

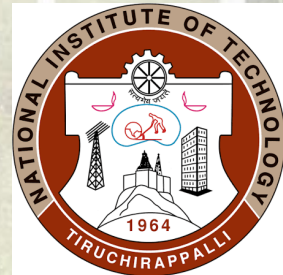
National Institute of Technology, Trichy, India

Safe System Approach to Road Safety

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Friday, 11 September 2026

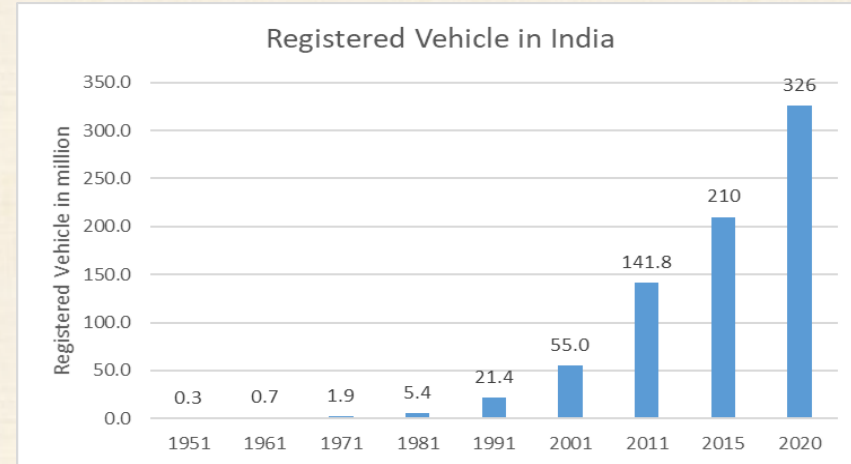
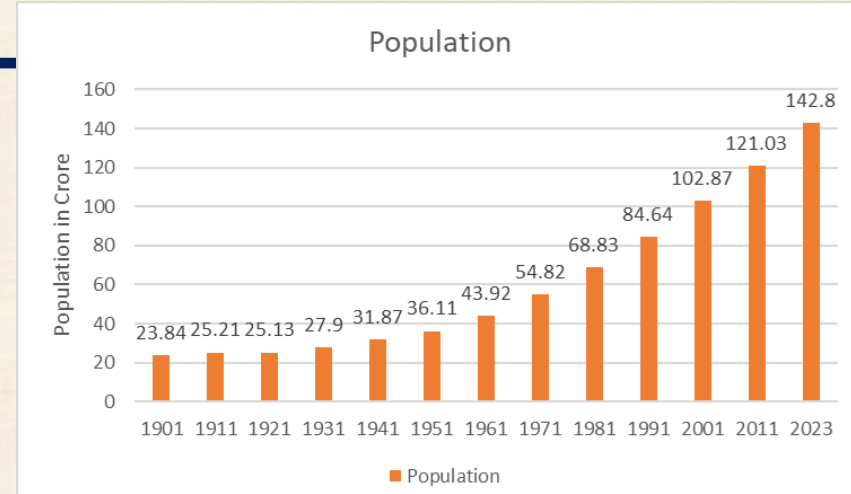


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- Careers in Road Safety
- Opportunities and Challenges

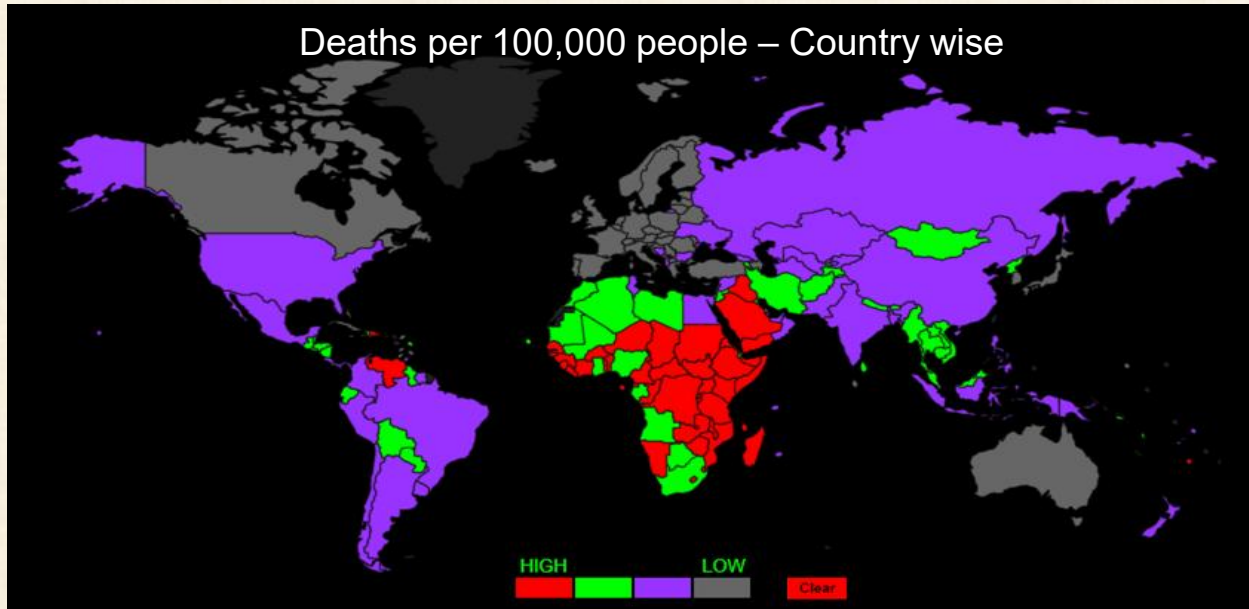
Growth Trends in India

- Population Growth in India
 - Mid-2025 - 146 crore (Source: UN)
 - Decadal Growth (2011-23) - 18.2%
 - Estimated Population by 2050 - 164 Crore (Source: UN)
- Vehicular Growth in India
 - 21 crore in 2015 to 42 crore in 2025 (Source: MoRTH)
 - Doubled in 10 years
- Urbanisation growth in India
 - 2024 - 35.4% live in urban areas (Statista)
 - Estimated urbanisation rate by 2050 - 50% (TERI)



Global Status of Road Trauma

- Globally, ~1.2 million preventable deaths on roads (equivalent to 6 jumbo jets crashing daily) and an estimated 50 million injuries each year (WHO, 2025)



Source: World Life Expectancy

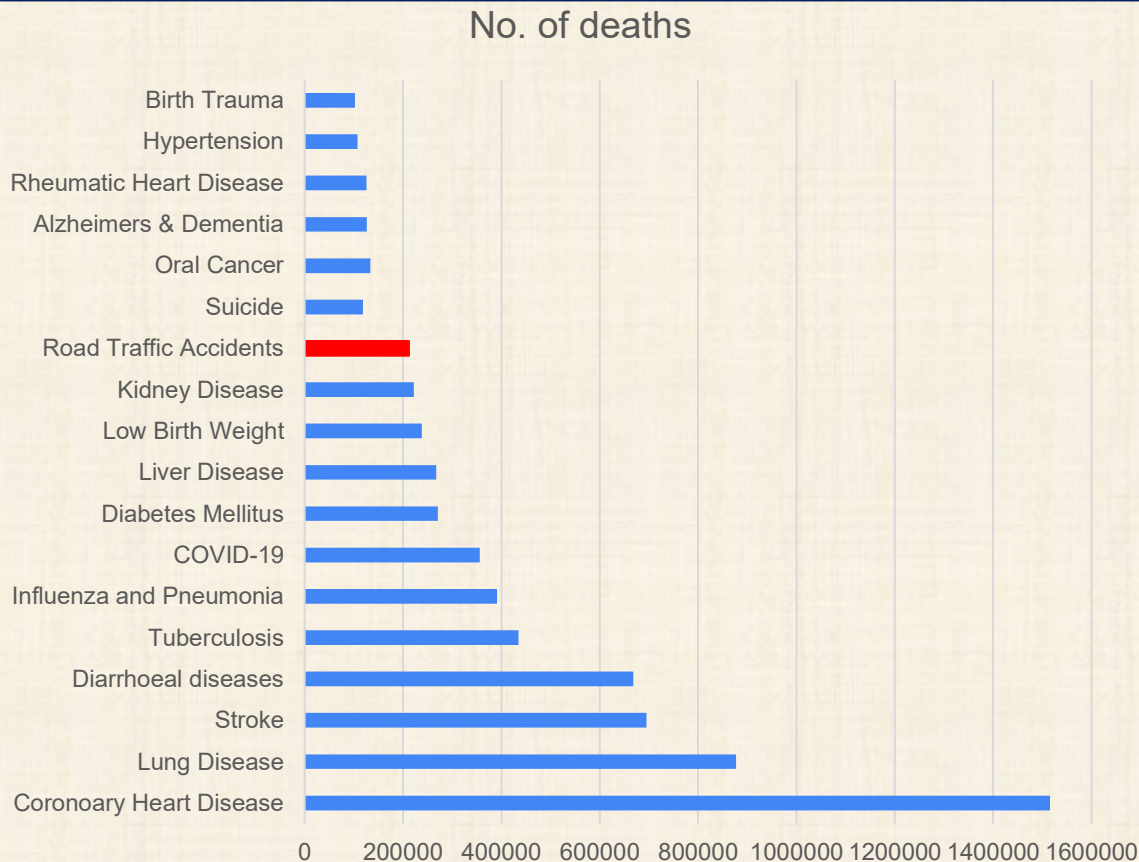
Global Status of Road Trauma

- Road crashes - **12th leading cause of death** worldwide
- Fatality rates are **3 times higher (~24 vs ~8 per 100,000 people)** in low- and middle-income countries (LMICs)
- 93% of fatalities are in LMICs - 60% of the world's vehicles
- Leading killer of **children and young people worldwide (5-29 years)**
- Young adults in the **age group of 18-45 years - 69%** of road deaths (World Bank, 2021)
- Over **50%** of road fatalities – **vulnerable users**

(Source: WHO, 2025)



Leading Causes of Death in India (FY2020-2021)



Status of Road Trauma in India

- Largest road network in the world (June 2026)
- Highest (absolute) number of casualties in road crashes
- About 520,000 (reported) crashes and 180,000 deaths in 2025
- 59 road crashes & 20 road deaths every hour, i.e. 1 death every 3 minutes
- **NHs** and **SHs** account for just 5% of the total roads = **61%** of the total road deaths (MoRTH, 2019).

1%
Vehicles

11% road
deaths



Source: World Bank, 2021

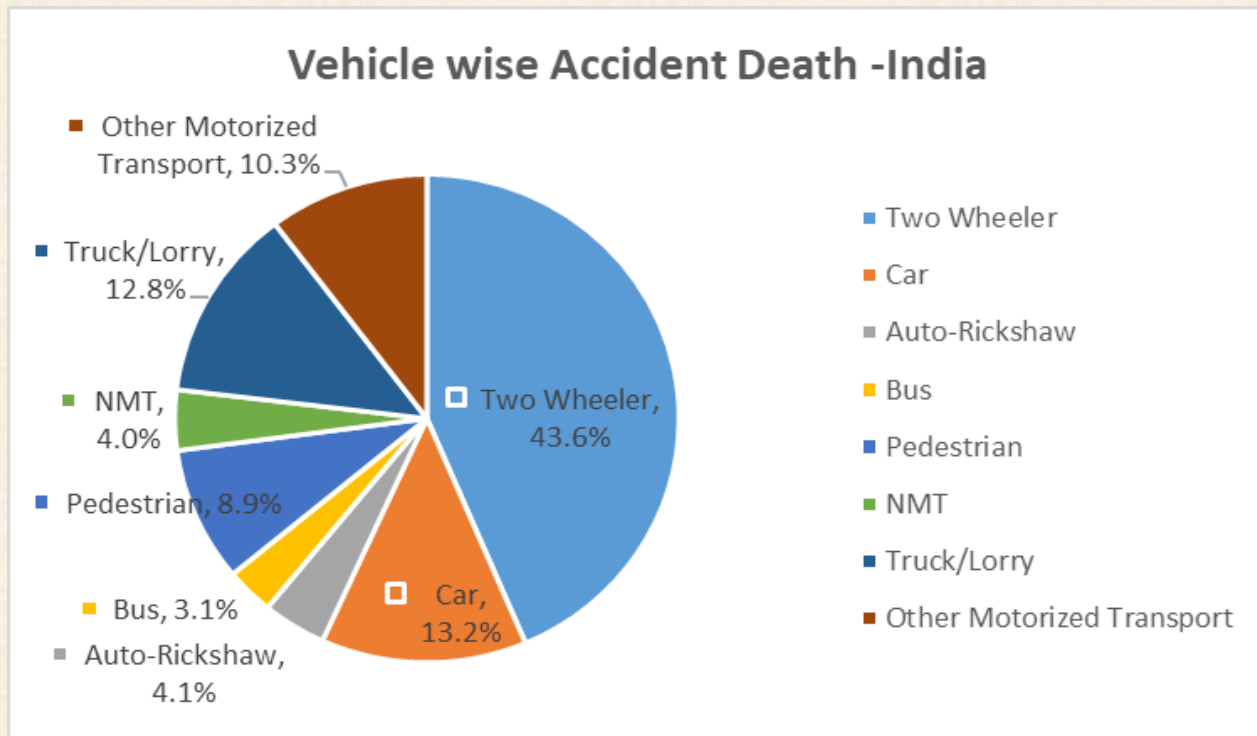
Status of Road Trauma in India

- 2-wheelers: **37%** of road deaths; pedestrians: **17%**; and light vehicles (comprising cars, jeeps and taxis): **16%** (MoRTH, 2019)
- **Speeding** accounted for most road crashes and deaths (63% to 73% for crashes and 62% to 70% for deaths) on National Highways

Source: World Bank, 2021



Road Crash Death by Travel Mode (India)



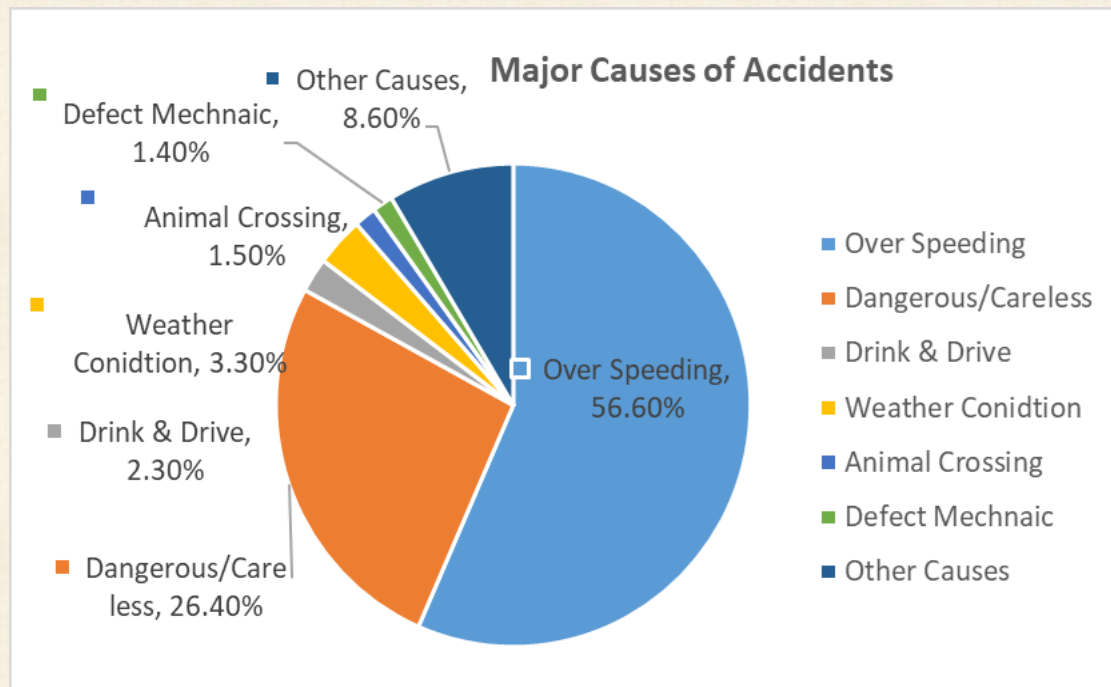
Source: METRO DPR, 2015

Crash Risk for Two Wheelers

- 2Ws (e.g. motorcycles, mopeds) - Most vulnerable
- 2Ws - 30 times more prone to crashes than cars (High DSI, World Bank)
- In India, six 2W riders die every hour in road crashes (Scroll.in)
- Not wearing helmets - about 30% of total road crash fatalities (MoRTH, India)
- Correct helmet use - 42% reduction in the risk of fatal injuries and a 69% reduction in the risk of head injuries (WHO)

Major Causes of Road Crash Deaths (National Level)

1. Over Speeding
2. Dangerous and Careless Driving
 - a. Non-adherence to lane driving and overtaking in a wrong manner,
 - b. Distractions to Driver,
 - c. Red Light Jumping
3. Drunken Driving
4. Animal Crossing
5. Weather Condition
6. Other causes



Safe Mobility

Travel Demand



Crashes and Road Deaths



- UN has established targets for Road Safety as part of SDGs.
- India is making efforts to strengthen Road Safety.



Need For Road Safety

- Road deaths and injuries affect **social and economic development** & public health
- Road Safety - facilitate progress in meeting social needs
- Road deaths and injuries - threats for sustainable development
- **SDG target 3.6 - 2020, halve the number of global road deaths and injuries**
- **SDG target 11.2 - By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all and improving road safety.**
- UN - target to reduce **road traffic deaths & injuries by at least 50%** by 2030



Voluntary Road Safety Performance Targets - UN



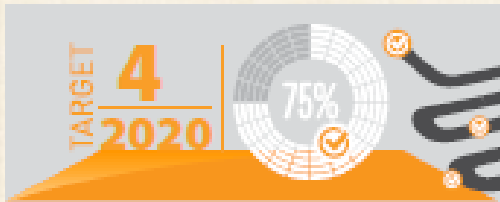
National Action Plan -
2020



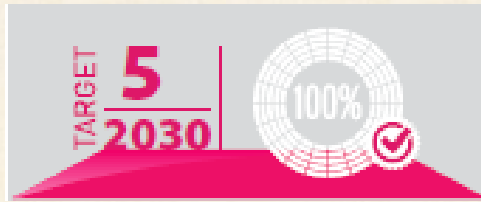
All countries on same
page - 2030



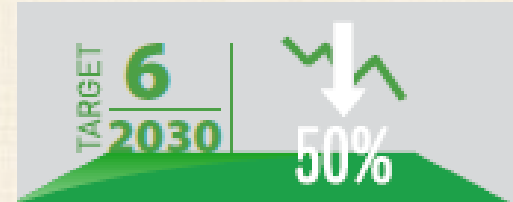
All new roads: 3-star rating
for all road users - 2030



75% of travel on existing
roads: 3 or higher star
rated roads- 2030



100% of new and used
vehicles - high safety
standard - 2030



50% reduction in proportion
of vehicles travelling over
speed limit - 2030

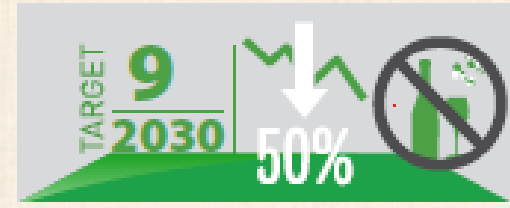
Voluntary Road Safety Performance Targets - UN



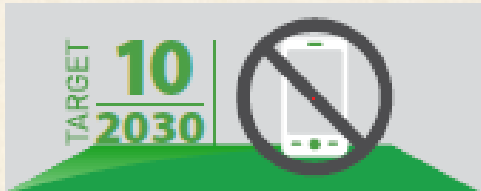
Close to 100% motorcycle riders wearing safe helmets - 2030



Close to 100% vehicle occupants wearing seat belts and child restraints - 2030



50% reduction in deaths and serious injuries due to driving under influence - 2030



All countries have national laws - restrict mobile phone use while driving - 2030



All countries have laws - driving time and rest period for professional drivers - 2030



All countries achieve targets - minimise arrival time for professional emergency care - 2030

How to Achieve UN Targets?

- **Safe System Approach** to Road Safety will help us achieve Vision Zero



* - fatalities per 100,000 people

What is the Safe System Approach?



Safe System Way of Thinking



Historical

Blaming people and victims.



Historical

Expect perfect human behaviour.



Historical

Mobility first.
Human life and health second.



Safe System

We have a shared responsibility to improve road safety.



Safe System

People make mistakes.
People are vulnerable.



Safe System

People first.
Efficiency and travel time second.

Safe System Way of Thinking



Historical

Roads and streets are designed to move cars.



Safe System

Roads and streets are places designed for people.



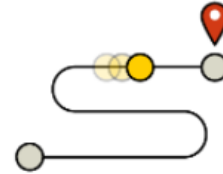
Historical

Cars and roads are the main focus of road safety



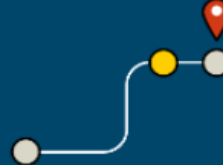
Safe System

Safety of people on foot, bikes, scooters, in cars, on buses, in trucks, trains and ferries.



Historical

We will get you there quickly, as safely as possible.



Safe System

We will get you there safely, as efficiently as possible.

Six Principles of Safe System Approach



Death/serious injury is unacceptable



Humans make mistakes



Humans are vulnerable





Responsibility is shared



Safety is proactive



Redundancy is crucial

'0' - Death & Serious Injury is Unacceptable

PARADIGM SHIFT



Focus on Fatalities and Serious Injuries



**Death/serious injury
is unacceptable**

Losing a loved one to a preventable traffic crash is unacceptable, heartbreaking, and life-changing.

Eliminating roadway fatalities is the **highest priority** of the Florida Department of Transportation (FDOT) and our traffic safety partners. We recognize achieving **zero** fatalities and serious injuries will not be easy and will require commitment, energy, and innovation. We also acknowledge that some policies, procedures, and practices must change; business as usual is not enough and systemic changes are needed to make meaningful progress.



Please join us in eliminating fatalities and serious injuries on our roadways – because even one is too many!



1



Humans Make Mistakes

PARADIGM SHIFT



Humans make mistakes

People as road users will inevitably make mistakes that can lead to crashes

In a Safe System approach, the system owners and operators should strive to make it easy for humans to not make mistakes by designing roads and vehicles to be in tune with human competences.



Source: FHWA

Humans are Vulnerable

The human body has a limited physical ability to tolerate crash forces before harm occurs.

‘Graham’: only human designed to sustain a crash



30km/h

The impact is similar to falling from the first floor of a building.



50km/h

The impact is similar to falling from the third floor of a building.



80km/h

The impact is similar to falling from the eighth floor of a building.



We have a Shared Responsibility



Responsibility is
shared

Implementing the Safe System
approach is a shared responsibility

*It cannot be achieved by
engineering alone*

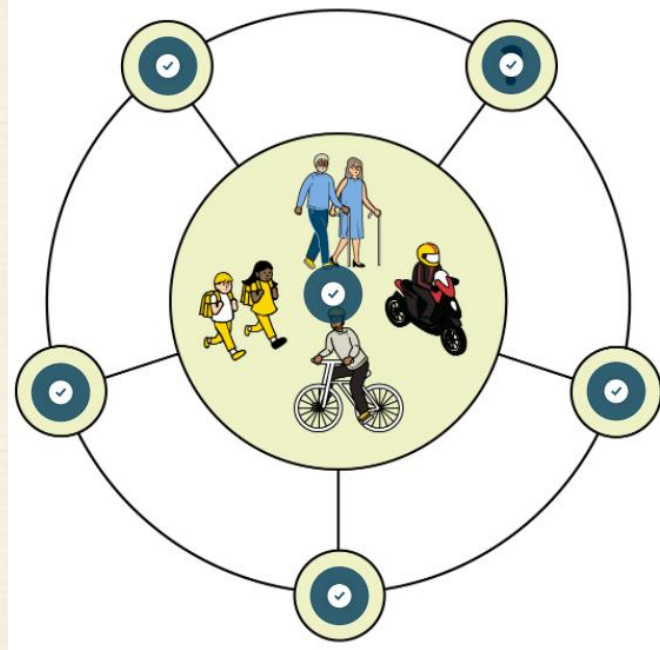




We have a Shared Responsibility

Employers and workplaces, vehicle importers and manufacturers, vehicle dealers and sellers, utility providers, insurers.

Engineers, planners, policy makers, regulators, police, investigators, emergency services.



Religious organizations, vehicle suppliers, fleet managers, NGOs, Hospitals, doctors

Schools and educational institutions, community leaders, public health organisations, advocacy groups.

Politicians and lawmakers, elected officials, investment decision makers, urban designers, media.

Safety is Proactive

PROACTIVE INTERVENTIONS:

Seek to include
features in road
design that prevent
crashes occurring

REACTIVE INTERVENTIONS:

Identify and remedy
problems in existing
infrastructure to reduce
crashes and prevent
injury

Redundancy is Crucial

Reducing severe injury and deadly crashes requires all parts of the transportation system to be improved. If one part does not work, the other parts offer other layers of protection for people.



Five Pillars of Safe System Approach





Some roads are engineered to accommodate higher speeds ...



... and others not.

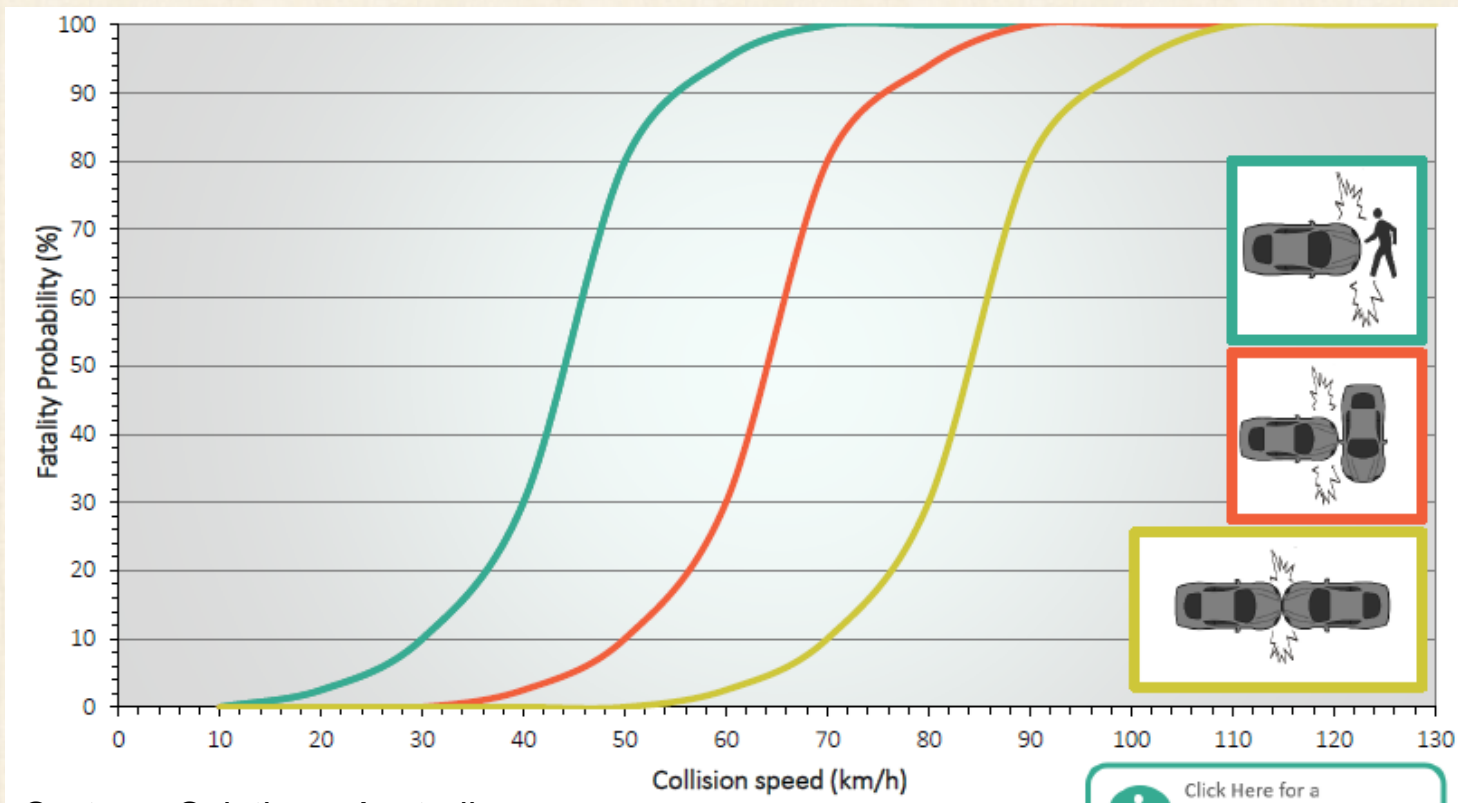
SAFE SPEEDS



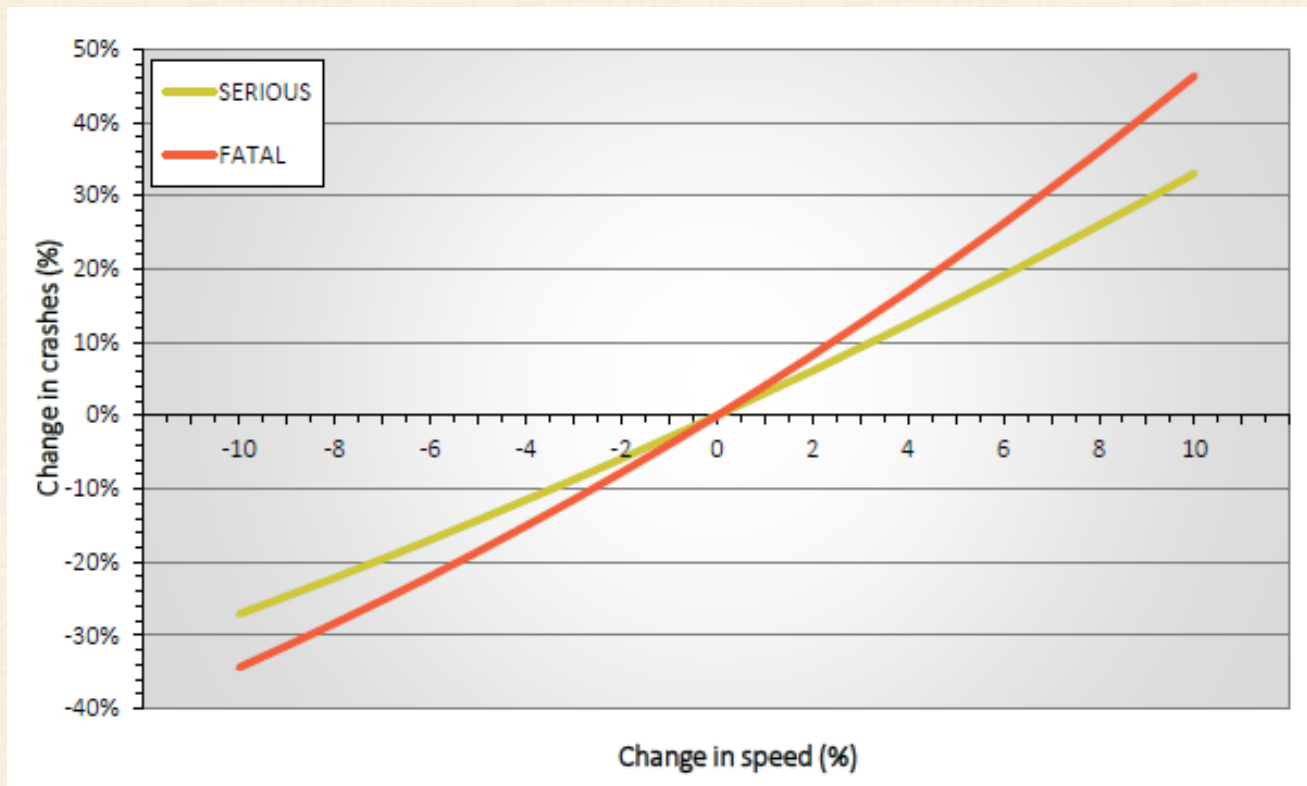
The Safe System approach is not about universally reducing speeds. It's about matching speed appropriate to the road conditions that exist.

Safer Speeds

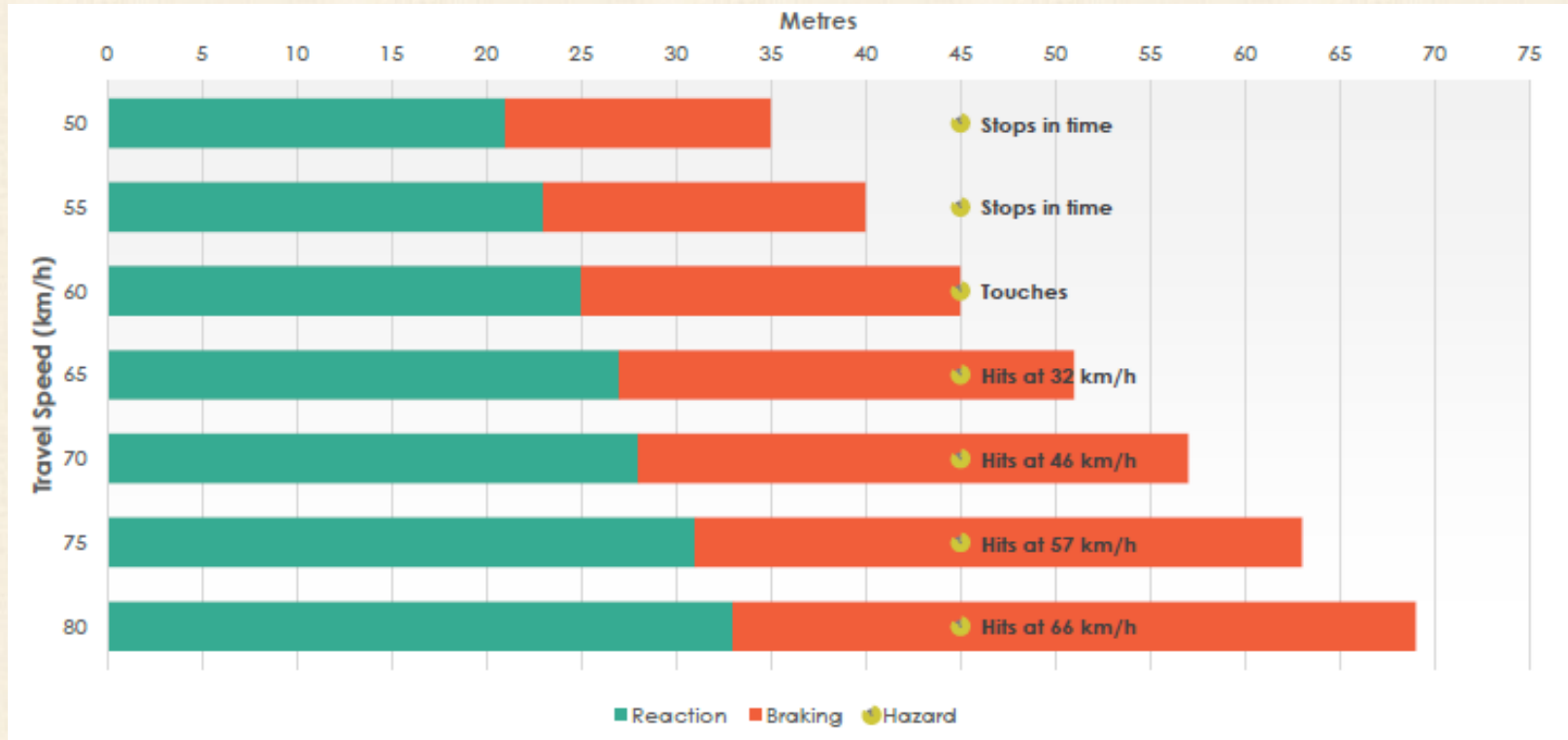
Speed Vs Road Fatalities



Change in Speed vs Change in Crashes



Speed vs Braking Distances



Traffic Calming Measures

- Four categories:
 - Horizontal Deflection
 - Vertical Deflection
 - Street Width Reduction
 - Routing Restriction



Horizontal Deflection

A **horizontal deflection** hinders the ability of a motorist to drive in a straight line by creating a horizontal shift in the roadway.

- ✓ Lateral shift
- ✓ Chicane
- ✓ Realigned intersection
- ✓ Traffic roundabout/circle
- ✓ Small modern roundabout and mini-roundabout
- ✓ Roundabout



Street width reduction

A **street width reduction** narrows the width of a vehicle travel lane. As a result, a motorist slows the vehicle in order to maintain an acceptable level of comfort and safety.

- Corner extension (i.e., a kerb extension at an intersection)
- Choker (i.e., a midblock kerb extension)
- Median island
- On-street parking



Vertical Deflection

A **vertical deflection** creates a change in the height of the roadway that forces a motorist to slow down in order to maintain an acceptable level of comfort. Speed hump

- Speed cushion
- Speed table
- Offset speed table
- Raised crosswalk
- Raised intersection



Routing Restriction

A **routing restriction** prevents particular vehicle movements at an intersection and is intended to eliminate some portions of cut-through traffic.

- Diagonal diverter
- Full closure
- Half closure
- Median barrier
- Forced turn island



Other Speed Management Techniques



Other Speed Management Techniques





Safe Vehicles



Active Safety	Passive Safety
Reduces the chance of a crash occurring	Protective systems for when crashes occur
• Lane departure warnings • Lane keeping assist • Forward collision warnings • Autonomous emergency braking • Pedestrian detection • Backup camera • Antilock brakes • Electronic stability control	• Seatbelts • Airbags • Crumple zones • Collapsible steering column

Leveraging connected and automated vehicle (CAV) technology to improve safety

Safe Vehicles

- **Advanced Driver Assistance Systems** — Help prevent crashes through lane keeping, blind-spot monitoring, and adaptive cruise control.
- **Autonomous Emergency Braking** — Detects pedestrians/cyclists and automatically brakes to avoid or reduce impact.
- **Intelligent Speed Assistance** — Supports safe speeds by warning or limiting speed when exceeding posted limits.
- **Improved Crashworthiness** — Stronger structures, airbags, and crumple zones reduce injury severity.
- **Pedestrian-friendly front-end design** — Softer bumpers, energy-absorbing bonnets, and better visibility reduce harm to vulnerable users.
- **Black box data recorders** — Support post-crash learning and system improvement.

Post-crash Care

- The first hour after the trauma - the '**Golden Hour**'
- Instant and proper first aid in golden hour increases the chance of survival.
- **Misconceptions** - road deaths happen due to severe injuries and loss of blood
- **Reality** - loss of oxygen supply due to airway blockage - the most common cause of death in road crashes
- <4 minutes for a blocked airway to cause death.

Priorities of treating a crash victim

Asphyxia (loss of oxygen)

Cardiac Arrest

Severe Haemorrhage (Bleeding)

Other Injuries/Illnesses



Post-crash Care



Since 2007 in Gujarat



Since March 2022 in Gujarat

Follow ABC rule

- Airway - Clear the airway i.e. breathing track
- Breathing - Help restore it by mouth to mouth resuscitation
- Circulation - Stop any bleeding



Safe Roads

- 'Forgiving Roads' forgive human error
 - redirecting vehicles, allowing clear zones, safe guardrails, etc.
- Self-explaining Roads' seek to prevent driver error
- Multi-Modal Roads' recognise that roads are not just for cars



Continuous 3-barrier (median and roadside barrier)



Assessed economics
for streamlined
investment pathway

Applicable cost range:
\$2M to \$5M per km

Assumed DSI reduction:
75%

Median barrier



Assessed economics for streamlined investment pathway

Applicable cost range:
\$1M to \$4M per km

Assumed DSI reduction:
65%

State Highway
1 Centennial
Highway,
Wellington -
median barrier
treatment

Wide centreline



Assessed economics
for streamlined
investment pathway

Applicable cost range:
\$0.25M to \$1.5M per km

Assumed DSI reduction:
35%

Roadside safety barrier at high-risk locations



**Assessed economics
for streamlined
investment pathway**

Applicable cost range:
**Between \$0.1M to
\$0.6M per km (based on
treating approx.
250 metres per km)**

Assumed DSI reduction:
30%

Shoulder widening at high-risk curves



**Assessed economics
for streamlined
investment pathway**

Applicable cost range:
**\$0.2M-\$0.45M per site
(based on an approx.
250 metre site length)**

Assumed DSI reduction:
25%

Figure 8
Widened shoulder
on a rural road

Audio tactile pavement markings (ATPM)



Assessed economics
for streamlined
investment pathway

Applicable cost range:

**\$0.01M and
\$0.05M per km**

Assumed DSI reduction:

20%

Figure 9
Centre and
edge line audio
tactile pavement
markings

Intersection speed zones



**Assessed economics
for streamlined
investment pathway**

Applicable cost range:

Up to \$0.5M per site

Assumed DSI reduction:

65%

Figure 10
State Highway 1
Himatangi Beach
intersection

Roundabout



**Assessed economics
for streamlined
investment pathway**

Applicable cost range:
\$0.5M - \$6M per site

Assumed DSI reduction:
75%

Figure 11
Rural
roundabout

Raised safety platforms (at existing signalised intersection/roundabouts)



**Assessed economics
for streamlined
investment pathway**

Applicable cost range:

\$0.3M - \$2M per site

Assumed DSI reduction:

40%

Figure 16
Mid-block raised
pedestrian crossing

Picture credit:
Department
of Transport
Victoria

Signalised intersection with raised safety platforms

(from an uncontrolled/priority controlled)



**Assessed economics
for streamlined
investment pathway**

Applicable cost range:
\$0.5M - \$2M per site

Assumed DSI reduction:
55%

Figure 14
Gordonton Road
Intersection,
Hamilton City
Council

Mid-block raised pedestrian crossing



**Assessed economics
for streamlined
investment pathway**

Applicable cost range:
\$0.03M - \$0.3M per site
(based on an approx.
250 metre site length)

Assumed DSI reduction:
20%

Figure 16
Mid-block raised
pedestrian
crossing

Signage and marking



Assessed economics
for streamlined
investment pathway

Applicable cost range:
Up to \$0.1M per km

Assumed DSI reduction:
10%

Figure 18
Signs and markings
delineation
upgrades

Speed management (speed limit changes)



Assessed economics
for streamlined
investment pathway

Applicable cost range:
up to \$0.1M per km

Assumed DSI reduction:
**Varies based on Nilssons
Power Model but
typically 15% - 30%**

Traffic calming



**Assessed economics
for streamlined
investment pathway**

Applicable cost range:
\$0.2M to \$1M per km

Assumed DSI reduction:
30%

Safe Roads





Safe Road Users



Walk



Bike



Drive



Transit



Other

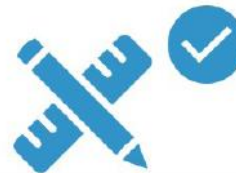
Source for all images: Fehr & Peers



**Not distracted
or impaired**



Follow rules



**Act within the
limits of the
road design**

Safe System Assessment Framework

- Refer to AustRoads Safe System Assessment Framework

Careers in the Road Safety Sector

- Researchers and Academicians
- Road Safety Practitioners/Engineers
- Road Safety Trainers
- Road/Highway Designers
- Temporary Traffic Management Trainers
- Software Trainers
- Road Database Developers
- NGOs and Advocacy Groups
- Digital Content Developers
- Government Authorities
- Management Consultants to Governments
- Road Contractors
- Crash Responders
- Crash Analysts
- Crash Investigators
- Global Agencies – World Bank, UN, WHO, ADB, etc.

Opportunities and Challenges of a Career Abroad

- **Professional Growth** — Exposure to advanced standards and technologies
 - **Higher Earning Potential** — Access to better salaries and benefits
 - **Global Networking** — Connections across countries and industries
 - **Cultural Exposure** — Builds adaptability and global awareness
 - **Personal Development** — Strengthens resilience, independence, and confidence
 - **Enhanced CV Value** — International experience stands out for senior roles
-
- **Family Relocation** — Schooling, childcare, and settling into a new community
 - **Cultural Adjustment** — Navigating workplace and social norms
 - **Visa Requirements** — Bureaucratic processes and compliance obligations
 - **Cost of Living** — Higher expenses for housing, healthcare, and transport
 - **Professional Licensing** — Need for local certifications or registrations
 - **Social Isolation** — Time required to build new social networks

Thank you for your attention..!

Any Questions?