International Course on Road Safety

Signage (IRC 67 and IRC SP-055) & Markings (IRC 35)

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July 2023
Introduction
Frequently used short-term measures

- Signboard
- Rumble strip
- Solar Blinker
- Junction
- Road markings
- Pedestrian crossing
- Road studs/cat-eye
- Bar marking
- Speed limit
- Speed breaker
Vienna Convention

• Vienna Convention on Road Signs and Signals, is a multilateral treaty designed to increase road safety and aid international road traffic by standardising the signing system for road traffic (road signs, traffic lights and road markings) in use internationally.
  • India is an acceding party to the Vienna convention
Wearing the Right Hat

client

AUDITOR

DESIGNER
Perception distance

+ Reaction distance

+ Braking distance

= TOTAL STOPPING DISTANCE
# Speed & Distance Traveled

<table>
<thead>
<tr>
<th>Speed (kmph)</th>
<th>Time (1 sec)</th>
<th>Time (2 sec)</th>
<th>Time (3 sec)</th>
<th>Time (4 sec)</th>
<th>Time (5 sec)</th>
<th>Time (6 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>meters</td>
<td>feet</td>
<td>meters</td>
<td>feet</td>
<td>meters</td>
<td>feet</td>
</tr>
<tr>
<td>30</td>
<td>8</td>
<td>27</td>
<td>2</td>
<td>55</td>
<td>2</td>
<td>82</td>
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<tr>
<td>40</td>
<td>11</td>
<td>36</td>
<td>36</td>
<td>73</td>
<td>36</td>
<td>109</td>
</tr>
<tr>
<td>50</td>
<td>14</td>
<td>46</td>
<td>45</td>
<td>91</td>
<td>45</td>
<td>137</td>
</tr>
<tr>
<td>60</td>
<td>17</td>
<td>55</td>
<td>54</td>
<td>109</td>
<td>54</td>
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<td>70</td>
<td>19</td>
<td>64</td>
<td>63</td>
<td>128</td>
<td>63</td>
<td>191</td>
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<tr>
<td>80</td>
<td>22</td>
<td>73</td>
<td>72</td>
<td>146</td>
<td>72</td>
<td>219</td>
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<tr>
<td>90</td>
<td>25</td>
<td>82</td>
<td>81</td>
<td>164</td>
<td>81</td>
<td>246</td>
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<tr>
<td>100</td>
<td>28</td>
<td>91</td>
<td>90</td>
<td>182</td>
<td>90</td>
<td>273</td>
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<tr>
<td>110</td>
<td>31</td>
<td>100</td>
<td>99</td>
<td>200</td>
<td>99</td>
<td>301</td>
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<tr>
<td>120</td>
<td>33</td>
<td>109</td>
<td>108</td>
<td>219</td>
<td>108</td>
<td>328</td>
</tr>
</tbody>
</table>
Which one?

Source: https://mothership.sg/2018/10/taiwan-toilet-elephant-giraffe-sign/
What will you do?

Source: https://ms-my.facebook.com/thenortheasternchronicle/photos/a.2149199991832941/5360931747326400/?type=3&theater
Which one is correct?
Traffic Sign Attributes
Testing-1 (0.75 sec)
Testing-1 (1.0 sec)
Testing-1 (2.0 sec)
Testing-2 (.25 sec)
Testing-2 (.50 sec)
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understandability</td>
<td>The ease with which the symbol can be <strong>understood</strong></td>
</tr>
<tr>
<td>2</td>
<td>Reaction Time</td>
<td>How <strong>quickly</strong> the meaning of the sign can be identified</td>
</tr>
<tr>
<td>3</td>
<td>Legibility Distance</td>
<td>Greatest <strong>distance</strong> at which the symbol can be clearly “read”</td>
</tr>
<tr>
<td>4</td>
<td>Glance Legibility</td>
<td>The ease with which the symbol can be read if the symbol is seen for only a <strong>fraction of a second</strong></td>
</tr>
<tr>
<td>5</td>
<td>Conspicuity</td>
<td>The extent to which a sign can be easily <strong>detected</strong> in visually complex environment</td>
</tr>
<tr>
<td>6</td>
<td>Learnability</td>
<td>The extent to which the meaning of a symbol can be <strong>learned and remembered</strong></td>
</tr>
</tbody>
</table>
IRC 67 - 2012
Code of Practice for Road Signs

<table>
<thead>
<tr>
<th>Publication</th>
<th>Date</th>
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<tbody>
<tr>
<td>First Published</td>
<td>March, 1978</td>
</tr>
<tr>
<td>First Revision</td>
<td>July, 2001</td>
</tr>
<tr>
<td>Second Revision</td>
<td>May, 2010</td>
</tr>
<tr>
<td>Third Revision</td>
<td>July, 2012</td>
</tr>
<tr>
<td>Fourth Revision</td>
<td>December, 2022</td>
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</table>
## Overview

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>Purpose, Principles, Placement &amp; Operations, Maintenance, and Uniformity</td>
</tr>
<tr>
<td>Why</td>
<td>Safe, uniform &amp; efficient operation</td>
</tr>
<tr>
<td>How</td>
<td>Orderly movement through notifying road user</td>
</tr>
<tr>
<td>What</td>
<td>Regulatory, warning &amp; information</td>
</tr>
<tr>
<td>Where</td>
<td>Expressways, National Highways, State Highways, Major District Roads, Other Rural Roads, Urban City Roads</td>
</tr>
</tbody>
</table>
| Principals                   | 1. Fulfill a need  
                                  | 2. Command attention  
                                  | 3. Convey a clear and simple meaning  
                                  | 4. Command respect from other user  
                                  | 5. Give adequate respect for user |
| Power to erect traffic signs | Section 116 of MV Act                                                        |
| Duty to obey traffic signs   | Section 119 of MV Act                                                        |
## IRC 67-2012: Table of Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presonnel of the Highways Specifications and Standards Committee</td>
<td>(i)</td>
</tr>
<tr>
<td>1. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2. General</td>
<td>2</td>
</tr>
<tr>
<td>3. Classification of Road Signs</td>
<td>4</td>
</tr>
<tr>
<td>4. Siting of Signs with respect to the Carriageway</td>
<td>6</td>
</tr>
<tr>
<td>5. Orientation of Signs</td>
<td>8</td>
</tr>
<tr>
<td>6. Material for Signs</td>
<td>9</td>
</tr>
<tr>
<td>7. Posts and Mountings for Signs</td>
<td>19</td>
</tr>
<tr>
<td>8. Colour for Signs</td>
<td>19</td>
</tr>
<tr>
<td>9. Size of Signs</td>
<td>21</td>
</tr>
<tr>
<td>10. Visibility of Signs</td>
<td>21</td>
</tr>
<tr>
<td>11. Size of Letters</td>
<td>21</td>
</tr>
<tr>
<td>12. Maintenance of Signs</td>
<td>23</td>
</tr>
<tr>
<td>13. Definition Plates/Supplementary Plates</td>
<td>24</td>
</tr>
<tr>
<td>14. Mandatory/Regulatory Signs</td>
<td>24</td>
</tr>
<tr>
<td>15. Cautionary/Warning Signs</td>
<td>36</td>
</tr>
<tr>
<td>16. Informatory Signs</td>
<td>46</td>
</tr>
<tr>
<td>17. Facility Information Signs</td>
<td>50</td>
</tr>
<tr>
<td>18. Other useful Information Signs</td>
<td>54</td>
</tr>
<tr>
<td>19. Signs for Persons with Disabilities</td>
<td>55</td>
</tr>
<tr>
<td>20. Route Marker Signs</td>
<td>56</td>
</tr>
<tr>
<td>21. Guidelines for Signs on Expressways</td>
<td>58</td>
</tr>
<tr>
<td>22. Guidelines for Signs on Urban and City Roads</td>
<td>60</td>
</tr>
<tr>
<td>23. Sign Plan Examples for Typical Situations</td>
<td>62</td>
</tr>
</tbody>
</table>
Placement & Operations

- Placement & Operations
  - Decision to install through traffic engineering study
  - Should be within the road user's view
  - Conveying proper meaning
  - Provide adequate response time to road users to read and take action at the operating speed
  - Unnecessary road signs should be removed

- Uniformity
  - A standard sign, used where it is not appropriate, is as objectionable as a nonstandard sign.
  - Uniformity assists road users, traffic police and highway agencies by giving everyone the same interpretation message.
  - Uniformity also promotes efficiency in the manufacture, installation, and maintenance
Classification of Road Signs

• **Mandatory/Regulatory signs**: give notice of traffic laws or regulations*.

• **Cautionary/Warning signs**: give notice of a situation that might not be readily apparent*.

• **Informatory/Guide signs**: show route designations, destinations, directions, distances, services, points of interest, and other geographical, recreational, or cultural information*.

*Definitions provided are from MUTCD 2009
A. Mandatory/Regulatory Signs

- **Shape**: Mostly Circular
- **Prohibitions** on vehicle maneuver or vehicle type
- **Positive guidance**
- **Other**

<table>
<thead>
<tr>
<th>Type</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prohibitory</td>
<td>Red Ring</td>
</tr>
<tr>
<td></td>
<td>White background</td>
</tr>
<tr>
<td></td>
<td>Black symbols or arrows</td>
</tr>
<tr>
<td></td>
<td>Diagonal red bar</td>
</tr>
<tr>
<td>Positive guidance</td>
<td>Blue background</td>
</tr>
<tr>
<td></td>
<td>White symbol</td>
</tr>
</tbody>
</table>

Vijay Kovvali
# A. Mandatory/Regulatory Signs

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Sign Name</th>
<th>Purpose</th>
<th>Shape, size &amp; colour</th>
<th>Remarks</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stop Sign</td>
<td>For indication priority of ROW</td>
<td>Shape - Octagonal, Colour - Red</td>
<td>located such that it does not impair major road visibility</td>
<td><img src="image1" alt="Stop Sign" /></td>
</tr>
<tr>
<td>2</td>
<td>Give Way Sign</td>
<td>Assign ROW at intersection</td>
<td>Equilateral triangle with apex downward</td>
<td>Colour - white with red borders</td>
<td><img src="image2" alt="Give Way Sign" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>location at way ahead where vehicle required to slow or stop, say 1.5 m to 12 m</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Prohibitory Sign</td>
<td>Indicates prohibited maneuver</td>
<td>Circular shape, red border, white background, black text</td>
<td>Two wheeler prohibited, bullock cart prohibited etc.</td>
<td><img src="image3" alt="Prohibitory Sign" /></td>
</tr>
<tr>
<td>4</td>
<td>No Parking Sign/No Stopping Sign</td>
<td>To guide for no stop and no parking</td>
<td>Circular with red border and blue background</td>
<td>No stopping/No standing</td>
<td><img src="image4" alt="No Parking Sign/No Stopping Sign" /></td>
</tr>
<tr>
<td>5</td>
<td>Speed limit Sign/Vehicle control Sign</td>
<td>To guide for speed limit</td>
<td>Circular shape, white background, red border, black text and numerals</td>
<td>Signs erected for length and height restricted vehicle advance to the restricted zone</td>
<td><img src="image5" alt="Speed limit Sign/Vehicle control Sign" /></td>
</tr>
<tr>
<td>6</td>
<td>Compulsory Direction control Sign</td>
<td>To guide direction to the vehicle</td>
<td>Circular shape, blue background, white border of 2 mm having symbols in white</td>
<td>Cyclist only, pedestrians only etc.</td>
<td><img src="image6" alt="Compulsory Direction control Sign" /></td>
</tr>
</tbody>
</table>
B. Cautionary/Warning Signs

• Shape Size & Colour
  • Equilateral triangle with apex upwards
  • Red border, black border, and white background

• Location and mounting
  • Should not be mounted on the same post of the Stop/Give-way sign
  • Warning signs should be based on 85th percentile speed

• Examples
### B. Cautionary/Warning Signs

<table>
<thead>
<tr>
<th>Design speed</th>
<th>Size</th>
<th>Side (mm)</th>
<th>Border (mm)</th>
<th>Clear Visibility Distances (m)</th>
<th>Distance of sign from hazard (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50 kmph</td>
<td>Small</td>
<td>600</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>51 - 65 kmph</td>
<td>Medium</td>
<td>750</td>
<td>60</td>
<td>60</td>
<td>45 - 110</td>
</tr>
<tr>
<td>66 - 80 kmph</td>
<td>Normal</td>
<td>900</td>
<td>70</td>
<td>60</td>
<td>110 - 180</td>
</tr>
<tr>
<td>&gt; 80 kmph</td>
<td>Large</td>
<td>1200</td>
<td>90</td>
<td>90</td>
<td>180 - 245</td>
</tr>
</tbody>
</table>
### C. Informatory/Guide Signs

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Sign Name</th>
<th>Purpose</th>
<th>Shape, size &amp; colour</th>
<th>Remarks</th>
<th>Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Direction and Place Identification signs</td>
<td>Give driver advance information for approach, type of junction and identify route within it's network</td>
<td>Rectangular in shape</td>
<td>Types – Advance direction Signs, Destination signs, truck layby, toll booth head etc.</td>
<td><img src="url" alt="Image" /></td>
</tr>
<tr>
<td>2</td>
<td>Facility Information Sign</td>
<td>Information regarding facility and service available in the vicinity</td>
<td>Shape Rectangular Blue Background, White symbol in rectangular block</td>
<td>Types- eating place, resting place, first aid post, toilet, hospital, public telephone, U turn ahead, industrial area</td>
<td><img src="url" alt="Image" /></td>
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<tr>
<td>3</td>
<td>Other Useful Information Signs</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3-a</td>
<td>Parking Sign</td>
<td>Display of parking information</td>
<td>Shape Rectangular Blue Background, White symbol in rectangular block</td>
<td>Types – Auto rikshaw parking, cycle parking, scooter and motorcycle parking</td>
<td><img src="url" alt="Image" /></td>
</tr>
<tr>
<td>3-b</td>
<td>Flood Gauge</td>
<td>To display height of flood level above road level</td>
<td></td>
<td>Installed at causeway and submersible bridges/culvert</td>
<td><img src="url" alt="Image" /></td>
</tr>
</tbody>
</table>

Source: TRL 701 Student Project – Alok Kumar Jha & Saurabh Singh
Sign Siting

- Usually, signs are provided on the left side of the road.
- In the case of hill roads, usually provided on the valley side unless traffic and road conditions warrant these to be placed on the hillside.
- Gantry-mounted signs should be mounted on columns preferably 7 m or more from the nearest traffic lane unless otherwise specified. If not, provide crash barriers.

Source: TRL 701 Student Project – Mehraab, Abhishek, Piyush
• On all roads with or without a kerb and with or without a shoulder, the extreme edge of the ground-mounted sign adjacent to the roadway shall be at a distance of 0.6 m to 3 m from the carriageway or paved shoulder edge depending upon the local conditions.

• For roads with kerbs, it shall not be less than 300 mm away from the kerb line, but in no case shall any part of the sign come in the way of vehicular traffic.

• On kerbed roads, the bottom edge of the lowest sign shall not be less than 2.1 m and not more than 2.5 m above the kerb. On roads without a kerb, the bottom edge of the lowest sign shall not be less than 2 m and not more than 2.5 m above the crown of the pavement. For more details read 4.2, 4.3, 4.4, 4.5
### Table 4.1 Height and Clearance Required for Sign Placement

<table>
<thead>
<tr>
<th></th>
<th>Minimum (mm)</th>
<th>Desirable (mm)</th>
<th>Maximum (mm)</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>600</td>
<td>1000</td>
<td>2500</td>
</tr>
<tr>
<td>B</td>
<td>1000</td>
<td>2000</td>
<td>3000</td>
</tr>
<tr>
<td>C</td>
<td>300</td>
<td>600</td>
<td>1000</td>
</tr>
<tr>
<td>D</td>
<td>2000</td>
<td>2000</td>
<td>2500</td>
</tr>
<tr>
<td>E</td>
<td>2100</td>
<td>2100</td>
<td>2500</td>
</tr>
<tr>
<td>F</td>
<td>5500</td>
<td>6000</td>
<td>6500</td>
</tr>
<tr>
<td>G</td>
<td>750</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>5000</td>
<td>7000</td>
<td>9000</td>
</tr>
<tr>
<td>J</td>
<td>1800</td>
<td>2000</td>
<td>2500</td>
</tr>
</tbody>
</table>

**Fig. 4.1 Siting of Signs with respect to Carriageway (Height and Clearance)**
**Concrete**: Concrete shall be of **M25** grade.

**Reinforcing Steel**: Reinforcing steel shall conform to the requirements of **IS 1786** unless otherwise specified.

**Bolts, Nuts and Washers**: High strength bolts shall conform to **IS 1367** whereas precision bolts, nuts, etc. shall conform to **IS 1364**.

**Plates and Supports**: Plates and support sections for the signposts shall conform to **IS 226** and **IS 2062** or any other stated IS specification.

**Substrate**: The substrate shall be either Aluminum sheeting or Aluminum Composite Material (ACM) conforming to TABLE 6.1

*Source: TRL 701 Student Project – Mehraab, Abhishek, Piyush*
# Sign Material - Substrate

## Table 6.1 Specifications for Aluminum Composite Material (ACM)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Specification for 4 mm</th>
<th>Specification for 3 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Standard Test</strong></td>
<td><strong>Acceptable Value</strong></td>
<td><strong>Acceptable Value</strong></td>
</tr>
<tr>
<td>A</td>
<td>Mechanical Properties of ACM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Peel off strength with retro reflective sheeting. (Drum Peel Test)</td>
<td>ASTM D903</td>
<td>Min. 4 N/mm</td>
</tr>
<tr>
<td>2</td>
<td>Tensile strength</td>
<td>ASTM E638</td>
<td>Min. 40 N/mm²</td>
</tr>
<tr>
<td>3</td>
<td>0.2% Proof Stress</td>
<td>ASTM E638</td>
<td>Min. 34 N/mm²</td>
</tr>
<tr>
<td>4</td>
<td>Elongation</td>
<td>ASTM E638</td>
<td>Min. 6 %</td>
</tr>
<tr>
<td>5</td>
<td>Flexural strength</td>
<td>ASTM C393</td>
<td>Min. 130 N/mm²</td>
</tr>
<tr>
<td>6</td>
<td>Shear strength with punch shear test</td>
<td>ASTM D732</td>
<td>Min. 18 N/mm²</td>
</tr>
<tr>
<td>B</td>
<td>Properties of Aluminium Skin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Tensile strength (Rm)</td>
<td>ASTM E8</td>
<td>Min. 150 N/mm²</td>
</tr>
<tr>
<td>2</td>
<td>Modulus of elasticity</td>
<td>ASTM E8</td>
<td>Min. 70,000 N/mm²</td>
</tr>
<tr>
<td>3</td>
<td>Elongation</td>
<td>ASTM E8</td>
<td>A₅₀ Min. 2%</td>
</tr>
<tr>
<td>4</td>
<td>0.2 % Proof Stress</td>
<td>ASTM E8</td>
<td>Min. 110 N/mm²</td>
</tr>
</tbody>
</table>
**CLASS A SHEETING:** - Engineering and Super Engineering Grade Sheeting as per ASTM D 4956-09 Type I and II.

**CLASS B SHEETING:** - High Intensity and High Intensity Prismatic grade sheeting as per ASTM D 4956-09 Type III and IV.

**CLASS C SHEETING:** - All Micro Prismatic grade sheets as per ASTM D 4956-09 Type VIII, IX and XI.
• Signs shall be provided with retro-reflective sheeting and/or overlay film.
• The reverse side of all signs shall be painted grey.
• Except in the case of railway level crossing signs, the signposts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black.
• For more details refer Tables 8.1 and 8.2.
Signs – Road Type: Colours & Fonts

• Colours

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Background</th>
<th>Arrows/Border/Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressway</td>
<td>Blue</td>
<td>White</td>
</tr>
<tr>
<td>National Highway (NH)</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>State Highway (SH)</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Major District Road (MDR)</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Village Road (ODR &amp; VR)</td>
<td>White</td>
<td>Black</td>
</tr>
<tr>
<td>Urban/City Road</td>
<td>Blue</td>
<td>White</td>
</tr>
</tbody>
</table>

• Fonts

<table>
<thead>
<tr>
<th>Sr No.</th>
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<tr>
<td>2</td>
<td>English</td>
<td>Transport Medium</td>
</tr>
<tr>
<td>3</td>
<td>Regional Language</td>
<td>As per local practice</td>
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Signs – Road Type: Colours & Fonts
Fig. 14.38 Maximum Speed Limit (Vehicle Type)
Recommendations on IRC 67, 2012

• Inclusion of bicycle lanes, pedestrian paths, etc. in carriageway types
• Reference to work zone signs (IRC SP-055)
• Accurate definitions for the usage of the signs
• Targets for states and other agencies to comply with standards
• More Guidance
  • Example from MUTCD 2009: “Excessive Usage - Regulatory and warning signs should be used conservatively because these signs, if used to excess, tend to lose their effectiveness. If used, route signs and directional guide signs should be used frequently because their use promotes efficient operations by keeping road users informed of their location.”
The Cyrus Mistry Crash
Understandability
Understandability
## IRC 35 - 2015

Code of Practice for Road Markings

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<tr>
<td>First Published</td>
<td>October 1970</td>
</tr>
<tr>
<td>First Revision</td>
<td>August 1997</td>
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<tr>
<td>Second Revision</td>
<td>January 2015</td>
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One-way or Two-way?
What do these mean?

- Broken Yellow Line
- Double Solid Yellow Line
- Solid Yellow Line
- Broken White Line
- Double Solid White Line
- Solid White Line
- Dotted White Line
• SECTION 1: INTRODUCTION
• SECTION 2: ROAD MARKING MATERIALS & GENERAL FEATURES
• SECTION 3: CLASSIFICATION OF PAVEMENT MARKINGS
• SECTION 4: MARKINGS FOR ROAD LINKS
• SECTION 5: ROAD STUDS
• SECTION 6: STOP AND GIVEWAY MARKINGS
• SECTION 7: MARKINGS FOR TRANSITION AND LANE CHANGE
• SECTION 8: ARROWS AND WORD MESSAGES
• SECTION 9: MARKINGS FOR AT-GRADE INTERSECTIONS
• SECTION 10: GRADE SEPARATED JUNCTIONS
• SECTION 11: MARKINGS FOR SPEED REDUCTION MEASURES, PEDESTRIAN CROSSING & CYCLISTS
• SECTION 12: MARKINGS FOR BUSES, TRUCK LAY-BY AND TO LL PLAZA
• SECTION 13: PARKING AND RESTRICTIONS
• SECTION 14: OBJECT PAINTINGS
• SECTION 15: PERFORMANCE ASSESSMENT AND MONITORING
• SECTION 16: WARRANTY AND TESTING METHODS
• Road markings are defined as lines, patterns, words except road signs which are applied or attached to the carriageway or kerbs or to objects within or adjacent to the carriageway for controlling, warning, guiding and informing the road users.
Material

<table>
<thead>
<tr>
<th>Thermoplastic</th>
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</thead>
<tbody>
<tr>
<td>• Most used</td>
<td></td>
</tr>
<tr>
<td>• Fast drying time</td>
<td></td>
</tr>
<tr>
<td>• Life of 2 to 3 years</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Solvent-borne and Water-borne</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>• Used in temporary Work Zone</td>
<td></td>
</tr>
<tr>
<td>• Water based are eco-friendly</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cold Applied</th>
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</thead>
<tbody>
<tr>
<td>• Audible</td>
<td></td>
</tr>
<tr>
<td>• Durable and better luminating</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Adhesive Tapes</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>• ASTM D4592-12</td>
<td></td>
</tr>
<tr>
<td>• High initial cost</td>
<td></td>
</tr>
<tr>
<td>• Easy to apply</td>
<td></td>
</tr>
<tr>
<td>• Good for areas with high traffic</td>
<td></td>
</tr>
</tbody>
</table>
• Thermoplastic Markings
  • Mixture of plasticizer and resins that serves to hold all of the other ingredients together
  • Applied hot in molten state adheres to pavement and get solidified immediately at the ambient temperature.
  • Fast drying time, highly durable – 2 to 3 years depending on traffic volumes

• Solventborne and Waterborne Road Marking Paints
  • Oldest form of pavement marking material
  • Short period – work zones, etc.

• Cold Applied Plastics
  • Best for coloured pavement marking
  • Audible raised pavement marking for edge lines
  • Retains original colour longer and higher luminance values

• Preformed Adhesive Tapes:
  • Confirmation to ASTM D4592-12
  • Service life of 3 to 6 months
Colours

- Widely used for road markings
- Used to impose prohibition
- For Public transport, bicycle and IPT
- To distinguish non-motorised road user facilities
- Used for informing about hazards

• Clearly visible at varying speeds.
• Good Retro reflectivity

Source: TRL 701 Student Project – Mehraab, Abhishek, Piyush
• White
  • Because of the visibility and good contrast against the road surface, the white colour should be widely used for road markings.

• Yellow
  • The longitudinal marking in yellow colour should be used to convey message where it is not permitted to cross the markings. Yellow colour is also used to show parking restrictions and to impose other traffic control.

• Blue
  • The blue colour should be used to indicate new and special markings which are not conventional.

• Green
  • The green colour should be deployed to distinguish the bicycle and non-motorised transport facilities provided on the road.

• Red/Purple
  • Where multiple road users are sharing the road space on hazardous locations
Retro-reflectivity

- Use of glass beads for retro-reflectivity
- Quality of glass beads correlates with retro-reflectivity
Marking Performance

• Key Factors
  • Road Surface
  • Traffic
  • Environmental

• Material selection to consider local factors

• Durability & retro-reflectivity performance
  • material composition;
  • application procedure;
  • application machines;
  • roadway surface and
  • presence of immediate traffic.
Pavement Marking Classification

1. Longitudinal
2. Transverse
3. Hazard
4. Block
5. Arrow
6. Directional
7. Facility
Pavement Marking Classification

• Longitudinal Marking (LM):
  • Provided for guiding the traffic movements.
  • Broken lines, single/double continuous lines and continuous lines are longitudinal markings.
  • Broken longitudinal markings can be crossed, while continuous can’t be crossed
  • Provided to direct the forward movement and control the overtaking manoeuvring.

• Transverse Markings (TM):
  • The marking provided across the carriageway for traffic control
  • Broken lines, single/ double continuous lines such as Stop marking and Give way marking
  • Compliance is Vital, as they establish traffic control

• Hazard Marking (HM):
  • Facilitates traffic merging/diverging, prohibiting to cross-over and to deflect the traffic ahead of hazardous situations.
  • Generally done with chevron and diagonal marking, hatch marking and Prohibitory marking
• Block Marking (BM)
  • The zebra crossing for pedestrians, triangular and checkered marking for speed breakers and Giveaway symbol which are painted in blocks on carriageway

• Arrow Marking (AM)
  • Direction for driver to take mandatorily are classified under Arrow Marking

• Directional Marking (DM)
  • The word message which are directional nature are classified under Directional Marking

• Facility Marking (FM)
  • The marking for parking, the word messages for buses, cyclists and disabled ones are classified under Facility Marking
Marking for Road Links (Section 4)

- **Functions**
  - Centre line
  - Traffic Lane
  - No overtaking
  - Warning lines
  - Border/Edge Lines

- **Locations**
  - Undivided Roads
  - Divided Roads
  - Ramp/Slip roads/One way street

Source: TRL 701 Student Project – Mehraab, Abhishek, Piyush
Pavement Marking Classification

• Centre Line:
  • The longitudinal marking are generally provided along the traffic movement. The broken lines, single/double continuous lines and continuity The center lines should be used only on single carriageway roads to separate the opposite streams of traffic and to facilitate their movements.
  • Center line is offset from center location if:
    • Carriageway width transition location
    • Additional turning lanes at junctions
    • Odd number of lanes on vertical and horizontal curves with limited sight
    • distances
    • Urban roads with parking permitted on one side only
    • Urban roads with odd number of lanes with extra lanes allotted to the predominant direction of flow.
    • On curves with extra widening are classified under Longitudinal Marking and abbreviated as LM01, LM02, LM03 etc. for easy referencing
Single/Intermediate Lane Bi-Directional Road (less than 5.5 m)

Two Lane Bi-Directional Road

Two Lane Bi-Directional Road with Paved Shoulder

Three Lane Bi-Directional Road

Six Lane Divided Road (One Carriageway Width more than 10.8 m)
The road studs to be placed on broken longitudinal markings and it shall always be placed at the centre of gap and shall never be upon the line segment or by the side of line segment.

In the case of the road studs to be placed on carriageway having a paved shoulder, it shall be placed outside the shoulder side edge line and shall be set back by 50 mm from the edge line.

In the case of the roads studs provided on median side edge, it is to be again ensured that it shall not be on the median line marking, but shall be in hard strip or kerb shyness width, keeping at least 50 mm set back distance from median side edge line by ensuring a minimum 100 mm clearance distance from the vertical face of the raised kerb.
Road Studs (Section 5)

Colour

- White road studs are to indicate traffic lane line and center of carriageway.
- Red road studs are to be used to indicate a line which should not be crossed, for road studs to be used on shoulder side edge line.
- Used to delineate right side edge of carriageway i.e., median side edge line.
- Green road studs are to be employed to indicate crossable edge line like the lay byes and acceleration/deceleration lanes on left hand side.

Source: TRL 701 Student Project – Mehraab, Abhishek, Piyush
STOP and GIVEWAY Marking (Section 6)

• Stop line indicates the location on the ground beyond which the vehicles should not proceed where it is in laid such as at the vicinity of traffic signals, pedestrian zebra crossings and on minor road approaches merging with major roads it is provided in conjunction with the stop sign.

• Stop lines shall not be used unless traffic control by any one of these means exist.
  • Single Stop Lines
    • Single Stop Line shall be applied in traffic signal and ahead of pedestrian crossing.
    • Single Stop Lines shall ordinarily be located not less than 2 metres and not more than 3 metres in advance from the desired location.
  • Double Stop lines
    • The Double Line is used exclusively at junctions controlled by “STOP” signs.

• Giveaway markings are two broken lines and are generally provided on minor roads at intersection that are not controlled by any traffic controlling measures.
• Diagonal and Chevron marking
  • Channelizing markings like diagonal and chevron markings are utilized to demarcate the neutral area at the nose of a channelizing island which can help in reducing the incidence of collision with kerb nose.
  • These markings provide for proper and safe use of acceleration and deceleration lanes.
  • The basic function is to inform the driver about the area/lane(s) which is set aside for the exclusive use of traffic on the main highway and thus enable the driver to adequately distinguish between through traffic lanes and the acceleration and deceleration lanes.
• Lane Changing and Diverging/Merging lines
  • The lane change and merging/diverging marking are provided to separate the auxiliary/slip lane and through lanes.
  • The lane change and merging and diverging at multilane highways will be critical.
• Hatch markings
  • Where traffic has to be deflected in an unusual situation, mere edge line will not be effective, hatch marking should be considered
• Lane reduction / narrowing situations and transitions
  • The reduction and transition of traffic lanes are frequent and generally carried out in the case of four lane divided carriageway getting reduced to 2-lane bi-directional carriageway condition.
  • In such situations, the drivers should be properly guided to transfer from 4-lane to 2-lane and vice versa. If one or more lanes are to be discontinued, the centre line and the lane lines should be merged in such a way that traffic safely merged on to the reduced number of lanes
Lane Change Marking and Nose Length in Multilane Highways

Four Lane to Two Lane Transition (Concentric)

Hatch markings
• Directional Arrows
  • Directional arrows should be used in advance to guide drivers to correct lane when approaching busy intersections whether signal controlled or not.

• Mandatory Turn Arrows
  • Lane arrows supplemented with the legend “TURN LEFT”, “TURN RIGHT” and “AHEAD ONLY” is prescribed. These versions may be used only where they indicate the effect of a statutory prohibition.

• Guidance Arrows
  • These are marked in the junction area where some guidance to traffic is considered to be helpful.

• Deflection Arrows
  • Deflection arrows are used in advance to warn of the approaching restriction and to direct the traffic to the correct lane and also to warn of a hazard or change of direction and to indicate the side on which traffic should pass.
• **Bifurcation arrows**
  
  • The bifurcation arrow should be provided at the commencement of deceleration lanes on the approach to junctions to guide vehicles ensuring that the full length of the lane is used to slow down for the junction without impeding the through vehicles on the main carriageway.
Table 8.3 Size of Letterings

<table>
<thead>
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<th>Speed</th>
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<td>Up to 50 kmph</td>
<td>1.25 m</td>
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<tr>
<td>51 -100 kmph</td>
<td>2.5 m</td>
</tr>
<tr>
<td>&gt;100 kmph &amp; Expressways</td>
<td>5 m</td>
</tr>
</tbody>
</table>
Markings at At-Grade Intersection (Section 9)

- Available width of approach road
- Minimum width of 3.5m at all cases.
- 4.5m with ghost island
  5m with Physical island
- 4.5m with ghost island
  5m with Physical island
  7m for two lanes approaches

Note: All dimensions are exclusive paved shoulder/hard strip.
At-Grade (Contd.)
At-Grade (Contd.)
Fig. 9.12  Typical Marking for Signalized Junction (Urban Section)
At-Grade (Contd.)

Fig. 9.5 Hatch Marking and Ghost Island
Merging/Diverging (Without Lane Gain/Lane Drop)
MARKINGS FOR SPEED REDUCTION MEASURES, PEDESTRIAN CROSSING & CYCLISTS (Section 11)

NOTE:
- In an Un-Signalised crossing, pedestrian crossing marking shall be around 2 to 3 m from stop line.
- In a Signalised crossing, pedestrian Marking around 1 to 1.5 m in advance of a primary signal.

Fig. 11.3 Pedestrian Crossing

Fig. 11.4 Pedestrian Crossing Marking on Priority Junction
Fig. 11.5 Pedestrian Crossing in Vulnerable Reach (Special Treatment)
MARKINGS FOR BUSES, TRUCK LAY-BY AND TOLL PLAZA (Section 12)

Fig. 12.1 Bus Lane
MARKINGS FOR BUSES, TRUCK LAY-BY AND TOLL PLAZA
(Contd.)

Fig. 12.3 Bus Bay

Fig. 12.4 Truck Lay-by
Fig. 13.1 On-Street Parking
Object Painting (Section 14)

Fig. 14.1
ANNEXURE : A  
(Refer Section 3 Under Para 3.2)  
TABLE : A.2 : TRANSVERSE MARKINGS (TM)  

<table>
<thead>
<tr>
<th>Marking Abbreviation</th>
<th>Type</th>
<th>Length of Line Segment (mm)</th>
<th>Length of Gap (mm)</th>
<th>Width (mm)</th>
<th>Colour</th>
<th>Pattern</th>
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<tr>
<td>TM01</td>
<td>Continuous</td>
<td>One Solid Line</td>
<td></td>
<td>200</td>
<td>White</td>
<td><img src="image" alt="Pattern" /></td>
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<td>TM02</td>
<td>Continuous</td>
<td>One Solid Line</td>
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<td>300</td>
<td>White</td>
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<td>TM03</td>
<td>Continuous (Two Lines separated by 300mm apart)</td>
<td>Two Solid Line</td>
<td>Each Solid Line of 200mm</td>
<td></td>
<td>White</td>
<td><img src="image" alt="Pattern" /></td>
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<td>TM04</td>
<td>Broken</td>
<td>600</td>
<td>300</td>
<td>100</td>
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<td>TM05</td>
<td>Broken</td>
<td>600</td>
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<td>TM06</td>
<td>Broken</td>
<td>600</td>
<td>300</td>
<td>200</td>
<td>White</td>
<td><img src="image" alt="Pattern" /></td>
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<tr>
<td>TM07</td>
<td>Broken (Two Lines separated by 300mm apart)</td>
<td>600</td>
<td>300</td>
<td>Each Broken Line of 200mm</td>
<td>White</td>
<td><img src="image" alt="Pattern" /></td>
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<td>TM08</td>
<td>Bar Marking (One Set)</td>
<td>Across Full Carriageway</td>
<td>6 Strips of 300mm wide, 5mm high @ 600mm apart</td>
<td>Yellow</td>
<td><img src="image" alt="Pattern" /></td>
<td></td>
</tr>
</tbody>
</table>
The Cyrus Mistry Crash

Source: https://www.cartoq.com/
The Cyrus Mistry Crash

Figure 3B-14. Examples of Applications of Lane-Reduction Transition Markings

A – Lane reduction

B – Lane reduction with lateral shift to the left

Notes:
1. Lane-reduction arrows are optional for speeds of less than 45 mph.
2. See Section 3F.04 for delineator spacing.
3. L = W/2 for speeds of 45 mph or greater and L = W/2/60 for speeds of less than 45 mph, where:
   L = Length of taper in feet
   S = Posted, 85th-percentile, or statutory speed in mph
   W = Offset in feet
4. d = Advance warning distance (see Section 2C.05).

Source: MUTCD
## IRC SP 055 - 2014

**Code of Practice for Road Markings**

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<th>Date</th>
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<tr>
<td>First Revision</td>
<td>January 2014</td>
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Section 1 Introduction
1.1 Background
1.2 Purpose of Work Zone Traffic Management Plans (WTMPs)
1.3 Who Should Prepare WTMPs?
1.4 What Can Make WTMPs Effective?
1.5 Judicious Application of WTMPs
1.6 Legal Aspects of WTMPs

Section 2 Commonly Used Terms

Section 3 Principles of Work Zones Traffic Management Plans
3.1 Basic Principles of WTMP
3.2 Planning of WTMP
3.2.1 Provide safety for road users and workers
3.2.2 Minimize hindrance or delay to road users
3.2.3 Provide clear and positive guidance to road users
3.2.4 Ensure roadside safety maintenance
3.2.5 Ensure that planners and decision makers have the necessary knowledge
3.2.6 Provide good public relations
3.3 Primary Features of WTMP
3.4 Requirements of Work Zone Traffic Management Plan
3.5 WTMP in Urban Areas
3.6 WTMP in Project Development

Section 4 Temporary Traffic Control Zones
4.1 Introduction
4.2 Elements of Temporary Traffic Control Zone
4.2.1 Advance warning zone
4.2.2 Approach transition zone
4.2.3 Activity zone
4.2.4 Terminal transition zone
4.2.5 Work zone end

Section 5 Traffic Control Devices
5.1 Road Signs
5.1.1 Retro reflective sheeting for road signs
5.1.2 Sign placement
5.1.3 Design of signs
5.1.4 Regulatory signs
5.1.5 Warning signs
5.1.6 Informatory signs
5.2 Channelizing Devices
5.2.1 Traffic cones
5.2.2 Tubular markers
5.2.3 Hazard markers
5.2.4 Drums
5.2.5 Barricades
5.2.6 Direction indicator barricades
5.2.7 New jersey barrier
5.2.8 Water-filled barricades
5.2.9 Detectable edging for pedestrians
5.2.10 Delineators
5.3 Temporary Pavement Markings & Road Studs
5.3.1 Road stud
5.4 Lighting Devices & Variable Message Signs
5.4.1 Lighting devices
5.4.2 Floodlights
5.4.3 Flashing warning beacons
5.4.4 Warning lights
5.4.5 Temporary traffic control signals
5.4.6 Portable variable message signs
5.4.7 Arrow boards

Section 6 Measures for Vulnerable Road Users (VRUs)
6.1 Measures for VRUs
6.2 Guidance
6.3 Barriers for Pedestrians & Cyclist

Section 7 Traffic Management Practices at Worksites
7.1 Introduction
7.1.1 Traffic control by give and take system
7.1.2 Traffic control by priority signs
7.1.3 Traffic control by stop/go boards
7.1.4 Traffic control by portable traffic signals
7.2 Detours
7.3 Diversions
7.4 Full Road Closures
7.5 Intermittent Closures
7.6 Lane Closures
7.7 Lane Constrictions
7.8 Median Crossovers
7.9 Use of Shoulder as a Travel Lane
7.10 Night Construction
7.11 Advantages and Disadvantages of Work Zone Design Strategies

Section 8 Roles and Responsibilities
8.1 Introduction
8.2 Critical Players or Stakeholders
8.2.1 Road authority
8.2.2 Road operator
8.2.3 Project director/in-charge
8.2.4 Designer
8.2.5 Road safety auditors
8.2.6 Contractor
8.2.7 Concessionaire
8.2.8 Supervision consultant/independent/resident Engineer
8.2.9 Local police
8.2.10 General public/community

6.4 Works on Footpath: Alternative Way for Pedestrians
6.5 Speed Reduction Measures

96
Work zone accidents are caused by several factors such as:
  • frequently changing environment that occurs during road work whereby the driver is often surprised
  • insufficient warning signs for normal and construction traffic
  • lack of audible warning to workers
  • inadequate provisions of safety devices to protect workers

Major contributing factors to work zone accidents are:
  • Drivers not paying sufficient attention
  • Going too fast for the prevailing conditions
  • Failure to yield the right-of-way
  • Following too close.
Three Types of Devices

- Road Signs
- Channelizing Devices
- Lighting Devices & Variable Message Signs
Work Zone Definition

Traffic Control Zone
Work Zone Site Marking & Signage

Fig. 5.3 Signs Mounted on Barricades
## Work Zone – Shape and Color Pattern

<table>
<thead>
<tr>
<th>Category</th>
<th>Colour</th>
<th>Shape</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory/Mandatory</td>
<td>As given in IRC:67-2012</td>
<td>Circular</td>
<td></td>
</tr>
<tr>
<td>Normal Regulatory (NR) Signs</td>
<td>Red &amp; White</td>
<td>Rectangular</td>
<td></td>
</tr>
<tr>
<td>Work Zone Regulatory (WR) Signs</td>
<td>Black &amp; Yellow</td>
<td>Triangular</td>
<td></td>
</tr>
<tr>
<td>Normal Warning (NW) Signs</td>
<td>As given in IRC:67-2012 but in yellow background</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning Sign</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Zone Warning (WW) Signs</td>
<td>Black &amp; Yellow</td>
<td>Rectangular</td>
<td></td>
</tr>
<tr>
<td>Informatory Signs</td>
<td>Black &amp; Yellow</td>
<td>Rectangular</td>
<td></td>
</tr>
<tr>
<td>Work Zone Information Signs (IS)</td>
<td>Black &amp; Yellow</td>
<td>Rectangular</td>
<td></td>
</tr>
<tr>
<td>Work Zone Direction on Signs (DS)</td>
<td>Black &amp; Yellow</td>
<td>Rectangular</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5.1 Shape & Color Pattern of Signs In WTMP
Warning Signs

Fig. WZ.NW01 Sign to indicate change of direction to left in a work zone

Fig. WZ.NW02 Sign to indicate change of direction to right in a work zone

Fig. WZ.NW03 Sign in case of a reverse bend where first is right turn in a work zone

Fig. WZ.NW04 Sign in case of a reverse bend, where first bend is a left turn in a work zone

Fig. WZ.NW05 Sign to indicate a traffic control in an alternate one way movement ahead through a portal signal.

Fig. WZ.NW06 Sign to indicate road from left is merging as part of temporary traffic management plan

Fig. WZ.NW07 Sign to traffic from right is merging as part of temporary traffic management plan

Fig. WZ.NW08 Sign to indicate road suddenly narrows due to road construction

Fig. WZ.NW09 Sign to indicate to pavement width widens ahead in a temporary traffic control zone

Fig. WZ.NW10 Sign to indicate narrow bridge ahead where the width of carriageway is less than the normal width of carriageway in work area

Fig. WZ.NW11 Sign to indicate to steep ascent more than 10% in a traffic control zone

Fig. WZ.NW12 Sign to indicate to steep descent more than 10% in a traffic control zone

Fig. WZ.NW13 Sign to indicate that left traffic lane tapers due to construction work

Fig. WZ.NW14 Sign to indicate that right traffic lane tapers due to construction work

Fig. WZ.NW15 Sign to indicate road becomes dual carriageway in a work zone

Fig. WZ.NW16 Sign to indicate road becomes undivided carriageway in a work zone

Fig. WZ.NW17 Sign to warn that pedestrians are crossing in work zone

Fig. WZ.NW18 Sign to warn that school in work zone area

Fig. WZ.NW19 Sign to warn that two way movement is ahead as part of WTMP

Fig. WZ.NW20 Sign to warn that one (right) lane closure out of two lanes

Fig. WZ.NW21 Sign to warn that one (right most) lane closure out of three lanes

Fig. WZ.NW22 Sign to warn that one (right most) lane closure out of four lanes

Fig. WZ.NW23 Sign to warn that traffic has to be shifted to other carriageway due to WTMP

Fig. WZ.NW24 Sign should be displayed when men or machines are working on the road or adjacent to it. The sign with supplementary plate "END" shall be provided at the leaving side of the work zone where traffic revert back to normal flow.
Lighting Devices

- Truck Mounted attenuator
- Warning Lights
- Flashing Warning Beacons
- Rotating Amber Light

Fig. 5.23 Types of Lighting Devices
Warning Signs in IRC SP055-2014
| 16+400 | Construction zone should have barricading as specified in IRC SP-55 Using flagman is good practice and it should be followed at all the diversions |
| Flag man present but the diversion is poorly maintained. Inadequate barricading. Poor diversion sign. | Diversion sign age as per IRC SP-55 should be used |
## Incorrect Signage Example - 2

<table>
<thead>
<tr>
<th>48+000 Package 2</th>
<th>Non standard sign ages</th>
<th>Standard sign ages as per IRC SP 55 should be used</th>
</tr>
</thead>
</table>

![Incorrect signage example](image_url)
There is not enough time
to do all the nothing
we want to do.

Bill Watterson
# Overview

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td><strong>Uniform system</strong> for road markings in India to provide <strong>guidance, procedures and recommendation</strong> on the type of road markings with details on dimensions including selection, installation and inspection procedure for different road marking materials.</td>
</tr>
<tr>
<td><strong>Why</strong></td>
<td>Ensure smooth and orderly flow of traffic</td>
</tr>
<tr>
<td><strong>How</strong></td>
<td>Guiding and controlling traffic by providing psychological barrier supporting delineation of traffic path and lateral clearance from traffic hazards</td>
</tr>
<tr>
<td><strong>Authority</strong></td>
<td>Road authorities in consultation with police where necessary</td>
</tr>
</tbody>
</table>
## Overview

<table>
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<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Materials</strong></td>
<td>• Road Markings</td>
</tr>
<tr>
<td></td>
<td>• Hot Applied Thermoplastic Compound</td>
</tr>
<tr>
<td></td>
<td>• Solvent borne and Waterborne Road Marking Paints</td>
</tr>
<tr>
<td></td>
<td>• Coloured Pavement Marking</td>
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<tr>
<td></td>
<td>• Cold Applied Plastics</td>
</tr>
<tr>
<td></td>
<td>• Other</td>
</tr>
<tr>
<td></td>
<td>• Performance Adhesive Tapes</td>
</tr>
<tr>
<td><strong>Technical Specifications</strong></td>
<td>The Clause 803 of “Specification for Road and Bridge Works” published by the Ministry of Road Transport &amp; Highways (MORTH)</td>
</tr>
</tbody>
</table>