

# 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.

## MMGSY 2025-26.

**Name of Work:-** Resurfacing of Various Roads in Olpad Taluka **PKG:-**  
**3/OLP/MMGSY/Resurfacing/Road Furniture/3-RD/2026-27.Total 3**  
**Road[1]Resurfacing of Bhandut-Selut Road Km 0/0 to 2/2, Ta.Olpad, Dist. Surat**  
**(Road Furniture Work)[2]Resurfacing of Lawachha Chorasi Road Ch. 0/0 to**  
**1/300 Km Ta.Olpad, Dist. Surat (Road Furniture Work)[3]Resurfacing of**  
**Bhandut Ahirwas Road Ch. 0/0 to 1/800 Km Ta.Olpad, Dist. Surat (Road**  
**Furniture Work)**

**ITEM WISE SPECIFICATION**

**Item No. 01** *Cautionary Warning Sign for Bump/Curve :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 60 x 60 x 60 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 reflektivsheeting 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.*

**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 coefficient 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. Sheeting 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 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

**Item No. 02 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 fabriated 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)...*

The work of providing and fixing Hazard marker sign shall be executed as per relevant specifications of Item No. 1 of this contract. The measurement shall be in numbers of Hazard sign board supplied and fixed in position.

**Rate shall be for unit of one Number**

**Item No. 03 STOP/SPEED SIGN:-***Providing and fixing sing boards made out of 2mm aluminium sheet;shall be octagonal in shape of 75 cm x 75 cm and shall have red background and white border. The word "STOP" written in white (in English or local language) with125 mm height letters, centrally positioned. The height of the octagon and border shall as per the design of IRC: 67-2012 pre treated with phospheting process & acid teching; 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 75x75x6mm as required; 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 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.(A) Engineer Grade.*

1. The relevant specifications of MORT&H fifth revision Section-800, clause 801.3 shall apply to this item & directed by engineer in charge.
2. The item shall be measured in No.

**Rate shall be for unit of one Number.**

**Item No. 04** *Regulatory/Mandatory Sign-Providing & Fixing Sign Board made out of 2 mm aluminium sheet,size 60 cms, Diameter 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 retro reflective sheeting as per latest M.O.S.T. Specification,3.1 m long stand post and frame fabricated from suitable size iron angle of 35X35X3 mm 75X75X6 mm as required painted with best quality epoxy coating in black and white bend,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 45X45X60 cms for each leg,including excavation curing etc.complete under the supervision of engineer in charge (A) Engineer Grade.....*

The work of supplying and fixing Jumbo bollard Swiss type shall be executed as per relevant specifications of Item No. 1 of this contract. The measurement shall be in numbers of **Regulatory/Mandatory** supplied and fixed in position.

**Rate shall be for unit of one Number.**

**Item No. 05** *Chevron Sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet/3mm ACP (Aluminium composite panel) size 60 x 50cms rectangular as per the design IRC-67-2012. pretreated 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; 3.3m long stand post of iron angle 75x75x6mm/ NB 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 or inspection / numerals for each board shall be as*

*per instruction of engineer incharge. 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 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 product offered shall be submitted by contractor. (A) class-B Type-4 Retro Reflective sheeting.*

The work of supplying and fixing Jumbo bollard Swiss type shall be executed as per relevant specifications of Item No. 1 of this contract. The measurement shall be in numbers of *Chevron Sign* supplied and fixed in position.

**Rate shall be for unit of one Number.**

**Item No. 06** *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  $35 \pm 5$  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

**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/ 1x.

### **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.

**Rate shall be for unit of one Number.**

**Item No. 07** Road marking with hot applied thermoplastic paint with reflectorising glass beads on bitumen surface providing and laying a hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is excluding of surface applied glass beads 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 colour 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 warranty for retroreflectivity shall be two years.

**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 Ordinary preparation and laying with surface application of glass beads at a specific rate. Upon cooling to ambient pavement temperature, it shall be 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 min.
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 :

#### **A) 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 cards on application to concrete blocks.

E) Softening point :  $102.5 \div 9.5$ ” as per ASTM D 36.

F) Flow resistance : Note 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 there 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.

### **REFLECTORZING GLASS BEADS**

GENERAL : This Specification covers two types of glass beads to be used for to production of reflectiorised 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, colcurless 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 GLASSBEADS**

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 spjeeres.

#### **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 test 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 not be less than 10 C. during application. All surface to be marked shall be thoroughly cleaned 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 on 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 labour, materials, tools, equipment, including all incidental costs necessary for carrying out the work at the site conforming to these specification 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.

**Rate shall be for unit of Sq. mt. Basis**

**Item No. 08** *Type-B THRIE : Metal Beam Crash Barrier*

*Providing and directing a "Thrie" beam metal crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 85 cm above road/ground level, fixed on ISMC series channel vertical post, 150x75x5mm spaced 2 m centre to centre, 2 m high with 1.15 m below ground level. The vertical post fixing at site shall be in M15 grade cement concrete of size 35 x 35 x 120 cms. for each post including excavation curing etc.completed. All steel parts and fitments to be galvanized by hot dip process all fittings to confirm to IS 1367 and IS 1364 metal beam rail to be fixed on the vertical post with a spacer of channel section 150x75x5 mm, 550 mm long completed as per Morth specification clause 810 including butt welding to all nuts & bolts & including 3 mm ACM type reflector 100 mm wide & 4.5 m long, type 4 class B high intensity Grade sheeting as per IRC 67:2012 etc. completed as per instruction of Engineer in charge. Also radium red yellow color strip of size 100x300 mm shall be fixed on vertical front side of post for better night visibility. The spacer post, thrie beam rail shall be cold roll formed & galvanized with 550 gm/sq.mtr.*

**2703.1. General**

- a) Bridge railing/crash barrier includes the portion of the structure erected on and above the kerb.
- b) Railings/crash barrier shall not be constructed until the centering false work for the span has been released and the span is self-supporting.
- c) For concrete with steel reinforcement, specifications for the items of controlled concrete and reinforcement mentioned under relevant sections of these specifications shall be applicable.
- d) The railing/crash barrier shall be carefully erected true to line and grade posts shall be vertical with a tolerance not exceeding 6mm in 3m. The pockets left for posts shall be filled with non shrink mortar.
- e) The type of railing/crash barrier to be constructed shall be as shown on the drawings and shall conform to IRC:6 and IRC:5. 15.4.5. Crash barriers shall provide a smooth and continuous face on the traffic side and shall be suitably extended into the approaches. Exposed rail ends, posts and sharp changes in the geometry of the railings shall be avoided. Suitable reflective (luminous) devices shall be provided on the traffic face of the barrier at intervals to ensure adequate visibility during night and foggy conditions.
- f) Care shall be exercised in assembling expansion joints in the railings to ensure that they function properly.

g) The bridge railings shall be amenable to quick repairs.

h) Warrants: The longitudinal roadside barriers are basically meant to shield two types of roadside hazards i.e. embankments and roadside obstacles and also for preventing the vehicles veering off the sharp curves. Therefore, all embankments with height 3 m or more shall have safety barriers at the edge of formation, with delineating reflectors fitted on them.

Normally on shoulder side the lateral distance of at least 0.75 to 1.0 m width from edge of paved portion (i.e. carriageway + paved shoulder) should be available without any obstacles. Wherever a permanent object cannot be removed for some reasons, provision of tandems viz. W-beam metal crash barriers and hazard markers with reflectors must be made. Further, frangible lighting columns and sign posts need to be used for minimizing the severity in case of collision.

Irrespective of type of barrier being used, the slope in front of W-beam or wire rope or rigid barrier shall be near to flat gradient so that safety barrier perform best when impacted by a vehicle and the slope of ground in front of barrier shall not be steeper than 10:1.

Some of the commonly encountered roadside obstacles are bridge piers, abutments and railing ends, roadside rock mass, culverts, pipes and headwalls, cut slopes, retaining walls, lighting supports, traffic signs and signal supports, trees and utility poles.

#### **Bridge rail / crash angles, transiting and end treatment.**

Traffic crash barrier is toe warrants. For an approach barrier to a bridge. The criteria for clear total requirements given in figure shall be apply. The crash barrier shall be provided where transition sanction between approach barrier and bridge railing / barrier. If the end of approach barrier terminate within clear tone, a crash worthy end treatment is also warranted.

The end of the road side barrier can batter dues if hit, therefore it should farm an integral part of crash barrier end treatment should have spear vault or roll, a vehicle for head on as angled impacts.

The end treatment on approach shall be modified eccentric loader terminal (MELT) as shown in fig.-13 and departure sides shall be trailing terminal (TT) arrangement shown in.

#### **Placement of crash barrier on road edge barrier.**

As far as possible, crash barrier should be placed at a distance 2.5 m of the carriage way (Travelled way) for range & continues stretches. The distance between barrier & hazard should not be less than destruction of barrier by on impact by full size vehicle.

In cash of embankments a minimum distance of 60 cm should be maintained between barrier and start of embankments - slope or hazard to in reverse for vehicle dropping.

When the kerb exists on the edge of road and on closed proximity of travelled way, weather and shoulders or median edge line a distance of 100 mm shall be maintained between vertical frames the kerb & W-beam force. The steel barrier shall be placed in such a way so as not to be collided by vehicle directly fig. - 17.

h) The material of metal railing/crash barrier shall be handled and stored with care ,so that it remains clean and free from damage. Railing/crash barrier materials shall be stored above the ground on platforms, skids, or other supports and kept free from grease, dirt and other contaminants.

Any material which is lost, stolen or damaged after delivery shall be replaced or repaired by the Contractor. Methods of repair shall not damage the material or protective coating.

### 2703.2. Metal Railings/Crash barrier

Materials, fabrication, transportation, erection and painting for bridge railings shall conform to the requirements of section 800

All complete steel rail elements, pipe terminal sections, posts, bolts, nuts, hardware and other steel fitting shall be galvanised or painted with an approved paint.

If galvanised, all elements of the railing shall be free from abrasions, rough or sharp edges, and not be kinked, twisted or bent. If straightening is necessary, it shall be done by methods approved by the Engineer.

Damaged galvanised surfaces, edges of holes and ends of steel railing cut after galvanising shall be cleaned and re-galvanised.

The railing/crash barrier shall be carefully adjusted prior to fixing in place to ensure proper matching at abutting joints and correct alignment and camber throughout their length. Holes for field connections shall be drilled with the railing in place in the structure at proper grade and alignment.

Unless otherwise specified on the drawings, metal railing/crash barrier shall be given one shop coat of paint and three coats of paint after erection if sections are not galvanised.

Railings/crash barrier shall not follow any irregularity in the alignment of the deck. When shown on the drawings, the rail elements shall be curved before erection.

- 1.0** The work shall consist of furnishing and erection of metal safety barrier of dimensions and at locations as shown on the drawing, 'or' as directed by the Engineer-in-charge.

#### 2.0 Materials

- 2.1 Metal beam rail shall be corrugated sheet of galvanized iron of the class, type section and thickness and shall be provided in one row as indicated in the item and shown on plan. Railing post shall be of steel section 150 mm x 75 mm x 5 mm. All complete steel rail elements, terminal sections, bolts, nuts, hardware and other fittings shall be galvanized. All elements of the railing shall be free from abrasion, rough or sharp edges and shall not be kinked twisted or bent, and shall confirm to the confirming to IS 2062 IS 1367 and LS 1364.
- 2.2 All steel members shall be galvanized with coating thickness not less than 550 gm/m<sup>2</sup> (gsm). galvanizing shall be as per MORTH specification. Fasteners/bolts shall be of grade 4.6 and diameter 16mm dome head bolts. W-beam metal crash barrier shall confirm to MORTH specification. MORTH specification for metal crash barrier shall be applicable.
- 2.3 3mm ACM type reflector, 100 mm wide and 4.50 m long, type 4 class-B, High intensity grade sheeting as per IRC 67-2012 including labour.
- 2.4 Anchor bolts shall be of minimum grade 4.6 and manufactured by Hilti or equivalent confirming to IS 1367 and LS 1364..

#### 3.0 Construction Operation :

- 3.1 Removing / Dismantling existing Parapet wall / Pipe Railing/crash barrier followed must by these specification item no 3
- 3.1 Installation of posts :

### **3.1.0. Workmanship**

**3.1.1.** The concrete base shall be cleared with relevant detailed specification.

3.2

3.2.1 The Pit shall be back filled with M-300 as shown on drawing or as directed.

3.3 While fixing steel post shall be embedded in concrete at 1.5 mt C/C with necessary base plate and anchor bolts using epoxy chemical. The line and grade of railing shall be true to that shown on the plan. The railing shall be carefully adjusted to fixing in place to ensure proper matching at abutting joints and correct alignments and caber throughout their length. Holes for field connection shall be drilled with the railing in place in the structure at proper grade and alignment. Placement / fixing crash barrier in accordance with guidelines specified in IRC 119, 2015.

3.4 Railing steel post shall be given one coat of primer and two coats of paint on structural steel after erection if the sections are not galvanized. Any part of assembly below ground shall be painted with two coats of red lead paint.

### **4.0 Erection:**

4.1 All ground rail anchors shall be set and attachment made and placed as indicated in the item and shown on the plan or as directed by the Engineer-in-charge.

4.2 All railings shall be erected, drawn and adjusted so that the longitudinal tension will be uniform throughout the entire length of the rail.

4.3 The post shall be vertical with a tolerance not exceeding 6 mm in a length of 3 meter. The railing barrier shall be erected true to line and grade.

### **5.0 Measurement for payment :**

5.1 Metal beam crash barrier will be measured and paid by **liner meter** of completed length as per plans and accepted in place.

5.2 No measurement for payment shall be made for excavation, back filling with concrete etc. performed in connection with this construction.

5.3 The contract unit rate shall include full compensation for furnishing of labour, material, tools, equipment's works involved in constructing the "W" type double beam Metal crash barrier complete in place in all respect as per these specification.

**Rate shall be for unit of one RMT.**

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