

**Name of work : MMGSY 2025-26 Providing Road Furniture in  
Various Roads Of Choryasi Taluka (3 Roads)  
Taluka. Choryasi, Dist. Surat.**

## TECHNICAL SPECIFICATIONS

## **TECHNICAL SPECIFICATIONS**

### **1.0 PREAMBLE:-**

1.1 The Technical Specifications contained herein shall be read in conjunction with the other Bidding Documents as specified in this Volume.

### **1.2 Site Information:-**

1.2.1 The information given here under provided elsewhere is given in good faith by the Employer but the Contractor shall satisfy himself regarding all aspects of site conditions and no claim will be entertained on the plea that the information supplied by the Employer is erroneous or insufficient.

### **2.0 GENERAL REQUIREMENTS:-**

The technical specifications in accordance with which the entire work described herein after shall be constructed and completed by the Contractor shall comprise of the "SPECIFICATION"

2.1 Though "SPECIFICATION" for each item are attached with tender they are based on following.

(1) "SPECIFICATION FOR ROAD AND BRIDGE WORKS" (Fourth REVISION printed in year 2001) issued by the Ministry of Road Transport & Highways (MORT & H), Government of India and Published by the Indian Roads Congress, hereinafter to as MORT & H Specifications.

(2) The General Technical Specifications for Road works.

(3) The General Technical Specifications for Bridge works.

Note:- (2) To (3) are Conventional Specifications Booklets usually attached for (R&B) Works.

2.2 If, a particular clause (which is incorporated in "SPECIFICATION") of specification booklets (1) to (3) above is Amended / Modified/ Added upon then the Amendment/ Modification/Addition shall supersede the relevant clause incorporated in " SPECIFICATION"

2.3 In, so far as Amended / Modified / Added Clause may come in conflict or be inconsistent with any of the provisions of the MORT & H Specifications under reference, the Amended/Modified/ Added Clause and the additional specifications shall always prevail.

2.4 In the absence of any definite provisions on any particular issue in the aforesaid Specifications, reference may be made to the latest codes and specification, of IRC and BIS in that order. Where even these are silent, the construction and completion of the works shall conform to sound engineering practice as approved by the ' Engineer' and , in case of any dispute arising out of the interpretation of the above, the decision of the 'Engineer' shall be final and binding on the Contractor.

The Technical Specifications contained herein shall be read in conjunction with the other Bidding stipulations.

### **1.0 TECHNICAL SPECIFICATIONS:**

The Technical Specifications in accordance with which the entire work described hereinafter shall be constructed and completed by the Contractor shall comprise of the following:

1.1 The General Technical Specifications shall be the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (FIFTH REVISION, April 2013)", as corrected in the original issued by the Ministry of Road Transport & Highway, Government of India and published by the Indian Roads Congress, New Delhi.

1.2 In the absence of any definite provisions on any particular issue in the aforesaid Specifications, reference may be made to the latest codes and specifications of IRC and BIS in that order. Where even these are silent, the construction and completion of the works shall conform to sound engineering practice as approved by the Engineer and in case of any dispute arising out of the interpretation of the above, the decision of the Engineer shall be final and binding on the Contractor.

1.3 During construction of foundation, substructure and superstructure of bridge, tilt or shift occur due to high flood; contractor / agency has to rectify the same as per IRC requirement at his own cost.

### **2.0 GENERAL SPECIFICATIONS**

2.1 The details of reinforcement of RCC work shall be as per design and instructions of Authority and his order will be considered final.

2.2 The Contractor shall have to maintain account of steel, cement and other materials that may be brought by him on site. The account shall be regularly maintained and kept open for inspection by Authority.

2.3 The Contractor shall remain responsible for workmen's compensation if any, when such case occurs, the Contractor shall arrange for red lamps at night and fencing and pagi and shall be responsible for any damage of life and lime or property if any happen, during the execution of work. In case of dispute for unseen or overlooked

items, the decision of Authority shall be final. The Contractor shall have to give site clean of all rubbish on completion of work and hand over the bridge with final finishing of the work as directed. All the rejected materials shall be removed from site within 24 hours by contractor at his risk and cost.

- 2.4 For mixing mortar either for masonry or for plaster or for any other purpose contractor shall have to prepare trough of bigger size and mix the mortar in required proportion. In no case he shall be allowed to mix the mortar either on floor or any finished surfaces.
- 2.5 The Contractor shall have to make his own arrangement for water required for the work and shall pay the water charges as per rules.
- 2.6 If in the interest of the Employer or site conditions it is necessary to change either any site or the design of the proposed work the Contractor shall carry out the same at his quoted rates, without charging any extra and he will be paid at the rates quoted by him and no claim for extra charges made will be entertained.
- 2.7 "Cement and Steel will not be supplied by the Employer. The Contractors have to make their own arrangements for procurement of indigenous Portland cement or imported Portland cement HYSD, TMT bars, Structural Steel and M.S. Round Bars including coils and Ribbed for Steel and prestressing strands for the entire work. The contractors shall have to give necessary test certificates as per relevant I.S Code before using the same in the work".
- 2.7.1 The Contractor will be fully responsible for compliance of the various provisions under Contract Labour Act, 1970 and the Rules framed there under.
- 2.8 All defective works are liable to be demolished, rebuilt and defective materials replaced by the Contractor at his own cost. In the event of such works being accepted by carrying out repairs etc as specified by the Engineer in charge, the cost of repairs will be borne by the Contractor and will be paid for the works actually carried out by him at reduced rates of the tendered rates, as may be considered reasonable by the Engineer in charge in the preparation of final or on account bills.

#### **2.10 Concrete Mix Design:**

It is brought to the notice of the Contractor that the concrete design mix for higher grade of controlled concrete is required for foundation, substructure and super structure of bridge and other work. This richer mix is necessary from technical considerations. The Contractor should therefore, study all the possibilities of achieving the desired results for the richer mix. He should collect the coarse and fine aggregates of the best quality. The cement used for this type of concrete should be got tested periodically and should not be more than 3 months old. The Contractor may study the possibility should of adding the necessary plasticizers and admixtures to achieve this strength with desired workability and finishes without affecting durability and damaging the reinforcement and high tensile steel. The cost for any plasticizer admixtures shall be borne by contractor.

#### **2.11 Setting out Works**

The Contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position's levels, dimensions and alignment of all parts of the works and for the provisions of all necessary instruments and appliances and labour in connection therewith. If at any time during the progress of works any error shall appear or arise in the positions, levels, dimensions or alignment of any part of the works, the Contractor on being required to do so by the Engineer shall at his own expenses rectify such errors to the satisfaction of the Engineer-in-Charge. The checking of any setting out or of any lines and levels by the Engineer-in-Charge or his representative shall not in any way relieve the Contractor of his responsibility for correctness thereof and the Contractor shall carefully protect, preserve and maintain all bench marks, site rails, pegs etc. used in setting out the works. The costs of providing, preserving, protecting and maintaining the site rails, pegs, benchmark etc. shall be deemed to be included in the rate quoted for various items in the schedule B and no separate payment will be made for the same.

The Contractor shall incorporate into the structure the fixtures for lighting, drainage, road markers, signals etc. as may be given to him by the Engineer-in Charge, without claiming any extra cost.

- 2.12 All permanent and temporary works shall conform to the latest specifications of Codes of Indian Road Congress, Specifications of Road & Bridge works by Ministry of Road Transport and Highways, IS Standards and code of other relevant codes and prevailing sound Engineering practices as mentioned in the contract documents or approved by the competent authority as applicable.

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**ITEM WISE SPECIFICATION**

**Item No.1 Village name :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 90 x 60cms. rectangle as as per the design of IRC-67-1977 pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest M.O.S.T. Specifications; Letters and numerals should be as per IRC-30-1968, 3.1m long (2 nos) stand post and frame fabricated from suitable size iron angle of 50 x 50 x 5mm painted with best quality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.(A) Engineer Grade(VR)...**

The signs illustrated in this section give information to the road user regarding their location or facilities available in the vicinity or about the destination. The detailed dimensioned drawings for direction information signs with guidance for design are shown in Plate-III and design principles are presented in Annexure-III. For facility information signs for normal sizes are shown in Plate-IV and signs of other sizes the symbols should be proportionately reduced or enlarged. The facility information signs are listed in Annexure-IV.

The signs are classified under the following sub-heads keeping in view their design and application:

- 1) Direction and Place Identification signs
- 2) Facility Information signs
- 3) Other Useful Information Signs
- 4) Parking Signs, and
- 5) Flood Gauge

Direction and Place Identification Signs

Following are the functions of the direction signs:

- It should give drivers advance information of their approach to a junction
- It should indicate the type of junction
- It should inform them of the destinations that may be reached from each exit
- It should identify the route and indicate its status within network

*Shape, Colour and Language of InscriptiOfJ*

These signs shall be rectangular. However direction signs may be in the shape of an elongated rectangle with the longer side horizontal, terminating in an arrowhead. The colour pattern for direction signs are given in Table 8.3 and size of the letters shall be as per Table 11.1. The English font shall be “Transport Medium” and Hindi shall be “Hindi7”. The design principles are presented pictorially in Figs. 16.01 to 16.16. All messages, borders, and legends shall be retro-reflective and all background shall be retro-reflective or illuminated.

The sign shall normally be located at a distance from the intersection as given in Table 11.1.

IRC: 67-2012

**Table 11.1 Letter Size and Siting of Information Signs (Shoulder & Gantry Mounted)**

	Advance Direction Signs (Shoulder Mounted)					Flag Type Direction Signs Reassurance Signs Place Identification Signs			Gantry Mounted Signs		
1	2	3	4	5	6	7	8	9	10	11	12
Design Speed	“x” height (mm) lower case	“X” height (mm) upper case	Minimum clear visibility to the sign (m)	ONE sign: distance from junction ( )	TWO signs: distance between 1 <sup>st</sup> and 2 <sup>nd</sup> sign ( )	“x” height (mm) lower case	“X” height (mm) upper case	Minimum clear visibility to the sign (m)	“x” height (mm) lower case	“X” height (mm) upper case	Minimum clear visibility to the sign (m)
Up to 30 km/h	75 (60) <sup>*</sup>	105 (84)	50 (35)	20		60 (50)	84 (70)	35 (30)	200 (175)	280 (245)	150
31 — 50 km/h	100 (75)	140 (105)	75 (45)	45	45	75 (60)	105 (84)	45 (35)			
51 - 65 km/h	125 (100)	175 (140)	100 (60)	90	50	100 (75)	140 (105)	60 (45)			
66 - 80 km/h	150 (125)	210 (175)	135	90 - 150	70	125 (100)	175 (140)	75 (60)			
81 - 100 km/h	200 (150)	280 (210)	165	150 — 225	100	150 (125)	210 (175)	105 (75)	250 (200)	350 (280)	200
101-110 km/h	250 (200)	350 (280)	225	225-300, See also Note 1	100	200 (150)	280 (210)	135 (105)	275 (250)	385 (350)	240
111-120 km/h	300 (250)	420 (350)	260	See Note 1	See Note 1	300 (250)	420 (350)	180 (150)	300 (275)	420 (385)	260
*Note: The values in brackets are the minimum values to be adopted when there are site/space constraints.											

*Derived from the first principle as presented in Annexure VI*

#### Notes:

- 1) For grade separated junction two or three advance direction signs are provided. These are located at the start of diverging lane, 250 m to 750 m from the junction and additionally 750 m to 1500 m from the junction.
- 2) The “x” height is the height of a lower case English “Transport medium” font and upper case shall be 1.4 times of lower case height.
- 3) In columns 2, 3, 7, 8, 10 and 11 of Table 11.1 the font heights shown are normal size to be used for respective

approach speeds and in brackets are the absolute minimum sizes to be used where site/space is limited. The font size can be increased by another 50 mm from the normal font size for those direction boards requiring special emphasis/attention.

#### *Destination sign*

The sign should be posted in advance at intersections of major importance or at intersections where approach speeds are high requiring advance information. The forward destination name with vertical arrow shall be the top panel, the left destination with arrow shall be the middle panel, and the right destination with arrow at the bottom of the assembly. The maximum number of destinations in a single destination sign shall not exceed three (Fig. 16.01).

#### *16.3.4. 1 Siting of Reassurance Sign*

***It should be placed 60 m beyond the far shoulder or curb line of the intersected road of the junction. In urban areas, reassurance sign may be placed in between intersections so as to keep the user informed. The names of the destination places should be the same as shown on the advance direction signs placed before the intersection. For major interchanges, it should be placed within a distance of 200 m from the last point at which vehicle could join the main carriageway. It may also be used along a route at spacing not greater than 10 km on highways or expressways.***

#### *Place/City Identification*

***The sign (Fig.16.06) should be used along highways to mark entrance to the place or city. It should be erected at the entrance to the area under the jurisdiction of the local authority.***

**Item No. 2 Cautionary Warning Sign :-**Providing and fixing sing boards made out of 2mm aluminium sheet; size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-1977. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with retro reflectivesheeting as per latest M.O.S.T.Specifications; 3.1m long stand postand frame fabricated from suitable sizeiron angle of 35 x 35 x 3mm, 75 x 75 x 6mm as required; painted with bestquality epoxy coatings in black andwhite bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge.(A) Engineer Grade(VR)

#### 801.1 GENERAL

- 801.1.1 The colour, configuration, size and location of all traffic signs for highways other than Expressways shall be in accordance with Code of Practice for Road Signs, IRC:67 or as shown on the drawings. For Expressways, the size of signs, letters and their placement shall be as specified in the Contract drawings and relevant specifications. In the absence of any details or for any missing details, the signs shall be provided as directed by the Engineer. The Aluminum sheet size to be fixed shall be as specified in the Item.
- 801.1.2 The signs shall be either reflectorised or non-reflectorised as shown on the drawing or as directed by the Engineer. When they are of reflectorised type, they shall be of retro-

reflectorised type and made of encapsulated lens type reflective sheeting vide Clause 801.3, fixed over aluminium sheeting as per these Specifications.

801.1.3 In general, cautionary and mandatory signs shall be fabricated. through process of screen printing. In regard to informatory signs with inscriptions, either the message could be printed over the reflective sheeting, or cut letters of non-reflective black sheeting used for the purpose which must be bonded well on the base sheeting as directed by the Engineer.

## 801.2 MATERIALS

The various materials and fabrication of the traffic signs shall conform to the following requirements :

801.2.1 Concrete: Concrete shall be of the grade shown on the contract drawings or otherwise as directed by the Engineer.

801.2.2 Reinforcing Steel: Reinforcing steel shall conform to the requirement of IS: 1786 unless otherwise shown on the drawing.

801.2.3 Bolts, nuts, washers: High strength bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364.

801.2.4 Plates and supports: Plates and support sections for the sign posts. Shall conform to IS: 226 and IS: 2062 or any other relevant IS Specifications.

801.2.5 Aluminium: Aluminium sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminium alloy conforming to IS:736 Material designation 24345 or 1900.

801.2.6 Signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5 mm thick. All others shall be at least 2 mm thick. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under the prevailing wind and other loads.

801.2.7 In respect of sign sizes not covered by IRC:67, the structural details (thickness, etc.) shall be as per the approved drawings.

## 801.3 TRAFFIC SIGNS HAVING RETRO-REFLECTIVE SHEETING

801.3.1 General Requirements: The retro-reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having tested the sheeting for these properties in an unprotected outdoor exposure facing the sun for two years and its having passed these tests shall be obtained from a reputed laboratory, by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering, Grade material with enclosed lens or of High Intensity Grade with encapsulated lens. The type of the sheeting to be used would depend upon the type, functional hierarchy and importance of the road.

801.3.3 Engineering grade sheeting: This sheeting shall be of enclosed lens type consisting of microscopic lens elements embedded beneath the surface of a smooth, flexible, transparent, water-proof plastic, resulting in a non-exposed lens optical reflecting system. The retro reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined In accordance with ASTM Standard :E-81 0) as indicated in Table 800-2.

Table 800 – 2

### ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR ENGINEERING GRADE SHEETING

(CANDELAS PER LUX PER SQUARE METRE)

Observation	Entrance	White	Yellow	Orange	Green	Red	Blue
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angle (in degrees)	Angle (in degrees)						
0.2	-4	70	50	25	9.0	14.5	4.0
0.2	+30	30	22	7.0	3.5	6.0	1.7
0.5	-4	30	25	13.5	4.5	7.5	2.0
0.5	+30	15	13	4.0	2.2	3.0	0.8

When totally wet, the, sheeting shall not show less than 90 per cent of the values, of retro-reflection indicated in Table 800-2. At the end of 5 years, the sheeting shall retain at least 50 per cent of its original retro reflectance.

801.3.4 Messages/Borders: The messages (legends, letters, numerals etc) and borders shall either be screen-printed or of cut-outs. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. Cut-outs shall be of materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer.

801.3.5 For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the values of corresponding colour in Tables 800-1 and 800-2, as applicable.

801.3.6 Cut-out messages and borders, wherever used, shall be made out of retro-reflective sheeting (as per Clause 801.3.2 or 801.3.3 as applicable), except those in black which shall be of non-reflective sheeting.

801.3.7 Colour : Unless otherwise specified, the general colour scheme shall be as stipulated in IS:5 "Colour for Ready Mixed Paints", viz

Blue	-	IS	Colour	No.166: French Blue
Red	-	IS	Colour	No.537 : Signal Red
Green	-	IS	Colour	No.284 : India Green
Orange	-	IS	Colour	No.591 : Deep Orange

The colours shall be durable and uniform in acceptable hue' when viewed in day light or under normal headlights at night

801.3.8 Adhesives: The sheeting shall either have a pressure sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, or a tack free adhesive activated by heat, applied in ct, heat-vacuum applicator, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate ,such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. In case of pressure-sensitive adhesive sheeting, the sheeting shall be applied in accordance with the manufacturer's specifications. Sheetting with adhesives requiring use of solvents or other preparation for adhesive shall be applied strictly In accordance with the manufacturer's instructions.

801.3.9 Refurbishment: Where existing signs are specified for refurbishment, the sheeting shall have a semi-rigid aluminium backing pre- coated with aggressive-tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the sign and should thoroughly bond with that material.

801.3.10 FABRICATION:

801.3.10.1 Surface to be reflectorised shall be effectively prepared to receive the retro reflective sheeting. The aluniinium sheeting shall be degreased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-



reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting.

801.3.10.2 Complete sheets of the material shall be used on the signs except where it is unavoidable; at splices, sheeting with pressure sensitive 1 adhesives shall be overlapped not less than 5 mm. Sheeting with heat activated adhesives may be spliced with an overlap not less than 5 mm or butted with a gap not exceeding 0.75 mm. Where screen printing with transparent colours is proposed, only butt jointing shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

801.3.11 Warranty and durability: The contractor shall obtain from the manufacturer a seven year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of high intensity grade and a five year warranty for the adhesive sheeting of engineering grade and submit the same to the Engineer. In addition, a seven year and a five year warranty for satisfactory in field performance of the finished sign with retro-reflective sheeting of high intensity grade and engineering grade respectively, inclusive of the screen printed or cut out letters/legends and their bonding to the retro-reflective sheeting shall be obtained from the Contractor/supplier and passed on to the Engineer. The Contractor/supplier shall also furnish a certification to that the signs and materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty.

Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant and, following cleaning, shall show no appreciable discolouration, cracking, blistering or dimensional change and shall not have less than 50 per cent of the specified minimum reflective intensity values (Tables 800-1 and 800-2) when subjected to accelerated weathering for 1000 hours, using type E or EH weather meter (AASHTO Designation M 268).

#### 801.4 INSTALLATION

801.4.1 Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area upto 0.9 sq.m. shall be mounted on a single post, and for greater area two or more supports shall be provided. Sign supports may be of mild steel, reinforced concrete or galvanized iron (G.I.) Post end(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant specifications as specified.

801.4.2 All components of signs and supports, other than the reflective portion and G.I. posts shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy paint. Any part of mild steel(M.S.) post , below ground shall be painted with three coats of red lead paint.

801.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or G.I. posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

#### 801.5 MEASUREMENTS FOR PAYMENT

The measurement of standard cautionary, mandatory and information signs shall be in numbers of different types or signs supplied and fixed.

#### 801.6 RATE

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the specifications.

. The mandatory/regulatory signs are listed in Annexure -1. These are classified under the following sub-heads keeping in view their design and application:

- i) "Stop" and "Give Way" signs (Right of way signs)
- ii) "Prohibitory" signs
- iii) "No Parking" and "No Stopping" signs
- iv) "Speed Limit" and "Vehicle Control" signs
- v) "Restriction Ends" sign, and
- vi) "Compulsory Direction Control" and other signs

It is essential that drivers and other road users have an unobstructed view of road signs. The distance which should be kept clear of obstructions to the sight line, whether caused by vegetation (e.g. bushes, trees), other signs or street furniture (e.g. crash barriers), is known as the clear visibility distance. The higher the prevailing traffic speeds, the greater this distance needs to be.

		Diameter (mm)	Diameter (mm)	Border (mm)	Oblique Bar (mm)	Font Size (mm)
Up to 65 kmph	In conjunction with traffic light signal		300	35	35	75
	Small	600	600	50	50	100
66 - 80 kmph	Medium	750	750	60	60	125
81 - 100 kmph	Normal	900	900	75	75	150
>100 kmph	Large	1200	1200	100	100	225

**It No. 3 Road marking with hot applied thermoplastic paints with reflectorising glass beads on bitumin surface providing and laying a hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250gms per sqm area, thickness of 2.5mm is excluding of surface applied glass beds as per IRC:35-2015. The finished surface to be level, uniform and free from streaks and holes. zebra patta /bump patta lane/center line/ edge line/cut patta. The white color marking should provide luminance coefficient on cement road shall be min 130 mcd/m<sup>2</sup>/lux and Asphalt road shall be min 100 mcd/m<sup>2</sup>/lux during the service life during the day time. The marking should meet the performance criteria for night time reflectivity, wet reflectivity and skid resistance as mentioned in the section-15 of IRC 35-2015.**

#### .803. ROAD MARKINGS

General :-

Hot Applied Thermoplastic Road Marking.

- (i) The work under this section consists of marking traffic stripes using a thermoplastic compound meeting the requirements specified herein.
- (ii) The Thermoplastic compound shall be screened / extruded on to The pavement surface in a molten state by suitable machine capable of controlled preparation and laying with surface

application of glass beads at a specific rate. Upon cooling to ambient pavement temperature, it shall produce an adherent pavement marking of specified thickness and width and capable of resisting deformation by traffic.

- (iii) The colour of the compound shall be white or yellow (IS : colour No. 356) as specified in drawings or as directed by the Engineer.
- (iv) Where the compound is to be applied to cement concrete pavement sealing primer as recommended by the manufacture, shall be applied to the pavement in advance of placing of the stripes to ensure proper bonding of the compound. On new concrete surface any laitance and / or curing compound shall be removed before the marking are applied.

#### Thermoplastic Materials

##### General :

The thermoplastic material shall be homogeneously composed of aggregate, pigment, resins and glass reflectorizing beads.

##### Requirement :

Composition: the pigment, beads and aggregate shall be uniformly dispersed in the resin. The material shall be free from all skins, dirt and foreign objects and shall comply with requirements indicated in Table 800 – 3.

Table 800 – 3 PROPORTIONS OF CONSTITUENTS OF MARKING MATERIAL ( percentage by weight )

Component	White	Yellow
Binder	18.00 min.	18.00
Glass Beads	30 – 40	30 – 40
Titanium Dioxide	10.00 min.	- - -
Calcium Carbonate and Inert Fillers	42.00 max	See Note
Yellow Pigments	- - -	- do -

Note : Amount of yellow pigment, calcium carbonate and inert fillers shall be at the option of the manufacturer, provide all other requirement of this Specification are met.

- II Properties : The properties of thermoplastic material, when tested in accordance with ASTM D36/ BX-3262- (Pa. T1) shall be as below :

##### Luminance :

White: Daylight luminance at 45 degree 65 per cent min. as per AASHTO M 249.

- B) Drying time: When applied at a temperature specification by the manufactures and to the required thickness, the material shall set to bear traffic in not more than 15 minutes.
- C) Skid resistance: not less than 45 as per BS 6044.
- D) Cracking resistance at low temperature: The material shall show no cracks on application to concrete blocks.
- E) Softening point: 102.5 ÷ 9.5” as per ASTM D 36.
- F) Flow resistance: Not more than 25 per cent as per AASHTO M 249.
- G) Yellowness index (for white thermoplastic paint) not more than 0.12 as per AASHTOM 249.

- III Storage life: The materials shall meet the requirement of their Specifications for period of one year. The thermoplastic material must also melt uniformly with no evidence of skins of un-melted particles for the one-year storage period. Any material not meeting the above requirements shall be replaced by the manufacturer/ supplier/ contractor.

- IV Reflectorisation : Shall be achieved by incorporation of beads, the grading and other properties of the beads shall be as specified in Clause 803.4.3 of MORT & H Specification.
- V Marking : Each container of the thermoplastic material shall be clearly and indelibly marked with the following information.
1. The name, trademark or other means of identification of manufacturer.
  2. Batch number.
  3. Date of manufacture.
  4. Colour (White or Yellow)
  5. Maximum application temperature and maximum safe heating temperature.
- VI Sampling and Testing : The thermoplastic material shall be sampled and tested in accordance with the appropriate ASTM/BS method. The Contractor shall furnish to the Employer a copy of certified test report from the manufacturer of the thermoplastic material showing results of all tests specified therein and shall certify that the materials meets all requirements of this Specification.

#### Reflectorizing glass beads

General : This Specification covers two types of glass beads to be used for to production of reflectionised pavement markings. Type 1 beads are those which are a constituent of the basic thermoplastic compound vide Table 800 – 3 and type – 2 beads are those which are to be sprayed on the surface vide Clause 803.6.3.

The glass beads shall be transparent, colourless and free from milliness, dark particles and excessive air inclusions.

These shall conform to the requirements spelt out in clause 5.4.3.3.

#### Specific requirements.

A Gradation : The glass beads shall meet the gradation requirements for the two types as given in Table 800 – 4.

TABLE 800-4 GRADATION REQUIREMENT FOR GLASS BEADS

Sieve Size	Per Cent Retained	
	Table – 1	Table – 2
1.18 mm	0 to 3	--
850 micron	5 to 20	0 to 5
600 micron	--	5 to 20
425 micron	65 to 95	--
300 micron	--	30 to 75
180 micron	0 to 10	10 to 30
Below 180 micron		0 to 15

- B. Roundness :  
The glass beads shall have a minimum of 70 per cent true spheres.
- C. Refractive index :  
The glass beads shall have a minimum refractive index of 1.50.
- D. Free flowing properties :  
The glass beads shall be free of hard lumps and clusters and shall dispense readily under any condition suitable for paints striping. They shall pass the free flow-test.

#### Test Methods :

The specific requirement shall be tested with the following methods.

- I Free-flow test : Spread 100grams of beads evenly in a 100 mm diameter glass dish. Place the dish in a 250 mm inside diameter desiccators which is filled within 25 mm of the top of a desiccators plate with sulphur acid water solution (specific gravity 1.10) Cover the desiccators and let it stand for 4 hours at 20 to 29 degree C. Remove Sample from

desiccators, transfer beads to a pan and inspect for lumps or clusters. Then pour beads into a clean dry glass funnel having a 100 mm stem and 6 mm orifice. If necessary, initiate flow by lightly tapping the funnel. The glass spheres shall be essentially free of lumps and clusters and shall flow freely through the funnel.

- II The requirements of gradation, roundness and refractive index of glass beads and the amount of glass beads in the compound shall be tested as per BS 6088 and BS 3262 (Part 1).
- III The Contractor shall furnish to the Employer a copy of certified test report from the manufacturer of glass beads obtained from a reputed laboratory showing results of all tests specified therein and shall certify that material meets all requirements of this Specification. However, if so required, these tests may be carried out as directed by the Engineer in charge.

#### Application properties of thermoplastic material

The thermoplastic materials shall readily get screed / extruded at temperatures specified by the manufacturers for respective method of application to produce a line of specified thickness which shall be continuous and uniform in shape having clear and sharp edges.

The materials upon heating to application temperatures shall not exude fumes which are toxic. Obnoxious or injurious to persons property.

#### Preparation :

- i) The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic materials to avoid local overheating. The temperature of the mass shall be within the range specified by the manufacturer, and shall on no account be allowed to exceed the maximum temperature started by the manufacturer. The molten material should be used as expeditiously as possible and for thermoplastic materials. Which has natural binders or is otherwise sensitive to prolonged heating the materials shall be maintained in a molten condition for more than 4 hours.
- II) After transfer to the laying equipment, the material shall be maintained within the temperature range specified by the manufacturer for achieving the desired consistency for laying.

#### Properties of finished road marking :

- a) The stripe shall not be slippery when wet.
- b) The marking shall not lift from the pavement in freezing weather.
- c) After application and proper drying the stripe shall show no appreciable deformation or discoloration under traffic and under road temperatures up to 60 °C.
- d) The marking shall not deteriorate by contact with sodium chloride calcium chloride or oil drippings from traffic.
- e) The stripe of marking shall maintain its original dimensions and position. Cold ductility of the material shall be such as to permit normal movement with the road surface without chipping or cracking.
- f) The colour of yellow marking shall conform to IS Colour No. 356 as given in IS : 164.

#### Reflectorised paint :

Reflectorised paint, if used shall conform to the specification by the manufacturers and approved by the engineer. Reflectorising glass beads for reflectorising paints where used shall conform to the requirements of Clause 5.3.

#### Application

Marking shall be done by machine. For locations where painting cannot be done machine, approved manual methods shall be used with prior approval of the Engineer. The Contractor shall maintain control over traffic while painting operations are in progress so as to cause minimum inconvenience to traffic compatible with protecting the workmen.

The thermoplastic materials shall be applied hot either by screening or extrusion process. After transfer to the laying apparatus, the material shall be laid at a temperature within the range specified by the manufacturer for the particular method of laying being used. The paint shall be applied using a screed or extrusion machine.

The pavement temperature shall be less than 10 C. during application. All surface to be marked shall be thoroughly cleansed of all dust, dirt, grease, oil and all other foreign matter before application of the paint.

The material, when formed into traffic stripes, must be readily renewable by placing an overlay of new material directly over an old line of compatible material. Such new material shall so bend itself to the old line that no splitting or separation takes place.

Thermoplastic paint shall be applied in intermittent or continuous lines of uniform thickness of at least 2.5 mm unless specified otherwise. Where arrows or letters are to be provided, thermoplastic compound may be hand-sprayed. In addition to the beads included in the material, a further quantity of glass beads of Type 2, conforming to the above noted specification shall be sprayed uniformly into a mono layer on to the hot paint line quick succession of the paint spraying operation. The glass beads shall be applied at the rate of 250 grams per square meter area.

The minimum thickness specified in exclusive of surface applied glass beads. The method of thickness measurement shall be in accordance with Appendices B and C of BS- 3262 (Part 3).

The finished lines shall be free from ruggedness on sides and ends and be parallel to the general alignment of the carriageway. The upper surface of the lines shall be level, uniform and free from streaks.

#### Measurement for Payment.

The painted marking shall be measured in sq. meters of actual area marked (excluding the gaps. If any). In respect of markings line directional arrows and lettering. Etc., the measurement shall be in Square meter basis.

#### Rate

The contractor unit rate for road markings shall be payment in full compensation of furnishing all labor, materials, tools, equipment, including all incidental costs necessary for carrying out the work at the site conforming to these specifications complete as per the approved drawing (s) or as directed by the Engineer and other incidental cost necessary to complete the work to these Specifications.

**Item No.4 Cat Eye / Road Stud / RPM: Supplying of Molded Twin Shanks Raised Pavement Markers made of polycarbonate and ABS moulded body and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face and shall support a load of 13635 kgs. tested in accordance to ASTM D 4280 Type H and complying to Specifications of Category A of MORTH Circular No RW/NH/33023/10-97 DO III Dt 11.06. 1997. The height, width and length shall not exceed 20 mm, 130 mm and 130 mm and with minimum reflective area of 13 Sqcm on each side and the slope to the base shall be 35 +/- 5 degree. The strength of detachment of the integrated cylindrical shanks, (of diameter not less than 19 +/- 2 mm and height not less than 30 +/- 2 mm) from the body is to be a minimum value of 500 Kgf. Fixing will be by drilling holes on the road for the shanks to go inside, without nails and using epoxy resin based adhesive as per manufacturers recommendation and The color of**

**the marker should be as per the IRC 35-2015 and as directed by Engineer-in-charge..**

- 1.1 General
 

Reflective Pavement marker (RPM) or road stud is device which is bonded to or anchored within the road surface for lane marking and delineation for night time visibility. It reflects incident light in directions close to the direction from which it came.
- 1.2 Definitions
  - 1.2.1 Description of Terms Specific to this standard
    - 1.2.1.1 Coefficient of luminous intensity (CIL) or specific intensity = the ratio of luminous intensity of the retro-reflector in the direction of observation to luminance at the retro-reflector on a plane perpendicular to the direction of the incident light expressed in terms of Milaca deal as per incident lux (med/ lx).
    - 1.2.1.2 Horizontal entrance angle – the angle in the horizontal plant between the direction of incident light and the normal to the leading edge of the marker.
    - 1.2.1.3 Observation angle – the angle in the reflector between the illumination axis and the observation axis.
    - 1.2.1.4 Retro – reflection – reflection in which the radiation is returned in direction close to the direction from which it came, this property being maintained over were variations of the direction of incident radiation.
    - 1.2.1.5 Head – that part of a road stud which is above the road surface where the road stud is fixed in position in the road.
    - 1.2.1.6 Upper surface – that part of the external surface of road stud which is visible when the road stud is fixed in position in the road.
    - 1.2.1.7 Anchorage – that part of a road stud which is below the road surface above the road stud is fixed position in the road.
- 1.3 Material
  - 1.3.1 Plastic body of RPM road stud shall be molded from ASA (Acrylic Sterner Acrylonitrile) or HIPS (Impacts polystyrene) or ABS or any other suitable material approved by the Engineer-in-charge. The marker shall support a load of 13635 kg tested in accordance with ASTM D4280.
  - 1.3.2 Reflective panels shall consist if number of lenses containing single or dual prismatic cubes capable of providing total internal reflection of the light entering the lens face. Lenses shall be molded of methyl methecrylate conforming to ASTMD 788 or equivalent.
- 1.4 Design
  - 1.4.1 The slope or retro-reflecting surface shall preferably be 35 + 5 degree to base.
  - 1.4.2 The area of each retro-reflecting surface shall not be less than 13.0 Sq.cm.
- 1.5 Optical Performance
  - 1.5.1 Unidirectional and bi-directional studs
    - 1.5.1.1 Each reflector or combination of reflectors on each face of the stud shall have a CIL not less than given in Table 1 or 2 as appropriate.

Table 1 Minimum C.I.L. Values for Category "A" studs.

Entrance angle	Observation angle	C.I.L. in med 1 x		
		White	Amber	Red
0" U 5" L & R	0.3"	220	110	44
0" U 10" L & R	0.5"	120	60	24

Table 1 Minimum C.I.L. Values for Category "B" studs.

Entrance angle	Observation angle	C.I.L. in med 1 x		
		White	Amber	Red

0" U 6" L & R	0.3"	20	10	4
0" U 10" L & R	0.5"	15	7.5	3

- Note: The entrance angle of 0"U corresponds to the normal aspect of the reflectors when the reflecting road stud is installed in horizontal road surface.
- 1.5.1.2 A stud that incorporates one or more corner cube reflectors shall be considered to be included in category "A". A stud that incorporates one or more biconvex reflectors shall be considered to be included in category "B".
- 1.5.2 Omni – directional studs  
Each omni-directional stud shall have a minimum C.I.L. of not less than med/ lx.
- 1.5.3 Tests
- 1.5.3.1 Coefficient of luminance intensity can be measured by produced described in ASTM D 809 "Practice for Measuring Photometric Characteristics" or as recommended in BS 873 Part 4:1973.
- 1.5.3.2 Under test conditions a stud shall not be considered to fail the photometric requirements of the measured C.I.L. at any one position of measurement is less than the values specified in Table 1 or 2 provided that.
- (A) The value is not less than 80% of the specified minimum, and
- (B) The average of the left and right measurements for the specific angle is greater than the specified minimum.
- 1.6 Fixing of Reflective Markers
- 1.6.1 Requirements
- 1.6.1.1 The enveloping profile of the head of the stud shall be smooth and the studs shall not present any sharp edges to traffic.
- 1.6.1.2 The reflecting portions of the studs shall be free from crevice or ledges where dirt might accumulate.
- 1.6.1.3 All road studs shall be legibly marked with the name, trade mark or other means of identification of the manufacture.
- 1.6.1.4 Marker height shall not exceed 20 mm.
- 1.6.1.5 Marker width shall not exceed 130 mm.
- 1.6.1.6 The base of the marker shall be flat within 1.3 mm. If the bottom of the marker is configured. The outermost faces of the configurations shall not deviate more than 1.3 mm from a flat surface.
- 1.6.2 Placement
- 1.6.2.1 The reflective marker shall be fixed to the road surface using the adhesives and the produced recommended by the manufacturer. No nails shall be used to affix the marker as nails are hazardous for the roads.
- 1.6.2.2 Regardless of the type of adhesive used. The markers shall not be fixed if the pavement is not surface dry and on new asphalt concrete surfacing unit the surfacing has been opened to traffic for a period of not less than 14 hours.
- 1.6.2.3 The portions of the highway surface, to which the marker is to be bonded by the adhesive, shall be free of dirt, curing compound, grease, oil, moisture, loose or unsound layers, paint and any other material which would adversely affect the bond of the adhesive.
- 1.6.2.4 Use a wire brush, if necessary to loosen and remove dirt. Then brush or blow clean.
- 1.6.2.5 The adhesive shall be placed uniformly on the cleaned pavement surface or on the bottom of the marker in a quantity sufficient to result in complete coverage of the area of contact of the marker with no voids present and with a slight excess after the marker has been lightly pressed in place.



- 1.6.2.6 For epoxy installations, excess adhesive around the edge of the marker, excess adhesive on the pavement and adhesive on the exposed surfaces of the markers shall be immediately removed. Soft rags moistened with mineral spirits or kerosene may be used as necessary to remove adhesive from exposed faces of pavement marker.
- 1.7 **Warranty and durability**  
 The contractor shall obtain from the manufacturer a two year warranty for satisfactory light performance including stipulated retro-reflectance of the reflecting panel and submit the same to the Engineer. In addition, a two year warranty for satisfactory infield performance of the finished road marker shall also be given by the contractor who carried out the work of fixing of reflective road markers. In case the markers are displaced, damaged, get worn out or lose their reflectivity compared to stipulated standards, the contractor would be required to replace all such markers within 15 days of the intimation from the Engineer at his own cost and with no extra remuneration to be paid for such works.
- 1.8 **Measurement for Payment**  
 The measurement of Cats eye (MMC) shall be in numbers of markers supplied and fixed.
- 1.9 **Rate**  
 The contract unit rate for Cats eye (MMC) shall be payment in full compensation for furnishing all labour, material, tools, equipment including incidental costs necessary for carrying out the work at site conforming to the specifications complete as per approved drawings or as directed.

**Item No.5 Regulatory / Mandatory Sign :-** Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60 cms. Dia Circle as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro reflective sheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.6mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with best quality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 7 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (B) Class-B Type-4 Retro Reflective sheeting. 406.1 SCOPE

## 14 MANDATORY & REGULATORY SIGNS

The detailed dimensioned drawings of normal sized sign and symbols thereon are shown in Plate-I for ease of reproduction. For signs of other sizes, the symbols should be proportionately

reduced or enlarged. The mandatory/regulatory signs are listed in Annexure -1. These are classified under the following sub-heads keeping in view their design and application:

- i) “Stop” and “Give Way” signs (Right of way signs)
- ii) “Prohibitory” signs
- iii) “No Parking” and “No Stopping” signs
- iv) “Speed Limit” and “Vehicle Control” signs
- v) “Restriction Ends” sign, and
- vi) “Compulsory Direction Control” and other signs

It is essential that drivers and other road users have an unobstructed view of road signs. The distance which should be kept clear of obstructions to the sight line, whether caused by vegetation (e.g. bushes, trees), other signs or street furniture (e.g. crash barriers), is known as the clear visibility distance. The higher the prevailing traffic speeds, the greater this distance needs to be.

Regulatory signs that indicate the beginning of a restriction or prohibition and to which direction it applies have to be placed in accordance with that direction. The requirement is that the signs must be placed on each side of the road or on each side of the appropriate carriageway of a dual carriageway road; except that signs need only be placed on one side if any of the following circumstances apply:

- i) Where the restriction, requirement or prohibition applies only to one side of the road.
- ii) At a junction where traffic turns from a one-way road into the relevant road. The sign should be angled to face towards the driver.
- iii) At a junction where the carriageway of the relevant road is less than 5 m wide and the centre of the sign is no more than 2 m from the edge of the carriageway.

Mandatory and regulatory signs are normally sited at or near the point where the instruction applies. Table 11.1 (Column 4) specifies minimum clear visibility distances for regulatory and mandatory signs. These should normally be measured from the center of most disadvantaged driving lanes. The more the number of signs which drivers are presented with simultaneously, the greater the difficulty they are likely to have in assimilating the information. Generally, not more than two signs should be erected on any one post when intended to be read from an approaching vehicle and this applies when signs are mounted at the same location on separate posts. Speed limit signs should be mounted alone. When a sign needs supplementary plate, the combination of sign and plate may be regarded as one sign.

#### **Item No.6 Providing and fixing guard stone as per I.R.C. type design including white washing etc. complete. (ii) Fixing in C.C. 1:5:10**

##### **(1) Fixing in Earth/Wearing Coat:**

1. The guard stone shall be of approved quality and of 20 cm x 15 cm. size and its length shall not be less than 75 cms. The top portion shall be rounded. The top 38 cm. shall be chisel dressed on all sides.

The size, shape and dimensions of the guard stones shall be exact and shall be neatly dressed and finished.

2. The guard stone shall be fixed in position as directed by the Engineer-in-charge in earth/wearing coat. If the guard stone shall be fixed in wearing coat, the equivalent volume covered by the guard stones shall be deducted from the gross measured quantity of wearing coat. The exposed part of the guard stones shall be given three coats of white wash. Any excavation necessary for fixing of the guard stones shall be done by the contractor at his own cost; The measurement for payment shall be per number of guard stone fixed in position.

3. Unit rate of guard stone includes the cost of all materials, labours, tools, fixing & white washing as directed by the Engineer-in-charge.

4. In case of Deep/Causeway the guard stone shall be fixed in masonry of head wall as directed by Engineer-in-charge.

#### **(2) Fixing in C.C. 1:5:10**

Specification same as 12 (1) above except that the indicator stone shall be fixed in C.C. 1:5:10 which will consist of one part of cement, five part of good sand and ten parts of good brick bats. Rate includes all labour and curing etc. necessary for concrete.

The measurement for payment shall be per number of guard stone fixed in position

**Item No.7 Hazard Marker Sign :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 90 x 30cms. rectangle as as per the design/drawing attached (IRC) pretreated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest M.O.S.T. Specifications; 3.1m long stand post and frame fabricated from suitable size iron angle of 35 x 35 x 3mm & 50 x 50 x 5mm painted with best quality epoxy coatings The fixing at site shall be in 1:2:4 CC block of size 45x45x 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.(A) Engineer Grade(VR)...**

dimensioned drawings of normal sized sign and symbols thereon are shown in Plate-II for ease of reproduction. For signs of other sizes, the symbols should be proportionately reduced or enlarged. The cautionary/warning signs are listed in Annexure-II.

Size, Shape and Colour

The signs shall be in the shape of an equilateral triangle, with apex pointing upwards.  
It shall

have red border and black symbols on white background. The size and placement details shall be as per Table 15.1.

**Table 15.1 The Sizes and Dimensions of Cautionary and their Siting Distances**

Design speed	Size	Side (mm)	Border (mm)	Clear Visibility Distances (m)	Distance of sign from haz

					ard (m)
Upto 50kmph	Small	600	45	45	4 5
51-65kmph	Medium	750	60	60	45 - 110
66-80kmph	Normal	900	70	60	110 - 180
>80kmph	Large	1200	90	90	180 - 245

### Location and Mounting

Warning signs should not be mounted on the same post as a STOP or GIVE WAY or speed limit sign, nor mounted on a traffic signal post. When mounted with other types of sign, the triangular warning signs should always be mounted at the top. Where two or more warning signs are erected together, the sign relating to the hazard first encountered should be placed uppermost. When a new sign is added to an existing post, it is important to ensure that the correct order is maintained, if necessary adjusting the position of the existing signs. The warning signs should normally be located depending upon 85<sup>th</sup> percentile speed of private cars (as given in Table 15.1) in advance of the hazard warned against. Distances may be increased on steep downhill gradients to account for higher speed. Where map type advance direction signs are posted in advance of the intersections, the warning signs relating to these junctions could be avoided to eliminate the clustering of signs.

### Hazard Marker

Road side hazard like bridges, trees which are coming in the roadway are to be illuminated by retro reflective Object Hazard Markers (OHM) and for a left side hazard Fig. 15.76 shall be used and for a right hazard Fig. 15.77 shall be used. If traffic is allowed to pass on either side the triangular island Two Hazard Marker Fig. 15.78 shall be used.

IRC:67-2012

PLATE - II  
(Continued)

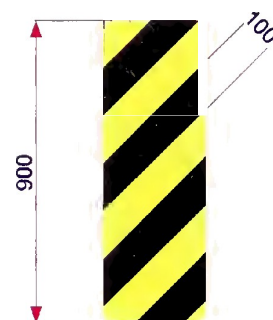
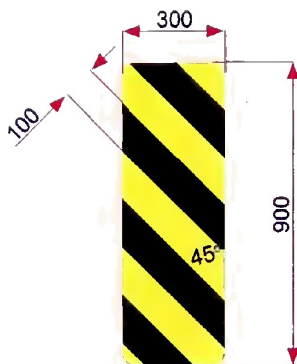


Fig. 15.76 Object Hazard (Left)

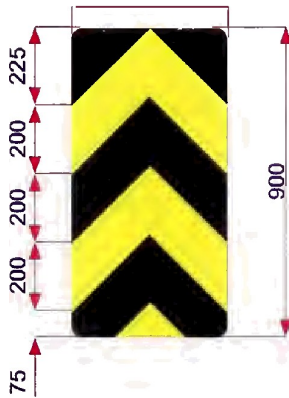


Fig. 15.78 Two Way Hazard Marker

**Item No.8**      **Chevron sign :-**Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 60x50cm rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro reflective sheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35x35x3mm; painted with best quality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 7 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-B Type-4 Retro Reflective sheeting

### **801.1 GENERAL**

801.1.1 The colour, configuration, size and location of all traffic signs for highways other than Expressways shall be in accordance with Code of Practice for Road Signs, IRC:67 or as shown on the drawings. For Expressways, the size of signs, letters and their placement shall be as specified in the Contract drawings and relevant specifications. In the absence of any details or for any missing details, the signs shall be provided as directed by the Engineer. The Aluminum sheet size to be fixed shall be as specified in the Item.

- 801.1.2 The signs shall be either reflectorised or non-reflectorised as shown on the drawing or as directed by the Engineer. When they are of reflectorised type, they shall be of retro-reflectorised type and made of encapsulated lens type reflective sheeting vide Clause 801.3, fixed over aluminium sheeting as per these Specifications.
- 801.1.3 In general, cautionary and mandatory signs shall be fabricated. through process of screen printing. In regard to informatory signs with inscriptions, either the message could be printed over the reflective sheeting, or cut letters of non-reflective black sheeting used for the purpose which must be bonded well on the base sheeting as directed by the Engineer.
- 801.2 MATERIALS**
- The various materials and fabrication of the traffic signs shall conform to the following requirements :
- 801.2.1 Concrete :** Concrete shall be of the grade shown on the contract drawings or otherwise as directed by the Engineer.
- 801.2.2 Reinforcing Steel :** Reinforcing steel shall conform to the requirement of IS : 1786 unless otherwise shown on the drawing.
- 801.2.3 Bolts, nuts, washers:** High strength bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364.
- 801.2.4 Plates and supports:** Plates and support sections for the sign posts. shall conform to IS:226 and IS:2062 or any other relevant IS Specifications.
- 801.2.5 Aluminium:** Aluminium sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminium alloy conforming to IS:736 Material designation 24345 or 1900.
- 801.2.6 Signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5 mm thick. All others shall be at least 2 mm thick. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under the prevailing wind and other loads.
- 801.2.7 In respect of sign sizes not covered by IRC:67, the structural details (thickness, etc.) shall be as per the approved drawings.
- 801.3 TRAFFIC SIGNS HAVING RETRO-REFLECTIVE SHEETING**
- 801.3.1 General Requirements:** The retro-reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having tested the sheeting for these properties in an unprotected outdoor exposure facing the sun for two years and its having passed these tests shall be obtained from a reputed laboratory, by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering, Grade material with enclosed lens or of High Intensity Grade with encapsulated lens. The type of the sheeting to be used would depend upon the type, functional hierarchy and importance of the road.
- 801.3.2 High Intensity Grade Sheetting :** This sheet shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard E:810) as indicated in Table 800-1 .

**Table 800-1**  
**ACCEPTABLE MINIMUM CO-EFFICIENT OF RETRO REFLECTION**  
**FOR HIGH INTENSITY GRADE SHEETING**  
**(CANDELAS PER LUX PER SQUARE METRE)**

Observation angle (in degrees)	Entrance Angle (in degrees)	White	Yellow	Orange	Green / Red	Blue
0.2	-4	250	170	100	45	20
0.2	+30	150	100	60	25	11
0.5	-4	95	62	30	15	7.5
0.5	+30	65	45	25	10	5.0

When totally wet, the sheeting shall not show less than 90 per cent of the values of retro-reflectance indicated in Table 800-1. At the end of 7 years, the sheeting shall retain at least 75 per cent of its original retro reflectance.

- 801.3.3 Engineering grade sheeting :** This sheeting shall be of enclosed lens type consisting of microscopic lens elements embedded beneath the surface of a smooth, flexible, transparent, water-proof plastic, resulting in a non-exposed lens optical reflecting system. The retro reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined In accordance with ASTM Standard :E-81 0) as indicated in Table 800-2.

**Table 800 – 2**  
**ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR**  
**ENGINEERING GRADE SHEETING**  
**(CANDELAS PER LUX PER SQUARE METRE)**

Observation angle (in degrees)	Entrance Angle (in degrees)	White	Yellow	Orange	Green	Red	Blue
0.2	-4	70	50	25	9.0	14.5	4.0
0.2	+30	30	22	7.0	3.5	6.0	1.7
0.5	-4	30	25	13.5	4.5	7.5	2.0
0.5	+30	15	13	4.0	2.2	3.0	0.8

When totally wet, the, sheeting shall not show less than 90 per cent of the values, of retro-reflection indicated in Table 800-2. At the end of 5 years, the sheeting shall retain at least 50 per cent of its original retro reflectance.

- 801.3.4 Messages/Borders:** The messages (legends, letters, numerals etc) and borders shall either be screen-printed or of cut-outs. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. Cut-outs shall be of materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer.

**801.3.5** For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the values of corresponding colour in Tables 800-1 and 800-2, as applicable.

**801.3.6** Cut-out messages and borders, wherever used, shall be made out of retro-reflective sheeting (as per Clause 801.3.2 or 801.3.3 as applicable), except those in black which shall be of non-reflective sheeting.

**801.3.7** **Colour :** Unless otherwise specified, the general colour scheme shall be as stipulated in IS:5 "Colour for Ready Mixed Paints", viz

Blue	-	IS	Colour	No.166: French Blue
Red	-	IS	Colour	No.537 : Signal Red
Green	-	IS	Colour	No.284 : India Green
Orange	-	IS	Colour	No.591 : Deep Orange

The colours shall be durable and uniform in acceptable hue' when viewed in day light or under normal headlights at night

**801.3.8** **Adhesives:** The sheeting shall either have a pressure sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, or a tack free adhesive activated by heat, applied in ct, heat-vacuum applicator, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate ,such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. In case of pressure-sensitive adhesive sheeting, the sheeting shall be applied in accordance with the manufacturer's specifications. Sheetting with adhesives requiring use of solvents or other preparation for adhesive shall be applied strictly In accordance with the manufacturer's instructions.

**801.3.9** **Refurbishment:** Where existing signs are specified for refurbishment, the sheeting shall have a semi-rigid aluminium backing pre- coated with aggressive-tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the sign and should thoroughly bond with that material.

#### **801.3.10 FABRICATION :**

**801.3.10.1** Surface to be reflectorised shall be effectively prepared to receive the retro reflective sheeting. The aluniinium sheeting shall be degreased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting.

**801.3.10.2** Complete sheets of the material shall be used on the signs except where it is unavoidable; at splices, sheeting with pressure sensitive 1 adhesives shall be overlapped not less than 5 mm. Sheetting with heat activated adhesives may be spliced with an overlap not less than 5 mm or butted with a gap not exceeding 0.75 mm. Where screen printing with transparent colours is proposed, only butt jointing shall be used. The material shall cover the sign surface evenly and shall be free from twists,



cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

- 801.3.11 Warranty and durability:** The contractor shall obtain from the manufacturer a seven year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of high intensity grade and a five year warranty for the adhesive sheeting of engineering grade and submit the same to the Engineer. In addition, a seven year and a five year warranty for satisfactory in field performance of the finished sign with retro-reflective sheeting of high intensity grade and engineering grade respectively, inclusive of the screen printed or cut out letters/legends and their bonding to the retro-reflective sheeting shall be obtained from the Contractor/supplier and passed on to the Engineer. The Contractor/supplier shall also furnish a certification to that the signs and materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty.

Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant and, following cleaning, shall show no appreciable discolouration, cracking, blistering or dimensional change and shall not have less than 50 per cent of the specified minimum reflective intensity values (Tables 800-1 and 800-2) when subjected to accelerated weathering for 1000 hours, using type E or EH weatherometer (AASHTO Designation M 268).

#### **801.4 INSTALLATION**

- 801.4.1** Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area upto 0.9 sq.m. shall be mounted on a single post, and for greater area two or more supports shall be provided. Sign supports may be of mild steel, reinforced concrete or galvanized iron (G.I.) Post end(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant specifications as specified.

- 801.4.2** All components of signs and supports, other than the reflective portion and G.I. posts shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy paint. Any part of mild steel(M.S.) post , below ground shall be painted with three coats of red lead paint.

- 801.4.3** The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or G.I. posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

#### **801.5 MEASUREMENTS FOR PAYMENT**

The measurement of standard cautionary, mandatory and information signs shall be in numbers of different types or signs supplied and fixed.

#### **801.6 RATE**

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the specifications.

Deputy Executive Engineer  
R & B Panchayat Sub Division  
Surat

Executive Engineer  
R & B Panchayat Division  
Surat