronic signboard. This provides immediate visibility, encourages immediate corrective action, and fosters a sustainable positive behavioural change in the driver, leading to calming of traffic.

Expert-level driver training and psychometric testing before issuing driving licence

The testing assesses and evaluates the capabilities/ skills of the driver/ operator under the various circumstances that arise while driving on the road. It features an anticipation test, judgement test, reaction test, aptitude test, and colour blindness and vision test. Along with these, advanced-level driver training and testing need to be made

7 IOT based automatic speed control system, International Journal of Research Publication and Reviews, Vol. 4, no. 10, pp 2,219-2,223, October 2023

accessible to the masses, especially in the case of commercial vehicles, using latest video analytics and simulation technology. Such training and testing should be mandated for issuing driving licence, rather than learning organically and receiving driving licence on reaching the permissible age for driving.

Curbing speed through the adoption/ installation of the above-mentioned technology systems would have a bearing on costs across stakeholders – manufacturers, regulators and citizens. Hence, setting up dedicated speed control funds to finance the adoption/ installation of these technologies in the initial stages will be crucial



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