Road Safety Requirements for Rural Roads

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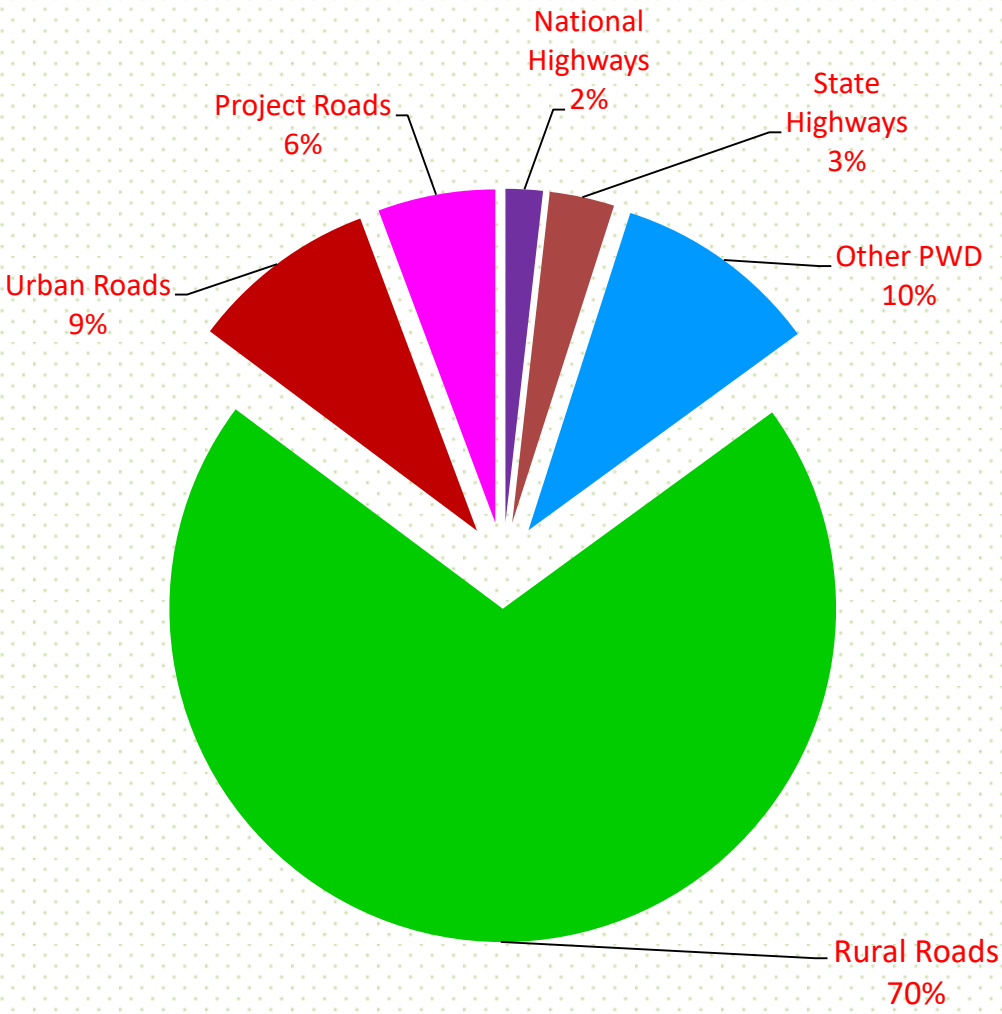
STATUS OF ROAD NETWORK IN INDIA

- **Total length of road network in India: 58,97,671 km**

- **National Highways : 1,14, 158 Km**
- **State Highways : 1,75,036 Km**
- **Other PWD Roads : 5,86,181 Km**
- **Rural Roads : 41,66,916 Km**
- **Urban Roads : 5,26,483 Km**
- **Project Roads : 3,28,897 Km**

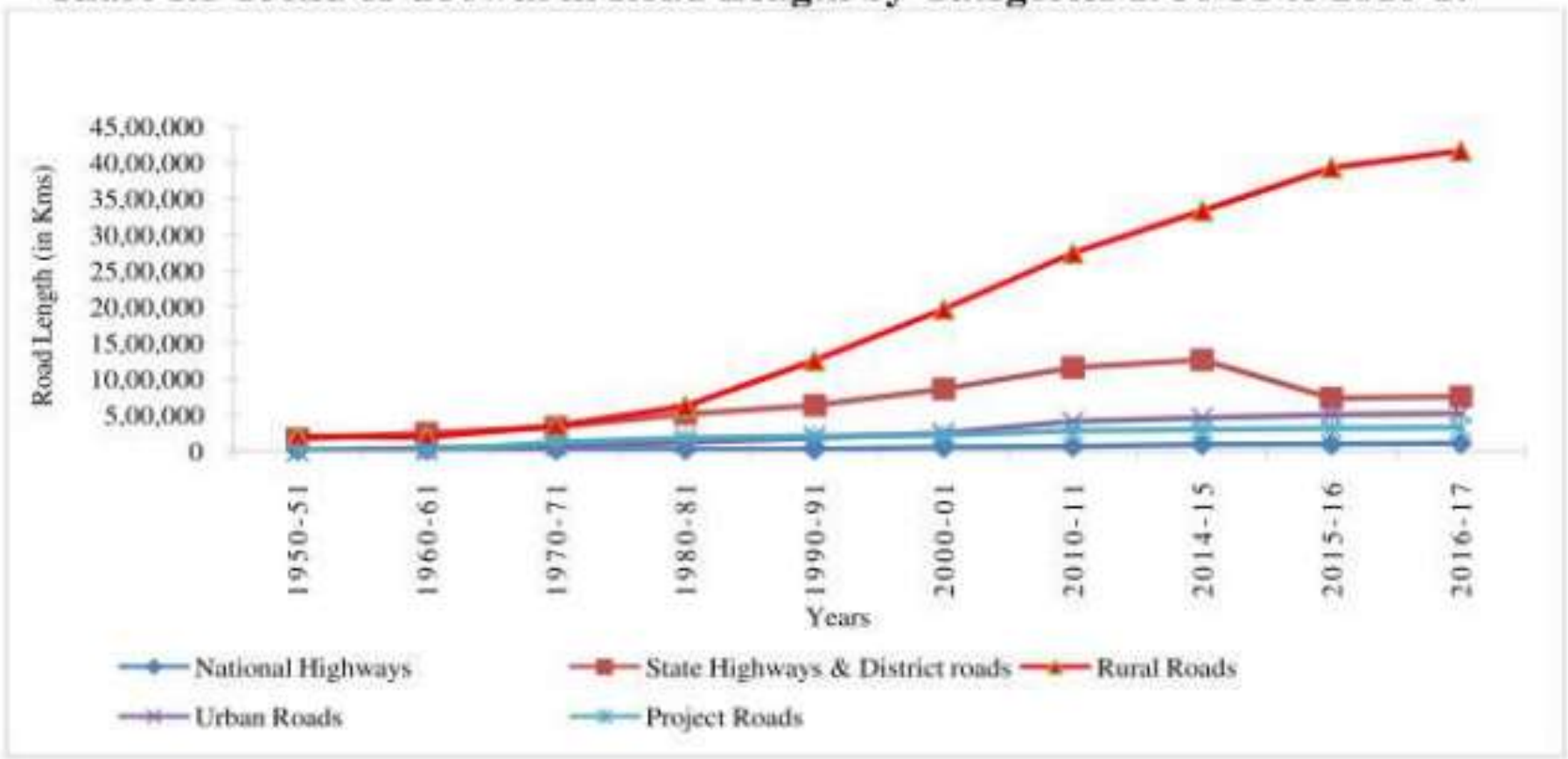


Source: MoRTH (2017)

Growth in Road Length by Category

Source: Basic Road Statistics of India-2017, MORTH

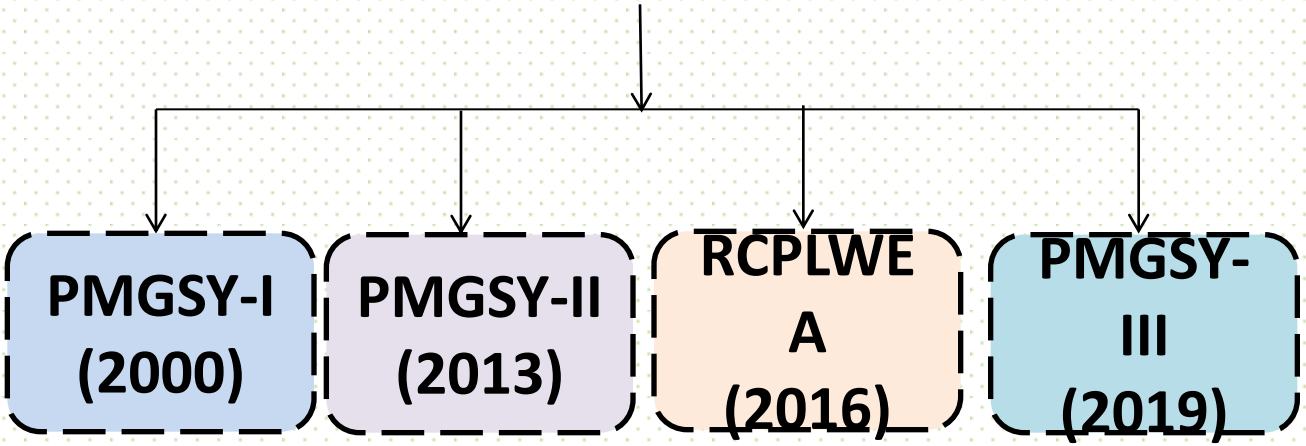
Chart 1.1 Trend of Growth in Road Length by Categories 1950-51 to 2016-17



Overview

Pradhan Mantri Gram Sadak Yojana

PMGSY



	PMGSY-I (2000)	PMGSY-II (2013)	RCPLWEA (2016)	PMGSY-III (2019)
Target	1,78,184 (habitations)	50,000 km	11,320 km	1,25,000 km
Achievement	1,70,004	38,883 km	2,648 km	2,130 km

Salient Features of PMGSY

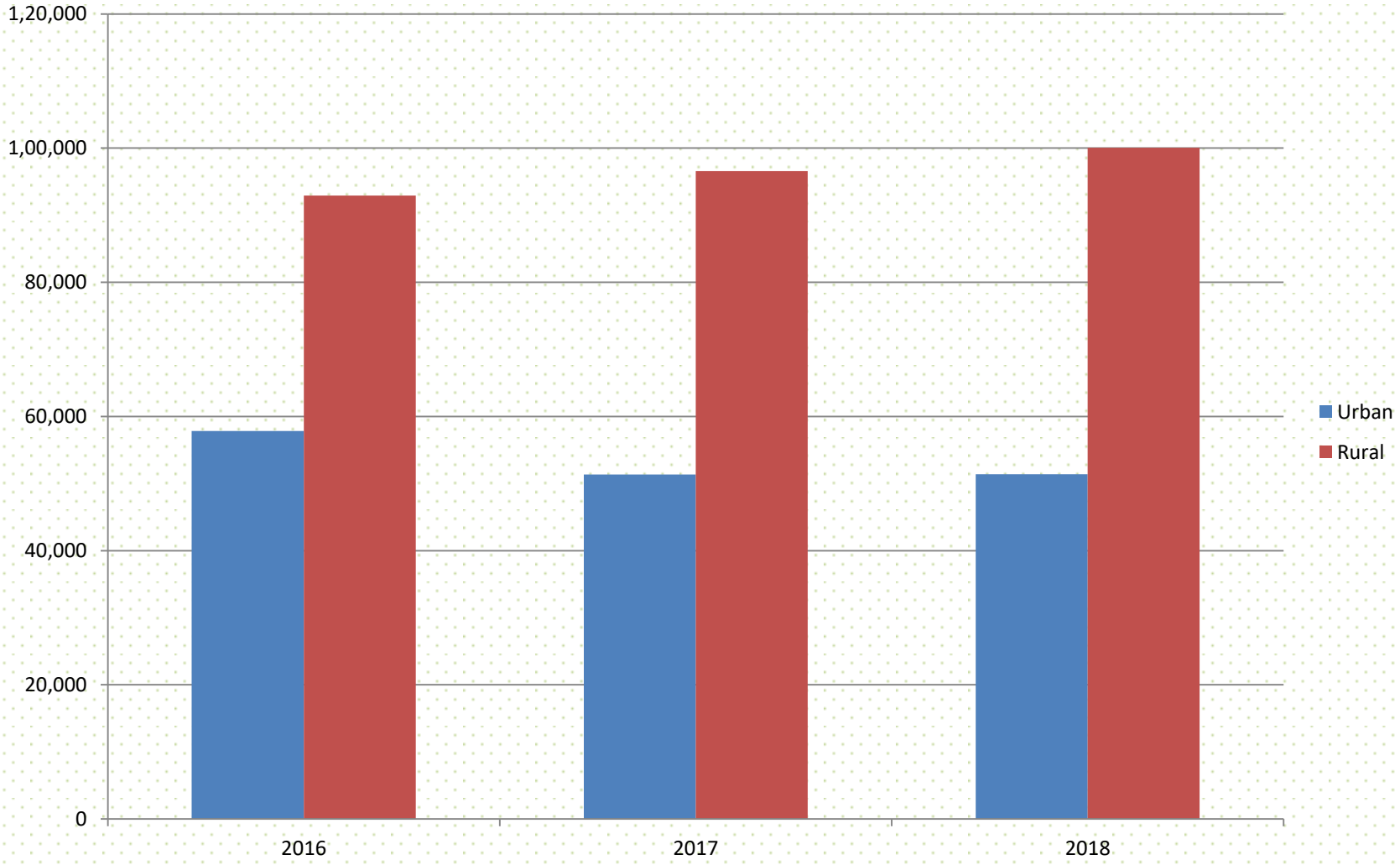
- Decentralized, evidence based planning
- Standards and specifications as per Indian Road Congress (IRC) and Rural Roads Manual
- Dedicated Implementation Mechanism: NRIDA, SRRDA and PIUs
- Detailed Project Reports (DPRs) scrutiny by State Technical Agencies, Principal Technical Agencies and NRIDA
- Strong IT backbone for monitoring and implementation (OMMAS, GEPNIC, eMARG, GIS)
- Three-tier Quality Management System
- Grievance Redressal Mechanism
- Unbroken flow of funds
- 5 year inbuilt maintenance included with performance guarantee of contractor

PMGSY - Implementation Status – Overall

	PMGSY-I	PMGSY-II	RCPLWEA
	99% Habitation Achievement 93% Road Length	78% Completion	28% Completion
Targeted Length	6,44,915 km	50,000 km	11,320 km**
Sanctioned Length	6,44,915 km	49,714 km*	9,296 km
Completed Length	5,98,232 km	38,883 km	2,648 km
Balance Length	31,773 km	10,442 km	6,637 km

*228 km for Andaman & Nicobar and Puducherry under consideration

Number of Fatalities in Urban Vs.Rural Areas



Road Safety Requirements of Rural Roads

- Land being through voluntary donation, compromises on road geometrics not ruled out
  - Speed limit signs
  - Traffic calming measures
- Sometimes, lack of sight distance and visibility at intersection with main roads
  - Traffic calming measures and road signs
- Lack of awareness among local communities
  - Awareness and education campaigns
  - Convincing them for a little extra land for improving geometrics

Safer Rural Roads

- Accident Data Records
- Geometric Characteristics and standards
- Design and layout of intersections
- Road Signs & Road Markings
- Raised Parapets or Crash barriers and delineators
- Traffic Calming measures for speed reduction
- Safety in construction zones
- Road Safety Audit
- Safety through maintenance
- Road Safety Education
- Emergency care
- Embedding safety measures in DPRs

DPR Preparation

- Road Design Brief
- Transect walk summary
- Traffic survey
- Geometric design standards
- Design speed
- Sight distance
- Alignment – Horizontal and vertical
- Camber and superelevation
- Extra widening at curves
- Design of Junctions
- Side slopes
- Checklist for road safety
- Road Safety Audit – IRC:SP-88

Lack of Traffic Control Devices

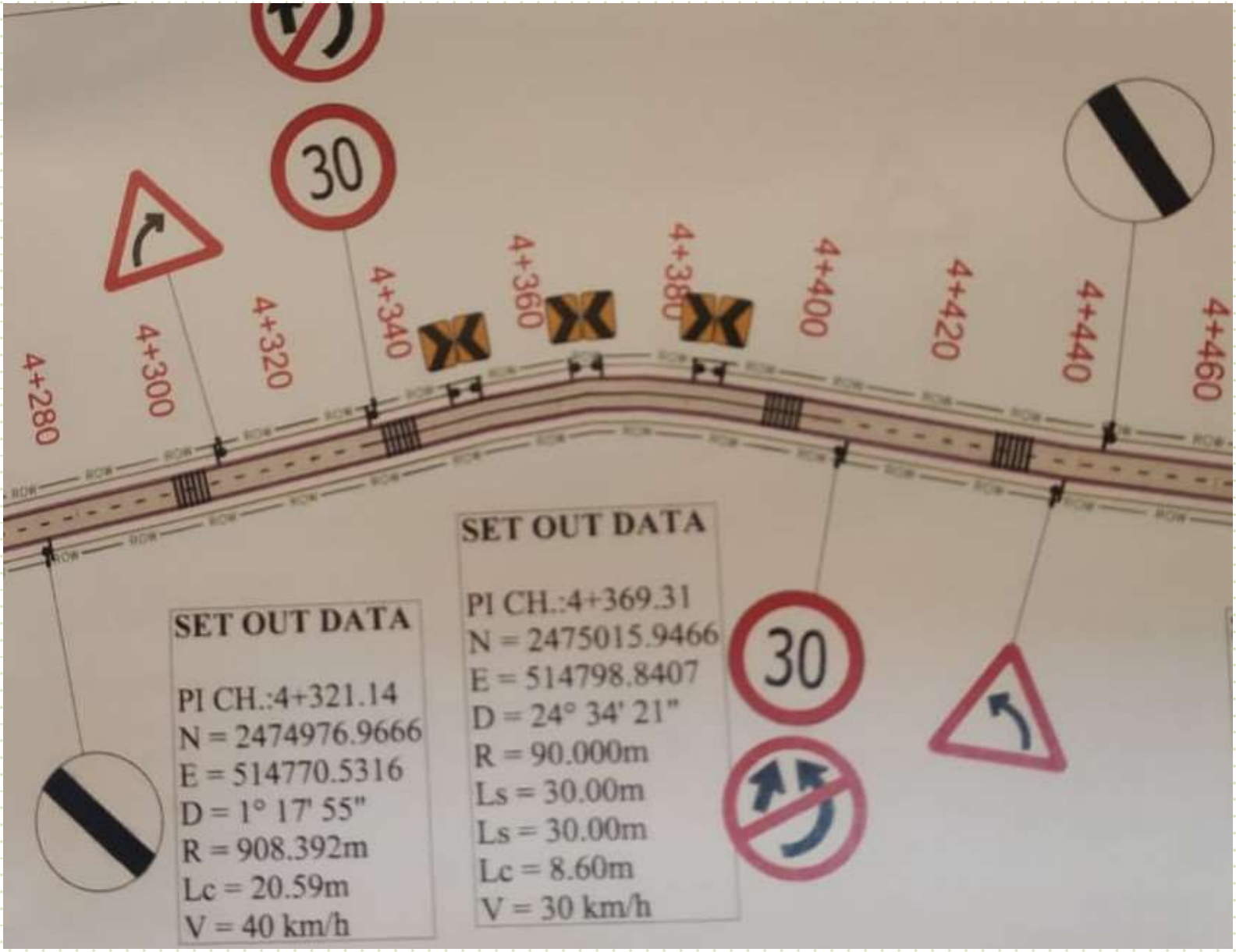
- Traffic Control Devices
  - Signs
  - Signals
  - Markings
    - Pavement
    - Kerb
  - Speed Calming

Horizontal Curves

- Horizontal Curves are Required in Roads because:
  - Obligatory points:
    - points through which the road alignment pass
    - points through which the road alignment must not pass
  - Topography of the area
- Design of curves must allow drivers to negotiate them smoothly and safely.
- Curves should offer enough sight distance so that Vehicles do not:
  - run into each other
  - hit unexpected hazards like:
    - broken down/parked vehicles
    - pedestrians or stray animals

Curves (Without proper sight distance)

Typical Signs &Markings in Curves



Use of Single Chevron Signs to make Curves Safer

Unsafe Junctions

- Junctions are crucial elements of a road network
- Most of the junctions on rural roads are priority junctions
- Minor road vehicles have to give way to major road vehicles
- Road agency has to define major and Minor roads and Priority for vehicles.
- Drivers of minor roads should be controlled in order to yield RoW to major road vehicles
  - Warning signs
  - Appropriate pavement markings
  - Signals (May not be required in rural roads)
  - Speed calming device like speed hump

Unsafe Junctions

Design of Junctions

Take off point of rural roads from higher category road needs to be carefully planned with well-designed intersection.

Following points be kept into consideration for the selection and design of takeoff point:

i. Take off should be perpendicular to higher category road. In any case, the angle should not be less than 70^{0}'
ii. It should preferably be at flat ground level (zero grade).
iii. The intersection should be designed as 'priority' intersection.
iv. The intersection should have prescribed sight distances.

Priority Junction
(Controlling Minor Road Vehicles)

Minimum Sight Triangle

Reference IRC 66 - 1976

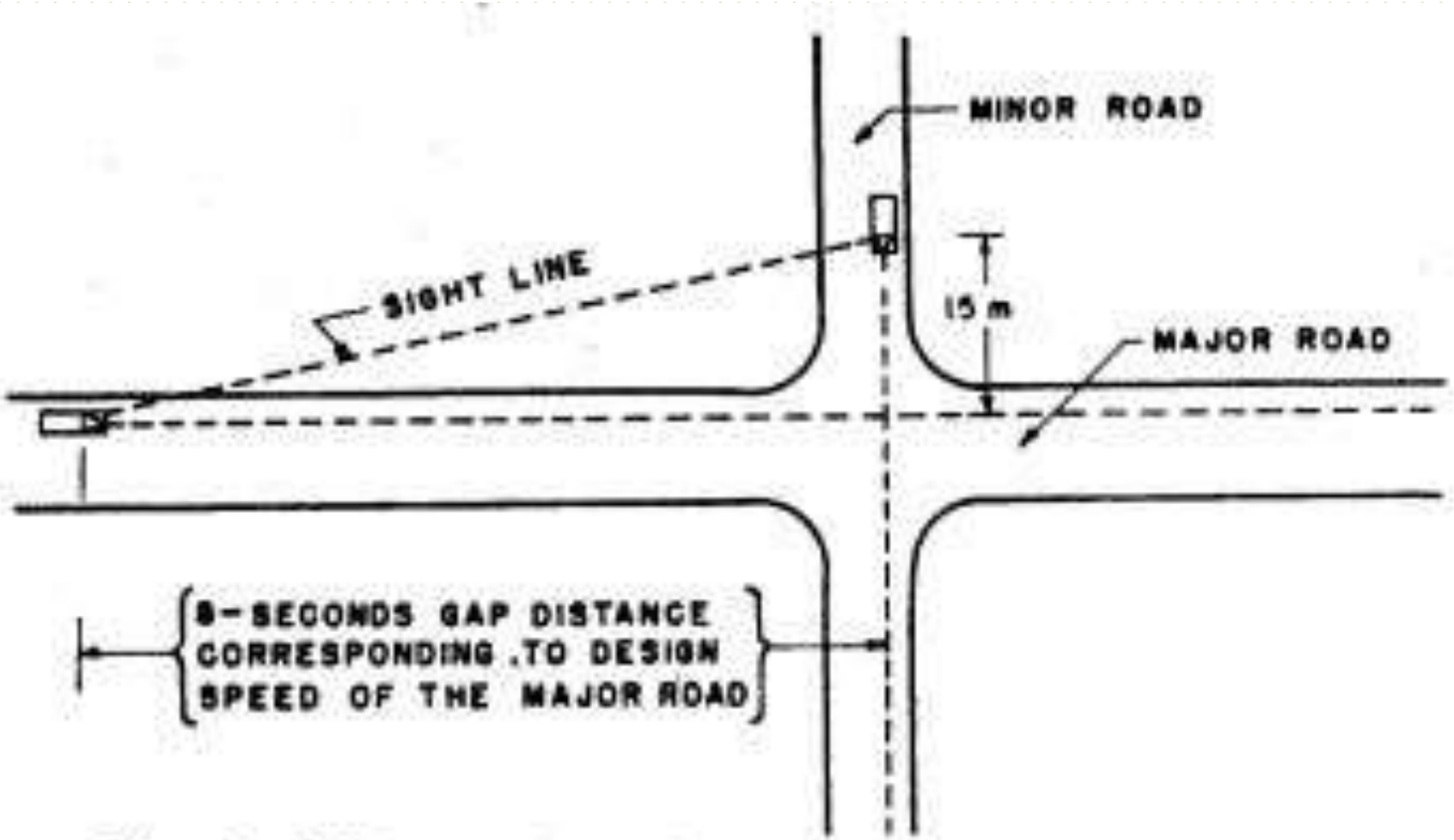
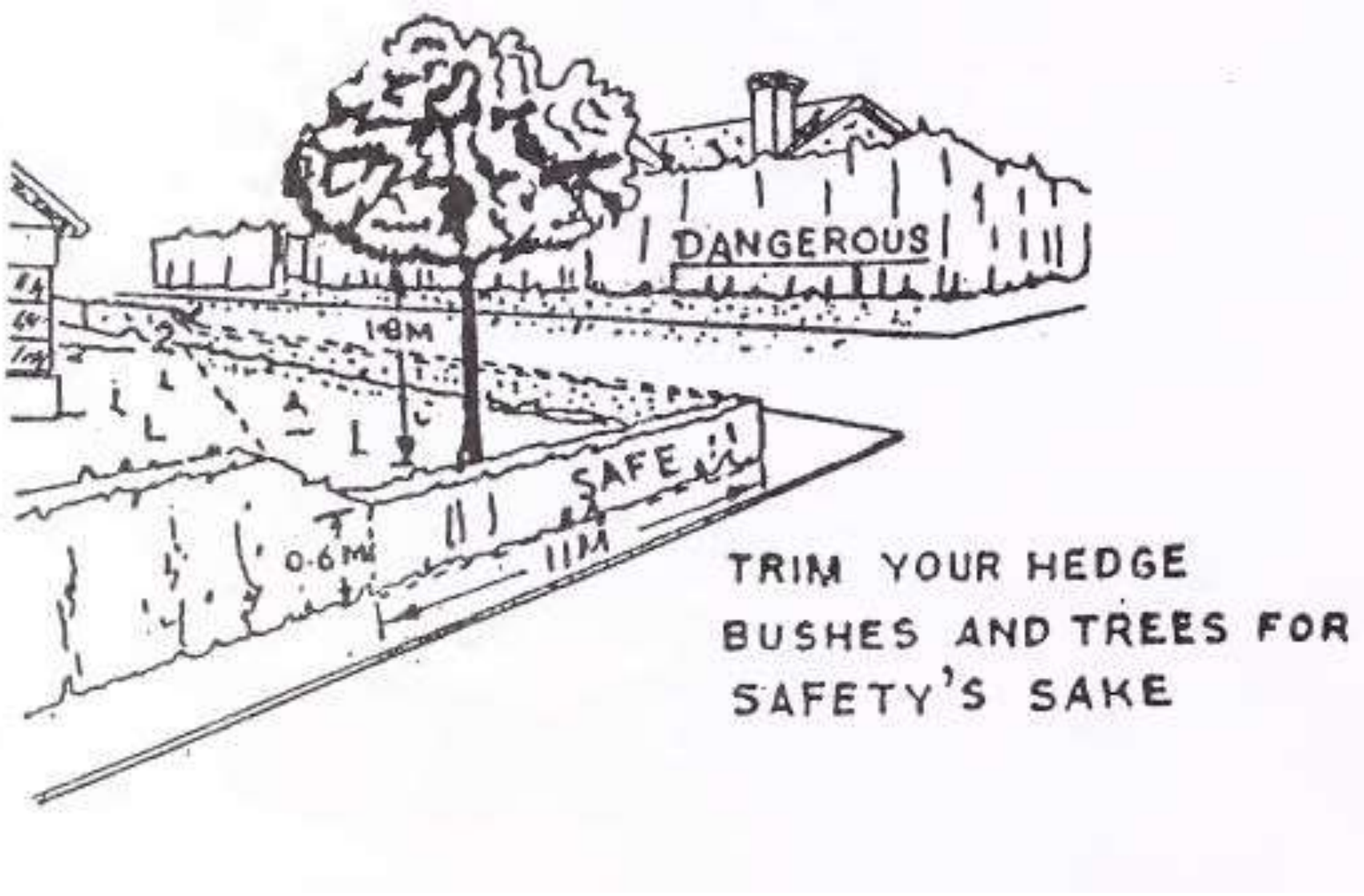


Fig. 4. Minimum sight triangle at priority intersections

Trimming of Trees/Hedges at Corners

Reference IRC SP 41 - 1994



Water bodies close to carriageway

- Rural roads alignments invariably pass close to many water bodies.
- General practice by road designers is to elevate the alignment.
- Many rural roads elevated alignments are not protected
  - Risk to the road itself
  - Risk to vehicles

Unprotected Water Bodies

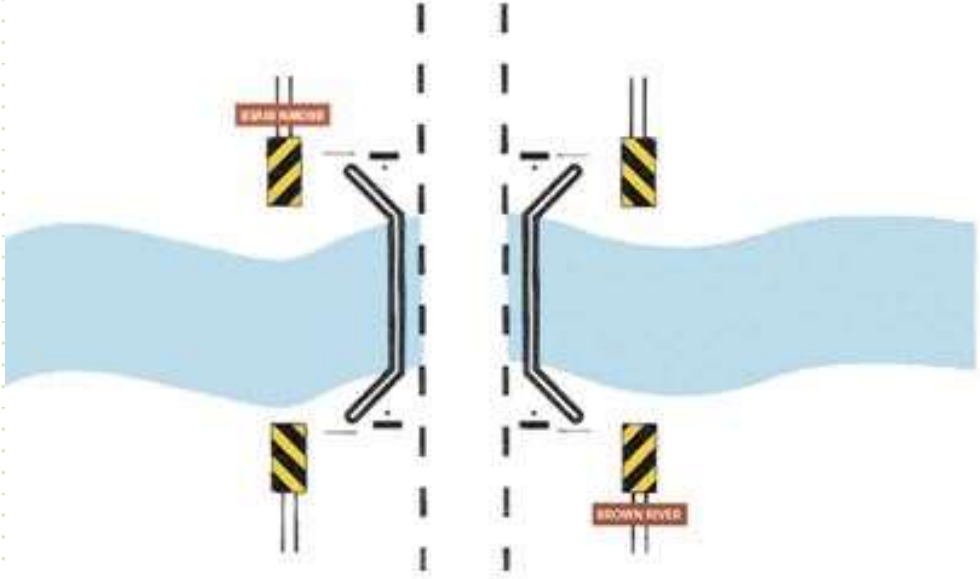
Unsafe Cross-Drainage Works

- Rural road alignments pass close to water bodies
- Cross-Drainage structures are required to allow water to pass from one side to another.
- Cross drainage structures should be designed and maintained properly
- Many culverts and minor bridges are not designed and maintained properly
- CD works become Road Safety Hazards for either vehicles or pedestrians

Unsafe Cross-Drainage Works

Safety at Cross-Drainage Structures

Reference: PMGSY-III Template



Sharp Corners in Habitations

Improper Shoulders

- PMGSY guidelines:
  - *"shoulder width on rural roads may preferably be 1.8 m to 2.4 m, but should never be less than 0.6m"*
  - *"where a large number of slow moving vehicles like animal drawn carts and bicyclists are to use the shoulder, a minimum width of 1.2m is considered necessary*"
- Not having enough shoulder width or having an improper shoulder is a recognized Road Safety Hazard
- Wide, strong and shoulders levelled with pavement are required to ensure safety
- C/W + Shoulders should be enough for two standard trucks/busses of 2.44 m width to cross each other

Improper Shoulders

Safe Shoulders

- Adequate space for VRUs such as pedestrians and cyclists
- If separate provision for their movement is not made, then they would use and share same road space as by motorized vehicles which could be dangerous for them.
- Rural Roads Manual prescribes 3.75 m width of carriageway and 7.5 m width for roadway.
- Therefore, width of 1.875 m should be available on both sides for shoulders.
- This width meets the requirement of minimum width of 1.8m, prescribed for pedestrian movements, by IRC: 103- 2012.
- Maintaining this width with well compacted gravel material would greatly facilitate pedestrian movement especially for school going children.

Safe Shoulders

Schools & Public Buildings

- In habitations, it is highly likely that the alignment will pass close to schools and public buildings
- Lot of vulnerable road users like school children, pedestrians and bicyclists are likely to share the road carriageway with vehicular traffic.
- Vehicular conflicts with vulnerable road users are not safe

Schools & Public Buildings

Trees and Poles close to C/W

- Trees & Electrical poles near C/W or on Shoulders are common on rural roads.
- Reluctance to cut down old/big trees due to formalities involved in getting approvals
- Formalities involved in shifting electrical poles
- Vehicles might crash into them if they are not visible from within the Safe Stopping Distance.
- More risk at night if they are not well painted/ marked with retro-reflective paints/stickers.

Trees and Poles close to C/W

Open Drains Close to C/W

- Uncovered roadside drains are roadside hazards
- Especially at night, the uncovered road side drains can are a danger to Vehicles as well as Pedestrian

Issues and Challenges for NRIDA/MoRD

- Size:
  - Country
  - Road Network
  - Work Force
- Diversity among States and UTs:
  - Social & Cultural
  - Topography
  - Weather
  - Soil & Foundations
- Prevailing Technology and Engineering Practices

Issues and Challenges Addressed by NRIDA/MoRD

1) Road Safety Manual published in 2011
2) With support of ADB/MoRD/NRIDA, Capacity building programs organised
3) Designed and offered 2-Week and 6-Week certified Road Safety Courses through our partner organizations like IATD, CRRI and IAHE
4) During PMGSY-II, MoRD/NRIDA released a Road Safety Audit Handbook and encouraged Road Safety Auditing
5) Empaneled about 800 Road Safety Auditors.
6) Started Road Safety Audits at different stages on rural roads funded under PMGSY-II.
7) In PMGSY-III, MoRD/NRIDA have prepared a DPR preparation Template to assist the consultants and states in preparing good quality DPRs.
8) In line with Supreme Court Committee on Road Safety , DPR Stage Road Safety Auditing of all rural roads more than 5.0 Km in length at Design Stage.
9) A Road Safety Audit module on OMMAS portal where Audit Reports have to be entered by the States.
10) Action Taken on RSA reports are being monitored by MoRD /NRIDA.

Issues and Challenges Addressed by NRIDA/MoRD

11) In ADB assisted States organised Road Safety Education Programs in schools and promotion of Road Safety Activities through pamphlets, audio and video clips.

12) Realizing that rural road junctions are critical road elements with scope for accidents MoRD/NRIDA has chosen a prestigious NIT to prepare Junction Drawing Templates for different geometric and terrain conditions.

13) 5-Pillar Architecture for Road Safety proposed by UN:

   a. Road Safety Management
   b. Safer Roads
   c. Safer Vehicles
   d. Safer Road Users, and
   e. Emergency Medical Response

14) MoRD/NRIDA have prepared Draft Rural Road Safety Action Plans for the 5 ADB states MP, CG, Odisha, ASSAM and WB. The Action Plan identifies and enumerates various activities and tasks under each activity, responsible stake holders, methods of monitoring achievement of each task, time-line and budget for each task.

Before and After RSA Scenario

- The change is not ‘dramatic’
- Efforts by NRIDA/MoRD and support of ADB are visible on the ground
- There is definite progress – slowly but surely
- From complete ignorance and disregard to road safety issues, NRIDA/MoRD has been able to raise road safety awareness and concern among road engineers.
- Case studies…

Before and After RSA Case Studies

Before and After RSA Case Studies

Before and After RSA Case Studies

Issue: low parapet wall

Solution: height of parapet should be raised and there should be hazard marking

Issue: rain cuts

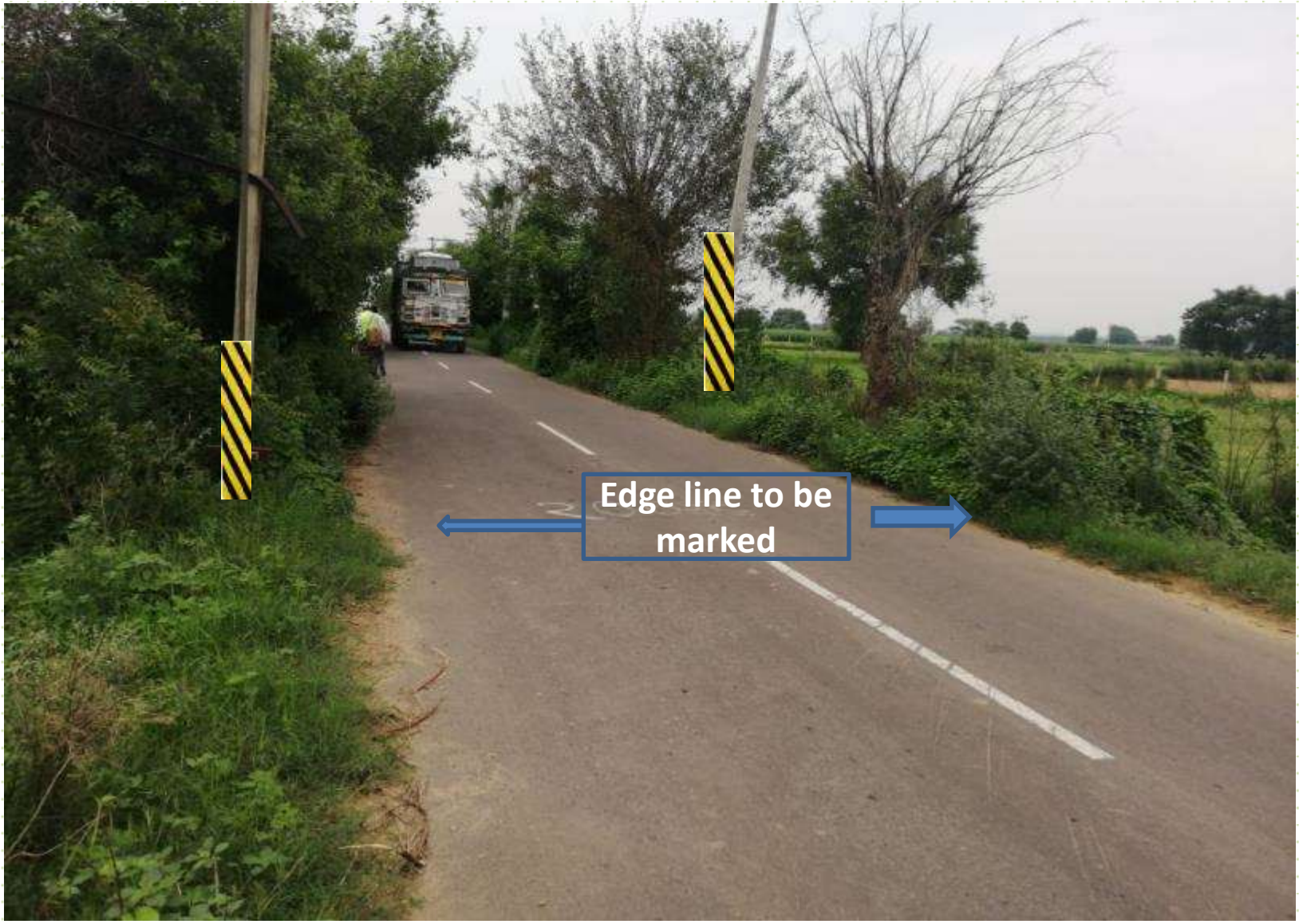
Solution: rain cuts should be filled and shoulder to be properly maintained

Issue:-
Road Edge Breaking

- Solution: Proper shoulder should be maintained

Issue:- Visibility obstructed

- Solution:- Vegetation should be removed from the shoulders.
- Tree branches should be trimmed
- Poles to be shifted or hazard marking on electric poles


Edge line to be marked

Factors Critical to Enhancing Road Safety

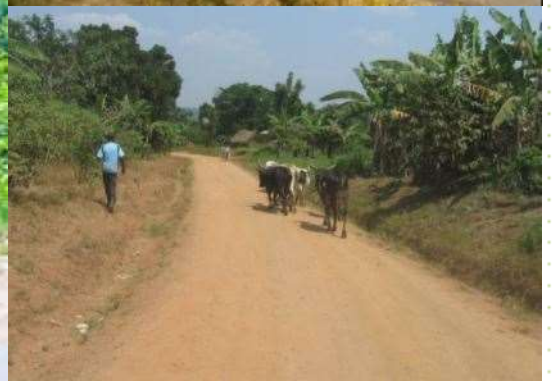
- Orientation to needs and concerns of road users particularly most **vulnerable road users**
- **Resources** (technical plus financial) commensurate with the extent of safety problem seen on roads
- **Coordinated approach** with the government, private sector, academia, research institutions and other stakeholders and exchange of information on the **best practices**
- **Enhancement of professional knowledge** in safety related actions **of all stakeholders** through Workshops, seminars, interactive dialogues
- Road safety programs driven by scientific principles and evidence based research **in our own milieu**
- Network with international institutions, learn from international practices
- Safety engineering measures integral part of DPR and road safety audit a practice

Vulnerable Road Users (VRUs)








VRUs Come in all Shapes and Sizes









Include Road Safety Provisions in DPRs

- Include Road Safety Provisions in SBD
- Dedicate a small share of Road Construction Cost to Road Safety Provisions
- Provide Traffic Control Devices generously – They Prevent Injuries and Save Lives
  - Signs
  - Markings
  - Studs/Cat Eyes
  - Roadway Delineation
  - Signals
  - Speed Calming
  - Traffic Islands

Types of Speed Calming

- Physical Speed Calming
  - Speed Humps
  - Thermo-Plastic Stripes
  - Rumble Stripes
  - Textured Pavements
  - Mini-roundabout
  - Trapezoidal Hump (Not recommended for Rural Roads)
- Psychological Speed Calming
  - Getaways

Speed Calming – Humps

Reference IRC 99 - 2018

Suitable Locations:

1) Before Hazards on Straight Roads
2) Just Before/Inside Habitations
3) On Minor Roads before Junctions

Unsuitable Locations:

1. On Horizontal Curves
2. Approach Speeds more than 30 Kmph

Precautions:

1. Must follow design standards
2. Signs are Mandatory
   a) Speed Limit Warning
   b) Speed Hump Warning
   c) Type of Hazard (School, Blind Curve or other hazards)
3. Regular Maintenance

Rumble Strips - India

Rumble Strips - Design

- Coarse Textured Rumble Strip made of premix or any other equivalent material of 200-300mm wide and of 20-30mm height and 1000mm apart (set of six strips).

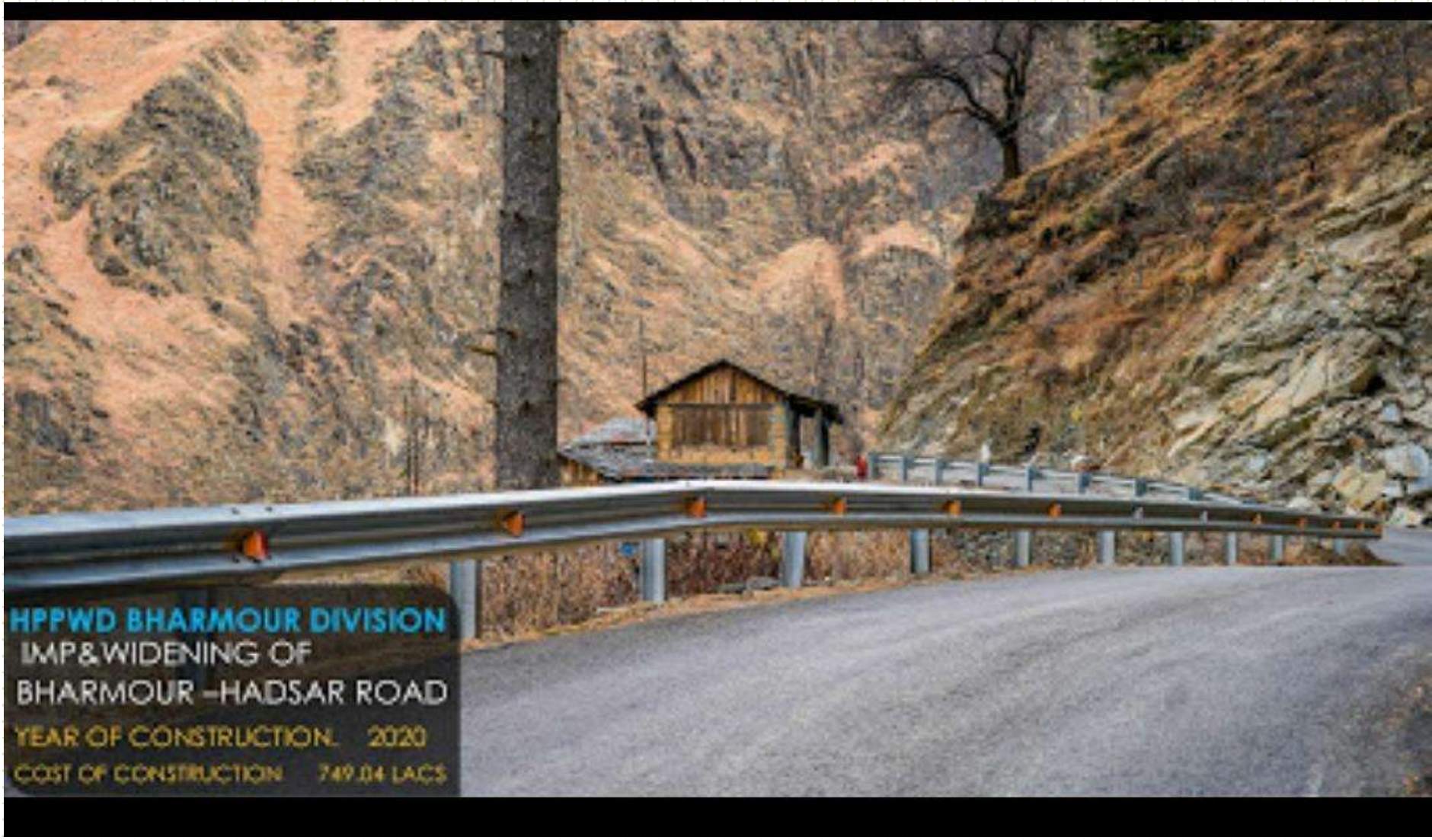
Design Issues in Hill Roads

- Poorly designed curves
- Required crash-barrier not provided
- Narrow shoulders
- Provision of Vision Berms on blind curves ignored
- Insufficient visibility/flaring at intersections
- Blocked visibility
- Poor sidewalks
- Improper placement of road signs or Signals
- Improper drainage

Issues of Maintenance- Hill Roads

- Potholes
- Road erosion
- Shoulder drops
- Broken crash-barriers
- Failure to remove roadway debris
- Failure to maintain signs and signals

Safety Measures-Hill Roads



Safety Measures- Hill Roads

Safety Measures-Hill Roads

Thank You!