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राष्ट्रीय सड़क सुरक्षा कोड

Draft Indian Standard

National Road Safety Code

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NATIONAL ROAD SAFETY CODE

PART A: National and State Highways, Expressways and MDRs

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

For BIS use only

NATIONAL ROAD SAFETY CODE

PART A: National and State Highways, Expressways and MDRs

NATIONAL ROAD SAFETY CODE

INTRODUCTION

The **NATIONAL ROAD SAFETY CODE (NRSC)** is a compilation of Road Safety Standards that will be introduced by the BIS over the period of time.

Part A of THE NATIONAL ROAD SAFETY CODE shall be known as **THE NATIONAL AND STATE HIGHWAYS, EXPRESSWAYS & MDRs** and shall cover the following:

I) Standards on sound engineering practices that shall be followed while designing, constructing, and maintaining National Highways, State Highways, Expressways and Major District Roads

II) Standards on the emergency medical care that should be provided by bystanders, in-ambulance attendants, hospitals and medical practitioners.

III) Standard enforcement measures that should be followed by enforcement officers to prevent road crashes, protect victims and witnesses of road crash and prosecute offenders.

This code has been formulated for the purpose of setting out standards that should be followed by drivers, pedestrians, bystanders, vehicle manufacturers, road construction engineers, medical officers, hospital authorities, and other law enforcement bodies/ officers.

The objective of this code is to encourage good road safety standards and practices that shall minimize road crashes and road fatalities.

Road safety is of prime importance as road crashes are one of the biggest causes of death in the country. India ranks first in the number of road crash deaths across the 199 countries and accounts for almost 11% of the crash-related deaths in the World[1].

Based on research and studies it has been found that there are three major risk factors that lead to road crashes, according to The Haddon Matrix they are - Humans, Vehicles and Equipment and Environment[2].

[1] MORTH, Road Accidents in India 2019, available at : https://morth.nic.in/sites/default/files/RA_Uploading.pdf

[2] https://www.who.int/violence_injury_prevention/road_traffic/activities/roadsafety_training_manual_unit_2.pdf

The Haddon matrix

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

Thus, in order to improve road safety, sustained efforts should be undertaken by the concerned authorities to improve road infrastructure, vehicular safety, enforcement of road rules and regulations, and emergency medical care.

The development of this code was prompted by the success of the Zero-Fatality Corridor (ZFC) initiative by SaveLIFE Foundation in collaboration with the Government of India and over 15 State Governments. The initiative has delivered a significant reduction in deaths and injuries across several highways and expressways in the country by adopting an approach to comprehensively address issues around road infrastructure, Police enforcement and emergency medical care.

Furthermore, the Government of India's efforts to improve vehicular safety have further complemented the ongoing efforts to reduce road crash fatalities and injuries. The standards for the same shall be documented and issued in future volumes of this code.

The **Part A of NRSC which is also known as THE NATIONAL AND STATE HIGHWAYS, EXPRESSWAYS & MDRs is divided into 4 parts** in the following manner:

PART 1 - VOCABULARY

Exhaustive list of terminologies used in this Code

PART 2 - ENGINEERING

Section I. OBJECT IMPACT CRASH

Section II. HEAD-ON CRASH

Section III. RUN-OFF CRASH

Section IV. IMPALEMENT

Section V. WRONG / UNPREDICTABLE MOVEMENT OF MOTORISTS

Section VI. REAR-END CRASH

Section VII. WRONG ZONE CRASHES

Section VIII. CRASH DUE TO SLIP & LOSS OF CONTROL

Section IX. CRASH DUE TO VEHICLE LOSS CONTROL

Section X. CRASH DUE TO SUDDEN APPEARANCE OF VEHICLE

Section XI. CRASH DUE TO POOR ROAD ETIQUETTE

Section XII. PEDESTRIAN CRASH

Section XIII. SIDESWIPE CRASH

Section XIV. CRASH DUE TO FATIGUE

Section XV. HYDROPLANING RELATED CRASH

PART 3 – EMERGENCY MEDICAL CARE

Section I – ACCESS TO EMERGENCY MEDICAL CARE

Section II – BYSTANDER CARE

Section III – AMBULANCE SERVICES

Section IV – IN-HOSPITAL EMERGENCY MEDICAL CARE

PART 4 - ENFORCEMENT

Section I - Forensic Crash Investigation

Section II - Road Crash: Preventive, Protective, Punitive, and Penal Measures

THE APPROACH

The approach of **THE NATIONAL AND STATE HIGHWAYS, EXPRESSWAYS & MDRs** has been developed keeping in mind the pragmatic solutions that relevant authorities/ bodies/ law abiding citizens may intend to refer to, while upholding the road safety standards in India. The approach adopted in this code are as follows -

1. **Engineering Chapter** - Strategic engineering approach to prevent specific types of road crashes (Law enforcement officers can refer to this chapter to identify the gaps in road engineering when a specific type of road crash is common in a specific corridor, thereby take necessary steps to fix such engineering gaps)
2. **Emergency Care Chapter** - Enhancing chain of survival approach (Law enforcement officers, Private hospitals, medical practitioners, bystander can refer to this chapter to understand the process to provide emergency care, save a life during a road crash)
3. **Enforcement Chapter** - Approach to prevent, protect and punish any known infractions that may lead to any form of road crash (Law enforcement officers can refer to this chapter and identify the enforcement measure they should take by them in order to prevent illegal or reckless behaviour of vehicles on the corridors)

This code is a living document, which shall evolve over time. Therefore, in the due course of time, new standards may be incorporated, scopes may be altered based on technological evolution, users' views over a period of time highlighting areas that need to be looked into from the perspective of road safety. In the meantime, all or some of the parts of the code may be adopted with or without changes by delegated legislative authorities in their regulations, administrative orders, and similar documents.

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NATIONAL AND STATE HIGHWAYs,

EXPRESSWAYS & MDRs

NATIONAL ROAD SAFETY CODE

PART I – VOCABULARY

1. SCOPE

This part of the code covers definitions and terms used in the field of road safety, which have been considered relevant keeping in view the contents of the code.

2. TERMINOLOGY

This section provides an exhaustive list of vocabulary used in this document.

3. GENERAL TERMS

Good Samaritan

A Good Samaritan is a person who, in good faith, without expectation of payment or reward and without any duty of care or special relationship, voluntarily comes forward to administer immediate assistance or emergency care to a person injured in an incident, or road crash, or emergency medical condition, or emergency situation.

Crash Barrier[3]

Traffic Safety Barriers, also known as Crash Barriers, are provided on high-speed highways to prevent fatality when vehicles lose control and run off the road. Crash barriers are specially provided at road sections with sharp curves, approaches to bridges with restricted roadway, high embankments, hazardous obstacles such as poles, trees and bridge structural elements. Crash barriers shall be suitably designed and properly located such that the crashed vehicle is redirected nearly parallel to the direction of the barrier, while the forces experienced by the vehicle occupants are contained within tolerable limits, the severity of the crash is minimized and the damage to property is reduced.

Crash Barriers also serve the following functions:

i. Protect out-of-control vehicles from striking fixed hard objects along/beside the road,
ii. Redirect out-of-control vehicles from running off the road to safely back onto the road in the direction of flow of traffic,
iii. Prevent out-of-control vehicles from crossing the median and crashing into oncoming vehicles, and
iv. Prevent out-of-control vehicles from running off the road and proceeding down a non-drivable or a non-recoverable slope.

Depending upon their mode of performance, traffic safety barriers can be classified generally as:

i. Flexible [e.g., Cable (wire) type barriers]

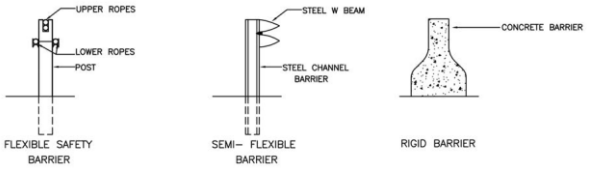
[3] IRC 119: 2015

ii. Semi-rigid [e.g., Steel beam-type barriers]
iii. Rigid [e.g., Concrete barriers]

The major difference among the various types is the amount of deflection that takes place in the barrier when it is hit. The flexible system is the most yielding type. It deflects considerably on being hit and thus requires considerable lateral clearance from fixed objects. The wire rope barrier has the minimum impact severity on the occupants of the vehicle.

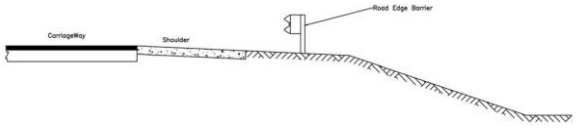
The semi-rigid system offers requisite resistance to control the deflection of the longitudinal member to an acceptable limit and the errant vehicle is redirected along the travel path.

Rigid barriers do not deflect on impact and cause the maximum severity of impact amongst the three types. The installation of a rigid system should be considered where small angles of impact are expected, such as along narrow medians or shoulders which could be expected in urban situations. As the system suffers little or no damage on impact, it requires the least maintenance effort.



Road Edge Barrier (Roadside Barriers)

Road Edge Barriers are those placed at the edge of the road. Road edge barriers usually consist of metal or concrete beams mounted 30-60 cm above the ground on strong posts of steel. These posts are driven into the ground to a depth of about 110 cm. This serves the purpose of absorbing energy as the posts move in the ground upon impact.



The following types of Road Edge Barriers are generally recommended:

i. Blocked out "W" beam type steel barrier
ii. Blocked out Thrie beam type steel barrier
iii. Wire rope barrier

Median

A median is a reserved space between opposing lanes of traffic on a divided road. Medians act as a buffer space to prevent head-on crashes between vehicles moving in opposite directions. The median may be paved or adapted for other functions such as glare protection, decorative landscaping, or median barrier. It also serves the following functions:

i. To channelize traffic into multiple streams at intersections
ii. To shadow the crossing and turning traffic
iii. To segregate slow traffic at built-up areas from the fast traffic on highways.
iv. To provide refuge space and protect pedestrians crossing the highway at authorized locations.

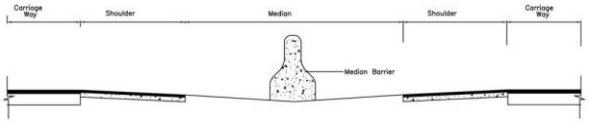
Median Crash Barrier

Median Crash Barriers are crash barriers provided on the medians of highways[4]. They

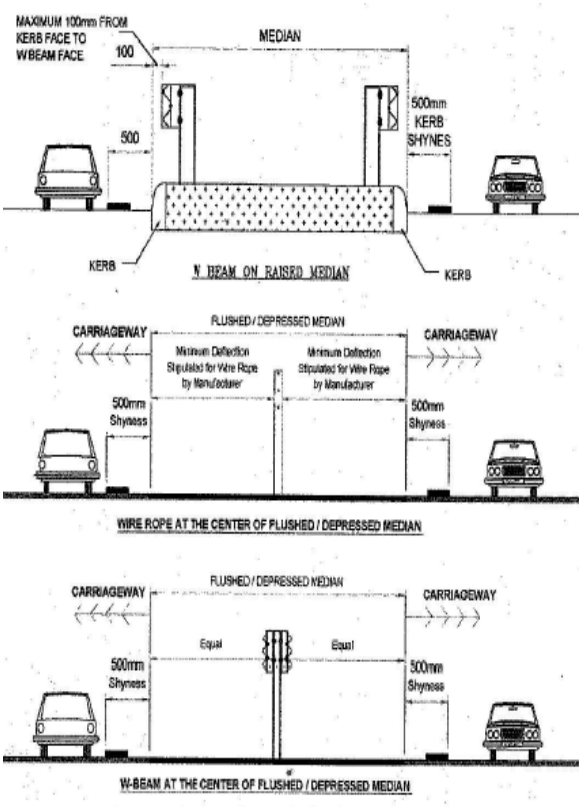
[4] IRC: 119-2015, Section 5.1

protect the traffic on both corridors from head-on crashes caused by out-of-control vehicles crossing the medians. They also shield out-of-control vehicles from crashing into fixed objects on the median.

Median Barriers of the rigid type (concrete) are popularly known as the New Jersey concrete barrier, because of its origin and popular usage in that State in the USA..



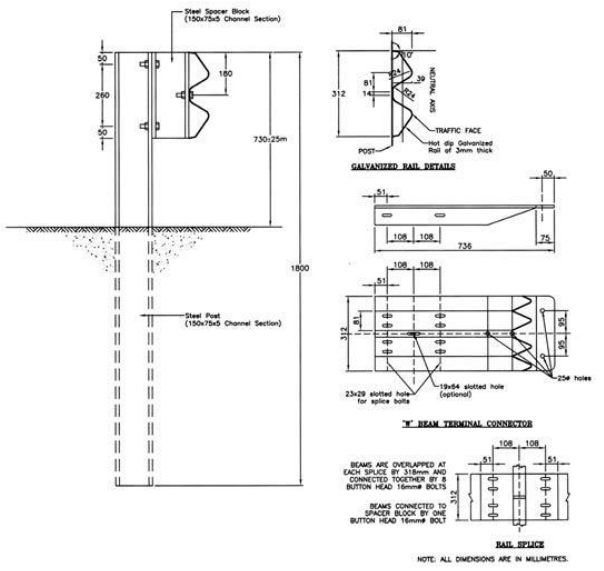
Median Barriers[5] are generally longitudinal metal beam crash barriers that separate opposing traffic on a divided highway and are designed to redirect vehicles striking either side of the barrier. Median crash barriers significantly reduce the number of cross-median crashes, which are attributed to the relatively high speeds that are typical on high speed divided highways.



"W" beam type steel barrier

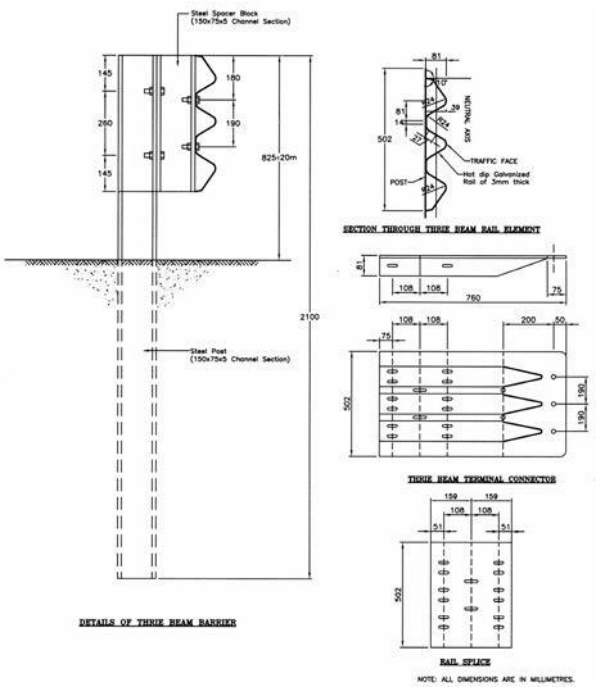
"W" beam type Steel Barrier consists of a 3 mm thick "W" beam rail element attached to a steel block, which in turn is attached to the steel post. The barrier is of a semi-rigid type. The steel post and the blocked-out spacer are channel sections 75 mm x 150 mm size 5 mm thick. The rail shall be 700 mm above the ground and 1100 mm below the ground and shall be spaced at 2 m centre to centre. The posts, beam, spacer and fasteners shall be galvanised by the hot-dip process.

5 https://safety.fhwa.dot.gov/provencountermeasures/median_barrier.cfm



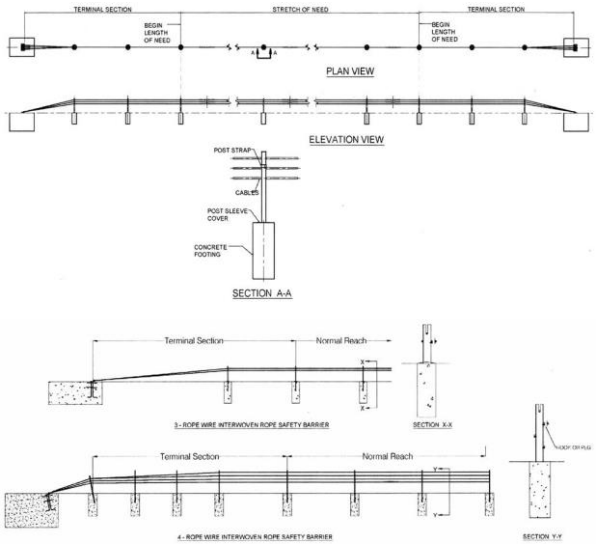
Thrie beam type steel barrier

A Thrie-Beam type steel barrier is less prone to damage by vehicle collisions, especially for shallow angle impacts, when compared with "W" beam type steel barrier. The post and spacer blocks are of steel channel section 75 mm x 150 mm x 5 mm. The spacing of the posts is 2 m centre to centre. The post is 850 mm above the ground and is driven into the ground to a length of 1150 mm. All the steel components and fasteners are galvanised by the hot dip process.

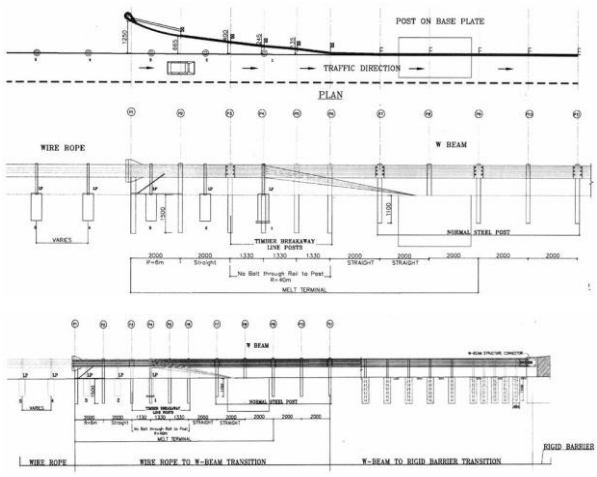


Wire rope barrier

Wire rope safety barriers have galvanized prestressed steel wire ropes (generally three or more in number) supported by galvanised steel posts at spacing of 2 – 4 m, depending upon the manufacturer's design. The overall length of the post is 680-700 mm above the ground. The posts are driven to a depth of 400 mm into the ground.



The details in image below show the transition from the wire rope to W-beam and wire rope to rigid barrier respectively.



Wire rope barriers shall not be used:

i. where the length of the barrier at full height would be less than 24 m;
ii. on horizontal curves of radius less than 200 m;
iii. on vertical sag curves of radius less than 3,000 m;
iv. where high mast lighting columns are situated within 10 m of the edge of the paved surface.

Concrete crash barrier

A concrete crash barrier is a type of crash barrier made of concrete. Concrete median barriers are rigid barriers having a sloped front in each face. It is generally installed to separate opposing traffic lanes when there is insufficient space to provide other types of metallic or non-metallic crash barriers.

Gaps in crash barrier

Gap in crash barriers are defined as a designed, created, or poor execution of installation due to which there is no overlap between the same type of crash barrier. A gap in the crash barrier is identified by a marked absence of a crash barrier for a short length. In case of deflectable crash barriers, the absence of overlap of crash barrier shall be considered as a gap in crash barrier.

Inappropriate transition of crash barrier

The gap between different types of crash barriers is known as the 'inappropriate transition of crash barrier'.

Kerb

A kerb, or curb, is the edge of the road where a raised sidewalk or median/central reservation meets a street or other roadway. It indicates the boundary between the pavement (road) and median/footpath/refuge-island/shoulder.

Kerbs are generally divided into three groups based on their functions:

i. Low kerb or mountable type kerb
ii. Semi-barrier type kerb
iii. Barrier type kerb

Corridor

A corridor is a part of the road of a multilane highway in which all vehicles travel in the same direction. In general, a divided carriageway will have two corridors.

Opposite Corridor

Opposite corridor is the corridor carrying the opposite directional traffic.

Run-off crash

A run-off-road crash is a vehicular crash in which one of the vehicles leaves the roadway on to the clear-zone. The contributing factors may include

- loss of control due to excessive or inappropriate speed
- distracted driving due to use of mobile phones or engaging in activities other than driving
- Fatigue or drowsiness
- high speed on a curve or misjudging sharpness of a curve
- attempting to avoid colliding with another road user or an animal.

Roll over crash

A roll over crash is a vehicular crash in which one of the vehicles rolls overs its side or its front. In general, vehicles tend to roll over on their side when negotiating a curve at high speed. Vehicles roll over their front when the vehicle goes head-on and down a sharp slope.

Head-on crash

A head-on crash is a crash where the front ends of two vehicles hit each other when traveling in opposite directions.

Sideswipe crashes

Sideswipe crashes happen when the sides of two vehicles make contact when next to each other. Generally, a sideswipe road crash is a crash between two vehicles that are traveling in the same direction where the right side of one vehicle impacts the left side of the other. These crashes typically occur because one of the two vehicles involved moved out of its lane before it was safe to do so.

Crash Attenuator

A crash attenuator is a device intended to reduce the damage to structures and vehicles, and lessen injuries to motorists resulting from a collision with a hard object. These devices are designed to absorb the colliding vehicle's energy. The devices are normally provided in

front of hard objects that cannot be removed, such as bridge pillars, nose of a median, or gore area of interchange ramps. The attenuators or crash cushions are generally composed of W-beam fender panels supported by a diaphragm with a trigger mechanism. Alternatively, it may be composed of sand barrels.

Hard Object

Any hard man-made or natural structure such as bridge pier, parapet wall, raised curb, rocks, large stone, bolder, bricks, NJBs present on the carriageway or clear zone is known as a 'hard object'.

Large Hard object

Any fixed hard object with a diameter of 10 cm or more or higher than 40 cm, present on the roadside or within the clear zone is identified as a large hard object. Concrete structures, bridge pillars, walls, to list a few, are some examples of large hard structures.

Small Hard object

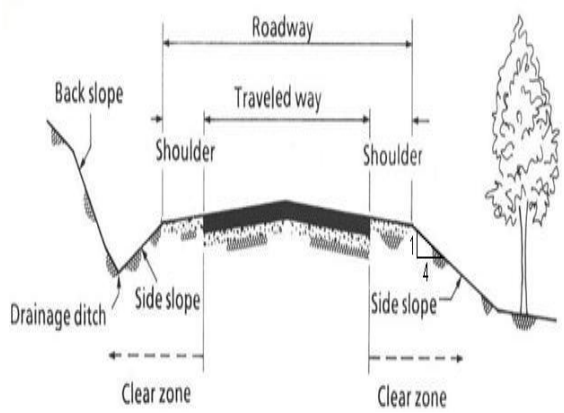
Any hard object with a diameter less than 40 cm within a clear zone is identified as a small hard object. Generally, a small hard object less than 10 cm on the clear-zone is not a safety concern as tyres will be able to roll over it without any adverse effect. Some examples include kerb stones, fallen rocks, footpath kerbs are a few examples of small hard objects.

Difficult to spot hard object

Any hard structure such as concrete structure, brick, or rocks, which is difficult to perceive by a driver travelling on the highway is known as 'difficult to spot hard object'. Such objects may be small in size or hidden behind soft vegetation which gives an illusion of safety.

Clear zone

Clear zone is the roadside side area, which starts from the edge of the traveled way. It is meant to be a safe space to accommodate out-of-control vehicles. The space acts as a buffer so that errant vehicles do not crash head-on to any hard objects. This area normally consists of a shoulder, a recoverable or non-recoverable slope, and/ or a clear run-out area.



Insufficient warning

Insufficient warning may be described as the lack of proper signage at an appropriate distance before the hazard. It can also be described as the lack of adequate sight distance before an unexpected hazard which may lead to a crash. Such crashes occur due to insufficient reaction time by drivers or other road users.

Poor visibility

Poor visibility is when road users cannot clearly see a distance of 100 m ahead due to

unfavorable conditions, such as low light, sun glare, rain, fog, or dust. This often occurs on highways, during a storm, on a glary day, or at night-time.

The limited visibility leads to crashes due to the insufficient reaction time.

Delineation

Delineation stands for any device or treatment whose aim is to outline the roadway or a portion of the roadway thereof. Delineation could include painted lines, raised pavement markers, posts, post-mounted reflectors, or contrast treatments of the pavement.[6]

The role of delineators is to provide visual assistance to drivers about the alignment of the road ahead, especially at night. Delineators are particularly effective in the case of complex locations involving changes in horizontal/vertical geometry and during severe weather conditions such as heavy rain, fog, or snow. Normally, reflectors are used on the delineators for better night-time visibility.

Retro-Reflection

Means the reflection of light that is returned in directions close to the direction from which it came, and this property is maintained even over wide variations of the direction of the incident radiation.

Retro-Reflective material[7]

It is the material which imbibes the property of retroreflectivity. The use of retro-reflective materials is the most effective way to increase conspicuity at night or under low-light conditions.[8] These materials are not conspicuous in daylight. Retro-reflective material is generally made using tiny glass beads which reflect light directly back toward its source, from a much wider angle than reflective material. Traffic signs and pavement markings are retro-reflective. Retro-reflective materials can be incorporated into clothing, helmets, bike equipment, backpacks, or attachable strips. Retro-reflective material can help create a visual "signature" for pedestrians at night or under low-light conditions.

End treatment of crash barrier

The treatment of the exposed end of the crash barrier is called end treatment. The end treatment forms an integral part of the safety barrier system, which includes highly efficient and expertly designed end terminals for guardrails and median dividers to protect motorists, workers and roads alike.

Potholes[9]

Potholes are bowl-shaped cavities of varying sizes on a bituminous surface or extending into

[6]IRC 79-2019

[7] https://safety.fhwa.dot.gov/saferjourney1/Library/countermeasures/63.htm

[8]IRC 67-2012

[9] IRC 82:2015, Section 7.5.3

the binder/ base course, caused by localized disintegration of the material.

Shoulder Edge Drop-off[10]

A shoulder or pavement edge drop-off refers to a defect of road geometry. A shoulder edge drop off is the presence of an unacceptable level difference between the travel lane and shoulder. It is generally present in locations with soft shoulders or are often created due to inadequate or incomplete highway construction or reconstruction.

When the shoulder or pavement edge drop-off is significant, it creates a dangerous condition for drivers, particularly smaller vehicles such as compact cars, motorcycles, and three-wheelers, as well as trailers.

Construction Zone/Work Zone

Construction Zone/Work Zones are Construction Zone/Work Zones on the highway. It is a stretch/ area of a road with construction, maintenance, or utility work activities. Signs, channelizing devices, barriers, pavement markings, and/or work vehicles typically mark a Construction Zone/Work Zone. The construction and maintenance activities would involve the movement of workers and construction equipment requiring dedicated space for performing the activities and moving materials for the activities.

Surface Defects[11]

Surface defects include fatty surface, smooth surface, streaking, and hungry surface. These are confined to surfacing and may be due to inappropriate quality and quantity of bitumen.

Footpath[12]

Pedestrian footpaths are defined as any area primarily used by pedestrians. They can be adjacent to roadways, or away from the road. Footpaths may be raised or at level with the roadway surface.

Pedestrian guardrails[13]

Pedestrian guardrails are an important design element to prevent indiscriminate crossing and spilling of pedestrians onto the road carrying motorised traffic. The judicious use of guard rails can help to ensure that pedestrians cross the streets at predetermined and safe locations. As the guardrails would confine the movement of pedestrians to the footpath, it is obligatory that sufficient width of footpath be made available.

Lane Width of Carriageway[14]

Lane width refers to the width of a single lane of traffic. In general the standard lane width of the project highway is 3.5 m. It may be reduced if there is lack of land availability or for improved safety of the location. However, when lane width is reduced to less than 3.5 m,

[10] https://www.autoaccident.com/dangers-of-road-shoulder-drop-off.html

[11] IRC 082:2015

[12] Section 6 of IRC 103:2012

[13] Section 6.1.9 of IRC 103:2012

[14] Section 2.4 of IRC SP 84:2019

the entire right-of-way shall be designed to ensure safety of all road users.

Driver Fatigue

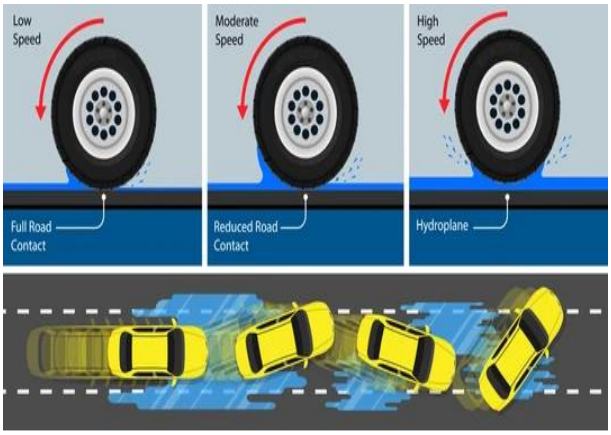
Driver fatigue refers to the tiredness of the driver due to lack of rest or due to underlying medical conditions. Fatigue is one of the most common dangers to road safety and poses a number of risks to drivers as well as passengers and pedestrians on the road. Fatigue means that drivers take more time to react to hazards as their focus and concentration are impaired.

Drowsy driving

Drowsy driving is the dangerous combination of driving when sleepy or fatigued. This usually happens when a driver has not slept enough, but it can also happen because of untreated sleep disorders, medications, drinking alcohol, or shift work. Drowsiness decreases the ability to pay driver's attention; as a result, the possibility of crashes increases.

Hydroplaning

Aquaplaning or hydroplaning by the tires of a road vehicle occurs when a layer of water builds between the wheels of the vehicle and the road surface, leading to a loss of traction that prevents the vehicle from responding to control inputs.



Intelligent Traffic Management System

Intelligent traffic management systems are the control and information systems that use integrated communications and data processing technologies for the purposes of improving the mobility of road users and goods, increasing traffic safety, reducing traffic congestion, and managing incidents effectively.

Electronic Enforcement

Electronic enforcement is the use of technology to assist in enforcement. The technology automatically detects road violations and issues e-Challans for rule-breakers. Such systems generate valuable traffic information which can help in gathering actionable insights for better traffic management.

Visible enforcement

Visible enforcement is a universal traffic safety approach designed to create deterrence and change unlawful traffic behaviours by creating a feeling of being watched. It combines highly visible and proactive law enforcement targeting specific traffic safety

issues and taking action against such violations.

Vehicle Actuated Speed Signs (VASS)

Vehicle activated speed signs (VASS) are electronic display signs which activate when a vehicle passes. The message can range from general information such as weather and warning to specific information such as speed of detected vehicle. In general, VASS are used for displaying speeds as a traffic calming measure.

Speed governors

Speed Governor is a microcontroller-based electronic unit, which constantly monitors the speed of a vehicle and limits the speed travel speed of the vehicle to a predetermined speed. In India, the speed for commercial vehicles are limited to 80 km/h.

Illegal parking

Parking at any undesignated or unauthorised place is illegal parking.

Ambulance

Ambulance or road ambulance may be specially equipped and is an ergonomically designed vehicle for transportation/emergency treatment of sick or injured people and capable of providing out-of-hospital medical care during transit/when stationary, commensurate with its designated level of care when appropriately staffed[15].

Definitive care

Definitive care means comprehensive care for the full spectrum of injuries beyond the initial assessment and resuscitation phase. In case of trauma, once a patient has been evaluated and adequately resuscitated, the team leader can begin to develop a plan regarding the patient's future care. This involves appropriate consultation and determining the patient's disposition. The interprofessional team often decides the patient's ultimate disposition. Depending on the capabilities of the provider's facility, the patient may need a transfer for definitive care[16].

Emergency Medical Care

Emergency medical care is the care rendered to stabilise patients who have a life-threatening or limb-threatening injury or illness. In contrast to preventive medicine or primary care, emergency medical care focuses on the provision of immediate or urgent medical interventions. It includes two major components: medical decision-making, and the actions necessary to prevent needless death or disability because of time-critical health problems, irrespective of the patient's age, gender, location or condition.

[15] AIS 125

[16] https://www.who.int/violence_injury_prevention/publications/services/en/guidelines_traumacare.pdf
https://www.ncbi.nlm.nih.gov/books/NBK547757/

Emergency Medical Services

Emergency Medical Services, more commonly known as EMS, is a system that provides emergency medical care. Once it is activated by an incident that causes serious illness or injury, the focus of EMS is the emergency medical care of the patient(s).

EMS is an intricate system, and each component of this system has an essential role to perform as part of a coordinated and seamless system of emergency medical care. An EMS system comprises all the following components:

a) Agencies and organisations (both private and public)

b) Communications and transportation networks

c) Trauma systems, hospitals, trauma centres, and speciality care centres

d) Rehabilitation facilities

e) Highly trained professionals

f) Volunteer and career prehospital personnel

g) Physicians, nurses, and therapists

h) Administrators

Emergency Response Centre (ERC)

Emergency Response Centre is a centralised and exclusive call centre that will receive, and handle emergencies received through SOS/ SMS/website/ mobile application. The ERC will function 24 hours per day for all days of the year through the universally accessible emergency contact number i.e., 112.

Golden Hour

The term "golden hour" is commonly used to characterise the urgent need for the care of trauma patients. This term implies that morbidity and mortality are affected if care is not instituted within the first hour after injury.

Good Samaritan

"Good Samaritan" means a person, who in good faith, voluntarily and without expectation of any reward or compensation renders emergency medical or non-medical care or assistance at the scene of an accident to the victim or transports such victim to the hospital.[17]

Trauma resuscitation team

The trauma resuscitation team consists of physicians, nurses, and allied health personnel. The size and composition of the team may vary with hospital size, the severity of the injury, and the corresponding level of trauma team activation.

Road Crash

"Road Crash" means the unforeseen, unexpected, or unintentional occurrence of an

[17] Explanation to Section 134A of the Motor Vehicles (Amendment) Act 2019

event that results in the risk of death or injury to any person on the road;

A road crash is an occurrence when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction, such as a tree, pole, or building. 'Road Crash' often results in injury, disability, death, and property damage as well as financial costs to both individuals involved and the society.

Interceptors

Interceptors are enforcement vehicles equipped with:

- Day/Night/All Weather speed enforcement system
- Stationary and Moving mode speed enforcement enabled through inbuilt GPS
- Day/Night All-Weather Automobile Grade Roof Mount PTZ HD Camera
    - Day/Night Tertiary Rear View Fixed Camera
    - Day/Night Quaternary Inside View Fixed Camera
    - Widescreen LED/TFT Auxiliary Display
    - Hard Drive Based Four-Channel HDD Recorder with remote viewing enabled
    - Breath Alcohol Analyzer capable of issuing instant challans
    - Roof Mount Programmable LED Signage
    - High intensity LED Spot Lamps on the roof rail
    - Onboard multimedia and Navigation
    - Multi-Tone Siren with Public Address System

Speed cameras

Speed cameras are digital cameras that are capable of capturing over speeding violation with the proof of violation to produce high-quality optical colour images, over a minimum of 4 traffic lanes in all desired direction such that:

1. The violation vehicle in its entirety, as well as its immediate surroundings, is clearly visible, not blurred, in focus, colour balanced, and exposed correctly for colour, brightness, and contrast.
2. The camera image resolution is able to provide images such that the violation vehicle's registration plate is clearly visible;
3. The data recorded on the image is clearly visible, in focus and legible.
4. The camera is capable of auto-adjusting itself to suit the lighting conditions of the traffic roads (Automatic Iris Control). The images shall not display blooming or smear results of glare from the vehicle's headlight and other lighting.
5. Image sensor and Effective Pixels (Resolution) 1" or higher, CMOS, Global Shutter, Minimum 9 MP, 4096(H) x 2160(V)
6. Electronic Shutter: 1/1000s to 1/10,000 s or better

7. Frame Rate - 12fps at 9MP resolution or better
8. Fixed Focal Length Lens - 25, 35, 50mm option to suit the application. The lens must focus visible.
9. Interface - RJ-45 for GigE Ethernet
10. Operational Temperature - 0°C to 50 °C
11. Outer Casing - Vandal Proof, IP65 Rated Housing, sun-shield
12. Power - PoE OR 12-24VDC
13. Certifications - CE, FCC, EN/UL, RoHS
14. Image Compression - JPEG
15. Video Compression - MJPEG, H.264

VASS

VASS or Vehicle Assessment Signatory Scheme are systems to relay the vehicle speed information to drivers.

Features:

1. The multilane vehicle activated speed sign shall consist of a 3D vehicle tracking system, computing device, and one message sign board per lane.
2. The system automatically monitors and displays the speed of moving traffic. The system shall be capable of displaying vehicles that travel between lanes.
3. The system allows the configuration of the vehicle speed limit. Speed limits can be configured per lane. E.g. a high-speed lane can have a speed limit of 100 km/hr and the other lanes can have a speed limit of 80 km/hr.
4. The system has a detection range of 250m and speed accuracy: Typ.< ±0.5 m/s for vehicles.
5. The system measures the speed of vehicles up to 300 km/h with accuracy ± 0.5 m/s.
6. The system shall have the configuration of messages that will be displayed when the vehicle is speeding along with the real-time speed of the vehicle. These messages are displayed to warn the speeding driver.

ITMS

ITMS or Intelligent Transit Management System is an advanced technological system that aims to better inform road user management services and road users to make safer use of transport networks. ITMS includes and is not limited to the automatic calling of emergency services in the event of a crash, enforcement of various laws, and improved awareness of the state of the road to commuters.

The technology involved in the implementation of ITMS vary from basic management systems such as traffic signal control systems, variable message signs, automatic number plate recognition (ANPR), speed traps, and automatic incident detection or stopped vehicle detection systems, to advanced systems that integrate live data and feedback data from multiple sources including and not limited to weather information, traffic volume information, social media monitoring,

and predictive techniques which compare the data with historical baseline data.

Violation Detection Cameras

Violation detection cameras are cameras that have a minimum of 80% accuracy in detection of number plates and min 95% of violations should be captured.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 1 - Object Impact Crash

1. SCOPE

This section of the code addresses the various factors for object impact crashes. The code highlights interventions that shall be adopted to reduce injury severity when a vehicle collides with a hard object within the clear zone. These hard objects may be removable or non-removable & present on the median shoulder, carriageway, or within the clear zone. Additionally, the objects may be large and easy to spot or small and difficult to spot by the driver. Some examples of such objects include and are not limited to concrete crash barriers, broken medians, large boulders, trees, bridge pillars, and parapet walls.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTOR

3.1 Object impact crash with non-removable large hard objects (>40 cm height) within the clear zone

It is to be noted that a clear, unobstructed, flat roadside is highly desirable. When these conditions cannot be met, barriers are needed. Object impact crashes with a large hard object over 40 cm height generally take place when a vehicle goes out of control. For instance, crashes with bridge parapet walls, large trees, bridge pillars, culvert walls, drainpipes, to list a few.

The removal of these hazards should be the first alternative to be considered. If it is not feasible or possible to remove or relocate a hazard, then a barrier may be necessary. However, the most appropriate barrier based on available space for deflection should be installed.

Type of Crash barrier

Crash barriers should be provided along the corridor where there is no sufficient run-away zone and the speed is greater than 40 km/h. The type of crash barrier depends on the speed, the predominant vehicle type, and the available deflection. The crash barrier should be provided such that the out-of-control vehicle hits the crash barrier first as it leaves the roadway.

Requirements of crash barrier

i. The space available behind the barrier must be adequate to permit the full deflection of the barrier.
ii. The barrier system must contain and redirect the vehicle at design conditions,

not allowing it to penetrate or vault over the barrier.

iii. It must not cause sudden acceleration or spin of the vehicle.

iv. The vehicle must remain upright during and after the impact and there should not be any loose elements that can penetrate the vehicle.

v. After impact, the final stopping position of the errant vehicle must intrude only minimally into the adjacent traffic lanes.

vi. It must provide a good visual guide to the road users.

vii. It must not entail heavy maintenance expenditure.

viii. It must be possible to terminate the system properly

ix. It must involve reasonably low initial cost, maintenance cost and accident cost to the motorist.

x. It must have an aesthetically pleasing appearance.

xi. There must be documented evidence of the barrier's performance in the field.

xii. The barrier systems should be capable of redirecting the largest vehicle which is regularly present on the road.

3.2 Object impact crash with non-removable hard objects in the median

These crashes occur due to the presence of non-removable hard objects in the median. Generally, such crashes happen when an out-of-control vehicle runs into the median. Non-removable hard objects include but are not limited to boulders, gantries, trees, bridge abutments, super-structures, walls and large storm drains, are located within the median.

To minimize the impact due to such crashes, crash barriers should be provided along the median. The crash barriers shall be provided such that it prevents head-on collisions, especially on highways with narrow medians, caused by out-of-control vehicles jumping across the medians.

In the case of narrow medians, as generally provided in urban areas, New Jersey-type concrete crash barriers shall be used along with an anti-glare screen. Alternatively, a flexible crash barrier is preferable if there is sufficient space on the median for deflection of the crash barrier.

3.3 Object impact crash with a concrete crash barrier

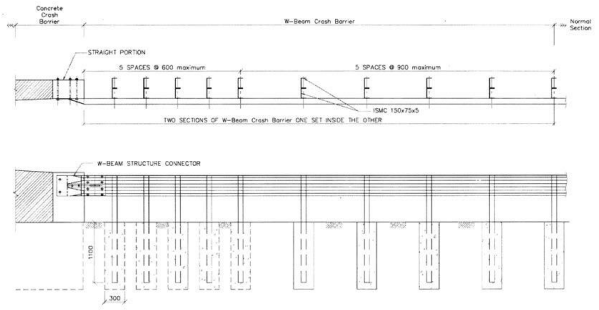
These crashes occur when a vehicle collides with the starting edge of the concrete crash barrier. Such crashes occur in the absence of proper crash attenuation, or due to damaged barriers or when there is an improper transition between a Metal Beam Crash Barrier and a Concrete Crash Barrier, or when there is a gap designed/ otherwise in the concrete crash barrier.

To minimize the impact due to such crashes, the following points should be considered:

i. Use of proper impact attenuators or crash cushions before the start of concrete crash barrier,
ii. Proper transition of crash barrier from flexible crash barrier to rigid concrete crash barrier. The approach and departure end of the rigid barrier shall be continued with a Metal beam barrier for a suitable length to ensure the continuity of the safety barrier,
iii. Timely repair or replacement of damaged crash barriers.

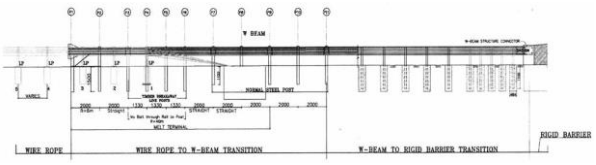
Transition of crash barrier from W Beam to Concrete

The W-beam to concrete transition shall be carried out by decreasing the post spacing, nesting one rail behind another and using a steel section behind the W-beam. The transition between W-beam and concrete barrier is detailed in figure below.



Transition of crash barrier from Wire Rope to Concrete

The figure below shows the transition from wire rope to concrete.



3.4 Object impact crash with difficult to spot hard objects

It has been observed that many times crashes occur due to difficulty in spotting hard objects. For instance, due to low light conditions on the road hard objects may not be visible due to which a vehicle may collide with such objects.

In order to minimise the impact of such crashes such spots should highlight objects with poor conspicuity using hazard marking or object markers. Safety requirements mentioned in IRC 79:2019 & IRC 35:2015 shall be followed.

3.5 Object impact crash with small hard objects

Crashes may also occur due to a vehicle colliding with a small hard object like kerbs, milestones markers, construction material, etc.

In order to minimise impact crashes with small hard objects, such small hard objects should be removed from clear zone and median or should be well delineated using retro-reflective paint marking or tapes or indicators. Safety requirements mentioned in IRC 119:2015 & IRC 79:2019 shall be followed.

3.6 Object impact crash with broken median infrastructure

Structures like median curbs are supposed to be designed to yield to impact force and, thereby, control the counterforce sustained by the vehicle striking the breakaway support[18]. Thus, when such structures are broken, and not repaired in time, the chances of injury during a subsequent crash increase. In order to prevent such a form of injury, all broken and discontinuous median curbs should be treated within 48 hours. The maintenance work shall include:

i. Closure of all unauthorized/broken median openings is needed at a regular interval
ii. Repair of crash barriers post-crash
iii. Road owning agencies shall ensure regular audits to identify and rectify newly created issues. A summary audit of the state of the highway shall be carried out on a monthly basis.

In addition to the summary audit, the road owning agency shall ensure that the road infrastructure is repaired after every known crash.

Case Example:

On NH 48, under the Zero Fatality Corridor initiative, 17 gaps in median were treated. As a result of the treatment, there has been a marked reduction in crashes at the treated intersections.

3.7 Object impact crash with objects on road

It has been observed that many times crashes occur with hard objects on the road. While no objects are allowed on the travel way, crashes occur with some objects left behind post maintenance, post crash, or post construction activity. The solution to this issue is the immediate removal of all objects on the road.

[18] Wang, Y. G., Chen, K. M., Ci, Y. S., & Hu, L. W. (2011). Safety performance audit for roadside and median barriers using freeway crash records: case study in Jiangxi, China. Scientia Iranica, 18(6), 1222-1230.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 2 – Head-on Crash

1. SCOPE

This section of the code gives recommendations for reducing head-on crashes. It highlights interventions that shall be adopted to prevent the collision of two or more vehicles that are moving in opposite directions on adjacent lanes of the main carriageway of the highway, where there is no demarcation or division of road based on an upward and downward journey for vehicles.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Head-on crash with vehicles of the opposite corridor

Head-on crashes generally take place on highways or roads where physical median barriers are absent or where the median barrier is ineffective or damaged. A vehicle traveling at highway speeds can cross over a highway median and strike opposing traffic head-on, causing serious injuries.

Median crossover crashes typically result in frontal or side impact crashes. Generally, in such crashes the damages are extremely high due to the high speed at which the vehicles collide. Often such crashes lead to the vehicle's passenger compartment being crushed, thereby injuring the passengers.

In order to prevent this form of road crashes, suitable crash barriers should be placed at the median. The broad specification and requirement of crash barrier is discussed in section 1 of this chapter.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 3 - Run-off crash

1. SCOPE

This section of the code specifies ways to prevent run-off on highways. There are a number of reasons due to which run-off may occur, the most common reasons for crashes due to run-off are - steep non-recoverable slopes, gaps in crash barriers, insufficient warning at curves, fatigue, and inadequate visibility.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

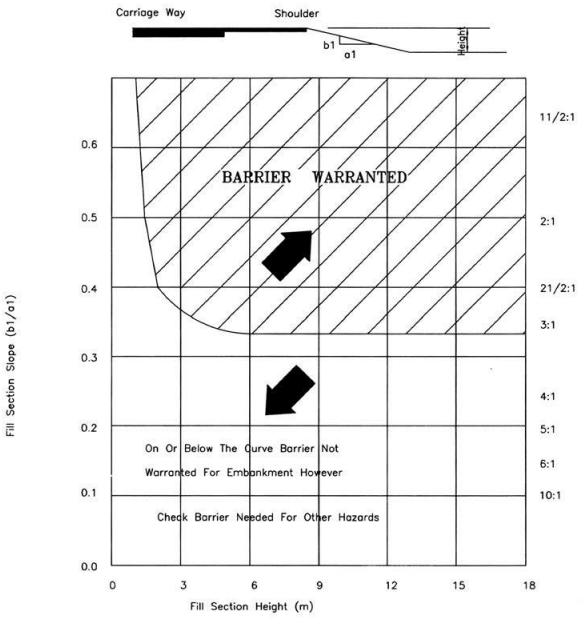
3. TYPES OF RISK FACTOR

3.1 Run-off crash along steep non-recoverable slopes

Steep slopes are non-drivable and non-recoverable slopes. Such slopes increase the risk of an errant vehicle to overturn. Overturning/roll-over crashes often result in serious injuries or fatalities. In order to prevent such run-off crashes, it is important that crash barriers be constructed along steep slopes.

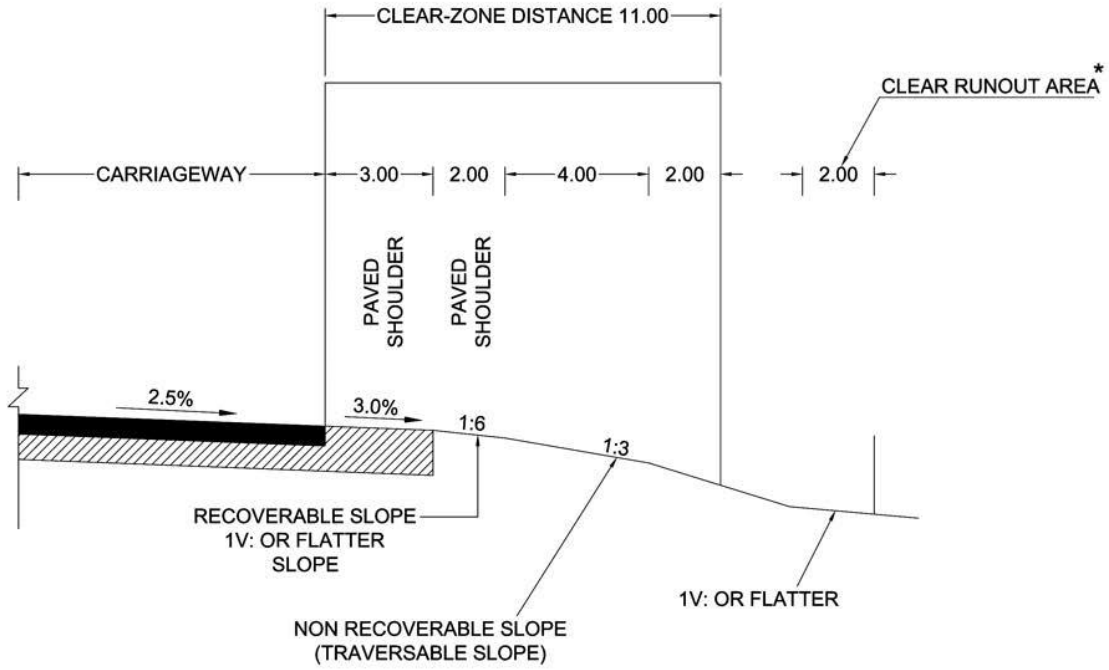
The warrants for the installation of road edge barriers on road embankments are governed by the height and slope of the embankment. These are given in figure below.

It may be noted that the barrier is not warranted for embankment slope of 3:1 or flatter.



For high-speed corridors, it is necessary to provide roadside safety barriers on embankments where the recoverable slope upto a distance of clear zone applicable for the design speed is not available as shown in image below.

The broad specification and requirement of the crash barrier is discussed in section 1 of this chapter.



*THE CLEAR RUNOUT AREA IS ADDITIONAL CLEAR-ZONE SPACE THAT IS NEEDED BECAUSE A PORTION OF THE SUGGESTED CLEAR-ZONE (SHADED AREA) FALLS ON A NON-RECOVERABLE SLOPE

3.2 Run-off crash due to gaps in crash barrier

Occasionally, gaps in guardrails are provided to accommodate trees, pillar boxes, signposts, electrical control boxes, etc. These often turn out to be dangerous especially from the perspective of road crashes.

Case Example:

A 178 km metal beam crash barrier was installed on the Mumbai Pune Expressway which led to a 52% fatality reduction on the Zero Fatality Corridor Project in the year between 2018 and 2020.

Thus, in order to prevent such crashes:

i. Unnecessary gaps in the crash barrier should be closed. The median crash barriers should be smooth and continuous.
ii. Routine maintenance of the crash barriers should be conducted to ensure that no broken/ damaged crash barrier system is present on/ near the roadway.

3.3 Run-off crashes at curves due to insufficient warning

Insufficient warnings on the curves lead to high risk while driving on the roads, as the driver is unable to see what lies ahead especially if there is a narrow lane ahead, change in road alignment etc.

Installing chevron signs at sharp curvature shall provide drivers an idea about the sharp curve ahead.

Safety requirements to be followed as per IRC 67-2012, Section 4.1,4.2,4.3,4.4, Siting of signs with respect to the carriageway (Page 6), Section 14, Mandatory/ Regulatory signs (Page No.24)

Section 15, Cautionary/ Warning Signs (Page No.36), Section 16, Informatory Signs (Page No.46), Section 5.1, Orientation of Signs (Page 8)

3.4 Run-off crashes due to fatigue

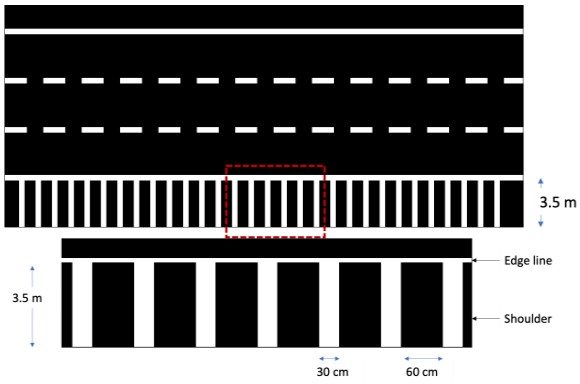
Driver fatigue (tiredness, drowsiness) has been one of the main causes of countless crashes. In order to prevent rear-end crashes due to fatigue, a consistent application like Audio Tactile Line Marking (ATLM) should be designed to address the risk of head-on crashes and run-off road crashes. Reference to the same can be found in Section 7 of the Enforcement Chapter.

Based on a study of the Zero Fatality Corridor it has been observed that after the installation of Audio Tactile Line Marking (ATLM).[19] There is a significant reduction of run-off crashes due to Fatigue.

ATLM involves installing a series of raised extruded thermoplastic bars that give an audible sound and vibration when traversed by a vehicle. This low-cost treatment follows Safe System principles and should be considered as one of a number of available options in achieving Towards Zero deaths and serious injuries. ATLM is considered to be a supporting treatment towards Safe System as it provides some crash reduction without providing a physical separation by a space or barrier between opposing traffic lanes. It is suggested that ATLM reduces not only the likelihood of head-on and run-off road crashes but also the severity as it may provide some drivers opportunity to apply emergency braking or steering to reduce the impact.

[19] https://www.vicroads.vic.gov.au/-/media/files/technical-documents-new/road-design-notes/road-design-note-0310-audio-tactile-line-marking-atlm-v10-june-2020.ashx

An illustration of the Tactile Shoulder Line with respect to the expressway is shown below. The area highlighted in the Red dotted line is illustrated in-depth in the subsequent figure



3.5 Run-off crash due to low-visibility crashes with the edge of the road

Roads with poor visibility are dangerous especially at night, as it could lead to the risk of fatal or serious injuries in a road crash.

Delineating highways with retro-reflective material shall be a major step to prevent such crashes.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 4 - Impalement

1. SCOPE

Impalement may occur when there is an untreated end of the steel type road edge/ or median barrier on/ near the main carriageway of the highway or road. It can be hazardous if hit because the barrier beam can penetrate the passenger compartment and cause the impact vehicle to stop abruptly. End treatment should, therefore, form an integral part of safety barriers. An end treatment should not spear, vault, or roll a vehicle for head-on or angled impacts.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

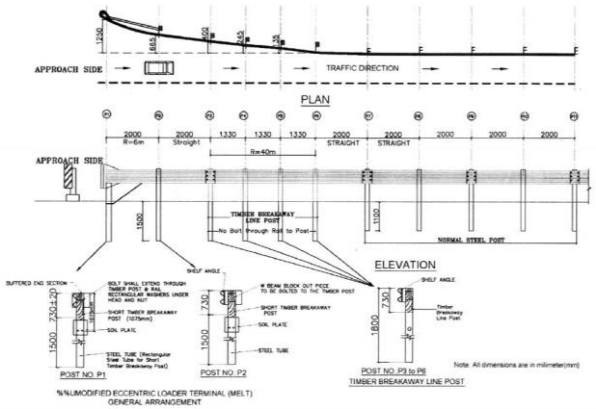
3. TYPES OF RISK FACTORS

3.1 Impalement of the steel type crash barrier to the vehicle

Sometimes a vehicle loses control due to over speeding, and the front of the vehicle impacts the end of the steel type crash barrier. If the end treatment of the steel-type crash barrier is not done, the crash barrier will impale into the vehicle and cause a serious crash injury. Reference to the same can be found in section 3 of the Enforcement Chapter.

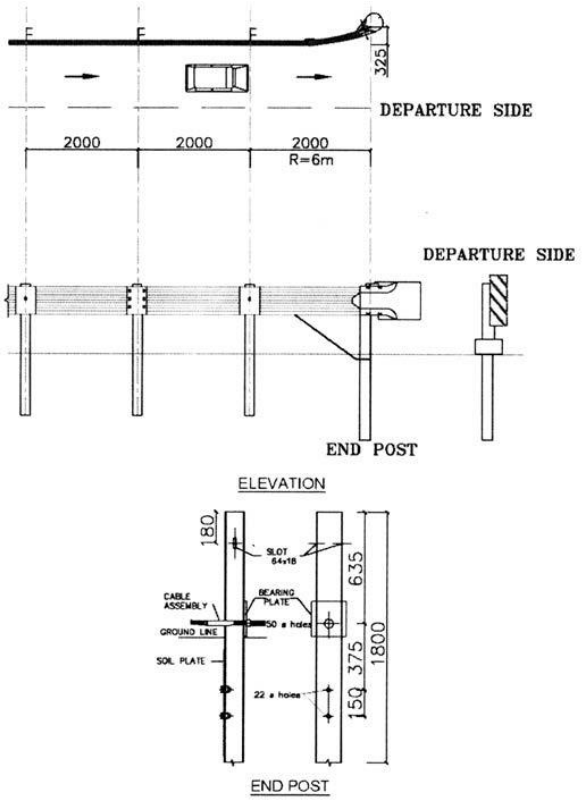
An untreated end of the roadside barrier can be hazardous if hit, because the barrier beam can penetrate the passenger compartment and cause the impact vehicle to stop abruptly. End treatments should, therefore, form an integral part of safety barriers. An end treatment should not spear, vault or roll a vehicle for head-on or angled impacts.

The end treatment on approach shall be Modified Eccentric Loader Terminal (MELT) arrangement as shown in figure below.

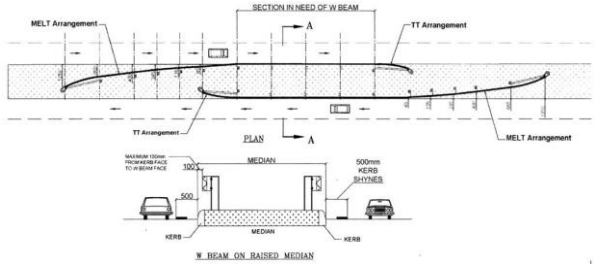


%%MODIFIED ECCENTRIC LOADER TERMINAL (MELT)
GENERAL ARRANGEMENT

In the departure sides, it shall be the Trailing Terminal (TT) arrangement shown in figure below.



Following the same end treatments, figure below gives the typical layout of W-beam whether on raised median sides or on depressed/flushed median sides.



At road cross-sections in cutting or if the road transitions from cut to fill, the safety barriers can be anchored in back slopes. The backslope covering the anchored portion of the barriers should be graded flat, with side slopes preferably not steeper than 10:1. The anchored portion should develop tensile strength in the rail element to prevent the rail from pulling out of the anchorage. The barrier can also be anchored in an earthen berm specially constructed for this purpose, provided the new berm itself is not a hazard to the traffic. The earthen berm should be made resistant to erosion.

Care must be taken that the end treatment on approach is Modified Eccentric Loader Terminal (MELT) arrangement and departure sides are of Trailing Terminal (TT) arrangement.

The **Modified Eccentric Loader Terminal (MELT)**[20] is designed to provide a soft, gating impact and reduce the severity of impacts occurring at the end of the safety barrier system. The MELT is a **parabolic-fared** terminal with W-beam rails supported by specially engineered, steel breakaway posts. The parabolic flare positions the end of the safety barrier system away from oncoming traffic. The MELT also anchors the safety barrier system and is suitable for use on the leading and trailing end of a safety barrier system.

[20]https://www.abovebeyondconcepts.com.au/index.cfm?module=storetigerv2&bit=products&product_id=249545&product_tab=description

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 5 – Wrong or Unpredictable Movement of Motorists

1. SCOPE

There can be various reasons why a motorist makes a wrong decision on the road and makes a wrong move. Some of the major reasons for such wrong/ unpredictable movements of motorists include lack of communication or wrong communication to the motorist, in order to avoid any hazard such as potholes, shoulder edge drop, lack of / faded road marking, inefficient road network planning, and lack of awareness of the road users.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPE OF RISK FACTORS

3.1 Wrong/Unpredictable movement of motorists due to lack of communication

The road signs are the means of communication to the road users, especially motorists. When such signages are absent the motorist/ driver may not be aware of what lies ahead on the road and thus may make the move based on his/ her prediction which may lead to a crash.

In order to avoid such crashes, it is important to install appropriate signages at relevant points on roads. The specification of road signages should follow IRC 67:2012 guidelines.

3.2 Wrong/Unpredictable movement of motorists due to wrong communication

There is an extreme chance of road crashes when the signages placed on the road are misleading or wrong. For instance, if signage indicates that there is a ‘curve ahead’ whereas the actual road has a ‘slope ahead’, the motorist may be misguided and may not be able to take the necessary precautions to drive on a slope, thereby increasing the chance of a road crash.

In order to prevent such crashes due to misinformation, it is essential to remove wrong signages from the roads. The specification of road signages mentioned in IRC 67:2012 should be followed.

3.3 Wrong/Unpredictable movement of motorists due to non-visible communication

Obstructed view of signages, whether caused by vegetation (e.g., bushes, trees), other signs or street furniture (e.g., crash barriers), may not allow a motorist to view the signage on the road which may lead to wrong or unpredictable movements of the motorist that can consequently lead to road accidents. In order to prevent such road accidents, it is essential that drivers and other road users should have a clear

view of road signs. Thus, it is essential that obstruction caused by vegetations should be regularly trimmed and maintained. The signage installation guidelines mentioned in IRC 67:2012 should be followed.

3.4 Wrong/Unpredictable movement of motorists (to avoid potholes)

Non-maintained surface roads can be expensive not only from the perspective of the number of lives lost due to such surface defects but also increases - vehicle operational cost, rise in the cost of restoration/ reconstruction of roads, etc.

Thus, in order to prevent such forms of accidents, it is essential to treat the surface defects and conduct routine maintenance of the same. Safety requirements to be followed as per IRC 082:2015, "Sections 3 & 4"

3.5 Wrong/Unpredictable movement of motorists (lack road markings)

One of the common causes of road accidents is the lack of road and pavement markings. Proper signs and road and pavement markings ensure and guide motorists/drivers and pedestrians to the right direction and periphery of the movement. Such markings act as a safety signal to any individual stepping out on the road.

Case Example:

On the Mumbai Pune Expressway 400 road signages were installed across a stretch of 94.5km which lead to a 52% fatality reduction on the Zero Fatality Corridor Project in the year between 2018 and 2020

3.6 Wrong/Unpredictable movement of motorists (faded road markings)

As discussed in the previous section, road markings are extremely important.

Faded road markings shall be non-effective as they shall not be clearly visible to pedestrians or motorists on the road.

Thus, to avoid wrong or unpredictable movement of motorists, reinstating faded pavement marking should be done on a regular basis. The same can be partially found in New Zealand's Road Maintenance Program.

3.7 Launching of vehicles into air due to sloped crash barrier end treatment

When a vehicle crashes with sloped crash barriers, it launches the vehicle into the air and the driver loses all control of the vehicle. To prevent such situations, the crash barrier ends shall be treated as mentioned in Section 4, 3.1

Sloped crash barriers shall be treated to ensure that the slope is eliminated or protected similar to a large hard object.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 6 – Rear-End Crash

1. SCOPE

A rear-end crash occurs when a vehicle crashes into the one in front of it. Common factors contributing to rear-end crashes include driver inattention or distraction, speed inconsistency, the presence of parked vehicles, and poor pavement conditions. This section of the code discusses the various factors that lead to rear-end crashes and the preventive measures that should be adopted.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Rear-end crash due to parked/stopped vehicles on the shoulder

Several times, it has been seen that vehicles are parked on the shoulder. The presence of parked vehicles on the shoulder could be a significant cause of rear-end crashes, especially at night-time. Reference to the same can be found in section 2 of the Enforcement Chapter

Vehicles generally stop on high-speed corridors only when it is an emergency or due to break down. In such cases, adequate visibility is the only viable solution to ensure safety. To ensure that adequate visibility is available, vegetation shall be trimmed along curves. Speed of the corridor shall be limited to the visibility available rather than the design speed of the pavement.

3.2 Rear-end crashes due to haphazard stopping of trucks on the side of the highway

Crashes often occur due to haphazard parking of trucks on the side of the highway. Truckers are forced to park haphazardly as, often, there is no designated parking area for parking. Reference to the same can be found in Section 1 of the Enforcement Chapter

Further, it has been seen that vehicles carrying iron rods, or other objects, that protrude from

the body of the vehicle often pose a serious risk of accidents like impalement resulting in the loss of life and property of others commuting on the same road. For instance, when a truck carrying iron rods suddenly breaks, the vehicle behind is caught unawares, almost always resulting in a fatal accident for those travelling in the vehicle behind. This problem gets aggravated further when such a truck is left irresponsibly stalled on the road. Thus, it is recommended that no vehicle running on the highway shall carry any protruding rod. Reference to the same can be found in Section 18 of the Enforcement Chapter.

It is also recommended that in order to avoid crashes due to haphazard stopping of trucks on the side of the highway, by-lanes should be constructed for trucks. Such by-lanes should be constructed in the following manner:

i. Maintain adequate number and size of truck lay-bye for parking of trucks by the side of the project highway
ii. Truck lay-byes shall, in general, be located near check barriers, interstate borders, places of conventional stops of the truck operators, etc. The places will be identified on the basis of field survey and shall have adequate space for facilities as specified in this section and future growth.
iii. The truck lay-byes shall have the following facilities - Paved parking, Rest areas with toilets, shower, drinking water, and a restaurant.
iv. The truck lay-byes and 50 m length of the project highway on either side shall be illuminated at night to provide an average illumination of 40 Lux. Suitably designed electric poles having aesthetic appeal and energy-saving bulbs may be used to provide the required illumination. Alternatively, illumination solutions may also be used as it is not hazardous to the drivers, and provides the recommended intensity of illumination.

3.3 Rear-ending crash due to lack of emergency stopping space

Rear-ending collisions may take place due to emergency stopping of a vehicle on the road. In order to prevent such crashes, it is quintessential to provide emergency stopping space on the highways. Reference to the same can be found in Section 2 of the Enforcement Chapter

These emergency stopping spaces can be road shoulders, which are strips of land immediately adjacent to the traffic lane of a road not bordered by kerb and channel. Shoulders are provided along the road edge to serve as an emergency lane for vehicles compelled to be taken out of the carriageway or roadway. Shoulders also act as service lanes for vehicles that have been broken down.

As per IRC SP 87: 2019, shoulders along the highway should be of a minimum of 2.5 meters wide (paved) and 1.5-meter (unpaved).

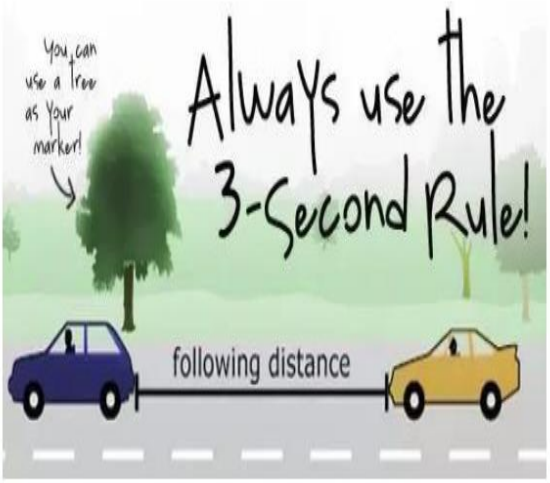
In addition to emergency stopping space, there needs to be safety treatment at steep slopes as per IRC:SP:48-1998.

3.4 Rear-ending Crash due to speed inconsistency between Vehicles

Rear-ending crashes due to speed inconsistency between vehicles is extremely common. The possibility of rear-ending crashes increases if the speed difference between two successive vehicles is significantly high.

One of the main reasons that rear-end collisions occur is because not enough space is left between drivers for the rear driver to stop in time without hitting the back of the first driver's vehicle. For this reason, it is advised to maintain a safe following distance. Reference to the same can be found in Section 16 of the Enforcement Chapter.

The recommendation is to abide by the three-second rule for determining whether or not you are safely far enough behind the first driver. The three-second rule simply requires that you look at a stationary object next to the driver in front of you and if you can count to three before you pass the same object, you are too close.



NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 7 – Construction Zone/Work Zone Crash

1. SCOPE

The road construction zones/work zones are areas of conflict between normal operating traffic, construction workers, road building equipment, and construction traffic. If it is a construction of a new road, normal operation of traffic will be disrupted. However, care needs to be taken to avoid and or remove conflicts between workers and construction machinery and traffic. The problem becomes more severe with the presence of vulnerable road users.

Construction Zone/Work Zone crashes are caused by several factors such as frequently changing environments that occur during road work whereby the driver is often surprised, insufficient warning signs for normal and construction traffic, lack of audible warning to workers, and inadequate provisions of safety devices to protect workers. At most construction zones/work zones, normal traffic is never more than 15 meters away from construction activities.

Major contributing factors to Construction Zone/Work Zone accidents include poor attention to the dangers, travelling too fast for the prevailing conditions, failure to yield the right-of-way, following too close, and lack of awareness of the construction/work zone.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Crash due to Construction Zone/Work Zones which creates a sudden change in the general road environment and sudden lane drop

Crashes on the road may occur due to the Construction Zone/Work Zone as the operating condition of the road changes because of construction and maintenance activities of the road, the drivers may not be aware of the change in the road condition. If such roads remain untreated the chances of road crashes increase. Thus, Construction Zone/Work Zones should have advanced warnings suggesting - the length of temporary traffic, presence of hazard marker sign, change in traffic arrangement, transition zone where the drivers are redirected from the normal path of travel, etc.

Further, flagmen should be deployed for safety compliance according to Section 9, of IRC SP 55-2014 in the following manner:

i. The flagmen or flaggers shall be deployed where -
   a. Workers or equipment intermittently block an unprotected traffic lane
   b. One lane is used for two directions of traffic
   c. Guidance, warning, and control of traffic is considered necessary
ii. The flagman shall be physically fit, well trained, alert, and capable enough to effectively perform the assigned duties.
iii. Flagman shall be provided with hand signalling devices such as flags and sign paddles.
iv. Flagmen must be provided with and must wear warning garments, safety headgear, footwear and gloves for their protection and for conspicuity, while flagging. Warning garments worn at night must be of reflective material.
v. Flags for signalling shall be minimum of 600 mm x 600 mm in size made of good red cloth and securely fastened to a staff of approximately 1m length. Sign paddle should be atleast 600 mm wide provided with a rigid handle. The background colour of STOP should be red and its shape shall be octagonal. The word STOP would be in white colour. Similarly, the background of SLOW sign should be yellow with black letters, and the GO sign shall be with green background with white letters.
vi. The control of traffic through the work area is an essential part of road construction and maintenance operations.
vii. Flagmen with hand signaling devices such as sign paddles play a crucial role in this context. STOP, SLOW, and GO paddles are used, and in some cases, temporary traffic lights are used in controlling traffic through the work area.

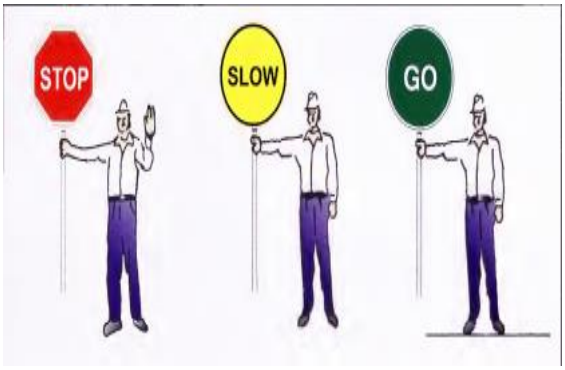
Besides red and green flags, octagonal and round-shaped hand paddles of 600 mm x 600 mm should be used with red, yellow, and green retro reflective if used at night time, whereas red and green flags can be of visible fabric materials for daytime usage.

Since Flagmen are responsible for the safety of road users and the workers, it is important that qualified personnel be selected. The flagmen at the worksites are expected to stop traffic intermittently and to maintain continuous traffic flow at the work site at reduced speeds to help protect the workmen. For both of these functions, the flagmen must, at all times be clearly visible to approaching traffic for a distance sufficient to permit a proper response by the drivers to the flagging instruction and to permit traffic to reduce speed before entering the worksite. This distance is basically related to approach speed and site conditions; however, 60 m to 100 m is desirable. In urban areas, this distance shall be reduced from 20 m to 50 m.

Another modern method is Marshalling torches are:

i. Hand flashers are tough and durable working on normal or rechargeable batteries with LED bulbs.

ii. To provide warning signal for impending hazard or danger on construction Construction Zone/Work Zone, repair sites, trenches, digging of road tunnels



Drivers should slow to the posted speed limit and move to the proper lane as instructed.

To avoid crashes, use safety cones, barrels, and barriers to clearly delineate specific areas of the Construction Zone/Work Zone such as material storage, areas where heavy equipment is being used, vehicle parking, and safe areas for workers on foot to move around. The traffic management practices at worksites mentioned in Section 7, of IRC SP 55: 2014 should be followed.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 8 – Loss of Vehicular Control

1. SCOPE

One of the very common causes of road crashes is loss of vehicular control which results in skidding. Loss of vehicle control is a common problem that frequently leads to major crashes that result in severe injuries for all those involved.

Common reasons why a driver may lose control of their vehicle and skid include

i. Skidding due to smooth surface
ii. Skidding due to difference in level
iii. Speeding, which generally makes it harder to control a vehicle, particularly around curves
iv. Vehicle Out of Control due to Mechanical failures.
v. Skidding due to poor drainage of water

Driving under the influence is also a common factor in these car accidents. Driving impaired makes you less likely to respond appropriately when loss of control does occur. A vehicle can skid on the road due to the road surface being slippery, a vehicle may also skid due to the unevenness of the road.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Skidding related crash due to smooth surface

Crashes may occur due to slipping on a smooth surface, as such surfaces are low skid resistant and become very slippery when it is wet (IRC 82-2015, Section 7.2.2.). Such a condition invites safety hazards, especially on gradients, bends, and intersections. A primary cause for a smooth surface is the polishing of aggregates under traffic. Excessive binder can also contribute to the formation of a smooth surface.

In order to prevent such crashes, **c**are should be taken to select aggregates that have proven

non-polishing characteristics. Slurry seals can also be used to impart anti-skid texture on a smooth surface.

3.2 Skidding due to difference in level (during overlay of the road)

Skidding related crashes may also take place when there is a difference in the level of a road. The presence of a significant level difference between the major and minor carriageway at a junction increases the probability of vehicular skidding while maneuvering from minor carriageway to major carriageway or vice versa. In order to avoid such crashes, the treatment of the road surface should be performed. There should not be any level difference between major and minor carriageways.

3.3 Vehicle Out of Control due to Over speeding

In general, excess speeding increases the possibility of vehicles being out of control. Speeding drivers may lose control of their vehicles more easily. Reference to the same can be found in Section 3 of the Enforcement Chapter. Hereby, it is recommended that

i. Speed signs are installed at regular intervals to inform traffic on the safe speed of the highway
ii. Traffic calming measures be provided at accident-prone zones/ or black spots to avoid chances of overspeeding crashes. The basic principle of traffic calming measures is to lower vehicle speeds in order to reduce accidents.

3.4 Vehicle Out of Control due to Mechanical Failure

Mechanical failures, such as tire blowouts and brake failures, lead to loss of control on the vehicle consequently leading to crashes. In order to prevent such crashes routinely, check on vehicles should be conducted.

3.5 Skidding due to poor drainage of water

Chances of road crash increase when there is the pooling of water due to poor drainage. There should not be standing water on the road. The specification is mentioned in Section 15.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 9 – Crash Due to Loss of Vehicular Control

1. SCOPE

This section of the code discusses the various risk factors due to which vehicles lose control and crash. The section scopes out the measures that should be adopted to prevent such crashes.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Crash due to Surface Defects

There are numerous types of defects that form on roads including deep potholes, shallow potholes, surface deterioration, edge failure, cracking, rutting, and subsidence, which can lead to fatal or serious injuries. In order to prevent crashes due to surface defects standards mentioned in IRC 82:2015 should be followed i.e. The shoulder and the pavement materials in the affected area should be fully removed to a regular section with vertical sides. The pavement and the shoulders should be built up simultaneously with thorough compaction. A bituminous surface similar to that in the adjacent reach should be laid. The shoulder should have adequate slope to drain away to water. A slope one percent steeper than the camber of the bituminous surface should be found generally necessary for earthen shoulders. In order to prevent the edges from getting broken again, the maintenance operations should include periodic inspection of the shoulder condition and replacement of worn-out shoulder material with adequate compaction. In sandy areas where the soil is likely to be eroded by wind and rain, it may be advantageous to have brick paving at least for some width to protect the edges. Surface and subsurface drainage, wherever deficient, should be improved.

3.2 Crash due to loss of control (Unmarked Speed Humps on Road)

Speed humps are parabolic vertical traffic calming devices intended to slow traffic speeds on low volume, low-speed roads. Speed hump should be marked with thermoplastic paint or retro-reflective paints. The absence of marking on the speed humps shall be identified as

unmarked speed humps. The absence of marking on the speed hump may lead to sudden braking by the speeding vehicle and may result in a loss of control type crash, especially at night. IRC 099:2018 shall be followed.

In order to prevent such crashes speed humps should be clearly marked with retro-reflective paints to give the driver the time needed to slow down the vehicle well in advance. Further, speed humps should be highlighted along with a warning sign of "Speed hump ahead" placed before the hump. The distance of the sign to be placed should be at least 50-100m before the hump for lower-speed highways.

3.3 Crash due to loss of control (Unauthorized Humps on Road)

Road crashes may occur due to surface defects like uneven and bumpy roads especially if the roads are not well planned and maintained. It becomes extremely difficult for a driver to be cautious about the surface defects ahead which may lead to road crashes.

In order to avoid such crashes, it is essential that speed breakers markings be supplemented with warning signs in advance of zebra crossing location and informatory signs at the location of the zebra crossing. Roads should have markings to

warn drivers about hazards ahead in advance. For better night-time visibility, the marking shall be made retroreflective and reinforced with road studs.

Care should be taken that such markings are made with Solar Powered Road Markers, as they are more effective and can immediately draw the attention of drivers. Such markings shall be provided at locations like approach to speed humps. Safety requirements to be followed as per IRC 035:2015, Section 11.1 Marking on speed breakers (Page No. 71)

3.4 Crash due to loss of control (sudden level difference at edge of the road)

Crashes may occur when a driver loses control of his/ her vehicle due to unevenness of the road, or edge drops at the soft shoulders.

In order to prevent such crashes:

Periodic Maintenance of Soft Shoulders [21]

Soft shoulders such as earthen or granular shoulders should be periodically maintained by levelling and compacting to avoid drop-off

[21] IRC SP 42:2014, Section 4.4.5, Drainage of Shoulders (Page No.18)

(depression at road edge), erosion, and consequential channelized flow of water in the longitudinal direction. Care should be taken to add fresh material to compensate for the loss of soil due to erosion, vehicle movement, etc., and compacting the same after mixing necessary moisture to achieve Maximum Dry Density (MDD).

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 10 – Crash Due to Sudden Appearance of Vehicle

1. SCOPE

This section of the code gives recommendations for reducing crashes due to the sudden appearance of vehicles due to lack of certain planned & preventive measures.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Crash due to sudden appearance of vehicles (U-Turn/ Right-turning vehicles from the median)

Road crashes may occur when there is a sudden appearance of vehicles especially at the turning points, and medians. The gaps in the crash barrier are frequently utilized by motorcyclists to a crossroad, resulting in an unsafe crossing of the road.

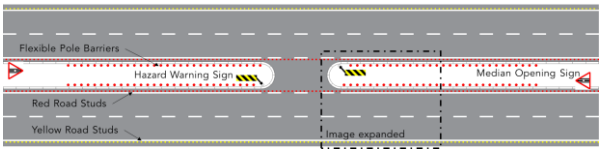
In order the prevent such crashes, treatment of the median gap should be done to improve conspicuity. The following standards mentioned in IRC SP 88-2019 should be followed.

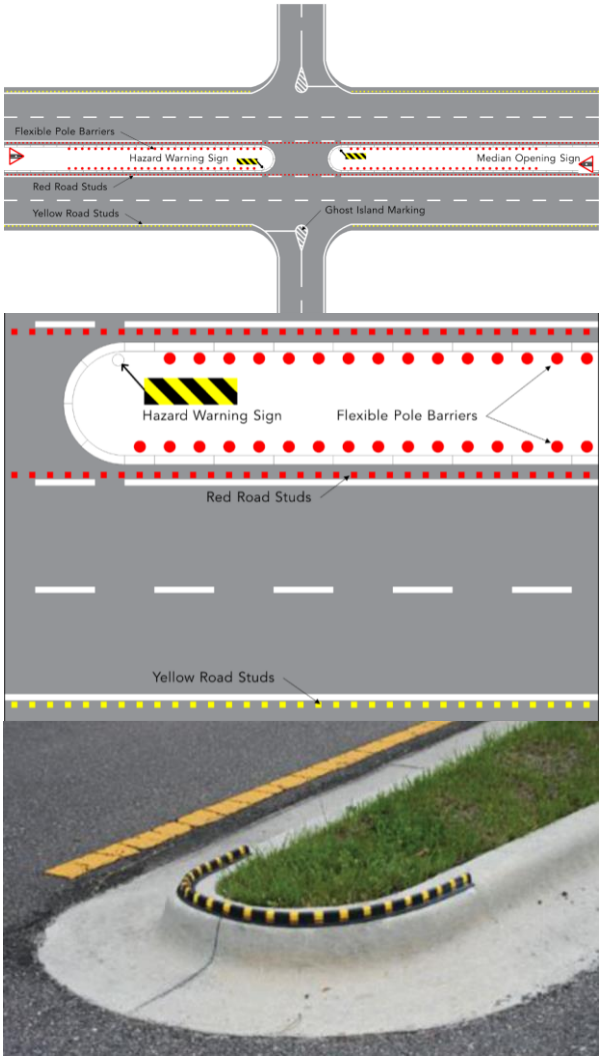
i. The unnecessary gaps in the crash barrier should be closed. The median crash barriers should be continuous.

ii. Regular asset management checks should be conducted to ensure that there is no broken crash barrier.

iii. Care must be taken that every unauthorized gap in the median is closed.

iv. Authorised gaps in the median shall be treated to improve visibility and safety.





Case Example:

As a part of the zero fatality corridor initiative on Mumbai Pune Expressway (MPEW), all unauthorized medians were closed. The number of gaps in the median was limited to required openings for emergency vehicles. The closure of median openings led to a significant reduction in fatalities on MPEW

3.2 Crash due to the sudden joining of vehicles from the service road to the highway

Road crashes may occur due to the absence of properly designed entry/exit ramps connecting the access between the service road and highway as there may be a sudden joining of vehicles from the service road to the highway.

In order to avoid such road crashes, standards as mentioned in IRC SP 87: 2019 shall be followed i.e. the service roads shall be connected to the main highway through properly designed entry/exit ramps at locations.

Traffic needing access to the main highway shall first come onto the service road and then join the main highway through an acceleration lane/entry ramp.

Similarly, all traffic exiting the main highway shall first come on to the service road through a deceleration lane/exit ramp from where it would distribute to the local road network for various destinations. Reference to the same can be found in Section 4 of the Enforcement Chapter.

However, when there is no settlement or roadside development abutting the Project Highway or the connecting roads are spaced more than 2 km, service roads may not be necessary and access can be given directly through acceleration/deceleration lanes.

The existing direct access to the highway shall also be modified accordingly

3.3 Crash due to sudden appearance of vehicles on the highway from minor roads

Road crashes may occur when a vehicle enters a highway through a minor road, as the drivers driving on the highway may not be aware of such minor intersections from where vehicles may appear on the highway. In order to avoid such road crashes minor intersections should be regularly treated and maintained.

3.4 Crashes at intersection

Crashes at intersections are common on highways. It is recommended that there shall be no intersections on highways. In the rare instances where intersections needs to be provided, the following measures shall be undertaken:

i. It is recommended that, the intersection shall be converted to a vehicle underpass or vehicle overpass.
ii. The intersection may be redesigned to form a series of safe minor road junctions and median openings.
iii. If traffic volume is high, the intersection may be converted to a signalised intersection
iv. There shall be illumination to ensure adequate visibility.

In many cases, crashes at intersections occur with pedestrians. Such crashes are described in Section 12 - Pedestrian Crash. Reference to the same can be found in Section 8 of the Enforcement Chapter.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 11 – Crash Due to Poor Driving Behaviour

1. SCOPE

This section of the code gives a clear idea of the crashes that often occur due to poor driving behaviour like overtaking using the shoulder. Not all poor driving behaviour can be treated through engineering measures, however, the road infrastructure should ensure that there is clarity in how the driver is expected to perform.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Crashes due to Overtaking using the shoulder

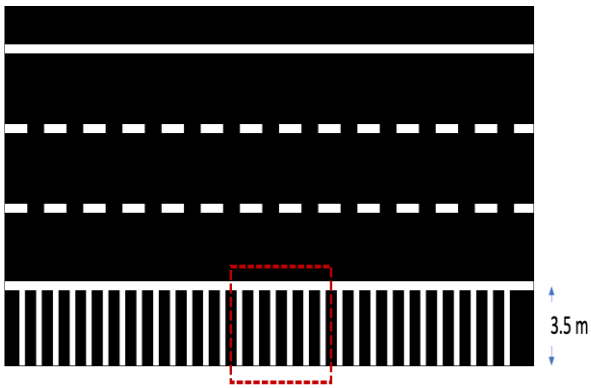
Road crashes may occur due to vehicle overtaking. Overtaking often takes place through the shoulder. Reference to the same can be found in Section 6 of the Enforcement Chapter.

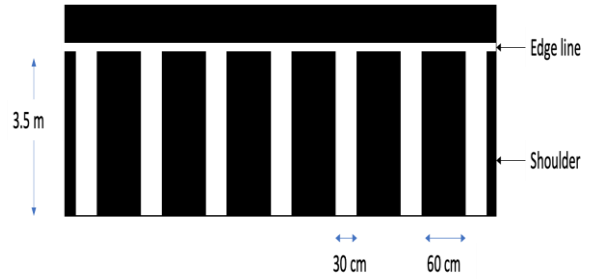
In order to prevent such crashes, Tactile Shoulder Line (TSL) should be installed. TSL will actively assist in preventing overtaking behavior using shoulder and rear-ending crashes.

In order to prevent crashes due to overtaking from the shoulder, Tactile Shoulder Lines should be constructed by every national and state highway. The measurements are mentioned in the illustration below. The thickness of the edge line shall be 10mm.

Case Example:

In Mumbai Pune Expressway after installation of Tactile Shoulder Lines, overall road crashes significantly reduced.

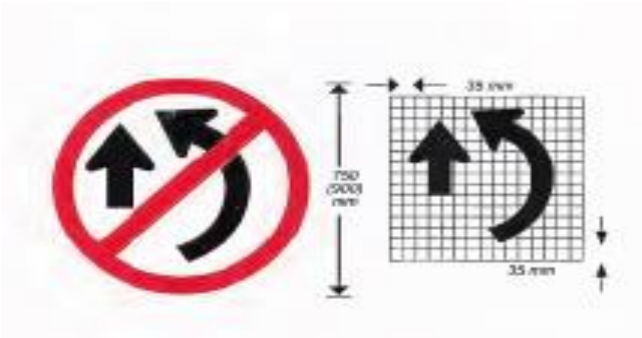




Warning signages mentioning (Overtaking Prohibited) should be placed at locations that are accident-prone zones/ black spots encountering road crashes due to overtaking.

The "No Overtaking" sign should be erected on each side of the road at the start of the affected length and should be supplemented by repeater signs at intervals not exceeding 400 m.

Safety Standard as per IRC 67-2012, Section 14.7.20; IRC 35-2015



3.2 Crashes due to over speeding

The details of over speeding are discussed in Section 8 (3.2). Reference to the same can be found in Section 2 of the Enforcement Chapter.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 12 – Pedestrian Crash

1. SCOPE

This section of the code discusses some of the most common risk factors of pedestrian crashes and how such crashes can be prevented.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Pedestrian crashes due to pedestrians on the main carriageway

Road crashes often occur when pedestrians indiscriminately use the main carriageway.

In order to prevent such crashes, the provision of safe and continuous pedestrian infrastructure should be built following the standards laid in IRC 103:2012 & IRC SP 84:2019. Reference to the same can be found in Section 2 of the Enforcement Chapter.

3.2 Pedestrians crash during the wait on the shoulder for public transport

The absence of a designated bus stop or the presence of a dysfunctional bus stop is a significant problem on Indian highways. In the absence of designated bus-stop facilities, buses stop anywhere, compelling pedestrians to wait on the main carriageway or shoulder; as a result, the risk of pedestrian-vehicular crashes increases. Further, the lack of proper access to the bus stops from the pedestrian sidewalk and crossing facilities, forcing pedestrians to take the unnecessary risk of dangerous crossing. Additionally, a stopped bus on the main carriageway enhances the possibility of a rear-ending crash. Reference to the same can be found in Sections 2 and 9 of the Enforcement Chapter.

In order to prevent such crashes -

i. Bus stops should follow design specifications as illustrated below to ensure the safety and comfort of commuters waiting for the bus.

ii. The layout of the pick-up bus stop should follow the specifications of IRC 80: 1981.

iii. The bus stop should be easily accessible from the pedestrian sidewalk and crossing facilities.

iv. A gap of 300 meters from the tangent point of intersection to the start/end of the layby will be desirable, particularly at junctions with main roads. In other cases, the distance may be relaxed to a certain extent having regard to the local conditions. At the minor intersections (e.g., junctions with village roads), the distance of 60 meters may be accepted as a special case. However, if a substantial volume of buses is to turn right at the intersection, it is necessary that

v. The bus stop should be located sufficiently ahead of the intersection so that the buses can be maneuvered easily from the pick-up stop on the left-hand side to the extreme right lane for turning.

3.3 Crashes due to haphazard movement of pedestrians on the road

Pedestrians may not be permitted to move on the space designated for vehicular traffic with speed limit more than 40 km/h. This shall be ensured by the provision of proper and dedicated pedestrian facilities. Reference to the same can be found in Section 8 of the Enforcement Chapter. Pedestrian facility shall be designed with the following factors

i. The pathway shall be continuous and unbroken.

ii. The pathway shall be easily accessible to differently-abled

iii. The pathway need not be continuous with the road and may be treated as a separate entity. However, it shall fully suffice the needs of all pedestrians.

iv. There shall be no objects on the pathway to limit the width.

v. At locations where the pathway is to cross minor roads, the pathway shall be leveled and the road shall rise to meet the pathway through a speed table.

vi. At locations where the pathway is to cross major roads, a zebra crossing shall be present

vii. At locations where the pathway is to cross multilane bi-directional traffic, there shall be safe refuge space for the pedestrians or the crossing shall be signalised for the safe movement of pedestrians.

viii. Illumination shall be provided for pedestrian pathways. The illumination need not be on high mast and may be limited to ensuring the visibility of the pathway.

In many cases, haphazard movement is seen during crossing, especially at intersections. Tactical redesign of a location, also referred to as Tactical Urbanism Trials in some literature, shall be undertaken if pedestrian and non-motorised traffic are the primary victims. Tactical redesign shall be undertaken for locations with:

i. High volume of pedestrian crossing at intersections,

ii. Haphazard movement of pedestrians along or across the road,

iii. Haphazard movement and unsafe mix of motorised traffic and non-motorised traffic in the same space.

3.4 Pedestrian crashes (school children) due to unsafe walking on the highway

Areas near a school require absolutely low speeds. School children are more prone to commit mistakes while negotiating with highway traffic. The absence of designated pedestrian crossing and sidewalk facilities near a school increases the risk of fatalities.

In order to prevent crashes at school zones, the following should adhered to:

i. All schools and institutional areas along the highway should be provided with raised pedestrian crossings at every 100-150 m. These crossings should be accompanied by advance warning signs stating, ‘speed breaker ahead’, ‘school/hospital area’, and 30 km/hr speed limit.

ii. In the case of high-density corridors where the setback from the highway is less than 6 m, traffic calming devices should be used to restrict corridor speed between 30 to 50 km/hr. Reference to the same can be found in Section 3 of the Enforcement Chapter.

iii. 2.5 m wide continuous paved shoulders should be provided along with a minimum of 1.5 m wide raised footpaths on both sides of the highway.

iv. Raised pedestrian crossings at every 100-150 m at all schools, hospitals, and institutional areas along the highway.
v. Advance warning signs stating, ‘speed breaker ahead’, ‘school area’, and 40 km/hr speed limit should be provided. Reference to the same can be found in Section 3 of the Enforcement Chapter.
vi. The school zone should be 100 meters on either side of the school.
vii. Absence of demarcation of the school zone on the pavement with letters "SCHOOL ZONE" in white and within a red background.
viii. Pedestrian underpass/foot over bridge shall also be provided within a distance of 200 m from a school.

3.4 Pedestrian crashes while Crossing

Pedestrian unsafe crossing behavior such as not using the designated crosswalks, jaywalking, signal violation, distraction while crossing increases the likelihood of pedestrian-vehicular crashes. In addition, the lack of pedestrian crossing facilities such as the absence of zebra crossing, FOB, or underpass increases the risk of pedestrian-vehicular crashes. Reference to the same can be found in Section 2 of the Enforcement Chapter.

In order to prevent such crashes, the following guidelines should adhere to:

i. Provision should be made for providing designated pedestrian crosswalks with a ‘pedestrian crossing sign’.
i. A continuous footpath and safe crossing facilities should be provided along with the built-up areas, school zones, and hospital zones.
ii. To improve visibility during the night, road studs should be provided along the pedestrian crosswalk. Pedestrian sidewalk and crosswalk facilities should be continuous and interconnected to other pedestrian facilities.
iii. Provision of installation of rumble strips at 10 m to 20 m before the pedestrian crossing.
iv. Absence of demarcation of the school zone on the pavement with letters "SCHOOL ZONE" in white and within a red background.
v. Pedestrian underpass/foot over bridge shall also be provided within a distance of 200 m from a school.

3.5 Lack of pedestrian Safety Treatment at Hospital Zone

Areas near a hospital require absolutely low speeds. The absence of designated pedestrian crossing and sidewalk facilities near a hospital increases the crossing risk as well as the chances of fatalities near a hospital. The presence of an emergency lane near a hospital is also needed to allow the non-interrupting movement of ambulances.

i. In order to prevent crashes near hospitals, following guidelines should be adhered:
ii. All hospital areas along the highway should be provided with raised pedestrian

crossings at every 100-150 m. These crossings should be accompanied by advance warning signs stating, 'speed breaker ahead', 'school/hospital area', and 30 km/hr speed limit.

iii. In the case of high-density corridors where the setback from the highway is less than 6 m, traffic calming devices should be used to restrict corridor speed between 30 to 50 km/hr. Reference to the same can be found in Section 3 of the Enforcement Chapter.

iv. 2.5 m wide continuous paved shoulders should be provided along with a minimum of 1.5 m wide raised footpaths on both sides of the highway.

v. Raised pedestrian crossings at every 100-150 m at all schools, hospitals, and institutional areas along the highway.

vi. Advance warning signs stating, 'speed breaker ahead', 'hospital area', and 40 km/hr speed limit should be provided.

vii. The 'hospital zone' pavement marking should be 100 meters on either side of the hospital.

viii. An emergency lane for an ambulance should be provided at the hospital zone for the non-interrupting movement of the ambulance.

ix. Pedestrian underpass/foot over bridge shall also be provided within a distance of 200 m from a hospital.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 13 – Sideswipe Crash

1. SCOPE

This section of the code discusses the various factors due to which sideswipe crashes occur. It also discusses the steps that can be taken to prevent such crashes.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Sideswipe crash due to poor visibility of highway at night

One of the major reasons for sideswipe crashes on the highway at night hours is due to poor visibility.

In order to prevent such crashes road visibility of the roads should be increased with the help of retro-reflective delineators and road signages. The installation of the same shall be based on the standards mentioned in IRC 67:2012 and IRC 79: 2019.

3.2 Sideswipe crashes due to lane narrowing or sudden lane drop

Sideswipe crashes also occur due to the unavailability of indicators or warnings about lane narrowing. In order. To avoid such crashes the risk factor should be addressed/ or rectified with the help of lane marking or by kerb markers, which shall indicate lane narrowing. The standard for laying such lane markers is mentioned in IRC 99:2018, Figure 2.2 (Page 7)

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 14 – Crash Due to Fatigue

1. SCOPE

This section of the code discusses one of the most concerning factors, ‘fatigue’. The section scopes out ways to prevent such crashes.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPES OF RISK FACTORS

3.1 Crash due to fatigue (Drowsiness)

One of the leading causes of truck crashes is driver fatigue. Truck drivers tend to work long, monotonous hours and prefer to drive late at night, as a result, the likelihood of crashes due to driver’s fatigue and drowsiness increases. Reference to the same can be found in Section 7 of the Enforcement Chapter.

In order to prevent such crashes provision of truck rest stop and truck lay-bye should be constructed as per IRC 12:2016 and IRC SP 87:2019, Section 12.6

As a part of the ZFC initiative, two truck rest stops were constructed on MPEW by Maharashtra State Road Development Corporation. The truck stops provided a safe space for truck drivers to take rest and sleep. This led to a marked fatality reduction.

NATIONAL ROAD SAFETY CODE

PART II - ENGINEERING

Section 15 – Hydroplaning Related Crash

1. SCOPE

This section of the code discusses crashes that occur due to hydroplaning. The section highlights the various steps that can be taken to prevent such crashes.

2. TERMINOLOGY

The definition of the terms used in this section are given in Part 1 of this code.

3. TYPE OF RISK FACTORS

3.1 Crash due to hydroplaning

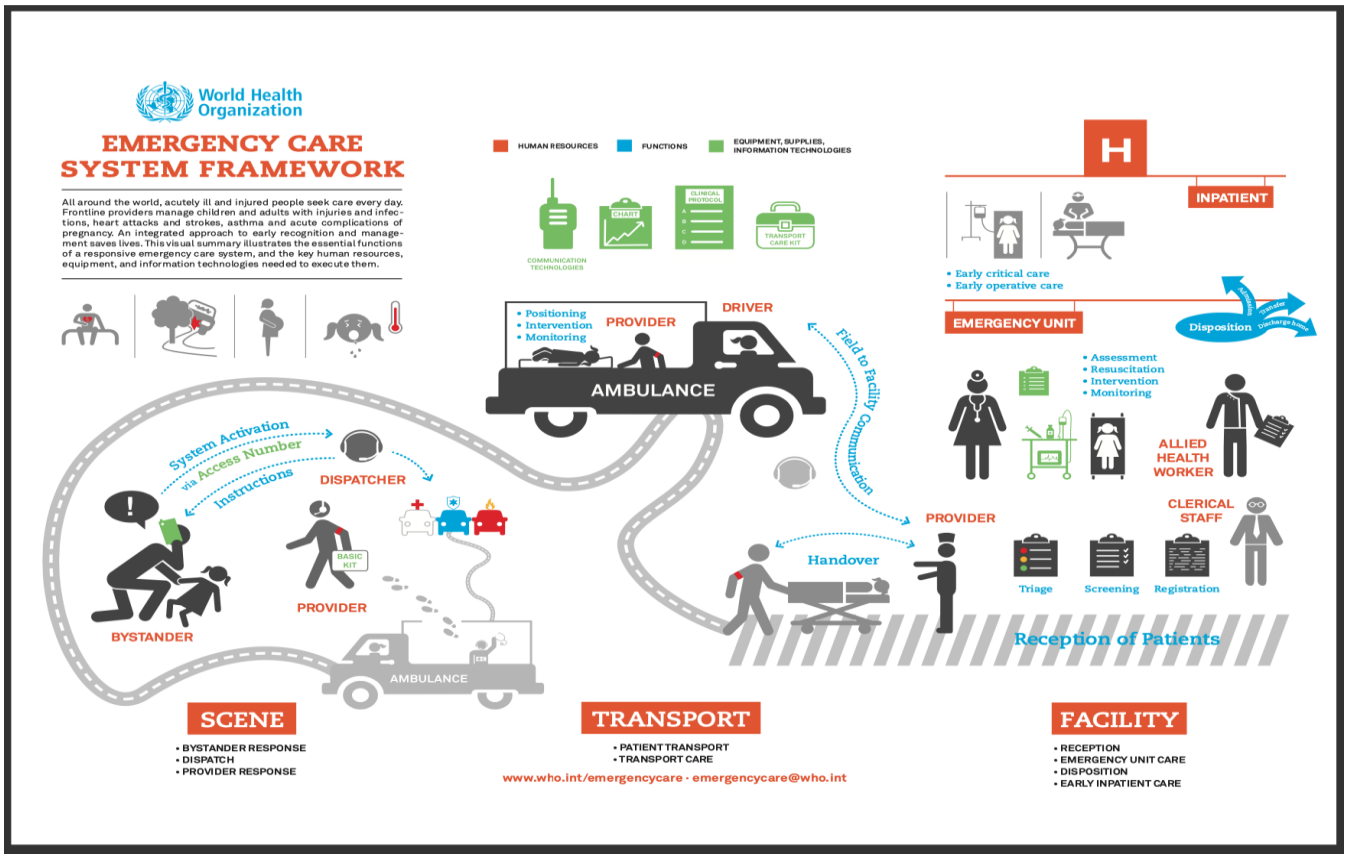
Chances of road crash increase when there is the pooling of water due to poor drainage. In order to prevent such pooling of water on the roads, standard hydroplaning should be done. Such planning should entail the construction of a minimum longitudinal gradient of 0.3%. For high type bituminous surfacing for non-kerbed roads the drainage slope should be between 2.0-2.5% and for roads with kerbs within 2.5%. For cement concrete surfacing for non-kerbed roads drainage slope should be between 2.0%-2.5% and for roads with kerb within 2.5%.

Safety requirements mentioned in IRC SP 42:2014, Section 4.4.1 and Crossfall/ Camber 4.4.2 (Page No.13)

NATIONAL ROAD SAFETY CODE

PART III - EMERGENCY MEDICAL CARE

Emergency Care Framework



NATIONAL ROAD SAFETY CODE

PART III - EMERGENCY MEDICAL CARE

Section 1 - Access to Emergency Medical Care

1. **Scope**

This section of the code focuses on the importance of access to emergency medical care in preventing road crash fatalities and serious injuries. The section highlights interventions that should be adopted to strengthen the access to emergency medical care systems for highway commuters, as timely access to medical care can help save many lives. Such care is especially essential for patients in need of critical, care-sensitive conditions such as acute myocardial infarction, stroke, sepsis, and major trauma.

2. **Terminology**

The definition of the terms used in this section are given in Part 1 of this code.

3. **Interventions**

3.1 Universal access number

Universal access is a short code number assigned to provide a universal, easy-to-remember number for people to access police, fire, emergency medical assistance or any other emergency service from any phone at any location, without having to look up specific phone numbers.

International Telecommunication Union (ITU)-T's Recommendation E.161.1 provides a formal definition for an emergency number as "A non- E.164 number allocated in the national numbering plan to enable emergency calls. Normally, the emergency number is a short code".

ITU-T's Q-series Recommendations – Supplement 47 (2004) defines an emergency call, as "a call requesting emergency services. A caller is given a fast and easy means of giving information about the emergency to the appropriate emergency organisation (e.g., fire department, police, ambulance). Emergency calls will be routed to the emergency services in accordance with national regulations"[22].

[22] https://www.itu.int/rec/dologin_pub.asp?lang=s&id=T-REC-E.161.1-200809-I!!PDF-E&type=items

The primary purpose of the universal access number is to create a centralised number that can provide quick help in any kind of distress, especially as time is a critical component while responding in emergency situations. A centralised database is recommended for implementing a single number based Integrated Emergency Communication and Response System in India. This can avoid delay in inter-operator coordination in time of need as a centralised database will have more direct control by government authority if required. This database can be controlled by a neutral body with strict security parameters in order to ensure callers privacy.

Currently, India has multiple sets of helpline numbers which at times can become a deterrent in distress situations.

Example:

- NATIONAL EMERGENCY NUMBER-112
- POLICE-100
- FIRE-101
- AMBULANCE-102
- Disaster Management Services-108
- Women Helpline-1091
- Road Accident Emergency Service:1073
- Road Accident Emergency Service on National Highways:1033

Therefore, a single emergency number should cater as a single point to contact for all primary emergency services related to Police, Ambulance, Fire, Women helpline, Emergency Disaster Management, and Accidents[23].

Ideally, a universal emergency telephone number should:

● be valid throughout the catchment area

● be available from every telephone device (landline or mobile)

● be readily accessible (e.g., available through emergency call boxes)

● be easy to remember and dial (i.e., limited to 3 or 4 digits)

● be free of charge

● provide access to a nearby emergency dispatch centre

● guarantee the confidentiality of the caller[24].

[23] https://trai.gov.in/sites/default/files/Priyank_Chandra_0.pdf

[24] Prehospital trauma care systems, WHO (2005)

Operation of universal number:

All calls requiring public safety resources (such as fire and rescue services, police, and emergency medical services) should be routed through a central reception centre, called a public safety answering point (PSAP). This will ensure that calls are distributed appropriately to the correct agencies. The coordinated management of an emergency response is best achieved by sharing dispatch functions or by using a secure electronic connection between centres that has the capability to immediately transfer calls[25].

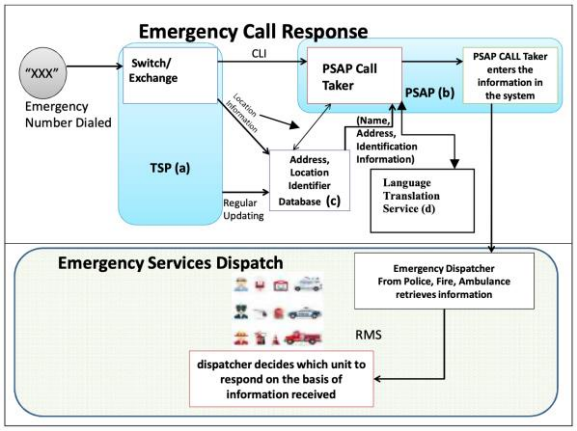
A call to emergency services starts a sequence of tasks by different stakeholders taking part in the emergency service chain.

Once a call is received at an emergency handling centre, the operator attending to the call shall collect the relevant data-location details and Caller Identification either from a database or from the caller and classify the nature of the emergency.

Based on the nature of the emergency, the call is handed over to the relevant responding agency at the centre which, in turn, shall be dispatched appropriate resources to the location where emergency assistance is required.

In this entire system, the following agencies should be included-

- Telecom Service Providers (TSPs),
- Public Safety Answering Points (PSAPs),
- Language translation service providers and
- The emergency service provider[26]



3.2 Promotion and placement of facilities and emergency contact number on highways

The Central and State Highway Authorities shall increase awareness about the universal emergency contact number in order to improve its access for highway commuters. General and targeted campaigns should be conducted to increase

[25] ibid

[26] https://www.trai.gov.in/sites/default/files/IECRS-07.04.15-Final.pdf

awareness about the universal emergency number.

Along every highway, there should be informatory road signs providing information on emergency care facilities for easy access to such facilities in case of a crash[27].

The specification of road signages mentioned in IRC 67:2012 should be followed.

Emergency number placed across the NH48 by SaveLIFE Foundation

27 https://morth.nic.in/sites/default/files/road_safety_books.pdf

NATIONAL ROAD SAFETY CODE

PART III - EMERGENCY MEDICAL CARE

Section 2 - Bystander Care

1. **Scope**

Road crash cases require the fastest care and rescue which could be provided by those closest to the scene of the accident. Bystanders' clear support is essential to enhance the chances of survival of a victim in the 'Golden Hour' i.e. the first hour of the injury[28]. Even the most sophisticated emergency care system will be ineffective if bystanders fail to recognize an emergency or do not know how or who to call for help[29].

Beyond recognising injury and calling for help, bystanders may also play a key role by delivering first aid prior to the arrival of formal providers[30]. Reluctance or hesitation by bystanders who are the first link in the chain of survival can be fatal, as the precious opportunity to save a life during the Golden Hour is lost. Hence, in order to ensure that bystanders come to the aid of road crash victims, it is essential to protect them from legal and procedural hassles.

> The Law Commission of India, in its 201st Report, states that 50% of lives can be saved if timely medical care is rendered within the first hour.

2. **Terminology**

The definition of the terms used in this section are given in Part 1 of this code.

3. **Interventions**

[28] Supreme Court

[29] Post Crash Response, supporting those affected by road crashes WHO, Pg 7

[30] Prehospital trauma care systems, WHO (2005)

3.1 Adherence to Good Samaritan Law

For the first time the idea of Good Samaritan law was widely discussed in India by the Hon'ble Supreme Court in the case of SaveLife Foundation and another Vs. Union of India and another in Writ Petition (Civil) No. 235 of 2012 *vide* its order dated 30th March 2016.

Hereinbelow are some recommendations that should be considered while implementing the Good Samaritan law.

3.2 Commissions for Good Samaritans

- It is recommended that quasi-judicial bodies/ commissions be set up at three levels - district, state, national[31] to monitor the operation of the law, discuss cases, determine compensation and awards.
- It is further recommended that the Commission shall organise and monitor the trainings for first responders (police officials, community members)
- The commission shall direct educational institutions to impart training to its every student above the age of twelve years in first aid for such duration as may be prescribed[32].
- The Central Government shall provide adequate funds to the State Government for carrying out such trainings[33].

3.3 Standards for Hospital and Medical Practitioners

It is recommended that every hospital and medical practitioner shall, while providing emergency medical treatment to a victim of an accident shall not—

(*a*) insist that it is a medico-legal case requiring information to the police authorities

(*b*) insist on making any payment for the screening and emergency medical treatment;

(*c*) inquire into facts whether victim has medical insurance or is a member of any medical scheme.

(*d*) raise any other unreasonable objection[34]

(e) Lack of response by a doctor in an emergency pertaining to road accidents, where he is expected to provide care, shall constitute "Professional Misconduct", under Chapter 7 of the Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulation, 2002 and

[31] Concept - Consumer Dispute Redressal Commission http://ncdrc.nic.in/default.html

[32] Good Samaritan Bill, 2019 http://164.100.47.4/billstexts/lsbilltexts/asintroduced/1425LS%20As%20Int....pdf , Sec 6 ; The Karnataka Good Samaritan and Medical Professional (Protection and Regulation During Emergency Situations) Bill 2016, Sec 27

[33] ibid, Sec 7

[34] ibid, Sec 3

disciplinary action shall be taken against such doctor under Chapter 8 of the said Regulations[35].

(f) All hospitals shall publish a legible[36] charter in Hindi, English, and the vernacular language of the State or Union territory at their entrance to the effect that they shall not detain bystander or good samaritan or ask depositing money from them for the treatment of a victim[37]. In addition to the above message to be displayed, the designation, complete address, telephone/fax nos. and E-mail address of the Head of the Emergency Department of the Hospital[38], Member of District Commission and SP, may be displayed[39].

(vii) In case a bystander or good samaritan so desires, the hospital shall provide an acknowledgement to such good samaritan, confirming that an injured person was brought to the hospital and the time and place of such occurrence, and the acknowledgement may be prepared in a standard format[40]

Sample[41]:

Name of the Good Samaritan (Pls use separate sheet for each Good Samaritan, in case it is more than one individual)	
Mobile Number	
Address	
Place of Accident (with detailed address)	
Date & Time of Accident	
CERTIFICATION BY HOSPITAL	
Name of the Doctor who attended first (with the Name and address of the Hospital)	
Name and Telephone number of the Hospital Head (MD/Director/Superintend. etc.)	
Brief Reason as to why it has been treated as fatal accident and to confirm that the aid was provided by the good Samaritan within the stipulated time of Golden Hour	
Signature of Authorized Official (with official seal)	

Date:
Place:

(Signature of the Authorized signatory)
[Name and Designation of the Authorized Signatory]

3.4 Records to be maintained by hospitals

Every hospital and the medical practitioner shall maintain a separate register containing the following information, namely: —

(*a*) name and address of the person injured, date and place of accident as reported, nature of injuries, and other relevant details

[35] Savelife Foundation & Anr. vs Union Of India & Anr https://indiankanoon.org/doc/79865001/

[36] Sec 18. INDUSTRIAL EMPLOYMENT (STANDING ORDERS) CENTRAL RULES, 1946; https://labour.gov.in/sites/default/files/INDUSTRIALEMPLOYMENT(STANDINGORDERS)1CENTRALRULES1946.pdf

[37] ibid

[38] NHFW, Guidelines for protection Good Samaritan, Sec. 4 ; available at https://www.mca.gov.in/Ministry/pdf/Guidelines_07sep2015.pdf

[39] Concept from CVC https://dtf.in/wp-content/files/Circular_dated_5.6.2009_-_Display_of_standard_notice_board_by_Departments-organisations-Reg.pdf

[40] ibid

[41] Concept from, MoRTH. Form of Acknowledgement for Good Samaritan Award, available at - https://morth.nic.in/sites/default/files/circulars_document/Scheme_for_grant_of_awards_to_Goods_Samaritan_0001.pdf

and the person who brought injured person to hospital

(*b*) name and address of the person purportedly brought in emergency medical condition, nature of emergency and nature of medical condition

(*c*) details of the screening medical tests done and the determination of emergency condition

(*d*) informed consent by victim, if given for emergency medical treatment including stabilization or for transfer or if he refused them

(*e*) detail of medical treatment not given for want of facilities at hospital

(*f*) detail of surgery conducted, along with time, date, and hours of treatment

(*g*) details of transfer to another hospital or medical practitioner

(*h*) details of fee paid to consultants or for laboratories tests

(*i*) details of expenditure incurred on emergency medical treatment; and

(*j*) other particulars a hospital or medical practitioner requires to comply under this act[42].

3.5 Standards to be followed by Police

It is recommended that any police officer especially investigating officer while interacting with a good samaritan:

(*a*) shall act with sensitivity towards him and complete the recording of his statement and all other proceedings relating to him in a timely manner with utmost care and respect

(*b*) the examination of the good samaritan shall be conducted at a time and place of his/ her convenience and the investigation officer be dressed in plain clothes

(*c*) if the good samaritan is required by the investigation officer to visit the police station, in a single examination in a reasonable and time-bound manner and the reasons for the requirement shall be recorded by the officer in writing; and

(*d*) if declares himself to be an eyewitness, he shall be allowed to give his evidence in the form of an affidavit[43].

(e) Disciplinary or departmental action shall be initiated by the Government

[42] Good Samaritan Bill, 2019 http://164.100.47.4/billstexts/lsbilltexts/asintroduced/1425LS%20As%20Int....pdf; Section 4

[43] ibid; Sec 5(3)

concerned against public officials who coerce or intimidate a bystander or good Samaritan for revealing his name or personal details[44].

It shall be the duty of every Officer-in-Charge to install a notice board at the entrance of the police station, the notice board shall be prominently visible, in English , Hindi and vernacular informing that no good samaritan shall be harassed by police, are no good samaritan is required to be brought to police station, in case such act is done by any police officer the concerned person/ person who has been harassed can reach out to the Officer in Charge, SP or the member of Good Samaritan Commission in the district. The contact number of such officers shall be clearly mentioned in the notice board.[45]

3.6 Examination of Good Samaritans by Court

It is recommended that courts that intend to examine a good samaritan should not insist on the appearance of Good Samaritans, unless necessary as that causes delay, expenses, and inconvenience. The concerned court should exercise the power to appoint the Commission for examination of Good Samaritans in accordance with the provisions contained in section 284 of the Code of Criminal Procedure, 1973 suo motu or on an application moved for that purpose, unless for the reasons to be recorded the personal presence of good Samaritan in court is considered necessary. In order to prevent harassment and inconvenience to good Samaritans. Video conferencing may be used extensively during the examination of a bystander or good samaritan including an eyewitness of a road accident[46]

[44] SaveLife Foundation & Anr vs Union Of India & Anr https://indiankanoon.org/doc/79865001/

[45] Adopted from Standing order of Delhi Police on JJ Act, available at https://dpjju.in/pdf/Standing-Order.pdf (5. b)

[46] ibid

NATIONAL ROAD SAFETY CODE

PART III - EMERGENCY MEDICAL CARE

Section 3 - Ambulance services

1. **Scope**

This section of the code details standards for ambulance equipment and staff. Ambulances play a crucial role in the emergency medical system, in providing pre-hospital care to the road crash victim. Thus, it is extremely important that the vehicle is of a certain standard to be able to provide adequate care and life support during the time of transportation from the crash site to definitive care.

2. Terminology

The definition of the terms used in this section are given in Part 1 of this code.

3. Interventions

3.1 Ambulance build and stocking

The design and construction of ambulances shall be classified under four categories, they shall be as follows[47]:

i. **Type A Road Ambulance:**

Medical First Responder Road ambulance designed to provide emergent out-of-hospital medical care to patients when stationary. This vehicle should be any CMVR-approved Category M or L vehicle suitable for the terrain to be used in but may not have the capability to transport patients in a supine state or provide them medical care inside the vehicle.

ii. **Type B Road Ambulance:**

Patient Transport Vehicle Road ambulances are designed and equipped for the transport of patients who are not expected to become emergency/critical patients.

Type B ambulances shall have basic professional equipment for first aid and nursing care.

iii. **Type C Road Ambulance:**

Basic Life Support Ambulance A vehicle ergonomically designed, suitably equipped, and appropriately staffed for the transport and treatment of patients requiring non-invasive airway management / basic monitoring. Type C ambulances shall have equipment for basic treatment and monitoring of

[47] National Ambulance Code [AIS-125 (Part 1)]

patients with the current methods of pre-hospital care.

iv. **Type D Road Ambulance:**

Advanced Life Support Ambulance A vehicle ergonomically designed, suitably equipped, and appropriately staffed for the transport and treatment of emergency patients requiring invasive airway management/intensive monitoring. Type D ambulances shall have equipment for advanced treatment and monitoring of patients with the current methods of pre-hospital intensive care.

Stocking:

The equipment that should be available in an ambulance are as follows[48]:

Table 9

Type of Patient Handling Equipment

No	Device	Standard	Type of Road Ambulances		
			B	C	D
1	Main Stretcher / Undercarriage (If the vehicle characteristics so require, the length of the stretcher maybe reduced to 1800mm and height from the loading assembly increased to 380mm)	EN 1865	1	1	1
2	Pick up stretcher	EN 1865	-	1	1
3	Vacuum Mattress	EN 1865	-	X	X
4	Transfer mattress / Carrying Sheet	EN 1865	X	X	X
5	Long spinal board complete with head immobilizer and securing straps	EN 1865	-	X	X

Table 10

Type of Immobilization Equipment

No	Device	Type of Road Ambulances		
		B	C	D
1	Traction Device	-	X	X
2	Immobilization, Set of fractures	-	1	1
3	Cervical upper spinal immobilization devices Cervical Collar Set	-	1	1
4	Extended Upper Spinal Immobilization Extrication Devices or Short Spinal Board (one of these)	-	1	1

Table 11

Type of Life SOT Equipment

No	Device	Type of Road Ambulances			
		A	B	C	D
1	Stationary Oxygen	X	X	Minimum 2 Nos. of 10L Water Capacity Cylinders at maximum 150 kgf/cm^2 filling pressure manufactured as per IS:7285 and certified by Chief Controller of Explosives, Nagpur	Minimum 1 No. of 46.7L and 10L Water Capacity Cylinders each at maximum 150 kgf/cm^2 filling pressure manufactured as per IS:7285 and certified by Chief Controller of Explosives, Nagpur
2	Portable Oxygen	Minimum 1 No. of 2.2L Water Capacity Aluminium Cylinder at maximum 150 kgf/cm^2 filling pressure manufactured as per IS:7285 and certified by Chief Controller of Explosives, Nagpur	Minimum 1 No. of 2.2L Water Capacity Aluminium Cylinder at maximum 150 kgf/cm^2 filling pressure manufactured as per IS:7285 and certified by Chief Controller of Explosives, Nagpur	Minimum 1 No. of 2.2L Water Capacity Aluminium Cylinder at maximum 150 kgf/cm^2 filling pressure manufactured as per IS:7285 and certified by Chief Controller of Explosives, Nagpur	Minimum 1 No. of 2.2L Water Capacity Aluminium Cylinder at maximum 150 kgf/cm^2 filling pressure manufactured as per IS:7285 and certified by Chief Controller of Explosives, Nagpur

[48] Section 6, National Ambulance Code

3	Valve for Cylinders at 1 and 2 above	3/8" Bull Nose Valve as per IS:3224	3/8" Bull Nose Valve as per IS:3224	3/8" Bull Nose Valve as per IS:3224	3/8" Bull Nose Valve as per IS:3224
4	Resuscitator with oxygen inlet and masks and airways for all ages and oxygen reservoir	X	X	1	1
5	Mouth to mask ventilator with oxygen inlet	1	1	X	X
6	Electric Portable Suction Aspirator with air flow of at least 30 L/min and a vacuum level of at least 600 mm Hg (ISO 10079-1-1999)	X	X	1	1
7	Portable Suction Aspirator, Manual	1	1	1	1

Table 12

Type of Diagnostic Equipment

No	Device	Standard	Type of Road Ambulances			
			A	B	C	D
1	Manual B. P. Monitor Cuff Size: 10 cm. - 66 cm.	-	-	-	1	1
2	Automatic B P Monitor, Cuff Size 10 cm. - 66 cm. A doppler type shall operate accurately in the conditions of electrical interference and vibration specified in 4.3.1 and 6.3.4	-	-	-	X	X
3	Oximeter	ISO 9919	-	-	1	1
4	Stethoscope	-	-	-	1	1
5	Thermometer Minimum Range: 28°C to 42°C	-	-	-	1	1
6	Device for Blood Sugar Determination	-	-	-	1	1
7	Diagnostic Light	-	-	-	1	1

Table 13

Type of Drug

No	Type of Drug	Type of Road Ambulances			
		A	B	C	D
1	Pain Relief	-	-	X	X

Table 14:

Type of Infusion Material or Equipment

No	Device	Type of Road Ambulances			
		A	B	C	D
1	Infusion Solutions, Litre	-	-	4	4
2	Equipments for injections and infusions set	-	-	2	2
3	Infusion Mounting	1	1	2	2
4	Pressure Infusion Device	-	-	-	1

Table 15

Type of Equipment for Management of Life Threatening Problems[a]

No	Device	Standard	Type of Road Ambulances			
			A	B	C	
1	Defibrillator with rhythm and patient data recording	ISO 60601-2-4	-	X	X	
2	Cardiac Monitor	ISO 60601-2-4	-	-	X	
3	External Cardiac Pacing	ISO 60601-2-4	-	-	X	
4	Portable airways care system (p.a.c.s.) Manual resuscitator Mouth to mask ventilator with oxygen inlet Airways oro- or nasopharyngeal airway Aspirator Suction catheter	-	-	-	1	
5	Portable advanced resuscitation system (p.a.r.s.) Contents of portable airways care System (p.a.c.s.) Infusion equipment - to include suitable venous indwelling cannulae Infusion administration sets Infusion solutions Adhesive fixing materials Intubation equipment-to include laryngoscope handle(s) with suitable blades Magill forceps Insertion stylets Endotracheal tubes with connectors Inflation tube clamp Inflation syringe Tube fixing material Stethoscope Drug administration equipment	-	-	-	-	1
6	Nebulization Apparatus	-	-	-	1	1
7	Thorax Drainage Kit	-	-	-	-	1
8	Volumetric Infusion Device	-	-	-	-	1
9	Central Vein Catheters	-	-	-	-	1
10	Requirements for emergency and transport ventilators	ISO 10651-3	-	-	-	1
11	PEEP Valve, Adjustable or Set	-	-	-	-	1
12	Capnometer	ISO 21647	-	-	-	1

a. If desired two or more of these functions can be combined within one device.

Table 16

Bandaging and Nursing

No	Device	Type of Road Ambulances			
		A	B	C	D
1	Bedding Equipment	-	1	1	1
2	Blanket	-	2	2	2
3	Material for treatment of wounds	1	1	1	1
4	Materials for treatment of burns and corrosives	1	-	1	1
5	Re-plantation container to maintain the internal temperature at (4 ± 2)°C for at least 2 h	-	-	X	X
6	Kidney Bowl	1	2	1	1
7	Vomiting Bag	1	2	1	1
8	Bed Pan	X	X	X	X
9	Non-Glass Urine Bottle	1	2	1	1
10	Sharps Container	1	1	1	1
11	Gastric Tube with Accessories	-	-	X	X
12	Sterile Surgical Gloves, Pairs	X	X	5	5
13	Non-Sterile Gloves for Single Use	100	100	100	100
14	Emergency Delivery Kit	X	X	1	1
15	Waste Bag	1	1	1	1
16	Clinical Waste Bag	X	X	X	X
17	Non-Woven Stretcher Sheet	1	1	1	1

Table 17

Personal protection Equipment (for Each Member of the Crew for Protection and to Identify the Staff as Road Ambulance Personnel)

No	Device	Type of Road Ambulances			
		A[a]	B[a]	C[a]	D[a]
1	Basic protective clothing including high visibility reflective jacket or tabard	1	2	1	1
2	Advanced Protection Wear	-	-	X	X
3	Safety / Debris Gloves, Pair	1	1	1	1
4	Safety Shoes, Pairs	X	X	1	1
5	Safety Helmet	-	-	1	1
6	Personal Protection Equipment against Infection	-	-	1	1

a. Numbers are quoted per crew member

Table 18

Rescue and Protection Material

No.	Device	Type of Road Ambulances			
		A	B	C	D
1	Cleaning and disinfection material	1	1	1	1
2	Rescue tools[a]	X	X	X	X
3	Seat belt cutter	1	1	1	1
4	Warning Triangle Lights	2	2	2	2
5	Spotlight	1	1	1	1
6	Fire Extinguisher, ABC Type (minimum 2.5 kg capacity complying with IS:13849 or IS:2171)	1	1	1	1

a. Wherever the Ambulance will be used for Crash Rescue, the ambulance must be equipped with Electrically / Hydraulically / Pneumatically powered rescue tools including Cutters, Spreaders, Rams and Lifters or should be supported by rescue vehicles equipped with the same

Table 19

Communication

No.	Device	Type of Road Ambulances			
		A	B	C	D
1	Mobile Radio Transceiver	X	X	X	X
2	Portable Radio Transceiver	X	X	X	X
3	Access to the public telephone network e.g. via the normal radio transmitter or by mobile (cellular) telephone	1	-	1	1
4	Internal communication between driver and patient compartment	-	-	1	1

Equipment and supplies				
Communications				
Wireless communication (e.g., radio, mobile phone)	I	D	D	D
Protection				
Non-sterile single-use gloves in size medium–large	D	E	E	E
Eye protection (plastic or glass goggles with side shields)	D	E	E	E
Light-reflective clothing (e.g., waistcoat) for identification and protection	D	D	E	E
Flags or other traffic control devices	D	D	E	E
Torch plus spare batteries and bulb or reflector or candle	D	D	E	E
Soap or bactericidal foam for hand washing	D	E	E	E
Cleaning solution	D	E	E	E
Towel	D	D	E	E
Protective clothing, gowns or aprons	I	D	E	E
Disinfectant solution for equipment	I	D	E	E
Plastic bags for non-biohazard waste	I	D	E	E
Waterproof matches	I	D	D	E
Incineration bags for biological waste	I	I	E	E
Fire extinguisher	I	I	E	E
Sharps container	I	I	E	E
Extrication				
Basic extrication equipment (e.g., machetes, crowbars, car jacks)	I	D	E	E
Other extrication equipment (e.g., shears, saw, rope, shovel, protective clothing)	I	PR	D	E
Short-board for extrication	I	I	E	E
Specialized extrication equipment (e.g., cutters, spreaders, rams)	I	I	PR	D
Immobilization and patient transfer				
Long, rigid wood, metal or plastic board	D	D	E	E
Boards for limb splints	I	D	E	E
Stretcher (wooden, plastic or cloth device)	I	D	E	E
Head immobilization device	I	I	E	E
Cervical collar	I	I	E	E
Airway and breathing management				
Face shield	I	D	E	E
Pocket mask (e.g., for mouth-to-mask breathing)	I	D	E	E
Bag–valve–mask	I	D	D	E
Nasopharyngeal and/or oropharyngeal airways (for infants, children and adults)	I	D	D	E
Nasal cannula and associated tubing	I	D	E	E
Tongue depressor	I	D	E	E
Fixed oxygen equipment and administration equipment	I	D	E	E
Non-rebreather face mask	I	I	E	E
Suction device(manual or powered)	I	I	E	E
Yankauer or other rigid suction tip	I	I	E	E
Blind insertion device	I	I	PR	D
Laryngoscope handle and blades	I	I	I	E
Endotracheal tube and connector	I	I	I	E
Introducing stylet/bougie	I	I	I	E
Splinter forceps	I	I	I	E
Oesophageal detector device	I	I	I	E
Magill forceps	I	I	D	E
Needle and syringe	I	I	I	E
Needle for thoracostomy	I	I	I	E
Haemorrhage control and skin injuries				
Potable water	D	D	E	E
Bandages	I	D	E	E
Elastic bandages	I	D	E	E
Gauze rolls	I	D	E	E
Compresses	I	D	E	E
Absorbent cotton wool	I	D	E	E
Adhesive tape	I	D	E	E
Oral rehydration solution	I	D	E	E
Blankets	I	D	E	E
Adhesive dressing bandage (wound plaster)	I	I	E	E
4 X 4 bandages, triangular bandages	I	I	E	E
Arterial tourniquet	I	I	E	E
Needles and syringes	I	I	E	E
Sterile compresses	I	I	E	E
Intravenous infusion set (lines and cannulas)	I	I	I	E
Intraosseous needle or equivalent	I	I	I	E
Burns				
Vaseline or paraffin gauze	I	I	E	E
Sterile dressing	I	I	D	E
Dressing for burns	I	I	I	D
Diagnosis and monitoring				
Clock or watch with second hand	I	D	E	E
Stethoscope	I	D	E	E
Blood-pressure measuring device	I	D	E	E
Penlight	I	I	E	E
Torch (flashlight)	I	D	E	E
Thermometer	I	I	D	E
Pulse oximeter	I	I	I	D
Electronic cardiac monitoring device	I	I	I	D
Medicines				
Oxygen	I	D	E	E
Topical antibiotic dressing	I	I	D	E
Diazepam (or equivalent)	I	I	I	D
Controlled substances lockbox	I	I	I	D
Morphine sulfate	I	I	I	D
Acetylsalicylic acid	I	I	I	D
Ibuprofen (or equivalent)	I	I	I	D
Paracetamol (acetaminophen)	I	I	I	D
50% dextrose solution	I	I	I	E
Crystalloid solutions (normal saline)	I	I	I	E
Water for injection	I	I	I	E
Miscellaneous				
List of local emergency contacts	D	E	E	E
Knife, scissors	I	D	E	E
Flask for drinking water or bottles of water	I	I	E	E
Container for supplies and equipment (e.g., shoulder bag, backpack or box)	I	I	E	E
Rescue blanket (silver/silver or silver/gold)	I	I	E	E
Shovel	I	I	D	E
Triage tags	I	I	D	E
Lubricating jelly	I	I	E	E
Writing material				
Pencil	I	D	E	E
Permanent marker	I	D	E	E
Notepad	I	I	E	E
Charts for documenting patient care and incident	I	I	D	E

[a] Items in the resource matrix are categorized as E for essential, D for desirable, PR for possibly required, and I for irrelevant.

3.2 Ambulance Staffing (Qualification)

The following are the minimum qualifications ascribed for the Ambulance staff[49]:

(I) Ambulance Paramedic:

a) Qualified Certificate course in Pre-Hospital Trauma Technician (PTT) from Government of India recognised institutions; or

b) Qualified Diploma in GNM or B.Sc. (Nursing) and registration with State Nursing Councils; or

c) Qualified Diploma in Pharmacy and registration with State Pharmacy Council

d) Should be trained in Emergency Medical Technician (EMT Basic) as per the National Occupational Standards notified by the National Skill Development Corporation in HSSC accredited institutions.

(II) Ambulance Drivers:

a) Qualified matriculation from a recognized Board/University or equivalent
b) Possess a valid driving licence for LMV (Light Motor Vehicle - Commercial)
c) Good driving skills
d) Trained in Basic first aid training (on the job training)

3.3 Prehospital Trauma Care

The prehospital trauma care process consists of six key steps: detection, reporting, response, on-scene care, care in transit and transfer to definitive care inspired from the EMS-symbol or so-called 'Star of Life' symbol created by the US National Highway Traffic Safety Administration which presents six EMS functions. The objectives of prehospital trauma care involve prompt communication and activation of the system, proper actions at the scene of the crash by first responders, and the prompt response of the system or simply offering fastest possible basic life support including, airway, breathing, control of bleeding, and transportation of the right patient to the right place at right time. This includes all the appropriate personnel safety precautions, assessment, and treatment of the injured people at the scene, and transport to trauma care facilities

[49] https://drive.google.com/file/d/1c7XNAxaqIcwkbXkEK8ynqlH7miVdHb2Q/view; https://drive.google.com/file/d/1xvSzu0Y3L2ON3rF6v7kUvmM8l8GAN5ad/view

while delivering the necessary medical care before arrival at the hospital.[50]

Thus, it is recommended that adequately qualified and skilled personnel (emergency medical technicians, paramedics, doctors, etc.), should be available for medical assistance, direction, and accountability for prehospital care.

Prehospital care should include the following:

1. Assessment of the patient
2. Extricating the patient from the motor vehicle
3. Initiation of first-aid or resuscitation
4. Stabilisation of the patient
5. Safe and timely transportation of a patient to the closest trauma centre or acute care facilities during steps 3 and 4 above.

Time-consuming field interventions should generally be avoided so as not to delay the definitive care to be received in a hospital.

Strong decision making is essential to transport a patient to a trauma centre that is equipped for the patient's medical needs. This is necessary to avoid undertriage (severely injured patients transported to lower-level trauma centres or other acute care facilities) of patients and over triage (minimally injured patients transported to higher-level trauma centres). Therefore, the pre-hospital patient care records should include:

- Type and mechanism of injury
- The anatomic and physiological condition of the patient
- Relevant time stamps of the incident
- Extricated condition of the patient
- Type of on-site care rendered
- The timing of, and patient's response to, interventions

Scene-safety protocols shall be essentially followed for the safety of patients and EMS personnel both at the scene of the emergency as well as during the transportation[51].

The standards to be followed by prehospital providers is listed in the following table[52]:

[50] Prehospital trauma care services in developing countries, Page 66; available at:http://www.apicareonline.com/wordpress/wp-content/uploads/2013/05/16-Prehospital-trauma-care-services.pdf

[51] USA. American College of Surgeons. Resources for Optimal Care of the Injured Patient. Prehospital Trauma Care

[52] Prehospital trauma care systems, WHO (2005), Pg. 42-43

	Type of provider in prehospital setting			
	Basic first aid	Advanced first aid	Basic prehospital trauma care	Advanced prehospital trauma care
Knowledge and skills				
Alert				
Able to call for help	E	E	E	E
Scene survey				
Assess scene safety (physical and environmental hazards)	E	E	E	E
Establish need for additional help	E	E	E	E
Assess cause of injury	D	D	E	E
Provider safety				
Receive training in universal precautions	E	E	E	E
Limit exposure to HIV, hepatitis B and C, using available supplies	E	E	E	E
Limit exposure to airborne pathogens	D	D	E	E
Patient assessment				
Initial assessment				
Evaluate adequacy of airway	E	E	E	E
Evaluate adequacy of breathing	E	E	E	E
Evaluate extent of external bleeding	E	E	E	E
Recognize level of consciousness	D	E	E	E
Recognize when injuries are not survivable	D	E	E	E
Establish priorities for immediate care	D	E	E	E
Conduct triage for multiple patients	PR	D	E	E
Recognize at-risk patients and arrange transport	D	E	E	E
Detailed assessment				
Assess head injury	I	D	E	E
Assess spinal injury	I	D	E	E
Assess chest injury	I	D	E	E
Assess abdominal injury	I	D	E	E
Assess extremity injury	I	D	E	E
Assess neurological function	I	D	E	E
Assess patient for psychological trauma	I	D	E	E
Recognize presence of life-threatening or limb-threatening injury	D	D	E	E
Evaluate level of discomfort	D	E	E	E
Recognize hypothermia	D	D	E	E
Assess evidence of shock	D	D	E	E
Assess wounds for potential mortality and disability	I	D	E	E
Assess degree of burns (depth and extent)	I	D	E	E
Formulate differential diagnosis of cause of shock	I	I	E	E
Recognize platysmal penetration	I	I	I	E
Interventions				
Scene management				
Manage rescue situation	PR	D	E	E
Manage safe rescue to prevent further neurovascular damage	PR	D	E	E
Manage crowds, traffic and other threats	D	E	E	E
Avoid secondary collisions and injury	D	E	E	E
Manage transport of patient	D	E	E	E
Document incident	I	D	E	E
Airway and breathing				
Remove foreign bodies from airway (e.g., using Heimlich manoeuvre)	E	E	E	E
Restore open airway using manual manoeuvres (e.g., chin lift, jaw thrust)	E	E	E	E
Restore open airway using recovery position	E	E	E	E
Provide respiratory support (mouth-to-mouth resuscitation)	PR	E	E	E
Use suction devices	I	D	E	E
Insert oropharyngeal or nasopharyngeal airway	I	D	E	E
Provide respiratory support (use pocket mask for mouth-to-mask ventilation)	I	D	E	E
Assist ventilation using bag–valve–mask device (BVM)	I	D	E	E
Administer oxygen	I	D	E	E
Use airway adjuncts (i.e., blind insertion devices)	I	I	D	E
Use three-way dressing	I	I	D	E
Use endotracheal intubation	I	I	I	E
Use oesophageal detection device	I	I	I	D
Perform needle cricothyroidotomy	I	I	I	E
Perform surgical cricothyroidotomy	I	I	I	PR
Perform gastric decompression	I	I	I	E
Perform needle thoracostomy for thoracic decompression	I	I	I	E
Perform tube thoracostomy	I	I	I	PR
Circulation, hypothermia and shock				
Control external haemorrhage through direct pressure	E	E	E	E
Elevate victim's legs if there is evidence of shock	D	D	E	E
Immobilize the patient to ease pain, reduce bleeding and complications	D	D	E	E
Splint fractures for haemorrhage control and pain control	D	D	E	E
Prevent heat loss with a blanket or other material	D	D	E	E
Use external rewarming for hypothermia (e.g., blankets)	D	D	D	E
Measure and record blood pressure and pulse rate	I	E	E	E
Monitor body temperature	I	D	E	E
Apply arterial tourniquet (in extreme situations)	I	PR	E	E
Understand parameters of fluid resuscitation	I	I	PR	E
Wrap pelvic fractures for haemorrhage control	I	I	D	E
Establish peripheral percutaneous intravenous access	I	I	PR	E
Administer intravenous fluid replacement	I	I	PR	E
Establish peripheral venous cutdown access	I	I	I	PR
Establish intraosseous access for children < 5 years	I	I	I	E
Transfusion knowledge and skills	I	I	I	PR
Wounds				
Nonsurgical management of wounds (e.g., dressings)	E	E	E	E
Use deep interfacial packing for severe wounds (e.g., landmine injuries)	I	I	D	E
Administer tetanus prophylaxis (toxoid)	I	I	I	PR
Administer tetanus antiserum	I	I	I	PR
Use minor surgical management of wounds (e.g., cleaning, suturing)	I	I	I	PR
Burns				
Cool the burn area with water	E	E	E	E
Cover the skin with clean dressings	E	E	E	E
Control risk of hypothermia	D	D	E	E
Cover the skin with sterile dressings	I	I	D	E
Use intravenous therapy for burn > 15% body surface area	I	I	PR	E
Injuries to extremities and fractures				
Use basic immobilization for fractured extremities	E	E	E	E
Use available material for splints	D	D	E	E
Use spine board	I	I	D	E
Use skin traction	I	I	D	E
Use closed reduction	I	I	I	PR
Head and spinal injuries				
Use spinal precautions when extricating or moving patients	E	E	E	E
Use selective immobilization (e.g., C-collar, backboard)	I	I	E	E
Properly manage immobilized patient to prevent complications	I	I	E	E
Maintain normotension and oxygenation to prevent secondary brain injury	I	I	D	E
Monitor neurological function	I	I	D	E
Pain management				
Manage pain without medicine using ice, elevation, immobilization	D	E	E	E
Manage pain with non-narcotic analgesics	I	I	PR	E
Manage pain with narcotic analgesics	I	I	I	E
Medicines				
Apply topical antibiotic dressing, disinfectants or antiseptics as appropriate	I	I	D	E
Administer vaccines and antibiotics (e.g., tetanus prophylaxis)	I	I	I	PR
Administer other medicines	I	I	PR	E

3.4 Prior Notification System

Prior (to arrival at hospital) notification is the communication by emergency medical services personnel, to a receiving hospital of the impending arrival of a patient requiring emergency care. It is an integral component of an advanced pre-hospital care system that provides the opportunity for the receiving hospital to improve preparedness for reception and resuscitation of a critically injured or unwell patient[53]. Prior notification can be

[53] https://www.aitsc.org/programs/australia-india-trauma-systems-collaboration-pre-hospital-notification/

conducted telephonically, using two-way radio such as walkie-talkie, or through a web-based application. It is recommended that a mobile-cum-web application be created that can be used by ambulance and emergency medical technicians (EMT) to notify emergency departments of hospitals about the impending arrival of a patient requiring advanced lifesaving assistance.

The "Soochna" application developed under the Indo-Australian collaboration on trauma care may be used in this regard.

3.5 Data collection, storage, and analysis

A systematic data collection approach should be maintained for every injured person in need of emergency medical care, in order to ensure life-saving interventions are performed on time and that no life-threatening conditions are missed.

Minimum information that should be collected to provide prehospital care[54]:

- who was injured and who provided care?
- what caused the injury and what was done to treat it?
- when did it occur?
- where did the injury occur?
- how did the patient respond to treatment (outcome)?

An expanded optional dataset might include the additional information described below.

- Who was injured and who provided care? An expanded dataset might include the patient's name, age, sex, and activity at the time of injury. It might also assign a unique number to each report (an incident number). These numbers may be assigned at the time an ambulance is sent out to an incident. Patients might also be assigned a patient care record number. And the ambulance number may also be recorded along with a crew member identifier number.
- What caused the injury and what was done to treat it? Additional data that might be recorded include a description of the incident, the signs and symptoms of injury reported by the rescuer, a description of the injury (such as the parts of the body injured), a clinical description of the injury, whether the patient is suspected of using drugs or alcohol, the patient's pulse rate and respiratory rate, as well as systolic blood pressure and Glasgow Coma Score. Rescuers may also record the safety equipment used by the patient at the time of injury (e.g., airbags, seatbelts, helmets, goggles). Additionally, a record of any procedures, treatments, or medicine given may also be kept.

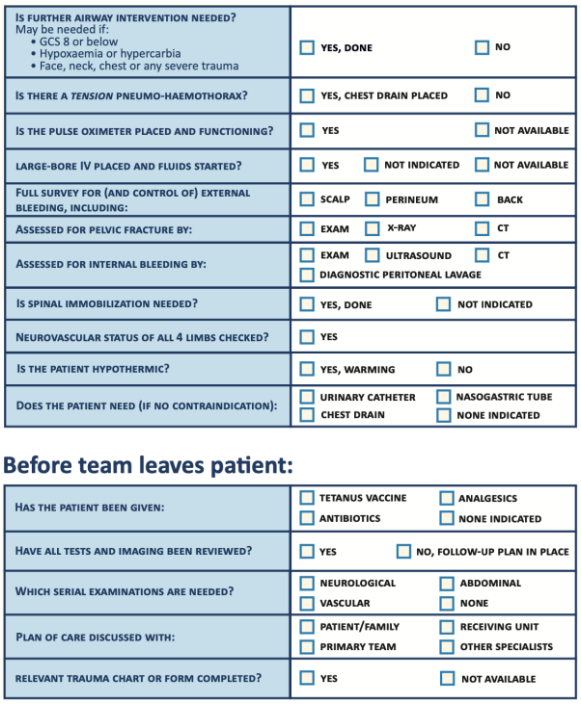
[54] Prehospital trauma care systems, WHO (2005), Pg. 38

● When did it occur? The date and time of the incident might be recorded as well as the time the rescuer arrived at the scene and the time the patient arrived at a fixed health-care facility.

● Where did the injury occur? The record could include information on the address where the incident occurred as well as the setting (e.g., home, workplace, street).

● How did the patient respond to treatment (outcome)? Additional data collected could include the destination facility, the patient's status on arrival at the facility and the patient's condition at the time of discharge.

In order to achieve the same Trauma Care Checklist (attached) should be filled up by the medical team members before initiating treatment of the victim of the crash. A shorter version is provided below.



IS FURTHER AIRWAY INTERVENTION NEEDED? May be needed if: • GCS 8 or below • Hypoxaemia or hypercarbia • Face, neck, chest or any severe trauma	☐ YES, DONE ☐ NO
IS THERE A *TENSION* PNEUMO-HAEMOTHORAX?	☐ YES, CHEST DRAIN PLACED ☐ NO
IS THE PULSE OXIMETER PLACED AND FUNCTIONING?	☐ YES ☐ NOT AVAILABLE
LARGE-BORE IV PLACED AND FLUIDS STARTED?	☐ YES ☐ NOT INDICATED ☐ NOT AVAILABLE
FULL SURVEY FOR (AND CONTROL OF) EXTERNAL BLEEDING, INCLUDING:	☐ SCALP ☐ PERINEUM ☐ BACK
ASSESSED FOR PELVIC FRACTURE BY:	☐ EXAM ☐ X-RAY ☐ CT
ASSESSED FOR INTERNAL BLEEDING BY:	☐ EXAM ☐ ULTRASOUND ☐ CT ☐ DIAGNOSTIC PERITONEAL LAVAGE
IS SPINAL IMMOBILIZATION NEEDED?	☐ YES, DONE ☐ NOT INDICATED
NEUROVASCULAR STATUS OF ALL 4 LIMBS CHECKED?	☐ YES
IS THE PATIENT HYPOTHERMIC?	☐ YES, WARMING ☐ NO
DOES THE PATIENT NEED (IF NO CONTRAINDICATION):	☐ URINARY CATHETER ☐ NASOGASTRIC TUBE ☐ CHEST DRAIN ☐ NONE INDICATED

Before team leaves patient:

HAS THE PATIENT BEEN GIVEN:	☐ TETANUS VACCINE ☐ ANALGESICS ☐ ANTIBIOTICS ☐ NONE INDICATED
HAVE ALL TESTS AND IMAGING BEEN REVIEWED?	☐ YES ☐ NO, FOLLOW-UP PLAN IN PLACE
WHICH SERIAL EXAMINATIONS ARE NEEDED?	☐ NEUROLOGICAL ☐ ABDOMINAL ☐ VASCULAR ☐ NONE
PLAN OF CARE DISCUSSED WITH:	☐ PATIENT/FAMILY ☐ RECEIVING UNIT ☐ PRIMARY TEAM ☐ OTHER SPECIALISTS
RELEVANT TRAUMA CHART OR FORM COMPLETED?	☐ YES ☐ NOT AVAILABLE

The detailed version is provided below. Jurisdictions may choose the appropriate format based on their local conditions and advice from the Chief Medical Officer.

WHO EMERGENCY UNIT FORM: TRAUMA

□ Mass Casualty

Hospital Registration Number:

Date: DD/MM/YY

Time of Arrival: ___ ___: ___ ___(24h)

Patient Surname:
First Name:

Age: _____
INF / CH / AD

Gender: □Male □Female □ Other: _____

Date of Birth: DD/MM/YY

Weight: kg

Arrival Mode: □Ambulance □Car/Truck (*circle* Private or Taxi)
□ Motorized 2/3-wheeler (*circle* Private or Taxi)
□ Public Transport □ Walk □ Other: _____

Number of prior facilities: ____
Referred from:

Occupation: □ Unknown

Patient Residence (at least City and Sub-district): □ Unknown

Sub-district where injury occurred: □ Unknown

Contact Person: Phone: Relation:

CHIEF COMPLAINT:

Triage Category:

INITIAL VS at ____ ____: ___ ___(24h)
Temp: _____ BP: _____ / _____ Pulse: _____
RR: _____ SpO_2: _____ % on _____
Pain score (see Ref Card for details): _____ / 10

□ **Dead on arrival**

TREATING PROVIDER ASSESSMENT: Date: DD/MM/YY **Time:** ___ ___: ___ ___ (24h)

PRIMARY SURVEY (see Reference Card for normal findings, only mark NML if all key elements are normal):

Airway □ NML
□ Angioedema □ Stridor □ Voice changes
□ Oral/Airway burns
Obstructed by: □ Tongue □ Blood □ Secretions □ Vomit □ Foreign body
Airway: □ Repositioning □ Suction □ OPA □ NPA □ LMA □ BVM □ ETT
Spine stabilized: □ Not needed □ Done before arrival □ Done in EU (not needed = not altered, no pain or TTP, no distracting injury, no focal neuro deficit)

Breathing □ NML
Spontaneous Respiratory Rate: _____
Chest Rise: □ Shallow □ Retractions □ Paradoxical
Trachea: □ Midline □Deviated to □L □R
Breath Sounds: □ L_____ □ R_____
Oxygen: _____ L
□NC □Mask □NRB
□BVM □CPAP/BiPAP
□Ventilator: _____
Chest needle / tube (circle):
□ L – Size: _____ Depth: _____ cm
□ R – Size: _____ Depth: _____ cm
□ **3-sided dressing**

Circulation □ NML
Skin: □ Warm □ Dry
□ Pale □ Cyanotic □ Moist □ Cool
Capillary refill: □ <3 sec or _____ sec
Pulses: □ Weak □ Asymmetric_____
JVD: □ Yes □No
□ Bleeding controlled (bandage, tourniquet, direct pressure)
Access: □IV: Loc _____ Size _____
□CVL: Loc _____ Size _____ □IO: Loc _____ Size _____
□**IVF:**_____mLs □NS □LR □Other_____
□Blood ordered □Pelvis stabilized

Disability □ NML
Blood glucose: _____ □Glucose □Naloxone
Responsiveness: □ A □ V □ P □ U
GCS: _____ (E_____ V_____M_____) □Qualified
Moves Extremities: □ LUE □RUE □LLE □RLE
Pupil: Size: L _____ R _____
Reactivity: L _____ R _____

Exposure □ Exposed completely

FAST □ NML
□ Not Indicated
□ Not Available
Peritoneum: □ Negative □ Indeterminate
□ Free Fluid: _____
Chest: □ Negative □ Indeterminate
□ Pneumothorax (R/L): _____
□ Pleural fluid (R/L): _____
□ Pericardial effusion

MEDICAL HISTORY: History obtained from:

Medications: □ Anticoagulant: _____ □ Unknown
Other:

Allergies: □ Unknown

Past Medical: □ HTN □ DM □ COPD □ Psych □ Renal Disease □ Unknown
Other:

Last Menstrual Cycle: _____ G____P____ □ Unknown
Pregnant? (circle) Yes / No □ Reported □ Testing done
Last Tetanus: _____ □ Unknown

Past Surgeries (type & date): □ Unknown

Substance Use: □Tobacco □Alcohol □ Drugs □ IV Drugs □ Unknown
Safe at home? _____

HISTORY OF PRESENT ILLNESS: Date of Injury: DD/MM/YY **Time:** ___ ___: ___ ___ (24h format)

Place of injury:

Activity at time of injury: □ Unknown

Mechanism of injury (select one or multiple):
□Road traffic incident: □ Driver □ Passenger □ Pedestrian
□ Airbag □ Seat belt □ Other vehicle restraint □ Helmet
□ Extricated Patient vehicle: _____
□ Ejected Hit by/crashed with: _____
□Fall from: _____ □Hit by falling object: _____
□Stab/Cut □Gunshot □Sexual Assault
□Other blunt force trauma (struck/hit): _____
□Suffocation, choking, hanging
□Drowning: _____ Life vest: Y / N
□Burn caused by: _____
□Poisoning/Toxic Exposure: _____
□Unknown □Other: _____

First care sought:
Prehospital care
□ None □ Layperson first aid □ Health care professional (EMT, medic)
Care given:

Other Details of Incident
□ Loss of consciousness (circle): <5 min 5-29 min 30-24 hr >24 hr
□ Head trauma: Y / N □ Neck trauma: Y / N
Other:

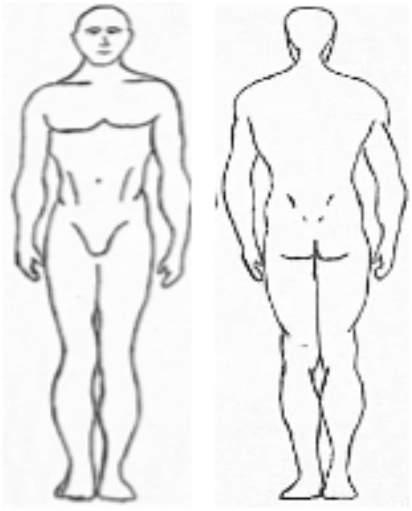
Intent: □ Unintentional or accidental □ Intentional: □Self harm □Assault □ Legal process, political unrest or war □ Unknown
Assaulted by (see Reference Card): _____
Hours since last meal: _____ hours □ Unknown
Substance use within 6 hours of injury:
□ Unknown □ None □ Reported □ Evidence (positive test or clinical findings)
□ Alcohol □ Other Substance (if known): _____

Form to be used with WHO Reference Card. See who.int/emergencycare for more information.

PHYSICAL EXAM: (See Reference Card for normal findings. Do NOT mark NML unless all key elements are normal.)

□NML	**General**	
□NML	**Neuro/Psych**	
□NML	**HEENT**	
□NML	**Neck**	
□NML	**Respiratory**	
□NML	**Cardiac**	
□NML	**Abdominal**	
□NML	**Pelvis**	
□NML	**GU/Rectal**	
□NML	**MSK**	
□NML	**Skin**	

Detail area of injury:



DIAGNOSTIC TESTS:

UPT: □ Positive □ Negative □ N/A

Hgb: _____ □ Result pending

Blood type: _____

Other:

List imaging studies with results (and check findings below):

□ Pneumothorax
□ Pulmonary Opacity
□ Pelvic Fracture
□ Extremity Fracture
□ Pleural Fluid
□ Rib Fracture
□ C-spine fracture

ADDITIONAL INTERVENTIONS:

Fluids and Medications Given	**Time** (24h)
□ IVF: _____ mLs □NS □LR □Other _____	____:____
□ Blood products (specify number of units given):	____:____
_____	____:____
□ Opioid Analgesia:_____	____:____
□ Other Analgesia:_____	____:____
□ Sedation/Paralytics:_____	____:____
□ Antibiotics:_____	____:____
□ Tetanus: _____	____:____
□ Other:	

Procedures (circle and note outcome)	**Time** (24h):
□ Intubation: _____	_____:_____
□ Chest Tube: _____	_____:_____
□ Splinting / Reduction: _____	_____:_____
□ Pelvic Stabilization: _____	_____:_____
□ Simple / Complex Laceration Repair: _____	_____:_____
□ Other:	

ASSESSMENT (include summary and differential) **AND PLAN** (imaging; meds/interventions; consults with time called/arrived and recs):

REASSESSMENT at ___ ___: ___ ___(24h) □ **Condition same**

Temp:_____ Pulse:_____ BP:____/____ RR:_____ SpO_2:____% on_____ Changes:_____

DISPOSITION: Checklist completed: □ Y □ N ED departure (date & time): DD/MM/YY ___ ___ : ___ ___ (24h)

Diagnoses/Impressions (list all):

Number of serious injuries as judged by provider (circle): 0 1 ≥2

□ **Admit to:** □ Ward _____ □ ICU □ OT

□ **Discharge:** Plan discussed with patient? □ Yes □ No

□ **Transfer to:** _____

□ **Left without being seen or before treatment complete**

□ **Died of** (specify cause - NOT cardiopulmonary arrest): _____

VS at Dispo at: ___ ___: ___ ___ (24h)
Temp:____ Pulse:____ BP:____/____ RR:____ SpO_2:___ % on_____

Accepting Provider: _____

Emergency Unit Provider Name/Title (include handovers)	**Signature and Date**

Form to be used with WHO Reference Card. See who.int/emergencycare for more information.

REFERENCE CARD FOR WHO EMERGENCY UNIT FORM: TRAUMA

DATES/TIMES: Do not leave dates/times blank. Where unknown, write UNK

MASS CASUALTY: Check box if patient part of a mass casualty event

AGE: If age unknown, circle category: IN (infant) if appears <1 year of age, CH (child) if 1-18 years, or AD (adult)

OCCUPATION: Be as specific as possible (eg. farm laborer or farm manager instead of farming)

PATIENT RESIDENCE: Note if homeless, migrant worker, other

CHIEF COMPLAINT: Always in the patient's own words

DEAD ON ARRIVAL: Use ONLY if NO signs of life on arrival

NORMAL VITAL SIGNS – FOR ALL: SpO_2 >92% on RA, Temp 36˚C - 38˚C

Paediatric:

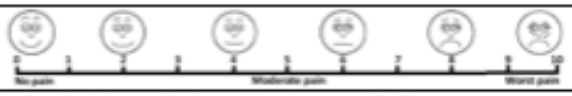
AGE	RESPIRATORY RATE
<2 months	40-60 breaths per minutes
2-11 months	25-50 breaths per minute
1-5 years	20-40 breaths per minute

AGE	PULSE RATE RANGE
0-1	100-160
1-3	90-150
3-6	80-140

*Record O_2 saturation and amount/route of O_2, eg. 94% on 2L by NC

Adult: Pulse 60-100 bpm, RR 10-20, SPB >90mmHg

Pain score: Ask the patient to choose the face that best represents the pain they are experiencing.



TREATING PROVIDER ASSESSMENT Date and time of first assessment of patient by medical provider at current facility

Primary Survey

Airway: *Normal (NML)*
•Patent (if they can speak normally)
•NO signs of obstruction, stridor, angioedema or burns

•OPA/NPA=oro-/naso-pharyngeal airway •LMA=laryngeal mask airway •BVM=bag valve mask •ETT=endotracheal tube •TTP=tenderness to palpation

Breathing: *NML*
• Effort normal
• Sounds clear

Abnormal
•Decreased breath sounds •Crepitation •Rhonchi •Wheezing
•Enter N/A for spontaneous RR if sedated, paralyzed or on ventilator

Supplemental Oxygen:
•NC=nasal cannula •NRB=non-rebreather mask •BVM=bag valve mask
•CPAP/BiPAP=continuous or bi-level positive airway pressure
•For ventilator: enter mode (eg. SIMV, AC, etc.)

Circulation: *NML*
•Skin warm & dry
•Pulse strong & symmetric (upper & lower extremities)

Abnormal
•JVD (jugular venous distention)
•Prolonged capillary refill (>3 sec)

Access: Document location (loc) and size
•IO=intraosseous •IV=peripheral intravenous •CVL=central venous line
IVF (intravenous fluids): •NS=normal saline •LR=Lactated Ringer's
•Other (write name)

Disability: *NML*
•Alert (A)
•Oriented to person/place/time
•No focal neuro deficit
•Blood glucose: >3.5 mmol/L
•Pupils: Enter size then reactivity. NML/brisk, slow or nonreactive (NR)

Abnormal
•Responds only to Verbal (V), Pain (P), or is Unconscious (U)
•Motor or sensory deficit
• Blood glucose: <3.5 mmol/L
•Large, pinpoint or unequal. Fixed, slow or nonreactive (NR)

GCS Eye Opening
4 – Spontaneously
3 – To verbal command
2 – To pain
1 – No response
GCS Verbal
5 – Talking and oriented
4 – Confused
3 – Inappropriate words
2 – Incomprehensible sounds
1 – No response

GCS Motor
6 – Obeys commands
5 – Localizes pain
4 – Withdraws to pain
3 – Flexes to pain
2 – Extends to pain
1— No response
***Qualified GCS**: Check box if patient sedated, intubated, or vision obstructed

Exposure: Detail ALL injuries (in space provided for physical exam) including
•tenderness •bony deformity •dislocation •amputation •crush injury
•ecchymosis/contusion •haematoma •vascular injury •laceration •abrasion
•burns •pulse deficit •oedema •motor or sensory deficit •foreign body

MEDICAL HISTORY

Past Medical History: •DM •COPD •HTN •Psych •Renal disease •Other (list conditions not noted, eg. heart disease, stroke, asthma, sickle cell, active cancer, HIV/AIDS)
Medication: include anticoagulants, traditional medicines, herbs, supplements

Tetanus status: Ask if up to date. Review card if available.
Safe at home: Ask about violence in the home

HISTORY OF PRESENT ILLNESS

Place of injury: Note type of location where injury occurred, eg. home, school, highway, nursing home, restaurant, farm, factory, sports field
Activity at time of injury: Note activity time of injury, eg. sports, leisure, working, attending school, in transit, sleeping
First care sought: First source of care for this injury/illness, eg. clinic, traditional healer, etc.
Prehospital care: Mark if care was provided at the scene of injury or prior to arrival at current facility; note any procedures performed
Assaulted by (relationship between patient and assaulter): •Spouse or partner •Parent •Other relative •Unrelated caregiver • Friend or acquaintance(s) •Stranger(s) •Other
Mechanism of injury (may use multiple mechanisms):
If road traffic incident: **Vehicle**: •Cycles (bicycle, etc) •Motorised 2- or 3-wheeler •Other non-motorised vehicles •Car •Minibus (<10 seater), pick-up truck, van •Bus (≥10 seater) •Heavy transport vehicle (eg. truck, lorry) •Other
Hit by/crashed with: •Pedestrian •Animal •Cycles •Motorised 2- or 3-wheeler •Other non-motorised vehicle •Car •Train or railway vehicle •Minibus, pick-up truck, van •Bus, heavy cargo truck or lorry •Fixed or stationary object •Non-collision transport incident •Other
When relevant, note: fall height, drowning with or without intent of being in the water, cause of burn (eg. electric, thermal, chemical), route of toxic exposure (ingestion, inhalation, cutaneous). "Other" mechanisms include: transport incident without road traffic (eg. boat, railway, air), animal bite/scratch, snake bite, electric/lightning injury, radiation exposure, explosive blast, exposure to nature, etc.

NOTE:** if more than one calendar is used in your setting by clinical providers and recorded as such on this form, all dates must be converted to Gregorian calendar and times converted to 24-hour format by data clerk before it is entered into registry.

To be used as a reference for completing the trauma form.
www.who/int/emergencycare

NORMAL EXAM (Do NOT mark "NML" unless all elements below are normal)

General: Well-developed, well-nourished, awake, alert
Neuro/Psychiatric: Oriented x3, cranial nerves (CN) intact, no focal weakness or sensory deficits
HEENT: Normocephalic, atraumatic, pupils equal and reactive, ocular movements intact, conjunctivae normal
Neck/C-spine: Trachea midline, neck supple, range of motion (ROM) nml
Respiratory: Nml effort, nml breath sounds, nml expansion, atraumatic
Cardiac: Nml rate and rhythm, strong pulses, nml sounds
Abdominal: Soft and non-tender, bowel sounds nml
Pelvis: Stable, no pain to palpation
GU/Rectal: External genitalia nml, no blood at meatus, nml urine color, atraumatic, rectal tone, no rectal bleeding
MSK: Range of motion nml, no deformities
Skin: Warm, capillary refill < 3 sec, atraumatic

ABNORMAL EXAM FINDINGS (specify **RIGHT** or **LEFT** when needed, draw arrow from injury on diagram to descriptive text)

General: Distressed, malnourished, diaphoretic, uncooperative, sedated, lethargic
Neuro/Psychiatric: Disoriented, cranial nerve deficit, sensory or motor deficit (RUE, LUE, RLE, LLE), abnormal gait or coordination, reflexes hypo or hyperactive, saddle anesthesia, no rectal tone
HEENT: Unequal pupils, eye injury, bleeding from ears, skull fracture (open or closed), penetrating head/face injury, scalp haematoma, scalp/face laceration, signs of basilar skull fracture (Raccoon eyes/Battle's sign, cerebrospinal fluid leak)
Neck/C-spine: C-spine tenderness, palpable deformity/step off, haematoma, limited ROM, neck crepitation, active bleeding, penetrating injury, superficial injury
Respiratory: Respiratory rate low or high, absent breath sounds, decreased breath sounds, crackles, wheezes, crepitation, transmitted upper airway sounds, paradoxical chest wall movement, sucking chest wound, penetrating injury, palpable rib fracture, superficial injury
Cardiac: Distant heart sounds, systolic or diastolic murmur, abnormal pulse, S3 or S4 gallop, irregular heartbeat, bradycardia, tachycardia, asymmetric pulses
Abdominal: Distension, tenderness, rebound, tense/guarding, evisceration, mass, penetrating abdominal injury, abnormal bowel sounds, superficial injury
if pregnant - no fetal heart rate
Pelvis: Unstable, pain with palpation, superficial injury, penetrating injury
GU/Rectal: Vaginal laceration, vaginal bleeding, penile laceration, priapism, blood at urethral meatus, high riding prostate, rectal bleeding, superficial injury, penetrating injury
MSK: Joint swelling, joint dislocation, sprain or muscle/tendon injury, decreased ROM or strength, extremity deformity/closed fracture, open fracture, crush injury, compartment syndrome, amputation
Skin: Superficial laceration, deep laceration, ecchymosis, abrasion, burn, foreign body, overlying infection if presentation delayed

DIAGNOSTIC TESTS:	**INTERVENTIONS** (if no interventions, write NONE)
UPT (urine pregnancy test), Hgb (hemoglobin), Blood type •Other: list lab study (eg. PT/INR, PTT, CK, lactate, electrolytes, lipase) and write result •List imaging studies done with results (or use tick boxes). *If study needed but not available, write this in other.*	**Fluids/Medications:** list Blood product type (eg. PRBC, platelets) and number of units, write medication name/dose in appropriate category if applicable (eg. Opioid Analgesia: Morphine 4 mg) •Other: Vasopressors, post-intubation gtt, etc. **Procedures:** list number of attempts, location, and outcome for each procedure, if applicable •Other: Diagnostic peritoneal lavage, regional block, central line placement (if not noted in "Circulation" section), suprapubic catheterization, cricothyroidotomy, foreign body removal, etc.

ASSESSMENT & PLAN: include summary & differential diagnosis, plan for further imaging, pain meds, consults

REASSESSMENT: Time, vital signs, and clinical condition at the time of disposition

DISPOSITION: Write date and time of ED departure, updated vital signs (VS), check box for destination
Checklist Completed: Use WHO trauma checklist to verify tasks have been completed

DIAGNOSIS: List ALL injuries including sprains, fractures, lacerations, burns, contusions, etc. Include shock, respiratory failure, AMS if relevant
Number of serious injuries as judged by provider: *Circle* number (0, 1, ≥2)

Admit or Transfer: Write the name of the accepting provider for all handovers.	**Discharge:** Confirm if plan was discussed with patient including follow-up care	**Death:** Specify cause of death, but DO NOT WRITE cardiac or respiratory failure/arrest. Instead, use precise terms such as "external haemorrhage secondary to road traffic accident" or "drowning" or "suicide."

Document all providers engaged in the patient's care including through shift handovers.

*****NOTE:** if more than one calendar is used in your setting by clinical providers and recorded as such on this form, all dates **must** be converted to Gregorian calendar and times converted to 24-hour format by data clerk before it is entered into registry.*******

To be used as a reference for completing the trauma form.
www.who/int/emergencycare

3.6 Optimised placement of vehicles

For an efficient emergency response system, it is essential that ambulance facilities are easily available and accessible. Optimised deployment of the ambulances is recommended as per the following criteria:

1. The road-owning agency along with the ambulance provider shall identify such locations on the highway that are prone to crashes.
2. Appropriate data from Police and other authorities shall be triangulated in this regard.
3. Ambulances shall be placed in such a manner that they are not father than 8 minutes' drive from such crash spots.
4. The type of ambulance (refer to Section 3.1) shall be determined based on the following criterion:

a. The time required to rescue the patient from the scene to the nearest and appropriate Trauma Care Facility

b. The type of ambulance required is mentioned in Section 3.1 based on the severity of the injury of the patient.

3. The rescue from the scene to the hospital handover should be done within 30 mins +/- 5 mins while following the appropriate care protocols during ambulance transfer.

3.7 non-conventional emergency ambulance

Use of non-conventional emergency ambulances such as "Motorcycle Ambulances" are recommended for rendering pre-hospital services during the "Golden Hour" as they can reach inaccessible or remote locations by traversing unmotorable roads, narrow streets, congested or unpaved roads that are otherwise inaccessible by the conventional four-wheeled ambulances.

- Such ambulance should be equipped with devices for basic medical care such as neck collars (Philadelphia or otherwise), a monitor for measuring vital parameters, air splint medical and oxygen kit, saline, and oxygen administration on the move, etc.[55]
- The non-conventional emergency ambulance riders should be paramedics or EMTs recruited and trained on managing emergencies, rendering first aid, and resuscitation measures to save the victim[56].
- The vehicles shall be conspicuous and riders shall wear the following safety gear:
  - ISI marked helmet
  - Boots
  - Elbow guards

55 https://crpf.gov.in/writereaddata/Portal/PressRls/188_1_48012021.pdf

56 https://karunadu.karnataka.gov.in/hfw/nhm/pages/refserv_bikeamb.aspx

- Retroreflective vest
- Chest Protector
- Back and spine protector

Dispatching rapid emergency care
for crash victims in Viet Nam
A project in Hanoi dispatched emergency care providers by motorcycle to road traffic crashes. The average response time was 5.18 ± 4.5 minutes, compared to an average ambulance response time of 11.16 ± 6.2 minutes.

NATIONAL ROAD SAFETY CODE

PART III - EMERGENCY MEDICAL CARE

Section 4 - In Hospital Emergency Medical Care

1. **Scope**

This section of the code discusses procedures for in-hospital emergency care, also known as definitive care. The fundamental tenet of a trauma system is to get the right patient to the right hospital at the right time. Along with stabilisation received from bystanders and ambulance staff, definitive care is essential for patients.

2. **Terminology**

The definition of the terms used in this section are given in Part 1 of this code.

3. **Interventions**

3.1 Gradation of facilities

The facilities have been graded according to the standards by the Operational Guidelines for Capacity Building for Developing Trauma Care Facilities on National Highways[57].

Level IV trauma care:

This would be provided by appropriately equipped and manned mobile hospitals/ambulances.

A Level IV trauma facility must have a good working relationship with the nearest Level I, II, or III trauma centre. This relationship is vital to the development of a rural trauma system in which realistic standards must be based on available resources. Also, it is essential for the Level IV facility to have the involvement of a committed physician who can provide leadership and sustain the affiliation with other centres[58].

Level IV trauma facilities provide advanced trauma life support before patient transfer in remote areas where no higher level of care is available. Because of geographic isolation, the Level IV trauma facility is the de facto primary care provider. A well-trained physician or midlevel provider shall be continually available to facilitate the service.

Level III trauma services:

[57] https://dghs.gov.in/WriteReadData/userfiles/file/Operational_Guidelines_Trauma.pdf,

[58] https://drive.google.com/file/d/1wXsYyvXXd568oYcCClL-TNTCnNxdZfsM/view

The Level III trauma services shall include services to the communities that do not have immediate access to a Level I or II institution. Level III trauma centres can provide prompt assessment, resuscitation, emergency operations, and stabilisation and also arrange for transfer to a facility that can provide definitive trauma care when needed. Well trained emergency department physicians and general surgeons are required in a Level III facility. Planning for care of injured patients in these hospitals requires transfer agreements and standardised treatment protocols.

Level III Trauma Care Facility: It is recommended that the following must be provided as part of such a facility:

- Initial evaluation and stabilisation (surgically if appropriate)
- Comprehensive medical and surgical inpatient services to patients in a stable or improving condition without specialised care.
- Emergency doctors and nurses, Physicians, surgeons, Orthopaedic surgeons and Anaesthetists are available round the clock.

The district/ tehsil hospitals with a bed capacity of 100 to 200 beds should be identified for level III care.

Level II trauma services:

Level II trauma care shall be provided in hospital that provides initial definitive trauma care, regardless of the severity of injury. Level I and Level II trauma centres are expected to be clinically equivalent except for complex, specialised injuries such as replantation. Depending on geographic location, patient volume, personnel, and resources, however, the Level II trauma centre may not be able to provide the same comprehensive care as a Level I trauma centre. Therefore, patients with more complex injuries may have to be transferred to a Level I centre. Level II trauma centres may be the most prevalent facility in a community, managing the majority of trauma patients[59].

Level II Trauma Care Facility provides definitive care for severe trauma patients. It is recommended that they should consist of the following:

- Emergency physicians, surgeons, Orthopaedicians and Anaesthetists are in-house and available to the trauma patients immediately on arrival
- On-call facility for neurosurgeons, and paediatricians

59 https://drive.google.com/file/d/1wXsYyvXXd568oYcCClL-TNTCnNxdZfsM/view

- Emergency department, intensive care unit, blood bank, rehabilitation services, a broad range of comprehensive diagnostic capabilities, and supportive services

The existing medical college hospitals or hospitals with bed strength of 300 to 500 should be identified as Level II Trauma Centre.

Level I trauma services:

The Level I facility is a regional resource trauma centre that is a tertiary care facility central to the trauma care system. Ultimately, all patients who require the resources of the Level I centre should have access to it, either directly or through efficient transfer processes. This facility must have the capability of providing leadership and total care for every aspect of injury, from prevention through rehabilitation. In its central role, the Level I centre must have adequate depth of resources and personnel[60].

Level I Trauma Care Facility provides the highest level of definitive and comprehensive care for patients with complex injuries. It is recommended that they should consist of the following:

- Emergency physicians, nurses and surgeons should be in-house and available to the trauma patient immediately on their arrival.
- The services of all major super specialities associated with trauma care should be available 24*7.

These should be tertiary care centres to which patients requiring highly specialised medical care may be referred.

3.2 Trauma Resuscitation Team[61]

The trauma resuscitation team in response to a less severely injured patient usually consists of only an emergency physician and the emergency department nurses until the general surgeon arrives. In order to handle more complex and severe cases, the Chief Medical Officer shall either compose a Trauma care team or establish protocols to transfer the patient to a center for higher care. The trauma care team for serious cases may contain the following members,

- A general surgeon or an emergency physician
- Surgical and emergency residents
- Emergency department nurses
- A laboratory technician
- A radiology technologist

60 https://drive.google.com/file/d/1wXsYyvXXd568oYcCClL-TNTCnNxdZfsM/view

61 https://drive.google.com/file/d/1wXsYyvXXd568oYcCClL-TNTCnNxdZfsM/view

- An anesthesiologist or certified registered nurse anaesthetist
- Operating room nurses
-
- Support services to provide emotional support[62]

3.3 Transfer protocols

When the nearest trauma facility to the patient does not have adequate capacity for treatment, the patient should be transferred to another trauma care facility that has the capacity for treatment. The following section discusses the transfer guidelines of a patient from one Trauma Facility to another[63]:

Following are the guidelines should be followed for transferring the patients:

- Identify patients needing a transfer to another trauma care facility
- Initiate the transfer process by directly contacting the receiving trauma surgeon
- Initiate resuscitation measures within the capabilities of the facility
- Determine the appropriate mode of transportation in consultation with the receiving surgeon
- Transfer all records, test results, and radiologic evaluations to the receiving facility
- A consent form for transfer needs to be signed by the patient/relative, the transferring hospital, and the receiving physician. This is for a legal binding so that there is no disparity in the situation.

Management during transportation of patient:

- Ensure that qualified personnel and equipment are available during transportation to meet anticipated contingencies
- Make sure that sufficient supplies—such as intravenous fluids, blood, and medications, as appropriate– accompany the patient during transport
- Monitor vital signs frequently
- Support vital functions
- Keep records during transport, and provide them to the receiving facility during patient handoff
- Maintain communication with on-line medical direction during transport

Receiving physician's responsibilities:

- Ensure that the resources required to care for the patient are available at the receiving facility
- Provide consultation to the referring physician regarding specifics of the

[62] Post Crash Response, supporting those affected by road crashes WHO, Pg. 15

[63] https://drive.google.com/file/d/1wXsYyvXXd568oYcCClL-TNTCnNxdZfsM/view

transfer, additional evaluation, or resuscitation before transport

- Once transfer of the patient is established, clarify who will provide medical control of the patient during transport
- Provide feedback to the transferring facility regarding the patient's condition, plan of care, and any other issues

Paediatric transfer:

- Establishing a relationship between facilities via transfer agreements and guidelines for mitigating unnecessary transfers of children
- Establishing an organised interfacility transfer process with clearly articulated steps and roles to improve outcomes in injured children
- A transfer checklist shall be created with the following particulars:
    - Patient medical record and testing information
    - Information on referring and receiving hospital
    - Caregiver information
    - Parent information including consents and directions

Interfacility transfer for rural communities[64]:

- Physicians should assess their own capabilities and those of their institution. This assessment allows for early recognition of patients who may be safely cared for in the local hospital and those who require transfer to an institution that can provide optimal care. Once the need for transfer is recognised, arrangements should be expedited and not delayed for diagnostic procedures that do not change the immediate plan of care.
- When possible, life-threatening injuries may be stabilised at the rural facility prior to transport. This treatment may require operative intervention to ensure that the patient is in the best possible condition for transfer. Intervention prior to transfer is a surgical decision.
- The physician initiating transfer should speak directly to the physician accepting the patient at the receiving hospital.
- Information concerning the patient's condition and needs during transport should be communicated to transporting personnel.
- A written record of the problem, treatment given, and patient status at the time of transfer, as well as certain physical items (such as lab findings,

[64] https://drive.google.com/file/d/1iFj-fWxVXux9yMHUO1qHqSZXNUSqoPbR/view?usp=sharing

lavage specimens, X-rays), shall be sent with the patient.

- Prior to the transfer, the patient should be resuscitated, and attempts made to stabilise his or her condition.
- During transport, continued management of vital functions and continuous revaluation is essential.

3.4 Trauma Registry

A trauma registry is a method to collect data, it is composed of a file of uniform data elements that describe the injury event, demographics, prehospital information, nature of the injury, and final diagnosis.

Data collection method:

- Trauma registry data must be collected and analysed as it is an important management tool that contains detailed, reliable, and readily accessible information needed to operate a trauma centre.
- The data should be collected in the format[65] prescribed by the National Injury Surveillance, Trauma Registry & Capacity Building Centre (RML Hospital, New Delhi).
- The data should then be sent to the National Trauma Registry and based on the data, the trends of trauma injuries can be analysed.
- MoHFW should develop a scheme for internal validation to detect errors in data entry or coding.

Duties of the trauma registrar:

- There shall be a trauma registrar to function as the custodian of the trauma registry.
- A trauma registrar is responsible for high-quality data entry into the trauma registry[66].
- The trauma registrar should receive initial training in duties before starting their role. The MoHFW shall prepare a module for the same. The module shall include topics relevant to trauma care. For example, organ injuries are appropriate training for registrars, because they are expected to code organ injuries, as well as the procedures performed to treat the injuries.
- The trauma registrar should work directly with the trauma team and report to the trauma program manager of the trauma centre.
- In the planning stages of a registry, it is useful to consider the mechanisms for data collection and entry from medical

[65] https://dghs.gov.in/WriteReadData/userfiles/file/comp1/Injury%20Surveillance%20format.PDF

[66] American College of Surgeons: Resources for Optimal Care of the Injured Patient, 2014, chapter 15, pg111-112 https://drive.google.com/file/d/1wXsYyvXXd568oYcCClL-TNTCnNxdZfsM/view

records and the hospital information system.

- Once collected, these data should be added to the main registry.

NATIONAL ROAD SAFETY CODE

PART IV - ENFORCEMENT

Section 1 - Forensic Crash Investigation

1. Scope

Forensic investigation of crashes is a process of systematic collection and analysis of information relating to a road traffic crash. A forensic crash investigation reveals the underlying causal or contributing factors (human/vehicle/infrastructure) influencing the crash and the resulting injuries. The objective of forensic investigation is to use evidence from the crash location, vehicle(s), witness interview, MLC reports, and post mortem reports to identify and isolate core factors across road user behaviour, road engineering, state of enforcement, emergency response, vehicle safety, and environmental factors responsible for deaths and injuries.

2. Terminology

The definition of the terms used in this section are given in Part 1 of this code.

3. Operating Procedure

In order to gather traffic crash evidence through forensic crash investigation, the police department shall maintain a sufficient number of personnel as investigating officers. These officers shall be skilled in the identification, collection, and preservation of crash evidence. The officers shall have a complete knowledge and understanding of on-site safety measures along with 'Basic Trauma and Life Support' skills. The investigators shall be available to respond to all traffic crashes that require the preservation of physical evidence.

Personnel assigned as forensic crash investigators shall be trained in crash evidence gathering techniques and shall be prepared to present evidence in judicial proceedings (if required). If the department does not have the resources to train and support crash scene specialists, properly trained personnel from other agencies may be activated as needed.

Forensic crash investigators shall document all traffic crash scene activities and submit detailed reports on crash scene investigations. Crash investigators will accurately account for crash scene physical

evidence, crash scene and vehicle photographs, site measurement figures, and all other pertinent information[67]. The investigating officer shall use the forensic crash investigation report for the purposes of filing the FIR, Charge-sheet and such other legal reference documents, which shall enable the courts and local authorities to adjudicate the crash and prevent recurrence of the same. The crash investigating report is included in the Annexure.

Operating Procedure for forensic crash investigators

It shall be the duty of every forensic crash investigator, as expeditiously as possible, to initiate the investigation within 24 hours of the crash where the various factors are taken into account.

Categorically there are four types of factors contributing to a road crash namely Human factors, Vehicular factors, Infrastructure factors and Environmental Factors. These factors are investigated on two levels. The first level focuses on the 'crash contributing factors' and the other focuses on the 'injury contributing factors'.

Crash contributing factors are those factors which lead to the crash to occur. For example, if a crash occurs with a parked vehicle on a highway, then the parked vehicle is the crash contributing factor. Essentially, the crash would not occur if the parked vehicle did not park at an unsafe location.

Injury contributing factors are those factors due to which the victim suffers injury. For example, in the above mentioned scenario, if the driver of the crashed vehicle is not wearing a seatbelt due to which the driver was thrown out of the vehicle. In such case, the victim not wearing the seat belt was the injury contributing factor. Perhaps, if the victim was wearing a seat belt, the injury may not have suffered an injury.

The list detailed below is not exhaustive, but an indicative list to help understand the nature of factors.

3.1 Crash contributing factors

There are four primary crash contributing factors. This section lists the factors and the sub-factors that contribute to crashes.

3.1.1 Human factors

- **Driver/Rider-Impairment and Distraction**
  - **Impaired by alcohol:** Crashes that occur when a driver is under the influence of alcohol.
  - **Impaired by drugs:** Crashes that occur

[67] https://www.iadlest.org/Portals/0/Files/Documents/DDACTS/Docs/Manual%20of%20Police%20Traffic%20Services%20Policies%20and%20Procedures,%20IACP,%20July%202004.pdf

when the driver of a vehicle is under the influence of drugs which may be illicit or medicinal

- **Distraction due to use of mobile phone:** Crashes that occur when the driver of the vehicle is distracted by use of mobile phone
- **Distraction inside vehicle:** Distraction with a vehicle which may be in the form of loud music, distraction caused by vehicle occupants or any other form of distraction may lead to road crash.
- **Distraction due to exterior factors:** Road crashes may occur when a driver of a vehicle is distracted by any exterior factors like sudden appearance of cattle on the road, sudden crossing of road by a pedestrian, or sudden stoppage of a car running ahead of the vehicle, to list a few
- **Sleep/Fatigue/Drowsiness:** Road crashes that occur when a driver is fatigued, sleepy or drowsy.

- **Speed**
  - **Exceeding speed limit:** Road crashes that occur when a vehicle travels at a speed exceeding the prescribed limit for the particular road.
  - **Excessive speed for conditions:** Road crashes that occur when a vehicle is within the speed limit, however, due to specific reasons like poor road condition, slippery road, sharp curves.
  - **Driving too slow for conditions:** Road crashes that occur when a vehicle moves in a lane at a speed which is far below the prescribed limit, as other vehicles may collide with the extremely slow speed vehicle.
- **Parked**
  - **Vehicle on the carriageway (full or partial):** Road crashes that occur when vehicle is parked on the carriageway
  - **Vehicle off the road:** Road crashes that occur when a vehicle is parked off-road along the roadway, it also includes vehicles parked on the shoulder.
  - **Stopped due to traffic:** Road crashes that occur when a vehicle suddenly stops on a busy road due to any reason.
- **Behaviour or Inexperience**
  - **Overtaking in undivided road:** Road crashes that occur on undivided roads, when a vehicle tries to overtake other vehicles from the side of the opposite flow of traffic. There is a high possibility of head on crash or a side swipe crash in such circumstances.
  - **Illegal road usage:** Road crashes that occur due to illegal road usage like a vehicle taking a left/ right turn at junctions or taking 'U' turn where it is not permitted or is on the wrong side of a dual carriageway.
  - **Failure to follow traffic signals and signs:** Road crashes that occur when the occupants of a vehicle fail to follow the traffic signals or signs. For instance,

failing to follow signs like “Go Slow”, “Work in Progress”, “Steep Turn” may lead to crashes like pedestrian crash, object impact crash, or sideswipe crash.

- **Failure to follow two-seconds space:** Road crashes that occur when vehicles fail to follow two seconds space between itself and other vehicles.
- **Overtaking on left side of vehicle:** Road crashes that occur when a vehicle tries to overtake another vehicle from the left side.
- **Improper lane change/lane usage:** Road crashes that occur when a vehicle uses the wrong lane to travel such a slow moving vehicle on the right most lane.
- **Disobey traffic signal:** Road crashes that occur when the occupants of a vehicle disobey a traffic signal.
- **Inexperienced Driver:** Road crashes that occur when drivers are inexperienced and unaware of traffic rules and regulations.
- **Vehicle reversing:** Road crashes that occur when a vehicle is reversing at location where it is dangerous to do so, or reversing without taking proper care and caution
- **Vehicle slowed down/stopped suddenly without any traffic influence:** Road crashes that occur when a vehicle suddenly slows down or stops moving without any external influence such as traffic congestion.
- **Pedestrian poor attention:** Road crashes that occur in case pedestrians fail to pay attention to check the traffic on the road while crossing a carriageway or act in a reckless or negligent manner.
- **Pedestrian reckless crossing behaviour:** Road crashes that occur due to pedestrians who were acting recklessly or carelessly or were in a hurry. This is a deliberate action taken in spite of the risks.
- **Pedestrians failed to judge a vehicle's path or speed:** Road crashes that occur due to pedestrians being unable to judge the oncoming vehicle's path or speed properly.
- **Pedestrian dangerous behaviour on roadway:** Road crashes that occur due to pedestrians acting in a dangerous manner in the carriageway either purposely or through negligence.

3.1.2 Vehicle crash contributing factors

- **Defective or poor maintenance of vehicle**
  - **Tires:** Road crashes that occur when tires are not properly maintained and checked at regular intervals. It is characterised by tire blow - outs, under/over - inflated tires, tires with low tread depths and defective tires.
  - **Brakes:** Road crashes that occur due to

a fault in the braking system

- **Suspension:** This is used in cases where defective suspension contributes to the occurrence of crash.
- **Defective or absent mirrors:** Road crashes that occur due to defective or missing absent from a vehicle as such mirrors help in observing movement of elements immediately outside and to the rear of the vehicle
- **Steering:** Road crashes that occur in case there is a defect in steering as the driver may not be able to navigate the vehicle in the appropriate direction.
- **Lights or indicators:** Road crashes that occur when there are defective light or indicators
- **Absence of reflectors:** Road crashes that occur especially at night time if reflectors are absent on vehicles.
- **Non-functional wiper:** Road crashes that occur due to non-functional wipers as the front view of the vehicle may become foggy or unclear especially when it rains.
- **Overloading goods:** Road crashes that occur when a vehicle carries goods beyond the permissible limit or beyond the capacity of safe navigation of the vehicle.
- **Overloading passengers:** Road crashes that occur when a passenger carrying vehicle is overloaded.
- **Goods not secured properly:** Crashes that occur when goods carried by a vehicle are not secured properly. Such goods fall off the vehicle in some form which in turn contributes to the occurrence of crash or injury.

- **Vision Obstruction**
- **Vision obstruction due to vehicle interiors:** Road crashes that occur when interiors of a vehicle are designed or placed in such a manner which blocks clear visibility of the driver. For instance objects covering up the rear-view mirror.

3.1.3 Infrastructure crash contributing factors

- **Road surface/ road design**
- **Defective road surface:** Road crashes that occur when the road surface is defective. This may include potholes, expansion joints, and level differences, to list a few.
- **Slippery road surface:** Road crashes that occur due to slippery roads due to rain, snow, sand, gravel or things that lead to loss of control of the vehicle.
- **Deposits on road surface (oil, mud, fluids, etc.):** Road crashes that occur due to any oil spill, water, silt, or any other debris is found deposited /spilt on the roadway
- **Poor road marking/signage:** Road crashes that occur when sign boards indicating the roadway alignment (e.g. U

- turn, curve road, etc.) or road marking (e.g. broken line, stop line) are not present and defective sign boards or road markings (peeling sign boards, damaged sign boards, degraded road markings) and the like, are observed, because of its absence or poor maintenance.

- **Poor street lighting:** Road crashes may occur when the roadway is poorly illuminated at dark or the roadway is not well lit.
- **Poor object conspicuity:** Road crashes may occur due to inadequately placed reflectors on the roadside delineators or sign boards, roadside objects, bridge walls etc.
- **Inadequate warning about road ahead** Road crashes may occur due to inadequate warning about road ahead.
- **Defective traffic signals:** Road crashes may occur due to defective traffic signals. Traffic signals not working due to power failure and other inabilities are also coded under this category.
- **Sharp Curvature:** Road crashes due to vehicle losing control while negotiating a sharp curvature which results in the crash.
- **Bridge:** Road crashes due to roadway narrowing due to presence of a bridge without any road sign indication or smooth transition and it contributes to occurrence of crash.
- **Narrow Shoulder:** Crashes due to narrow width of shoulder for any avoidance manoeuvre. This code should be used only if the driver is in directional control of the vehicle while entering the shoulder (Not to be used if the vehicle is Yawing or Rolling). Vehicles parked partially on road due to narrow width of the shoulder are also coded under this category if the parked vehicle contributed to the occurrence of the crash.
- **Uphill gradient:** Crashes when a vehicle slowed down or braked down due to an uphill gradient and which contributed to the occurrence of crash..
- **Narrow lane-** Crashes due to narrow road/lane width is used when road structure is very narrow for two way or even one way traffic and that contributes to occurrence of crash.
- **Sudden lane narrowing:** Crashes due to road/lane width narrows suddenly.

- **Pedestrian Infrastructure**

- **Poor pedestrian infrastructure:** Crashes due to absent or poor pedestrian facilities such as pedestrian crossing (Zebra crossing), footover bridge, raised pavement pedestrian crossing within 100 metres of the crash location.
- **Walking alongside:** Crashes due to lack of pedestrian walking facilities such as pedestrian footway, pedestrian grade separation, and shoulder, due to which

pedestrians walk along the carriageway. This type of crash includes times when pedestrian footpath is unavailable due to encroachment by vendors which forced pedestrians to walk on the road.

- **Absence of bus stop:** Crashes due to absent bus stops, not enough room for commuters waiting for a bus, or encroachment of bus stops by hawkers.

- **Vision Obstruction**

- **Parked Vehicle:** Crashes due to any parked vehicle which limits the driver's visibility.
- **Man-made objects:** Crashes with manmade objects on the roadway or in the median/shoulder which limited the driver's visibility and subsequently the reaction time.
- **Trees/Plantation:** Crashes due to excessive roadside vegetation or wild bushes along the road which decreases the conspicuity of road to the driver leading to the crash.
- **Hillcrest:** Crashes due to limited visibility because of the presence of a hillcrest (especially on undivided carriageways) which obstructs the visibility of oncoming vehicles.
- **Road Curvature:** Crashes due to curvature of the road which obstructs the driver/rider's visibility.
- **Rain/Fog:** Crashes due to weather such as rain/fog which limits the driver's visibility and subsequently the reaction time..
- **Water splash from another vehicle:** Crashes due to water splashed by another vehicle from any pool of water on the right of way.

- **Road Traffic Flow**

- **Undivided road:** Crashes due to undivided two - way traffic.
- **Gap - in - median:** Crashes due to 'Gap - in - median' on road
- **Intersection:** Crashes due to intersection or due to the influence of the intersection.
- **Work zone:** Crashes due to work zones along the road. Such crashes occur when the roadway is under construction or maintenance, accounting for an improper driving environment, thus leading to the crash.
- **Animal/object on roadway:** Crashes with animal or non - fixed objects on the roadway.

3.1.4 Environmental crash contributing factors

- **Weather**

- **Rain /precipitation:** Crashes due to hydropaning of vehicles when the road surface is wet and slippery due to rain/ precipitation.
- **Fog and / or mist:** : Crashes due to inadequate visibility due to fog and / or

mist may lead to vehicular crash

- **Snow:** Road crashes that occur due to slippery road surfaces which may be caused due to snowfall or ice.
- **Dust Storms:** Road crashes that occur due to inadequate visibility caused by dust storms.

3.2 Injury causal factors

As explained above, injury contributing factors are those factors which lead to injury or even death of the road crash victim.

3.2.1 Human injury causal factors

- **Lack of use of Safety Systems**
  - **Seat Belt:** Injuries due to non-usage or improper use of safety seatbelts.
  - **Helmet:** Injuries due to non-usage or improper use of certified helmets.
- **Vehicle Misuse**
  - **Occupants in cargo area:** Injuries suffered due to occupants travelling in the cargo area of a vehicle. The victim suffers injuries during the crash due to the absence of a secure and safe seating.
  - **Overloading of occupant:** Injuries due to overloading occupants in the vehicle were beyond the safe and specified capacity of the vehicle. Generally, a crash with overloaded occupants results in multiple injuries.
- **Lifesaving skills**
  - **Inadequate crash management skills:** Injuries caused due to adequately trained or absent lifesaving skills by bystanders. This includes proper crash site management.
  - **Lack of first - aid skills:** Injuries due to absent or poor first aid provided to the crash victim. It includes delayed first-aid and incorrect first-aid to victims.
  - **Improper evacuation of occupant:** Additional injuries to victim due to rough handling of victim post-crash. This type of injury is generally seen when the victim is improperly rescued from the crashed vehicle or scene.

3.2.2 Vehicle injury causal factors

- **Crash Protection**
  - **Seat belts not available/usable:** Injuries suffered due to absence of seatbelt or if the seatbelt is unusable.
  - **Passenger Compartment Intrusion:** Injury due to passenger compartment crushing the crash victim.
  - **Non - enclosed occupant cabin:** Injuries due to ejectment from a vehicle due to unavailability of occupant cabins. Such ejectment will be common in vehicles like auto rickshaw, tractor, and convertibles, to list a few.
  - **Knockdown:** Injuries suffered by pedestrians, street occupants,r two wheeler occupants, or any road user being knocked down by motorists.

- **Runover of Pedestrian:** Injuries suffered by pedestrians, street occupants,r two wheeler occupants, or any road user being run over.
- **Runover of bus occupant:** Injuries suffered by bus commuters when the commuter falls off a bus and is then run over by the bus or any other vehicle.
- **Exposed passenger/ driver/ rider on vehicle :** Injuries suffered by passengers/ drivers due to brushed type of fall over type of crash on the road. fall down or brushed by other vehicles on the road. Such forms of injury are common for riders of bicycles/ M2Ws.
- **Cargo bed oversized than passenger cabin:** Injuries suffered due to collision of road users with oversized cabins. This type of injury is normally seen in commercial vehicle type crashes.

- **Illegal alteration or fitment**
- **Illegal alteration/fitment-** Injuries due to illegal alteration is made to the vehicle such as changes in the fuel system or fitment of exterior accessories like Bull bars, guards, leg guards, and hooks, to list a few.
- **Vehicle cargo misuse**
- **Protruding/oversized cargo:** Injuries due to protruding rods or oversized cargo.
- **Unsecured cargo:** Injuries due to unsecured cargo or poorly secured cargo.

- **Lifesaving skills**
- **Entrapment:** Injuries due to entrapment of occupants in the passenger compartment or in any non - enclosed area.
- **Fire:** Injuries due to fire in the vehicle.
- **Ejection:** Injuries due to occupant ejection from the vehicle.

3.2.3 Infrastructure injury causal factors

- **Road Infrastructure**
- **Object impact with roadside trees/plants:** Injuries due to impact with roadside trees or plants or other natural roadside objects.
- **Object impact - roadside manmade structures:** Injuries due to impact with roadside manmade structures such as traffic barriers or poles, buildings, etc.
- **Steep slope/Drop off:** Injuries suffered due to vehicles running off the roadside steep slope or drop off.
- **Medical response**
- **EMS availability/Evacuation team:** Injuries suffered due to absent in-time medical care by emergency medical response team. If EMS and evacuation team availability is remote location, the response time increases thereby increasing the severity of injuries.
- **Distance to hospital:** Injuries suffered

due to absent in-time medical care by the hospital. For example, if the medical facility is far away, the response time increases thereby increasing the severity of injuries.

Crash Examination

The crash investigator shall conduct the investigation as an on-ground exercise at the earliest -post the crash event. The early investigation will ensure that there is minimal loss of evidence. The investigator shall examine:

A. All vehicles involved in the crash, and
B. The scene of the crash.

A. Vehicle Examination

Vehicle examination is an organised evaluation exercise that involves measurement of damages, correlation of damage to the crash narrative, and identification of occupant contacts in regard to the accidents. Vehicle examination is composed of two parts.

Exterior examination

- Identifying the direct and indirect damage through paint transfers, scratch marks, crack patterns on windshield, shape of damage.
- Documentation of dimensions of direct and indirect damages for energy calculations
- The brake line and driveline damage
- Air pressure
- Headlight and tail lamps damage
- Integrity damage by checking the glazing and door status on whether it opens or is jammed
- Mirror damages around the vehicle related to the crash
- Underride/Override
- Tire damage and measurement of tire pressure & tread depth
- Reflectors colour and condition
- Rear Underride protection device (RUPD) status details, if applicable

Interior examination

- Checking the steering, brakes, air pressures in the brake line, and damage to the dashboard
- Identifying the intruded components
- Identifying the occupant injury with visible marks on the vehicle
- Check for safety system usage- seat belt usage, usage of child seat, helmets, and the proper storage of goods

- Check for airbag deployment
- Check for seat deformation in the crash.

B. Scene Examination

Scene examination is an evaluation exercise that involves measurement of damages to property, correlation of damage to the crash narrative, and correlation of damage and evidence to crash. The following factors must be kept in mind when conducting a scene examination:

Road Geometry - The investigator shall document the road width, shoulder width, presence of curve, number of lanes, gradient, and other relevant information while conducting the scene examination.

Tire marks - These are one of the most vital scene evidence that needs to be collected and studied thoroughly and carefully for crash reconstruction. The tyre marks reveal if the vehicle applied brakes, performed any avoidance manoeuvres and the direction of the movement of the vehicle.

Gouge marks - Path of the vehicle, rotation and the final rest position of the vehicle can be determined if the investigator identifies and documents the gouge marks. These marks generally appear on the road or shoulder due to the contact between the metal parts of the vehicle with the road surface. Gouge marks help reveal tyre bursts as the metal rims of the vehicle create a different pattern than tyre marks. Gouge marks also reveal the various points of impact of vehicle with the road, which in turn will help correlate the crash sequence.

Oil pool - To clarify point of impact and final rest position of the vehicle, oil pool may act as an evidence. Oil spill takes place generally due to radiator damage, engine bed

damage or even spillage from various liquid tanks. This pool of oil in turn helps determine the final rest position and point of impact.

Blood pool - Blood pool helps us to determine the final rest position of the injured victim.

Infrastructural causal factors shall also include safety interventions as discussed in Chapter II (Engineering) of this Code. The forensic crash investigator shall document the presence or absence of all safety features from an engineering/ infrastructure stand point which may have eliminated the crash or reduced the severity of injury. Examples of such interventions may include, installation of crash barriers, proper end treatment of crash barriers, treatment of potholes to list a few.

Calculating the speed of a vehicle

One of the essential factors required of a forensic crash investigation is the knowledge of the speed of the vehicle. A similar crash at 30 km/h and 80 km/h will have drastically different outcomes in terms of damage and injury.

Newton's laws of motion is used to calculate the speed of the vehicle:

1. $v^2 = u^2 + 2as$ *(equation of motion)*

Here, v stands for final velocity (SI unit: m/s), u stands for initial velocity (SI unit: m/s), a stands for acceleration/deceleration (SI unit: m/s^2) and s stands for distance travelled (SI unit metres).

2. $u^2 = v^2 + EES^2$ (derived from the Law of conservation of energy after the neglecting the change in mass after the collision)

Here, v stands for final velocity (SI unit: m/s), u stands for initial velocity(SI unit: m/s), EES stands for Energy equivalent speed (SI unit: m/s) and s stands for distance travelled (SI unit metres).

According to the deformation of the

damage, we assume the value of EES. Due to the impact a vehicle loses or gains speed, EES represents this gained or reduced speed.

Further, In some cases investigator may have to take the help of momentum equation:

3. $m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$ (general form of momentum equation, this is for linear vehicle direction. It can be further derived for nonlinear vehicle paths)

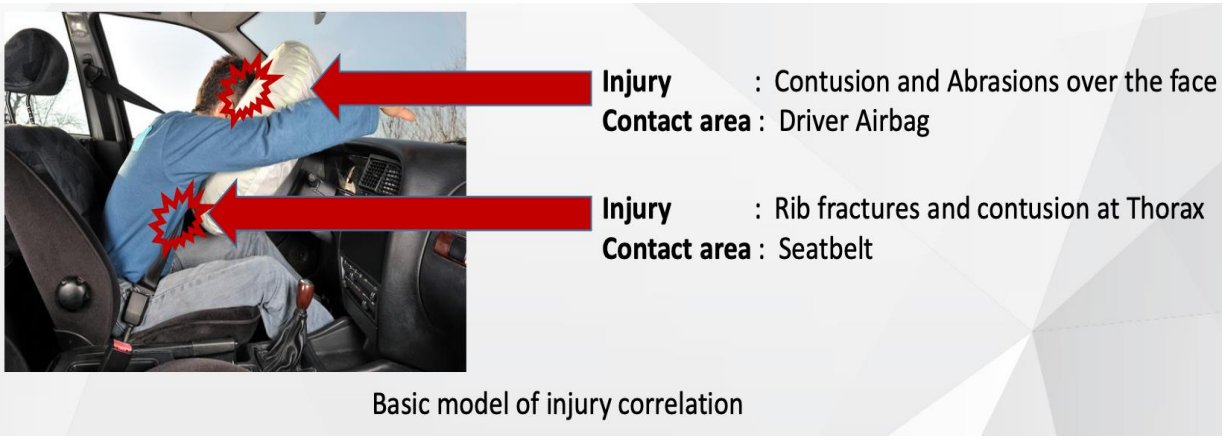
Here, m_1 & m_2 stands for mass of vehicles involved (SI unit: kg), v_1 & v_2 stands for velocity of vehicles before impact (SI unit: m/s), v_1' & v_2' stands for velocity of vehicles after the impact (SI unit: m/s)

It is recommended that the investigator fills in the details of the findings from the field investigation in a form **Annexure A - Crash Investigation Report**. The fields in the form may be made longer if required by the nature of the crash.

C. Injury coding and correlation

The investigating officer needs to ensure that the injury correlates with the crash. For example, if there is a head injury, the forensic crash investigation needs to establish the area of contact where the injury occurred. The correlation is established with proof of contact such as blood marks at the contact point.

- Once the data is collected from the field; every injury should be decoded in an excel sheet
- Correlating vehicle damage, scene evidence and injury data using occupant kinematics
- Coding down the correlated data for analysis purposes to bring more clarity to the case



Basic model of injury correlation

Sharing of crash information for action

The end result of a forensic crash investigation is actionable change to

ensure that such crashes are not repeated. The investigating officer shall share the details of the forensic crash investigation along with the supporting data such as victim interview, photos, injury reports or post mortem reports, with all relevant stakeholders within 07 days of the crash. The stakeholders include and are not limited to:

1. Intimate the Lead Agency[68] from the transport department
2. Additional Director General of Police
3. Designated PWD Engineer or like and Regional Inspector (Technical) or the Chief Engineer of the road owning agency.

[68] Mandated by the Supreme Court Committee on Road Safety (SCCoRS);

NATIONAL ROAD SAFETY CODE

PART IV - ENFORCEMENT

Section 2 - Road Crash: Preventive, Protective, Punitive, and Penal Measures

1. Scope

Traffic law enforcement influences driving behaviour through two processes: general deterrence and specific deterrence. General deterrence can be described as the impact of the threat of legal punishment on the public at large. Specific deterrence can be seen as the impact of actual legal punishment on those who have been apprehended[69].

This section scopes out the various enforcement measures that should be taken by law enforcement officers when specific types of crashes occur on roads and highways.

This section strongly recommends the usage of two concepts simultaneously.

1. Zero Tolerance Enforcement Drive
2. Active Visible Patrolling

The enforcement shall be of two types:

1. **Static enforcement** - Enforcement measures undertaken at a fixed
2. location of known violation issues and high crash risk. Static enforcement does not require relocation during the enforcement period. Such enforcement shall be conducted at regular intervals to ensure compliance. Static enforcement creates a minimum standard of the presence of enforcement. Examples of such include checking using police booths, checking at toll plazas, speed traps, and CCTV cameras, to list a few.

3. **Dynamic enforcement** - Enforcement measures that require the active movement of the enforcement agency to various locations are dynamic enforcement. Dynamic enforcement creates a level of unpredictability. Such enforcement shall be undertaken at random times and random locations to ensure a level of unpredictability.

[69] http://dacota-project.eu/Links/erso/knowledge/Content/21_speed_enforcement/speed%20enforcement.htm

Examples of such techniques include actively moving patrolling using interceptor vehicles, enforcement officers placed at random locations, and relocatable speed cameras, to list a few.

1.1 Zero Tolerance Enforcement Drive

Zero Tolerance Enforcement Drive is a focused enforcement exercise carried out during a limited period of time on one or two crash contributing factors or injury contributing factors, such as:

1. Rear seat belt compliance,
2. Wrong lane driving,
3. Wrong side driving, and
4. Over-speeding, to list a few

During the drive, the enforcement agency shall penalise all violators not only through the MVAA but also by applying IPC sections. The violations for which a Zero Tolerance Enforcement Drive may be carried out can be obtained by studying the crash data of the jurisdiction. The focus of the Zero Tolerance Enforcement Drive shall be to reduce fatality through compliance.

Officers conducting Zero Tolerance Enforcement Drive shall:

1. Impose criminal liability under IPC along with charges under MVAA, on the offender for violating traffic rules and regulations
2. Conduct robust, transparent, and continuous drive by trained officers designated to conduct the Zero Tolerance Enforcement Drives.

Example:

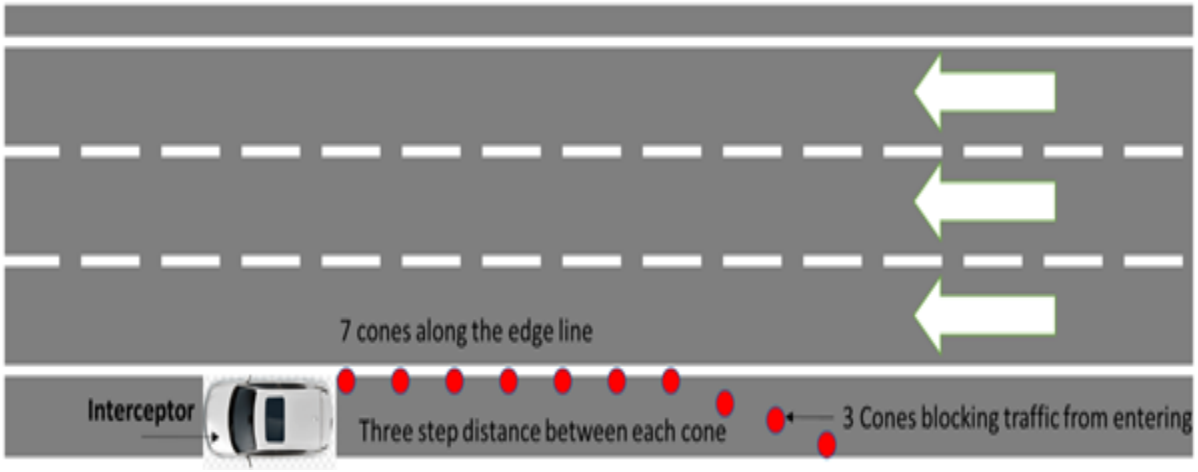
Gurgaon traffic police and all the area police stations observed Zero Tolerance Day against traffic violations across the city.

The drive started at 10 am and continued till 6 pm, during which special teams monitored traffic and fined the erring motorists – for not wearing helmets or jumping signals, or overspeeding. Not many could escape the eagle eyes of the inspectors if they did not wear mandatory seat belts when driving four-wheelers.

Each team comprised three to four persons, and till 6 pm, 21,769 motorists were fined. The traffic police collected a sum of Rs 25,49,600 and impounded 102 vehicles.

As against the 3,500 challans issued on a daily basis, during the drive, the vehicles fined stood over six times[70].

[70] https://www.cityspidey.com/news/5234/gurgaon-traffic-police-starts-the-year-with-zero-tolerance-drive



Safe stopping during enforcement drives

During the Zero Tolerance Enforcement Drives, the vehicle will need to make multiple stops. To ensure that crashes do not occur with the stopped vehicles, cones shall be placed behind the enforcement vehicles as illustrated in figure below.

1.2 Active Visible Enforcement

Active and Visible Enforcement (AVE) is a traffic safety approach to be undertaken by enforcement officers to ensure road safety. An AVE fundamentally relies on the proactive approach of the enforcement agency in capturing violations and in the display of penalisation on violations such that the community at large understands that violations are not tolerated and will be subject to penalisation.

Such proactive measures and visible displays of enforcement are undertaken through pulling over violators and issuing challans, seatbelt and helmet enforcement using barricades, and speed cameras with flash. Such enforcements are designed to deter unlawful behaviour and promote voluntary behaviour change in accordance with traffic laws. AVE deters risky behaviour by reminding motorists through visible action by enforcement agency that they may be pulled over for illegal behaviours[71].

[71] USA. NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRARION. Traffic Tech Technology Transfer Series, DOT HS 813 070, US.

To ensure that the enforcement agency can conduct an AVE,

- Enforcement officers shall have equipment related to the drive such as automatic speed detection equipment, alcometers, drug test metres, to list a few.
- Enforcement Officers shall have the power to stop vehicles on all roads, including motorways in order to prevent illegal behaviour on road.
- Enforcement officer recording any offender through a body wearable camera or dash-board camera shall inform such offender about such recording or as prescribed in Rule 167A of The Central Motor Vehicles Rules, 1989.
- Enforcement officer's vehicles shall attract attention by flashing amber lights/ flashes/sirens either from the front or from behind.

2.Terminology

The definition of the terms used in this section are given in Part 1 of this code.

3. Types of infractions leading to crashes

3.1 Crashes due to parking on the shoulder

Road crashes may occur due to parking on the shoulder. The most common form of the crash that occurs due to parking on the shoulder is Rear-end Crash. The same has been discussed in detail in section 6 of Part II of this code.

In order to prevent such crashes, it is recommended that the following enforcement measures shall be adopted:

Dynamic Enforcement

- Active Visible Patrolling by enforcement officers to check and remove illegally parked vehicles on the shoulders. Monetary penalties shall be issued to all illegally parked vehicles. Additional focus is required at known locations where vehicles tend to stop illegally such as eateries and shade of bridges or trees.

3.2 Crashes due to illegal stops/parking on the carriageway

Road crashes may occur due to illegal stops/ parking on the road as there is a sudden disruption in the flow of the traffic, in such situations there is a high possibility of rear-end crash. Rear-end Crash has been discussed in detail in section 6 of Part II of this code.

In order to prevent such crashes, it is recommended that the following enforcement measures shall be adopted:

Dynamic Enforcement

- Active Visible Patrolling by enforcement officers to check and remove such illegal stops/ parking on the

road, such patrolling drivers should look for private vehicles and transports which stop at undesignated spots/ stops (bus-stop, etc.). Monetary penalties shall be issued to all vehicles which are illegally stopped or parked on the carriageway.

3.3 Crashes due to speeding above legal limits

Road crashes may occur when vehicles exceed the prescribed speed limit on the stretch. The most common form of crash that may occur when prescribed speed limit is not followed is Head-on crash (Section 2 of Part II of this code), Run-off crash (Section 3 of Part II of this code), Impalement (Section 4 of Part II of this code), Rear-end crash (Section 6 of Part II of this code), Construction or Work Zone Crash (Section 7 of Part II of this code), Slip and Loss of Control (Section 8 of Part II of this code), Crash due to loss of vehicular control (Section 9 of Part II of this code), Crash due to poor driving behaviour (Section 11 of Part II of this code), Pedestrian Crashes (Section 12 of Part II of this code). Hit and Run cases are quite common in case of vehicles speeding over legal limits.

Research indicates that combining specific public education campaigns with visible enforcement of speed can result in measurable reductions in speed-related crashes[72]

Inorder to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Installation of speed cameras at spots known for speeding violations and crashes..
- Installation of VASS at locations of known crashes to alert drivers of their speed

Dynamic Enforcement

- Active Visible Patrolling with interceptors at random times. The patrolling should not be limited for a jurisdiction, but shall be undertaken for the entire length of highway.
- Placement of actively relocatable speed cameras to check speed violations and issue monetary fines to the violators

3.4 Crashes due to wrong lane usage

Lanes are demarcated for vehicles considering various factors like length, breadth, the weight of the vehicle, direction of movement of the vehicle, the maximum and minimum speed of the vehicle. When a vehicle fails to follow the direction to use

[72] Elliott B. Road safety mass media campaigns: a meta analysis. Canberra, Australian Transport Safety Bureau, 1993 (www.atsb.gov.au/publications/1993/pdf/Edu_Media_1.pdf).

the specific lane for movement crashes may occur. The most common type of crashes that occur are head-on crash (Section 2 of Part II of this code), crash due to sudden appearance of vehicle (Section 10 of Part II of this code)

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Installation of cameras capable of identifying wrong lane usage at locations of known violations. Some speed cameras are also capable of auto-detecting such violations.

Dynamic Enforcement

- Active Visible Enforcement with monetary fines to violators using a 'Zero Tolerance Policy' approach
- Placement of actively relocatable speed cameras at locations of known violations.

3.5 Crashes due to wrong side overtaking (reckless driving)

According to the road regulations in India, every motor vehicle shall drive the vehicle as close to the left side of the road as may be expedient and shall allow all traffic that is proceeding in the opposite direction to pass on from the right side. Thus, when any vehicle breaches the road regulation and overtakes another vehicle from the wrong side there is a high possibility of rear-end crash (Section 6 of Part II of this code)

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Cameras capable of detecting the violation shall be installed across stretches, especially where there are open medians and open access to roads. The monetary fines shall also be issued to slow moving vehicles on the right lane.

Dynamic Enforcement

- Active Visible Enforcement using interceptors at random time.
- Placement of actively relocatable cameras to check the wrong side overtaking

Protocol for Dynamic Enforcement of wrong lane usage

- When the interceptor spots a vehicle in the wrong lane, it shall first pull up and travel behind the violating vehicle.
- Interceptor shall turn on siren for a minimum of 5 seconds to alert the driver.
- Announcement shall be made through the PA system in the following format: "Vehicle number XXXX, travel in the left lane. Right lane is for overtaking"
- If warranted, a challan shall be issued for a lane violation.

3.6 Crashes due to overtaking using shoulder (reckless driving)

Shoulders are the portion of the road that falls outside the outer lane and is designed for emergency use by traffic, when a motor vehicle uses the shoulder to overtake other vehicles there are a high possibility of rear-end crash (Section 6 of Part II of this code) or sideswipe crashes (Section 13 of Part II of this code). The same has been detailed in section 11 of Part II of this code.

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Cameras capable of violation detection should be installed across stretches, especially where there are open medians and open access to roads

Dynamic Enforcement

- Active Visible Enforcement using interceptors at random time.
- Placement of actively relocatable cameras to check for overtaking using the shoulder. Some speed cameras can be tuned to capture such violations.

3.7 Crashes due to illegal crossing by pedestrians or presence of commuters on road

The presence of commuters especially on high speed corridors can lead to pedestrian crashes which may also lead to fatality.

In order to prevent such crashes the following enforcement measure shall be adopted:

Dynamic Enforcement

- Interceptors on the corridor shall provide support to pedestrians on the highway by transporting them to a safe spot/ destination. While providing this service, care must be taken that the inspector puts on flashers and sirens to alert other vehicles on the road.

3.8 Crashes due to wrong side driving

Vehicles should move in the prescribed direction, violating the same may lead to road crashes like head-on crashes (Section 2 of Part II of this code)

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Installation of cameras capable of identifying wrong side driving at locations of known violations. Some speed cameras are also capable of auto-detecting such violations.

Dynamic Enforcement

- Active Visible Enforcement using interceptors at random time.
- Placement of actively relocatable cameras to check for wrong side driving. Some speed cameras can be tuned to capture such violations.

3.9 Crashes due to use of road by unauthorised vehicles

Only vehicles authorised to ply on a certain road/ stretch/ lane shall be ply on the particular road/ stretch/lane. When unauthorised vehicles enter such road/ stretch/ lane road crashes may occur as the road is not designed for such use. Rear-end crash (Section 2 of Part II of this code) is the most common type of crash that may occur due to this anomaly.

Dynamic Enforcement

- Active Visible Enforcement using interceptors at random time.

3.10 Crashes due to distracted driving (mobile phones)

Distracted driving is a serious and growing threat to road safety. The number of accidents occurring due to distracted driving has increased in the past decades. With more and more people owning mobile phones, and the rapid introduction of new "in-vehicle" communication systems, this problem is likely to escalate. Reading messages, replying to texts, taking calls, reading, and grooming, to list a few issues. behind the wheel can be fatal. Distracted driving is a serious and growing threat to road safety. Studies suggest that drivers using a mobile phone are approximately four times more likely to be involved in a crash than when a driver does not use a phone[73]. Rear-end crashes (Section 2 of Part II of this code) and run-off crashes (Section 3 of Part II of this code) are the most common types of crashes that may occur due to distracted driving.

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

[73] https://www.who.int/violence_injury_prevention/publications/road_traffic/distracted_driving_summary.pdf

- Installation of cameras capable of identifying and penalising distracted driving at locations of known violations.

Dynamic Enforcement

- Active Visible Enforcement using interceptors at random times against distracted driving.

3.11 Crashes due to drunk driving and influence of drugs

Alcohol or drug consumption before driving impairs several of the driver's functional capabilities, including reaction time, tracking ability, proper speed management, vision, divided attention, and vigilance, and this leads to increased crash risk. The risk for drivers with a blood alcohol concentration (BAC) of 0.5 g/L is estimated to be about 1.4 times as high as that of a sober driver; at 1.0 g/L the risk is nearly five times as high, and at 1.5 g/L the risk is 20 times as high.

Drugs can affect human mental and physical functioning by either stimulating or slowing down the activity of the brain and nervous system or by interfering with the brain and central nervous system in a way that distorts the user's perception of reality. The increase in crash risk associated with drug use in traffic accidents has been investigated in case-control studies (DRUID, USA and in several meta-analyses. In these studies, the largest risk increase, with risk at least five times higher than driving without drugs, has been found for amphetamines, multiple drug use, and combining alcohol and drugs. The use of benzodiazepines, cocaine, and opiates is associated with a 1.5–3 times increase in crash risk. The estimates for risk increase for cannabis use vary from less than 1.5 to 2.5 times higher[74]. The most common type of crashes that may occur due to drunk driving are rear-end crash (Section 2 of Part II of this code), run-off crash (Section 3 of Part II of this code), and pedestrian crash (Section 12 of Part II of this code)

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Compulsorily conduct alcohol levels tests at toll plazas and locations of compulsory stoppages on highway

Dynamic Enforcement

- Active Visible Enforcement by conducting alcohol levels tests at random locations at random times on the highway

74 https://www.sciencedirect.com/science/article/pii/S0386111220300698#bb0005

3.12 Crashes due to overloading of goods and passengers

Overloaded vehicles are a hazard to all other vehicles on the road. Road crashes may occur due to overloading of vehicles as:

- Tires on the truck may burst from excess weight
- Brake fading due to increased heat by friction caused by the overloading
- Roads may collapse due to trucks that exceed proper weight ratings
- Trucks may rollover due to the shift in centre of gravity from overloading
- Excess weight may add momentum to a truck travelling downhill and severely slow it down when travelling up an incline
- An overloaded truck whose weight is shifted to the rear of the truck, making steering much more difficult; and
- Partially loaded tanker trucks carrying liquids that slosh back and forth, upsetting the natural centre of gravity of the truck[75].

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Compulsorily check of overloading (passenger and goods) at toll plazas and locations of compulsory stoppages on highway
- Weigh-in motion devices should be available at toll plazas, to check overloaded vehicles

Dynamic Enforcement

- Active Visible Enforcement by penalising overloaded vehicles (passenger and goods) at random locations at random times on the highway

3.13 Crashes due to traffic light violations

If a vehicle enters an intersection any time after the signal light has turned red, or obstructs the free flow of traffic when the signal has turned green, the driver has committed a violation. The most common type of crash that may occur due to red light violations are side pedestrian crash (Section 12 of Part II of this code), swipe crash (Section 13 of Part II of this code), object impact crash (Section 1 of Part II of this code)

In order to prevent such crashes the following enforcement measure shall be adopted:

[75] https://www.lundylaw.com/blog/auto-accident/serious-accidents-caused-overloaded-trucks/

Static Enforcement

- 'Zero Tolerance Enforcement' drives at random red lights to catch violators.
- Installation of red light cameras at traffic signals. Red-light cameras automatically photograph vehicles that go through red lights. The cameras are connected to the traffic signal and to sensors that monitor traffic flow just before the crosswalk or stop line. The system continuously monitors the traffic signal, and the camera captures any vehicle that doesn't stop during the red phase. Many red light camera programs provide motorists with grace periods of up to half a second after the light switches to red[76].

3.14 Crashes due to protruding rods

Many dangerous/ fatal accidents take place due to vehicles carrying protruding rods and materials. The Government of India, Ministry of Road Transport and Highways vide its notification GSR 152(E) dated 5th March 2014 prohibited goods carrier loader to carry any protruding rods[77]. Violation of the law may lead to impalement (Section 4 of Part II of this code)

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Compulsorily check of protruding rods at toll plazas and locations of compulsory stoppages on highway

Dynamic Enforcement

- Active Visible Enforcement by penalising vehicles with protruding rods at random locations at random times on the highway

3.15 Crashes due to the absence of vehicle retroreflectivity

Retro-Reflective markings should be present on all heavy and long vehicles, their trailers and semi-trailers[78]. In absence of such markings, crashes may occur, the most common types of crashes that may occur are object impact crash (Section 1 of Part II of this code) and rear-end crash (Section 6 of Part II of this code)

In order to prevent such crashes the following enforcement measure shall be adopted:

Static Enforcement

- Compulsorily check of retroreflective stickers at toll plazas and locations of compulsory stoppages on highway

Dynamic Enforcement

[76] https://www.iihs.org/topics/red-light-running

[77] https://morth.nic.in/sites/default/files/circulars_document/Advisory_to_all_States_on_strict_implementation_of_Amended_Rule_93(8)_of_CMVR_letter_dated_9.1.2015.pdf

[78] AIS-090

- Active Visible Enforcement by penalising vehicles without adequate retro reflectivity during patrolling on the highway

3.16 Injuries due to non-usage of seatbelts

Seat belts are the best defence against impaired, aggressive, and distracted drivers. Being buckled up during a crash helps keep you safe and secure inside your vehicle; being completely ejected from a vehicle is almost always deadly[79]. Studies show that seatbelt use can reduce fatal and non-fatal injuries in front and rear seat occupants by 60% and 44% respectively. In addition, it has been found that drivers without seatbelts are 8.3 times more likely to sustain fatal injury and 5.2 times more likely to sustain a serious injury compared to the drivers who use seat belts[80]

In order to prevent injuries due to non-usage of seatbelts the following enforcement measure shall be adopted:

Static Enforcement

- Compulsorily checks for seat belts for all passengers (including rear passengers) at toll plazas and locations of compulsory stoppages on highway
- Installation of cameras capable of identifying and penalising seatbelt violations

Dynamic Enforcement

- Active Visible Enforcement by penalising commuters without seatbelts during patrolling on the highway

3.17 Injuries due to non-usage of helmets

Every two wheeler rider is required to wear standard helmets, violating the law not only attracts a penalty but also may lead to crashes like head-on crashes (Section 2 of Part II of this code)

In order to prevent injuries due to non-usage of seatbelts the following enforcement measure shall be adopted:

Static Enforcement

- Compulsorily checks for helmets for all passengers (including rear passengers) at toll plazas and locations of compulsory stoppages on highway
- Installation of cameras capable of identifying and penalising helmet violations

Dynamic Enforcement

- Active Visible Enforcement by penalising commuters without helmets during patrolling on the highway

[79] https://www.nhtsa.gov/risky-driving/seat-belts

[80] https://etrr.springeropen.com/articles/10.1186/s12544-020-0401-5

3.18 Crashes due to unsecured cargo

Accidents caused by unsecured cargo most often involve trucks, but any vehicle carrying items on its exterior can become a liability. The most common cargo involved in these accidents includes construction materials, household items such as furniture or mattresses, and car parts such as tires. These items can be found littering the sides of highways, illustrating how easy it is for them to fall from moving vehicles. Falling cargo can strike nearby vehicles or land on the road, requiring drivers to stop or swerve suddenly and potentially cause an accident. It is not just items that fall off vehicles that can cause accidents. Even if an enclosed truck loses items, it can be extremely dangerous, as it can make trucks more prone to rollover accidents. Cargoes can shift as the truck moves, particularly if they make a sharp turn, which can redistribute the weight in the trailer to one side. This can cause the trailer to hinge sharply at the cab or tip over. Crashes that may occur due to unsecured cargo are object impact crash (Section 1 of Part II of this code), impalement (Section 4 of Part II of this code), pedestrian crash (Section 12 of Part II of this code)

In order to prevent such crashes, drivers who are moving large amounts of cargo must ensure that it is properly loaded and secured in order to prevent devastating accidents. This includes making sure items stay put during the trip and checking the integrity of ropes and tarps to ensure they do not fail. It is important to check periodically that everything is still secured properly during the trip. Skipping vital safety steps to meet deadlines or maximize efficiency can have deadly consequences[81]. Further, the enforcement authorities shall adopt the following measures:

Static Enforcement

- Random checks for unsecure cargo at toll plazas and locations of compulsory stoppages on highway

Dynamic Enforcement

- Stopping of vehicles with unsecure cargo during Active Visible Patrolling. Relaying information to the toll plaza ahead to stop the errant vehicle till the cargo has been made secure.

3.19 Crashes due to non-functioning / not visible rear lights

Crashes may occur due to non-visibility of rear lights as such vehicles may not be visible especially during night time. The most common form of crashes that may occur are rear end (Section 6 of Part II of

[81] https://www.hg.org/legal-articles/risks-of-unsecured-cargo-48605

this code), object impact crash (Section 1 of Part II of this code)

In order to prevent injuries due to non-usage of seatbelts the following enforcement measure shall be adopted:

Static Enforcement

- Random checks for working and visible rear lights at toll plazas and locations of compulsory stoppages on highway

Dynamic Enforcement

- Stopping of vehicles with non-functioning or not visible rear lights and issuing monetary fines during Active Visible Patrolling.

3.20 Crashes due to extremely low speed on high-speed corridors

Extremely slow vehicles moving on high speed corridors (i.e. corridors with speeds >70 km/h) should not have speed difference of >50km/h (i.e. a road with 100 km/h should have a min speed of 50km/h and a road with 120 km/h should have a min speed of 70km/h). To ensure safe overtaking manoeuvre, the left lane shall be used for travelling and the right lane shall be used for overtaking. Once the overtaking manoeuvre is complete, the vehicle shall return to the left lane.[82]

Note: considering that in exceptional circumstances slow moving vehicles carrying oversized cargo need to move on high speed corridors, additional safety measures shall be taken to ensure crashes do not occur due to the presence of the slow moving vehicle.

The most common type of crash that may occur is rear-end crash (Section 6 of Part II of this code).

In order to prevent injuries due to non usage of seatbelts the following enforcement measure shall be adopted:

Static Enforcement

- Installation of speed cameras at locations known for speeding violations. (The speed difference is a major concern due to which speed cameras are to be located.)

Dynamic Enforcement

- Assist extreme slow moving vehicles by following it with sirens (front and rear) and flashers.

3.21 Crashes due to sleep and fatigue

Due to fatigue and sleep deprivation drivers may encounter crashes, such crashes may include object impact crash (Section 1 of Part II of this code), head-on crash (Section 2 of Part II of this code), runoff crash (Section 3 of Part II of this code), rear-end crash (Section 6 of Part II of this code),

[82] Road Traffic (Expressway Traffic) Rules, Singapore, available at https://sso.agc.gov.sg/SL/RTA1961-R23?DocDate=20170502

pedestrian crash(Section 12 of Part II of this code)

In order to prevent injuries due to non-usage of seatbelts the following enforcement measure shall be adopted.

Dynamic Enforcement

- Stop vehicles driving in a zig-zag pattern due to fatigue during Active Visible Patrolling. Redirect such vehicles to rest areas for a short nap or proper rest.
- RTO's must encourage retrofit installation of in-vehicle fatigue detection

Annexure A- Crash Investigation Report

ROAD ACCIDENT RECORDING FORM

A. Accident Identification Details			
1. FIR No.:	2. Time of accident H H M M a.m. / p.m.	3.Date of accident D D M M Y Y Y Y	
4. Name of Place:		5. Police Station:	
6. District:		7. State:	
8. Type of Area	Urban ☐	Rural ☐	
9. Accident Type	Fatal ☐	Grievously Injured (Hospitalized) ☐	Minor Injury ☐ No Injury ☐
10. No. of fatal ☐	No. of grievously injured ☐	No. of minor injuries ☐	No. of non-injured ☐
11. No. of motorized vehicles involved ☐	No. of non-motorized vehicles involved ☐	No. of pedestrians involved ☐	
12. Type of weather	☐ Sunny/Clear ☐ Rainy ☐ Foggy/Mist ☐ Hail/Sleet ☐ Others (specify):		
13. Hit & Run	☐ Yes	☐ No	
14. Type of Collision (A)	☐ Vehicle to Vehicle	☐ Vehicle to Pedestrian	☐ Vehicle to bicycle
	☐ Vehicle to animal	☐ Fixed/Stationary object	
(B)	☐ Rear-end collision	☐ Hit from side/ Sideswipe	☐ Run off road
	☐ Overturned/ Rollover	☐ Head-on collision	☐ Others (Specify):

B. Road Related Details				
15. Road Name:		16. Direction to:		
17. Landmark:		18. Chainage:		
19. GPS Location	Latitude:	Longitude:		
20 (a). No. of Lanes:		20 (b). Lane of Occurrence:		
21. Surface Condition	☐ Paved	☐ Un-Paved	☐ Wet	☐ Dry
22. Road Type (A)	☐ Expressway	☐ National Highway	☐ State Highway	☐ Other Roads
(B)	☐ Urban		☐ Rural	
23. Road with median	☐ Yes	☐ No		
24. Construction zone	☐ Yes	☐ No		
25. Speed Limit:	_____ km/hr.	☐ Unknown		
26. Area of occurrence	☐ Built-up Area (Town/ City)	☐ Agricultural fields	☐ Hills/ Ghat	
	☐ Built-up Area (Village/ rural)	☐ Others (specify):		
27. Road Features (A)	☐ Straight Road	☐ Curved Road		
(B)	☐ Bridge	☐ Culvert	☐ None	
(C)	Potholes	☐ Yes	☐ No	
(D)	Steep Gradient	☐ Yes	☐ No	
28. Road Junction (If applicable)	☐ T-Junction	☐ Y-Junction	☐ Four arm Junction	
	☐ Staggered Junction	☐ Round about Junction	☐ None	
29. Type of Traffic Control devices (if applicable)	☐ Traffic Light Signal	☐ Police Control	☐ Stop Sign	
	☐ Flashing Signal/ Blinker	☐ Unmanned		
30. Pedestrian Infrastructure (if applicable) (A)	Footpath	☐ Yes	☐ No	
(B)	Foot over Bridge/ Subway	☐ Yes	☐ No	
(C)	Zebra Crossing	☐ Yes	☐ No	
(D)	Hawkers on the footpath	☐ Yes	☐ No	

Chainage: This is the distance measured along the road center line from a clear start point of the road. This information can be retrieved from NHAI or PWD.
GPS Location: Global Positioning System (GPS) device can provide the exact location of a point. A GPS device can give latitude and longitude of a location. This is used to mark the location on a digital map.

C. Vehicles involved in Accident:

Vehicle No. (Q. 31)	Type of Vehicle* (Q. 32)	Registration No. (Q. 33)	Disposition* (Q. 34)	Load Condition* (Q. 35)		Mechanical Failure* (Q. 36)	Model Year (Q. 37)	Vehicle Movement* (Q. 38)	Passenger Compartment Intrusion* (Q. 39)
				Passenger	Goods				

Coding Instructions:

Q. No. 32 *		Q. No. 34 *	Q. No. 35 *	Q. No. 36 *	Q. No. 38 *	Q. No. 39 *
1. Motorized Two-Wheeler	8. Bicycle	1. Needs to be towed	1. Normally Loaded	1. Yes	1. Moving	1. Yes
2. Auto Rickshaw	9. Cycle Rickshaw	2. Can be driven away	2. Overload/Hanging	2. No	2. Parked	2. No
3. Car/Jeep/Van/Taxi	10. Hand drawn cart		3. Empty			
4. Bus	11. Animal Drawn cart		4. Not known			
5. Truck/Lorry	12. Others (specify)					
6. Heavy Articulated Vehicle/ Trolly	13. Not known					
7. Tempo/Tractor						

D. Driver Details

Driver of Vehicle No. (Col. 31) (Q. 40)	Driver of Vehicle type* (Col. 32) (Q. 41)	Sex* (Q. 42)	Age (Q. 43)	Impacting Vehicle No. (Col. 31) (Q. 44)	Impacting Vehicle type (Col. 32) (Q. 45)	Type of Licence* (Q. 46)	License No. (Q. 47)	Intoxication* (Q. 48)	Type of Traffic Violation* (Q. 49)	Type of Injury* (Q. 50)	Safety Device* (Q. 51)	Trapped inside vehicle* (Q. 52)

Coding Instructions:

Q. No. 42 *	Q. No. 45 *	Q. No. 46 *	Q. No. 48 *	Q. No. 49 *	Q. No. 50 *	Q. No. 51 *	Q. No. 52 *
1. Male	Same as No. 32	1. Valid Driving License	1. Yes	1. Overspeeding	1. Fatal	1. Seat Belt	1. Yes
2. Female		2. Learner License	2. No	2. Jumping Red light	2. Injured (Needs Hospitalization)	2. Helmet	2. No
		3. Without License	3. Unknown	3. Wrong side driving	3. Injured (No Hospitalization needed)	3. Unknown	
		4. Unknown		4. Drunk Driving	4. No Injury		
				5. Use of Mobile Phone	5. Unknown		
				6. Non-Violator			
				7. Unknown			

E. People Other than Drivers Involved in the Crash

Persons Sl. No. (Q. 53)	Person Type (Q. 54)	Occupant of Vehicle No. (col31) (Q. 55)	Occupant of vehicle type (col32) (Q. 56)	Sex (Q. 57)	Age (Q. 58)	Impacting Vehicle No. (col 31) (Q. 59)	Impacting Vehicle Type (col 32) (Q. 60)	Type of Injury (Q. 61)	Safety Device (Q. 62)	Entrapped (Q. 63)

Coding Instructions:

Q.No. 54 *	Q.No. 55 & No. 59 *	Q.No. 56 & No. 60 *	Q.No. 54 *	Q.No. 61 *	Q.No. 62 *	Q. No. 63 *
1. Passenger	Same as No. 31	Same as No. 32	1. Male	1. Fatal	1. Seat Belt	1. Yes
2. Pedestrian			2. Female	2. Injured (Needs Hospitalization)	2. Helmet	2. No
3. Cyclist				3. Injured (No Hospitalization needed)	3. Unknown (Incase of Hit & Run)	

F. Scene Sketch:

G. Crash Scene Photographs*:		
Figure 1:	*Figure 2:*	*Figure 3:*
Figure 4:	*Figure 5:*	*Figure 6:*
Figure 7:	*Figure 8:*	*Figure 9:*
Figure 10:	*Figure 11:*	*Figure 12:*
Figure 13:	*Figure 14:*	*Figure 15:*

* Procedure to capture crash scene photographs is attached in the annexure

H. Vehicle Details			
Vehicle No. (Q-31):			
64. Manufacturer:	65. Model:		66. Trim:
67. No. of Seats: ☐	68. Brakes Damaged	☐ Yes ☐ No	☐ Unknown
69. Brakes Actuation Type	☐ Pneumatic	☐ Hydraulic	☐ Mechanical
70. Brakes Type	Front Brakes	☐ Disc	☐ Drum
	Rear Brakes	☐ Disc	☐ Drum
71. Airbags deployed	Driver	☐ Yes	☐ No
	Front Passenger	☐ Yes	☐ No
72. Driveline Damaged	☐ Yes	☐ No	
73. Tire Burst ☐ Yes	☐ No	74. Fire post impact	☐ Yes ☐ No
75. Total Number of Events:			

I. Vehicle Photographs:

Figure 1: 12 o'clock Angle

Figure 2: 1 o'clock Angle

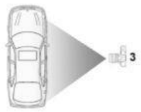


Figure 3: 3 o'clock Angle

Figure 4: 5 o'clock Angle

Figure 5: 6 o'clock Angle

Figure 6: 7 o'clock Angle

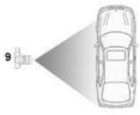


Figure 7: 9 o'clock Angle

Figure 8: 11 o'clock Angle

J. Haddon Matrix:

Phase	Human	Vehicle	Infrastructure
Pre-crash (Crash Prevention)			
Crash (Injury Prevention During the crash sequence)			
Post-crash (Life Sustaining)			

K. Crash Summary

The crash occurred on ___ / ___ / ____ at ___:___ a.m. / p.m. The crash involved ___ no. of vehicles, ___ no. of non-motorized vehicles and ___ no. of pedestrians in the crash. This crash led to ___ no. fatalities, ___ no. of victims suffered major injuries, ___ no. of victims suffered minor injuries and ___ no. of victims suffered no injuries.

Vehicle 1 (car / bus / truck / bike / 2-wheeler / other specify_____) manufactured by _____, with vehicle model _____ carrying ___ no. of occupants.
Vehicle 2 (car / bus / truck / bike / 2-wheeler / other specify_____) manufactured by _____, with vehicle model _____ carrying ___ no. of occupants.
Vehicle 3 (car / bus / truck / bike / 2-wheeler / other specify_____) manufactured by _____, with vehicle model _____ carrying ___ no. of occupants.
Vehicle 4 (car / bus / truck / bike / 2-wheeler / other specify_____) manufactured by _____, with vehicle model _____ carrying ___ no. of occupants.
Vehicle 5 (car / bus / truck / bike / 2-wheeler / other specify_____) manufactured by _____, with vehicle model _____ carrying ___ no. of occupants.

Followed by,
Pedestrian 1: (male / female / other) of ___ years of age.
Pedestrian 2: (male / female / other) of ___ years of age.

K. Crash Summary

Scenario:

Vehicle No. ___ was heading towards ____________ from ____________ on the (right lane / left lane / right shoulder / left shoulder / parked) and was ____________ (ahead of vehicle / behind vehicle / alongside) of vehicle no. ___.
The vehicle/ driver ____(remarks).

Vehicle No. ___ was heading towards ____________ from ____________ on the (right lane / left lane / right shoulder / left shoulder / parked) and was ____________ (ahead of vehicle / behind vehicle / alongside) of vehicle no. ___.
The vehicle/ driver ____(remarks).

Vehicle No. ___ was heading towards ____________ from ____________ on the (right lane / left lane / right shoulder / left shoulder / parked) and was ____________ (ahead of vehicle / behind vehicle / alongside) of vehicle no. ___.
The vehicle/ driver ____(remarks).

Vehicle No. ___ was heading towards ____________ from ____________ on the (right lane / left lane / right shoulder / left shoulder / parked) and was ____________ (ahead of vehicle / behind vehicle / alongside) of vehicle no. ___.
The vehicle/ driver ____(remarks).

Vehicle No. ___ was heading towards ____________ from ____________ on the (right lane / left lane / right shoulder / left shoulder / parked) and was ____________ (ahead of vehicle / behind vehicle / alongside) of vehicle no. ___.
The vehicle/ driver ____(remarks).

Pedestrian no. ___ was ___________ (sitting / standing / walking / crossing the road / others specify: ___________________) and was ____________ (facing away / facing towards / on left side / on right side) of vehicle no. ___.

Pedestrian no. ___ was ___________ (sitting / standing / walking / crossing the road / others specify: ___________________) and was ____________ (facing away / facing towards / on left side / on right side) of vehicle no. ___.

Pedestrian no. ___ was ___________ (sitting / standing / walking / crossing the road / others specify: ___________________) and was ____________ (facing away / facing towards / on left side / on right side) of vehicle no. ___.

Events:

Event no.1: ____ (detail of first event)
Reason: Event no. 1 happened because ____(reason for the event)
Effect: Because of the event ____
____ happened.

Subsequently, event ___ occurred.
Event no. 2: ____ (detail of first event)
Reason: Event no. 2 happened because ____(reason for the event)
Effect: Because of the event ____
____ happened.

Subsequently, event ___ occurred.
Event no. 3: ____ (detail of first event)
Reason: Event no. 3 happened because ____(reason for the event)
Effect: Because of the event ____
____ happened.

Subsequently, event ___ occurred.
Event no. 4: ____ (detail of first event)
Reason: Event no. 4 happened because ____(reason for the event)
Effect: Because of the event ____
____ happened.

Subsequently, event ___ occurred.
Event no. 5: ____ (detail of first event)
Reason: Event no. 5 happened because ____(reason for the event)
Effect: Because of the event ____
____ happened.

Annexure

A. Accident Identification Details

1. FIR Number – The registered FIR Number of the crash.
2. Time of Accident – The time of crash occurrence in hh:mm format.
3. Date of Accident – The date of crash occurrence in DD/MM/YYYY.
4. Name of Place – The locality of the crash occurrence.
5. Police Station – The Police Station under whose jurisdiction the crash occurred.
6. District – The name of the district at which the crash occurred.
7. State – The name of the state at which the crash occurred.
8. Type of Area:
    a. Urban – Any location which falls under a metropolitan city or a municipality.
    b. Rural – Any location which falls under panchayat or gram panchayat.

9. Accident type:
    a. Fatal – A crash in which at least one individual was fatal.
    b. Grievously Injured (Hospitalized) – A crash in which no victims were fatal. But at least one victim has sustained one or more serious injuries. Injuries such as fractures, internal body injury, severe general shock, unconsciousness. Thus, needs hospitalization for medical treatment.
    c. Minor Injury – A crash in which no victims were fatal or hospitalized. But at least one of the victims has injuries and requires first aid.
    d. No Injury – A crash in which no victims were harmed.

10. Number of personalities:
    a. No. of Fatal – The total number of people who were fatal in the crash.
    b. No. of grievously injured – The total number of victims who were hospitalized due to the accident.
    c. No. of minor injured – The total number of victims who were administered first aid but were not hospitalized due to the accident.
    d. No. of non-injured – The total number of victims who were unharmed.

11. Number of Motorized/Non-motorized Vehicles Involved:
    a. Number of Motorized Vehicles – The number of motorized vehicles (s) involved in the accident.
    b. Number of Non-Motorized Vehicles – The number of the non-motorized vehicle(s) involved in the accident.
    c. Number of Pedestrians Involved – Number of victims other than a driver or passenger involved in the crash. Victims attending to a vehicle (e.g., for changing tires, repairing the engine, etc.) are pedestrians.

12. Type of weather:
    a. Sunny – Sunny day, clear skies, slightly cloudy or cloudy with no impedance to visibility.
    b. Rainy – Light rain, showers, heavy rain, intermittent rain, the period after rain during which the roads are still wet/slippery.
    c. Foggy/Misty – Light fog, dense fog, mist or any condition which hampers the visibility by precipitation. (whitish and cloud-like)
    d. Hail/Sleet – Hail, sleet, or any weather conditions which reduces the tire friction due to ice formation.
    e. Others – Weather conditions such as dust storms, night, heavy winds, cyclones etc. The weather under this condition needs to be specified in the space provided.

13. 13. Hit and Run: A crash in which the offending vehicle flees the crash location, or no information is available about the offending vehicle, is Yes. All other cases are crashes are No.

14. Type of Collision:
    A. Collision between – Describes the collision parties involved. For e.g., Vehicle – Vehicle, Vehicle – Pedestrian, etc. Mark all appropriate options. Multiple options may be checked if required.
    B. Crash Configuration: Describes the crash configuration of the crash.
        a. Rear-end collision – If any of the vehicles involved in the crash were hit from behind.
        b. Hit from side/ sideswipe – If any of the vehicles involved in the crash was either hit from the side or right-angle.
        c. Run off-Road – If the vehicle leaves the carriageway or runs off-road.
        d. Overturned/ Rollover – If any of the vehicles involved in the crash has overturned.
        e. Head-on Collision – If the front end of two vehicles hit each other in opposite direction.
        f. Hit Stationary Object – If the crash involves any one vehicle which collided with a fixed object.

B. Road Related Details

15. Road Name – Name of the Road.
16. Direction – The direction to where the road leads.
17. Landmark – Nearby landmark which helps in identifying the exact location of the accident site.
18. Chainage – The chainage of the road (can be approximated from the nearest km stone).
19. GPS Location – The latitude and longitude of the accident location to six decimal places precision.
20. No. of Lanes:
    a. No. of lanes – The total number of lanes on the highway.
    b. Lane of occurrence – Mention the lane on which the crash occurred. For example, Left, Right, Middle, Right Shoulder, Left Shoulder, Median, etc.

Annexure

B. Road Related Details

21. Surface condition:
    a. Paved – covered with a firm surface like paving stones or concrete or asphalt
    b. Unpaved – not covered with a firm surface like gravel road, moorum road.
    c. Wet – having any liquid/moisture content on the road surface
    d. Dry – having no liquid/moisture content on the road surface.

22. Road Type – Road Type describes the category of the road. Check the appropriate road type.
23. Median – The reserved area that separates opposing lanes of traffic on divided roadways. If a median is present along the road, then mark Yes. All other cases are marked No.
24. Ongoing Road works/ Construction – Any accident which occurs in the vicinity of a road construction/repair zone is marked Yes. All other cases are marked No.
25. Speed Limit – Write the speed limit of the road if it is known. Else mark Unknown.
26. Area of Occurrence: It denotes the type of predominant human activity. Only one should be marked.
    a. Residential – If majority of the building near the accident location are houses, residential apartments or housing complexes.
    b. Institutional – If majority of the building near the accident location are institutions like schools, colleges, hospitals or large government establishments.
    c. Commercial – If the accident location is near a market or business centers.
    d. Open Area – If the accident location is near an open ground or field. These locations normally do not have any human activities in the vicinity.
    e. Others – If the accident locations do not fall in any of the above categories, then specify the type of location.

27. Road Features
    a. A – Mark if the road is straight or curved at the location of accident.
    b. B – Mark if the road has a bridge or culvert at the location of accident.
    c. C – Mark if potholes are present on the road at the location of accident.
    d. D – Mark if the location of accident is at a steep gradient (uphill/downhill, ramps, etc.).

28. Road Junction – Check the appropriate junction type if the accident occurred at a junction.
29. Type of Traffic Control (if crash is at a junction) – Check the appropriate type of traffic control at the location of accident.
30. Pedestrian Infrastructure – Check the appropriate type of pedestrian infrastructure at the location of accident. If there are no pedestrian infrastructure provided, mark No.

C. Vehicles involved in Accident:

31. Vehicle No. – Vehicle serial no. is to be recorded as numbers (1,2,3….) to help identify the vehicle involved in the subsequent tables of Road Accident Recording Form.
32. Type of Vehicle – To be filled with the appropriate code given from the coding instruction.
33. Registration Number – Registration Number of the vehicle if available.
34. Disposition – Disposition describes the mechanism used to transport the vehicle from the accident site. To be filled with the appropriate code given coding instructions .
35. Load Condition – Load condition describes the loading condition of the vehicle. To be filled with the appropriate code given coding instructions.
36. Mechanical Failure – Mechanical failure describes the mechanical defects of the vehicle. To be filled with the appropriate code given coding instructions.
37. Model year – The year of manufacturing of the vehicle.
38. Vehicle Movement – Whether the vehicle was in motion (moving) or was parked. To be filled with the appropriate code given coding instructions.
39. Passenger Compartment Intrusion – Whether there were any physical intrusions in the passenger compartment. To be filled with the appropriate code given coding instructions.

D. Driver Details

40. Driver of Vehicle No. – Driver of Vehicle should correspond to Vehicle No. (Q.No. 31) and recorded as numbers (1,2,3….) to help identify the vehicle involved in the preceding table of Road Accident Recording Form.
41. Driver of Vehicle Type – Vehicle type should correspond to Type of vehicle (Item No.32). To be filled with the appropriate code given coding instructions.
42. Sex – The gender of the driver to be mentioned here. To be filled with the appropriate code given coding instructions.
43. Age – The age of the driver of the vehicle involved in the accident.
44. Impacting Vehicle No. – Impacting Vehicle is the vehicle (from question no. 31) which is the other vehicle involved in accident. In case of accidents involving more than two vehicles, multiple vehicles can be referred in the single column.
45. Impacting Vehicle Type – This is the vehicle type of impacting vehicle (question no. 32). To be filled with the appropriate code given coding instructions.
46. Type of License – The category of drivers' license. This item is not applicable for non-motorized vehicle. To be filled with the appropriate code given coding instructions.

Annexure

D. Driver Details

47. License No. – License number of the driver involved in the accident. This item is not applicable for non-motorized vehicle.
48. Intoxication – Mentioned the state of intoxication of the driver involved in the crash. To be filled with the appropriate code given coding instructions.
49. Type of Traffic Violation – To be filled with the appropriate code given at the end of page 2 of the Road Accident Recording Form.
50. Type of Injury – The highest injury severity of the crash. To be filled with the appropriate code given coding instructions.
51. Safety Device – The requisite safety device used by the driver involved in the crash. This item is not applicable for non-motorized vehicle. To be filled with the appropriate code given coding instructions.
52. Entrapped – If the driver is physically restrained by the vehicle or its components. To be filled with the appropriate code given coding instructions.

E. People Other than Drivers Involved in the Accident

53. Persons Sl.No. – The serial number of persons is to be recorded as numbers (1,2,3….) to help identify the number of people other than driver involved in the crash.
54. Person Type – Person type includes all other persons except the drivers, who are involved in the accidents.
55. Occupant of Vehicle No. – Occupant of Vehicle Number should correspond with question no. 31 to help identify passengers of a vehicle.
56. Occupant of Vehicle Type – Occupant of Vehicle Type should correspond with question no. 55 to help identify passengers of a of vehicle. To be filled with the appropriate code given at the end of page 2 of the Road Accident Recording Form.
57. Sex: The gender of the occupant to be mentioned here. To be filled with the appropriate code given coding instructions.
58. Age: The age of the occupants involved in the crash.
59. Impacting Vehicle No. – Impacting Vehicle is the vehicle from Item No. 31 which is the other vehicle involved in the crash. In case of accidents involving more than two vehicles, multiple vehicles can be referred in the single column.
60. Impacting Vehicle Type – It is the vehicle type of impacting vehicle (question no. 59).
61. Type of Injury – Mention the highest injury severity of the crash. To be filled with the appropriate code given coding instructions.
62. Safety Device – The requisite safety device used by the occupant during the crash. This item is not applicable for non-motorized vehicle. To be filled with the appropriate code given at the end of page 2 of the Road Accident Recording Form.
63. Entrapped – If the occupants are physically restrained by the vehicle or its components. To be filled with the appropriate code given coding instructions.

G. Vehicle Details

64. Manufacturer – Mention the vehicle manufacturer involved in the crash.
65. Model – Mention the variant of the vehicle involved in the crash.
66. Trim – A particular version of a model with a particular set of configuration.
67. No. of seats – The number of passengers the vehicle can carry including the driver.
68. Brakes damaged – Mention if the brakes of the vehicle were damaged.
69. Brakes Actuation Type:
    a. Pneumatic – Type of friction brake in which compressed air pressing on a piston is used to apply the pressure to the brake pad needed to stop the vehicle.
    b. Hydraulic – Type of braking system in which hydraulic fluid is used to transmit the brake pedal or brake lever force from the brake pedal or brake lever to the final drum shoes or disc caliper in order to stop the vehicle.
    c. Mechanical – Type of braking system in which the brake force applied on the brake pedal is carried to the final brake drum or disc rotor by the various mechanical linkages like cylindrical rods, fulcrums, springs etc. in order to stop the vehicle.

70. Brakes Type: Mention the type of brake type used
    a. Disc – A type of vehicle brake employing the friction of pads against a disc attached to the wheel.
    b. Drum – A type of vehicle brake in which brake shoes press against the inside of a drum on the wheel.

71. Airbags deployed – Mention if the airbags were deployed in the vehicle for driver and the front passenger.
72. Driveline Damaged – Mention if the driveline of the vehicle was damaged. The driveline of your vehicle transfers power from the engine and transmission to the wheels.
73. Tire Burst – Mention of the tire of the vehicle burst.
74. Fire post impact – Mention if the vehicle caught fire post impact in the crash.
75. Total Number of Events – Total number of crash events for the vehicle.

Annexure

F. Crash Scene Photographs