Signage fixed on Roadside Hazards

Avoid Clustering of Signs

Night Visibility on Project Highway

PAVEMENT MARKINGS PROPOSAL
Pavement Marking

It **Guides & Controls** traffic on a highway

- It help in **delineation of traffic path** and its lateral clearance from traffic hazards facilitating safe movement
- It **channelize the pedestrians & cyclists** movement into safe location
- Road markings normally include **longitudinal markings, transverse markings, text and symbols** etc. on the road surfaces

---

Zebra and No Overtaking Pavement Marking

---

Transverse Bar Markings
Markings of Ghost Island

Roadway Delineators

Signs and Markings on Intersections

- Intersection on 2-lane road with sizable right turning traffic and 3m wide ghost island created with markings in land constrained conditions
Signs and Markings on Intersections

- Intersection on 2-lane road with sizable right turning traffic and physical island created with storage lane

LIGHTING SCHEME
Solar Lighting on Hill Roads

Lighting poles fixed on concrete crash barrier protrude pole foundation towards Carriageway

Electric Wires Should be Concealed inside VUP/PUP

Street Light with Blinkers
Methodology for Fixing of Lighting Poles on ROB’s / Flyovers

KM and HECTOMETER STONES

Methodology for Fixing of Hectometre Stones / 200m Stones as per IRC: 26-1967

Methodology for Fixing of Hectometer Stones as per IRC: 8 - 1980
BUS BAY AND TRUCK LAYBY

Provision of Bus Bay

- **Bus bays:** to be provided safe side or avoid conflict with moving traffic
  - It should be located at least 60 m away from minor intersections
  - Preferably located where the road is straight on both side
  - Bus stops shall be away from structures (Bridges)

Source: IRC:SP-73

Provision of Bus Bay

- On Main Highway in Plain Terrain
- On Main Highway in Hilly Terrain

Provision of Bus Bay

- On Main Highway in Plain Terrain
- On Main Highway in Hilly Terrain
Provision of Truck lay bye

Truck lay bye: to be provided safe side or avoid conflict with moving traffic
- It shall be located near to check barriers, interstate borders or as per field survey
- Preferably located where the road is straight on both side

Source: IRC:SP-84

Provision of Truck layby

Bus Bay Provided Intersection - Unsafe

Safety Audit For Pedestrian Facilities
Pedestrian Provisions on Intersections

- Provide safe crossing of pedestrians
- Pedestrian paths should be as short as possible
- Pedestrian paths shall be delineated by Zebra stripes
- On intersection arms, pedestrian railings shall be fixed to confine pedestrian movement and crossing the road
- Provide Central Refuge in case the width of road to be crossed more than 10m
- Footpath shall be sloped 1 in 12 in case of curbed footpath
- Provide gap in raised median for safe passage of wheelchair.
- Provide textured paving tiles (Tactile) for safe movement and crossing of road by visually blinds

Pedestrian Crossings- At Grade

- Uncontrolled Crossings: marked by studs or paint line but not controlled by signals generally in case of mid blocks

Pedestrian Facilities

DRAINAGE
Highway Drainage

- It is a process of removing and controlling excess surface and sub-soil water within the right of way.
- It includes interception and diversion of water from the road surface and sub grade.

Major Drainage Design Aspects

- Quick Draining of surface water from the carriageway and shoulder without allowing it to percolate to sub grade.
- Quick Draining of Sub Surface Water.
- Prevent Excessive Collection of Surface water from adjoining land.
- Side drain should have sufficient capacity and longitudinal slope to carry away all surface water collected.
- Flow of surface water across the road and shoulders and along slopes should not cause formation of cross ruts or erosion.

Side Drains (Hilly Terrain)

- 60cm Road surface
  - 30 cm
  - Sand Bed
  - 100mm Thk, Stone pitching
  - 20-25mm Thk, 1:4 Cement-sand mortar
  - 50mm Thk, Bed concrete

- 60cm Road surface
  - 10 - 20cm
  - Sand Bed
  - 15cm
  - R R Masonry in cement mortar
  - 1:4 or Precast cement concrete of M-25 Grade concrete
  - 50mm Thk, Bed concrete
Deep Drains Leading to Accidents

Drains on Intersections

Rotary Drainage

Intersection Drainage
Cutting Section Drainage

Provided on Hill Slopes to intercept storm water flowing from upper reaches and guide such flow onto culverts.

Should be regularly cleaned and repaired.

Catch Water Drains

Bridge Deck Drainage

Retaining Structure Drainage
Safety Barriers?

1. Reduce Severity of Accidents
   i. When Vehicle Lose Control
   ii. Vehicle Runoff from the Road

2. Reduce Impacts to Occupants

3. Reduce Damage to Properties

Protection for Roadside Hazards

Valley side of hill road and outer edge of sharp curve which require more than 15 kmph speed reduction shall be provided with reflectors @ 8m

i. On valley side install W-beam or Gabion safety barrier 1m x 1m, if 2m clear zone is available from edge of carriageway

ii. W-beam or Gabion safety barrier on approached to bridges

iii. W-beam or Gabion safety barrier on outer edge of sharp curve

iv. Provide Crash barrier in front of HT line/transformer located adjacent to carriageway

v. Provide Hazard Marker signs in flot of objects falling within roadway
### Safety Barriers Performance

<table>
<thead>
<tr>
<th>SI #</th>
<th>Barriers Types</th>
<th>Yield /Deflection</th>
<th>Action of Barrier Impact</th>
<th>Impact Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Flexible Barrier e.g., Cable (wire) type barrier</td>
<td>Maximum (1 to 1.5m)</td>
<td>Carries Containment by Considerable deflection and Redirect</td>
<td>Negligible</td>
</tr>
<tr>
<td>2.</td>
<td>Semi Rigid Barrier e.g., Steel beam type</td>
<td>Moderate (0.1 to 0.5m)</td>
<td>Offer resistance to control deflection and Redirects</td>
<td>Moderate</td>
</tr>
<tr>
<td>3</td>
<td>Rigid Barrier e.g., Concrete barrier</td>
<td>Nil</td>
<td>Don’t Deflect. Redirect only small angle impacts</td>
<td>Highest if impact angle is large</td>
</tr>
</tbody>
</table>

### Parapet Walls on Retaining Walls

### Unsafe Parapet Walls

### Barriers for Bridge Rail Ends
Metal Beam Crash Barrier fixed Before Kerb

Correct Method of fixing Metal Crash Barrier

Safety Barrier Required on Outer Edge of Curve

Night Visibility of Metal Crash Barrier

Night Visibility of Metal Crash Barrier
MBCB & CCB Connection

MBCB on Bridge and Causeway

Gabion Safety Barrier on Bridge and Causeway

Parapet Provision between Bridges
SLOPE PROTECTION

Slope Protection Measures: Geogrids

Slope Protection Measures: Geocells

Slope Protection Measures: Sand Bags/Geotextile
Slope Protection Measures: Gabion Protection

Slope Protection Measures: Wire Mesh

Slope Protection Measures: Breast Wall/ Retaining Wall/Toe Wall
Slope Protection Measures:
Banded Breast Wall/ Toe Wall

Traffic Calming Measures on Highways

i. Provide Speed Breakers/Rumble strips on both extremities of settlements
ii. Provide Edge line markings and no overtaking markings
iii. Provide Pedestrian Crossing markings and signs
Traffic Calming Measures: Psychological

i. Transverse Bar Markings on both extremities of settlements
ii. Provide Edge line markings and no overtaking markings
iii. Provide Pedestrian Crossing markings and signs

Roadside Hill View Points

Roadside Guest House
Sudershan K. Popli, Master in Transport Planning from School of Planning & Architecture, New Delhi.

He has 35 years experience in the field of Transport Planning, Traffic Engineering, Highway Design, Black Spot Management and Safety Engineering. Presently, Working as Advisor (Road Safety) and contributed towards development of Safety Audit Mobile App, Model Safe Road, DPR Safety Audit, etc.

Worked as Team Leader on design and Safety projects funded by MoRTH, NHAI, NHIDCL, PWDs and International Lending Agencies viz. WB/ADB/AFDB/ITEC and BOT, DBFOT, Annuity, EPC projects.

As Road Safety Auditor cum TL, completed audit of 10,000 lane km at Feasibility, DPR, Construction stage, Pre opening audit and O & M stage of Expressways, 8 lane/6 lane/4/2 lane highways.

Life Fellow of Indian Roads Congress, Life Fellow of Institution of Engineers, Fellow of Institute of Town Planners, Life Member of Institute of Urban Transport. As Member of Indian Roads Congress H 1 Committee-Transport Planning and Traffic Engineering and H 7 Committee-Road Safety and Design, contributed revision of IRC codes 8, 32, 35, 39, 46, 62, 67, 79, 80, 108, 131 and IRC SP 30, 55, 85, 88.


Countries Worked: India, Botswana, Guyana, Kenya, Nepal, Myanmar, Nigeria