

Name of Work:- M & R to various roads under Jurisdiction of R & b Sub Division Visnagar. (Road Furnishing Work) (Annual Rate) Year 2024-25.

Item no. 22:- Providing and fixing retro Reflective Hi Intensity Micro Prismatic Grade Board using 2mm Aluminum / 4mm ACP, angle iron 75 x 75 x 6mm. Descaling and degreasing the board as per requirement using epoxy reflective process by screen painting as directed etc. complete including transporting and fixing in C.C. 1:2:4 with necessary excavation curing etc. complete as per I.R.C. 67-2012 design. 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 Type4(MDR/ODR) retro reflective sheeting (SOR IT No- 26091 Pg No- 201) SOR 2024-25.

801.1 Scope

The work shall consist of the fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for road signs, IRC : 67 -2010.

801.1.1 The colour, configuration, size and location of all traffic signs for highways other than Expressways shall be in accordance with the code of Practice for Road Signs, IRC: 67 or as shown on the drawings. For Expressways, the size of the 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.

801.1.2 The signs shall be either reflectorized or non-reflectorized as shown on the drawings or as directed by the Engineer. When they are of reflectorized type, they shall be of retro-reflectorized 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 otherwise shown on the drawing.

801.2.1 Concrete

Concrete for foundation shall be of M 15 grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the engineer.

801.2.2 Reinforcing steel

Reinforcing steel shall confirm 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 signposts shall conform to IS: 226and IS: 2062or any other relevant IS Specifications.

801.2.5 Substrate:

Sign panels shall be fabricated on aluminum sheet, aluminum composite panel, fiber glass sheeting, or sheet molding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminum alloy conforming to IS:736-Material Designation 24345 or 1900. Aluminum Composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LOPE) between two thick skins/sheets of aluminum with overall thickness and 3 mm or 4 mm (as specified in the Contract), and aluminum skin of thickness 0.5 mm and 0.3 mm respectively on both sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in Table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specification for Aluminum Composite Material (ACM)

Sr.No.	Description	Specification	
		Standard Test	Acceptable Value
A	Mechanical Properties of ACM		
1	Peel off strength with retro reflective sheeting (Drum Peel Test)	ASTM D903	Min. 4 N/mm

2	Tensile strength	ASTM E8	Min 40 N/mm2
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm2
4	Elongation	ASTM E8	Min. 6%
5	Flexural strength	ASTM 393	Min. 130 N/mm2
6	Flexural Modulus	ASTM 393	Min. 44 N/mm2
7	Shear strength with punch shear test	ASTM 732	
B	Properties of Aluminium Skin		
1	Tensile strength	ASTM E8	Min. 65 N/mm2
2	Modulus of elasticity	ASTM E8	Min. 70000 N/mm2
3	Elongation	ASTM E8	A50 Min. 2%
4	0.2% Proof Stress	ASTM E8	Min. 10 N/mm2

801.2.6. Plate Thickness

Signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm 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 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 sheeting: This sheeting 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 800-2. Acceptable Minimum Co-efficient of Retro-Reflection for High Intensity Grade Sheeting (Type III) (Encapsulated Lens Type) (Candles Per Lux Per Square Metre)

Observation Angle in Degrees	Entrance Angle in Degrees	White	Yellow	Orange	Green	Red	Blue	Brown
0.1 ⁰ B	(-4 ⁰)	300	200	120	54	54	24	14
0.1 ⁰ B	(+30 ⁰)	180	120	72	32	32	14	10
0.2 ⁰	(-4 ⁰)	150	170	100	45	45	20	12
0.2 ⁰	(+30 ⁰)	95	100	60	25	25	11	8.5
0.5 ⁰	(-4 ⁰)	65	62	30	15	15	7.5	5
0.5 ⁰	(+30 ⁰)	65	45	25	10	10	5	3.5

A. Minimum of coefficient of Retro-reflection (RA)

B. Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90%, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 % of its original retro-reflection.

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-810) as indicated in Table 800-2.

TABLE 800-3. 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	Brown
0.1 ^{0 B}	(-4 ⁰)	500	380	200	70	90	42	25
0.1 ^{0 B}	(+30 ⁰)	240	175	94	32	42	20	12
0.2 ⁰	(-4 ⁰)	360	270	145	50	65	30	18
0.2 ⁰	(+30 ⁰)	170	135	68	25	30	14	8.5
0.5 ⁰	(-4 ⁰)	150	110	60	21	27	13	7.5
0.5 ⁰	(+30 ⁰)	72	54	28	10	13	6	3.5

- A. Minimum of coefficient of Retro-reflection (RA)
 B. Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90%, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 % of its original retro-reflectance.

801.3.4. Prismatic Grade Sheeting

801.3.4 Prismatic Grade Sheeting (Type VIII)

801.3.4.1 Prismatic Grade Sheeting

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after clearing with soap and water and in dry condition shall have the minimum coefficient of retro reflection (determined in accordance with ASTM E810) as indicated in Table 800-4.

801.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro-reflective sheeting made of micro prismatic retro-reflective material. The retro-reflective surface, after clearing with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined in accordance with ASTM E810) as indicated in Table 800-5.

TABLE 800-4. ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR PRISMATIC GRADE SHEETING (Type VI) (CANDELAS PER LUX PER SQUARE METRE)

Observation Angle in Degrees	Entrance Angle in Degrees	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow/Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^{0 B}	(-4 ⁰)	1000	750	375	100	150	45	30	800	600	300
0.1 ^{0 B}	(+30 ⁰)	460	345	175	46	69	21	14	370	280	135
0.2 ⁰	(-4 ⁰)	700	525	265	70	105	32	21	560	420	210
0.2 ⁰	(+30 ⁰)	325	245	120	33	49	15	10	260	200	95
0.5 ⁰	(-4 ⁰)	250	190	94	25	38	11	7.5	200	150	75
0.5 ⁰	(+30 ⁰)	115	86	43	12	17	5	3.5	92	69	35

- A. Minimum of coefficient of Retro-reflection (R^A) cd/fc/ft² (cd-lx-1m²)
 B. Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90%, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 % of its original retro-reflectance.

TABLE 800-5. ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR PRISMATIC GRADE SHEETING (Type IX) (CANDELAS PER LUX PER SQUARE METRE)

Observation Angle in Degrees	Entrance Angle in Degrees	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow/Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^{0B}	(-4 ⁰)	600	500	250	66	130	130	530	400	200
0.1 ^{0B}	(+30 ⁰)	370	280	140	37	74	17	300	220	110
0.2 ⁰	(-4 ⁰)	380	285	145	38	76	17	300	230	115
0.2 ⁰	(+30 ⁰)	215	162	82	22	43	10	170	130	65
0.5 ⁰	(-4 ⁰)	240	180	90	24	48	11	190	145	72
0.5 ⁰	(+30 ⁰)	135	100	50	14	27	6	110	81	41
1.0 ⁰	(-4 ⁰)	80	60	30	8	16	3.6	64	48	24
1.0 ⁰	(+30 ⁰)	45	34	17	4.5	9	2	36	27	14

- A. Minimum of coefficient of Retro-reflection (R^A) cd/fc/ft² (cd-lx-1m²)
- B. Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90%, of the values of retro reflectance indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 % of its original retro-reflectance.

801.3.4.3 Prismatic Grade Sheeting (Type XI)

A Retro-reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro-reflective sheeting made of micro prismatic retro-reflective material. The retro-reflective surface, after clearing with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM E 810) as indicated in Table 800-6.

TABLE 800-6. ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR PRISMATIC GRADE SHEETING TYPE A (Type XI) (CANDELAS PER LUX PER SQUARE METRE)

Observation Angle in Degrees	Entrance Angle in Degrees	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow/Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^{0B}	(-4 ⁰)	830	620	290	83	125	37	25	660	500	250
0.1 ^{0B}	(+30 ⁰)	325	245	115	33	50	15	10	260	200	100
0.2 ⁰	(-4 ⁰)	580	435	200	58	87	26	17	460	350	175
0.2 ⁰	(+30 ⁰)	220	165	77	22	33	10	7	180	130	66
0.5 ⁰	(-4 ⁰)	420	315	150	42	63	19	13	340	250	125
0.5 ⁰	(+30 ⁰)	150	110	53	15	23	7	5	120	90	45
1.0 ⁰	(-4 ⁰)	120	90	42	12	18	5	4	96	72	36
1.0 ⁰	(+30 ⁰)	45	34	16	5	7	2	1	36	27	14

- A. Minimum of coefficient of Retro-reflection (R^A) cd/fc/ft² (cd-lx-1m²)
- B. Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90%, of the values of retro reflectance indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 % of its original retro-reflectance.

801.3.5.

Adhesives : The sheeting shall either have 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 a 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.

801.3.6. Fabrication:

Where existing signs are specified for refurbishment, the sheeting shall have a semi-rigid aluminum 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.

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminum sheeting shall be de-greased 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.

Complete sheets of the material shall be used on the signs except where it is unavoidable; at splices, sheeting with pressure sensitive 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.

801.3.7 Messages/ Borders

The messages (legends, letters, numerals etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the coefficient of retro-reflection shall not be less than 50 percent of the values of corresponding colour in Tables 800-2 to 800-8 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

801.3.8 Colour of signs

801.3.8.1

Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink. The reverse side of all signs shall be painted grey.

801.3.8.2

Except in the case of railway level crossing signs the sign posts shall be painted in 250 mm side bands, alternately black and white. The lowest band next to the ground shall be in black.

801.3.8.3

The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 800-7 and comply with the luminance factor when measured as per ASTM D-4956.

TABLE 800-7. Colour specified limits (Daytime)

Colour	1		2		3		4		Daytime Luminance Factor (Y%)	
	X	y	x	y	x	y	x	y	Min.	Max.
White	0.303	0.3	0.368	0.366	0.34	0.393	0.274	0.329	15	-
Yellow	0.498	0.412	0.557	0.442	0.479	0.52	0.438	0.472	24	45
Green	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771	2.5	11
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346	2.5	11
Blue	0.140	0.035	0.244	0.21	0.19	0.255	0.065	0.216	1	10
Orange	0.558	0.352	0.636	0.364	0.57	0.429	0.506	0.404	12	30
Brown	0.43	0.34	0.61	0.390	0.55	0.45	0.43	0.39	1	6

Fluorescent Yellow-Green	0.387	0.61	0.369	0.546	0.428	0.496	0.46	0.54	60	-
Fluorescent Yellow	0.479	0.52	0.446	0.483	0.512	0.421	0.557	0.442	45	-
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355	25	-

801.3.8.4

The regulatory/prohibitory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black colour. The mandatory sign shall be provided with blue background and white symbol/letter.

801.3.8.5

The colours chosen for informative or guide signs shall be distinct for different classes of roads. For national highways and state highways, these signs shall be of green background and for expressways these signs shall be of blue background with white border, legends and word messages.

801.3.9 Refurbishment

Where existing signs are specified for refurbishment, the sheeting shall have a semi-rigid aluminium backing or materials as per Clause 801.2.5, 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 Sizes of letters

801.3.10.1 Location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

TABLE 800-8. Acceptable limits for sizes of letters

Design Speed (Km./hr.)	Minimum 'x' height of the letters (mm)	Minimum Sight distance/ Clear visibility distance (m)	Maximum distance from centre line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width, the heights are indicated in Table IV (a) of the Annexure-4 of IRC:67 to facilitate the design of the informatory signs and definition plates.

801.3.10.2

For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for Expressway, National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in upper case letters only.

801.3.10.3

Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken into two lines and size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

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 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 discoloration, cracking, blistering or dimensional change and shall not have less than 80 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 up to 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.

. 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 Re

801.5. Measurements for Payment

The measurement of standard cautionary, mandatory and information signs shall be in numbers of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by area in square metres.

The mode of Measurement shall be made in Number basis.

The description of Item shall be self-specification of work shall be carried as per IRC and drawing supplied by engineer in charge.

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.

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.

The Measurement & Payment shall be made of No. Basis.

Item no. 23:- Providing and fixing retro Reflective Prismatic grade Board using 2mm Aluminum / 4mm ACP, angle iron 75 x 75 x 6mm. Descaling and degreasing the board as per requirement using epoxyprimer epoxy paint and carrying retro reflective process by screen painting as directed etc. complete including transporting and fixing in C.C. 1:2:4 with necessary excavation curing etc. complete as per I.R.C 67-2012 design. A warranty for 10 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 -C Type-11(NH/SH) retro reflective sheeting (SOR IT No- 26091A Pg No- 201) SOR 2024-25.

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no. 24 :- Cautionary Warning Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle 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 reflectivesheeting 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 bestquality 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 blockof 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 (SOR IT CODE-26092B) (A) For MDR,ODR & VR

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no. 25:- Cautionary Warning Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle 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 Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 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 bestquality epoxy coatings in black and white 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 warranty for 10 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. (SOR CODE-26092C) (A) For SH.

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no 26: - Facility Informatory Sign: -Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 80 x 60 cms. rectangular as per design of 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; 3.6mtr 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. (SOR NEW CODE-26093B) (A) For MDR,ODR & VR.

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no. 27: - Facility Informatory Sign: -Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 80 x 60 cms rectangular as per design of 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 Micro Prismatic Grade retro reflective sheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 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 10 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. (SOR NEW IT CODE-26093C) (A) For SH.

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no. 46: - Sign Board per square Meter :-Providing and fixing sign boards made out of 2mm aluminium sheet/4 mm ACP (Aluminum Composite Panel) ; size 1 Meter x 1 Meter as as per the design of 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; 4 mtr long post (2 Nos) of iron angle 75*75*6 mm/ 65 NB Circular MS pipe as required and frame fabricated from suitable size iron angle of 50*50*6mm,painted with best quality coatings in black and white bends.The details of symbol or instruction/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*45*60 cms for each legs 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 years 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 (New SOR It.No-26103B)

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no. 47: - Sign Board per square Meter :-Providing and fixing sign boards made out of 2mm aluminium sheet/4 mm ACP (Aluminum Composite Panel) ; size 1 Meter x 1 Meter as as per the design of 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; 4 mtr long post (2 Nos) of iron angle 75*75*6 mm/ 65 NB Circular MS pipe as required and frame fabricated from suitable size iron angle of 50*50*6mm,painted with best quality coatings in black and white bends.The details of symbol or instruction/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*45*60 cms for each legs including excavation curing etc complete under the supervision of engineer in charge. A warranty for 7 years for the retro reflective sheeting from original Manufacture & a certified copy of 3 years outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor (B) Class C Type -11 Retro Reflective Sheeting (New SOR It.No-26103C)

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no. 48: - Men at work (2' x 2') sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60cmx60cm 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 reflectivesheeting 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 50x50x5mm; painted with bestquality 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. (B) Class-B Type-4 Retro Reflective sheeting. (SOR NEW IT CODE-26105B) (A) For MDR,ODR & VR

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no. 49:- Men at work (2' x 2') sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60cm x 60cm square 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 Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality 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 10 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-C Type-11 Retro Reflective sheeting (SOR NEW IT CODE-26105C) (A) For SH

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis.

Item no. 50:- Tree Guard sign :-Providing & fixing sign board made out of 2mm aluminium sheet / 3mm ACP (Aluminum composite Panel) ,size 30cms diameter circle, pretreated with phosphating process and acid etching, painted 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. 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. (SOR NEW IT CODE-26107B) (A) For MDR,ODR & VR

The sign board shall conform to IRC-67-1977 and ninth schedule of the motor vehicle Act. It shall be providing and fixed as directed by the Engineer in charge.

1.2 Traffic Signs having retro-reflective sheeting :

1.2.1 General Requirements :

The retro-reflective sheetings used on the sign shall consist of 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 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/ micro prismatic type. The type of sheeting to be used would depend upon the type, functional hierarchy and importance of the road.

1.2.2 High Intensity Grade Sheetting :

1.2.2.1 Encapsulated Lens Type :

This sheeting 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 REFLECTIVE FOR HIGH INTENSITY GRADE SHEETING (CANDELAS PER LUX 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% of the values of retro reflectance indicated in Table 800-1. At the end of 7 years, the sheeting shall retain at least 75% of its original retro-reflectance.

1.3.2 Engineering Grade Sheetting :

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, resulting in a non-exposed lens optical reflecting systems. 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-810) as indicated in Table 800-2.

TABLE 800-2

ACCEPTABLE MINIMUM CO-EFFICIENT OF RETRO REFLECTIVE FOR ENGINEERING GRADE SHEETING (CANDELAS PER LUX 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	14.5	7.5	2.0
0.5	+30	15	13	4.0	2.2	3.0	0.8

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

1.1.3 Messages/Boarders : 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.

1.1.4 For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro- reflection shall not be less than 50% of the values of corresponding colour in Tables 800-1(a), 800- 1(b) and 800-2 as applicable.

1.1.5 Cut out messages and borders, wherever used, shall be made out of retro-reflective sheeting (as per Clause 1.1.2) except those in black which shall be of non-reflective sheeting.

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

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 but when viewed in day light or under normal headlights at night.

1.1.7 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 adhesive activated by heat, applied in a 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.

1.1.8 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 type of material used for the sign and should thoroughly bond with that material.

1.1.9 Fabrication :

1.1.9.1 Surface to be reflectorised shall be prepared to receive the retro-reflective sheeting. The 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.

1.1.9.2 Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure sensitive adhesive 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.

1.1.10 Warranty Durability : For each lot of sheetings procured, the contractor shall obtain from the manufacturer a 7 years warranty for satisfactory field performance including stipulated retro-reflectance of the sheetings of high intensity grade and a 5 years warranty for the engineering grade and submit the same to the Engineer. In addition, a 7 years and a five years 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 that the signs and materials supplied against the assigned work meet 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 percent 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).

1.2 Installation :

1.2.1 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 galvanised 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.

1.2.2 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.

1.2.3 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.

1.3 Measurements for Payment :

The measurement for standard cautionary, mandatory and information sign shall be in number of different types of signs supplied and fixed as per above details and specifications.

1.4 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. 51:- Tree Guard sign :-Providing & fixing sign board made out of 2mm aluminium sheet / 3mm ACP (Aluminum composite Panel) , size 30cms diameter circle, pretreated with phosphating process and acid etching, painted 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. A warranty for 10 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-C Type-11 Retro Reflective sheeting (SOR NEW IT CODE-26107C) (A) For SH

Specifications should be as per Item no. 50 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 54:- Danger Plate sign :-Providing & fixing sign board made out of 2.0 mm aluminium sheet /4mm ACP (aluminum Composite Panel), size 30cms diameter circle, pretreated with phosphating process and acid etching, painted 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. 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 (SOR NEW IT CODE-26109B) (A) For MDR,ODR & VR

Specifications should be as per Item no. 50 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 55:- Danger Plate :-Providing & fixing sign board made out of 2.0 mm aluminium sheet /4mm ACP (aluminum Composite Panel), size 30cms diameter circle, pretreated with phosphating process and acid etching, painted 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. A warranty for 10 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-C Type-11 Retro Reflective sheeting (SOR NEW IT CODE-26109C) (A) For SH

Specifications should be as per Item no. 50 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 56:- Railway crossing sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle plus 90x30cm additional plate 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 reflectivesheeting 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 bestquality 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 blockof 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 (SOR NEW IT CODE-26110B) (A) For MDR,ODR & VR

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 57:- Railway crossing sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle plus 90x30cm additional plate 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 Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 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 bestquality epoxy coatings in black and white 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 warranty for 10 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-C Type-11 Retro Reflective sheeting (SOR NEW IT CODE-26110C) (A) For SH

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 58:- Four (Two) Lane Ahead Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 120x120 cms. square plus 120x60cm additional plate 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 reflectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4 mtr long stand post (2 Nos.) 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 bestquality 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 blockof 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 (SOR NEW IT CODE-26111B) (A) For MDR,ODR & VR

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 59:- Four (Two) Lane Ahead Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 120x120 cms. square plus 120x60 cm additional plate 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 Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4 mtr long stand post (2 Nos.) of 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 bestquality epoxy coatings in black and white 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 warranty for 10 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-C Type-11 Retro Reflective sheeting (SOR NEW IT CODE-26111C) (A) For SH

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 60:- Diversion Ahead Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x60 cms. rectangular 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 reflectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.1 mtr long stand post (2 Nos.) of Iron Angle 50 x 50 x 5mm / 50NB 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 (SOR NEW IT CODE-26112B) (A) For MDR,ODR & VR

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 61:- Diversion Ahead Sign :- Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x60 cms. rectangular 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 Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.1 mtr long stand post (2 Nos.) of 50 x 50 x 5mm / 50NB 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 10 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-C Type-11 Retro Reflective sheeting (SOR NEW IT CODE-26112C) (A) For SH

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 62:- Kerb guard sign board (small) :- Providing & Fixing sign boards made out of 2mm aluminium sheet, size 240 x 30 cms in U shape; as per the attached drawing 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 reflectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; stand post and frame fabricated from iron angle of 50x50x5mm, 10mm sq. bar as required, painted with best quality epoxy coating 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 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 (SOR NEW IT CODE-26113B) (A) For MDR,ODR & VR

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 63:- Kerb guard sign board (small) :- Providing & Fixing sign boards made out of 2mm aluminium sheet, size 240 x 30 cms in U shape; as per the attached drawing pre treated with phosphating process & acid etching. coated with one coat of epoxy primer and two coats of best quality epoxy paint reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; stand post and frame fabricated from iron angle of 50x50x5mm, 10mm sq. bar as required, painted with best quality epoxy coating 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 warranty for 10 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. (SOR NEW IT CODE-26113C) (A) For SH

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 64:- Around the Island / Road Direction Sign (Small) :- Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60x60 cms. 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

reflectivesheeting 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 35 x 35 x 3mm; painted with bestquality 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 blockof 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 (SOR NEW IT CODE-26116B) (A) For MDR,ODR & VR

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 65:- Around the Island / road Direction Sign board (Small) :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60x60 cms. 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 Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 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 bestquality epoxy coatings in black and white 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 warranty for 10 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. (SOR NEW IT CODE-26116C) (A) For SH

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis.

Item no. 66:- 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 liminance coefficinet on cemend road shalll be min 130 mcd/m2/lux and Asphalt road shall be min 100 mcd/m2/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 the Retro reflectivity should be two years.holes.

ROAD SPECIFICATION BOOKLET ITEM NO.40 PAGE NO.64.

Item no. 67:- Supplying and fixing cat eye (Stimsonite) made out from Acrilo beaultile sterine injection high compressed molding with reflector made of MMC (prismatic type of size 12cm x 6cm x 2.5cm) provided with bituminous adhesive 100g. with each unit for fixing. (High Intensity grade) .

ROAD SPECIFICATION BOOKLET ITEM NO.41 PAGE NO.66.

Item no. 68 :- Flexible Median Marker :Providing and Fixing of Flexible Median Marker that are made of tough, high impact resistant, injectionmolded, thermoplastic body with property of flexibility to provide high durability. The dimension of Flexible Median Marker should not exceed 18.4 cm in height(including shank height),12.5 Cm in width. ,0.65 cm in thickness and shank depth shall be 3.4 cm The body structure shall be rounded at all its corners and edges. The plastic used for molding the Flexible Median Marker should survive impact load of 5kg continuously for 750 times at room temperature. The logo of the manufacturer shall be embossed on either side of the body in the injection molding process. The Median Marker shall have flame like shaped body with, fluorescent yellow color retro-reflective sheeting of size not less than 90 Cm square, with fully reflective micro prismatic cube corners as its retro-reflective elements

as per IRC 67 2012 and ASTM D4956-09 type XI specifications reflectivity values. The retro-reflective sheeting shall be on one or both sides of the Flexible Median Marker and shall be edge protected with no exposed edges which will prevent edge lifting, vandalism, sheeting damage, etc. The Flexible Median Marker shall be fixed by a combination of epoxy adhesive and grouting as recommended by manufacturer and Engineer in charge. (NEW SOR It No-26164)

4. MEDIAN MARKER

Flexible Median Marker (FMM) should be used for improving median visibility during dark hours. Use of Median Marker provides safety against collision happening with medians during night time or severe weather. Flexible Median Markers shall be provided with fluorescent yellow colour retro reflective sheeting Type XI as per IRC:67. Flexible Median Marker shall be of tough, high impact resistant, injection-molded, thermoplastic body with property of flexibility to provide high durability and U shape structure having rebound/bounce back property (refer Fig. 7 for typical illustration).

As mentioned earlier, the sheeting shall be of Type XI conforming to IRC:67 and it should be on both the faces whereby providing maximum reflectivity at longer distances with adequate durability. The logo of the manufacturer shall be embossed on either side of the body during the injection molding process. FMM shall be fixed by a combination of epoxy adhesive and grouting/ drilling on concrete medians or properly constructed solid medians.

A. Colour

The marker body shall be produced in neutral Black colour. The colour of the retro reflective element shall be Florescent Yellow.

B. Material

The plastic body of the FMM shall be moulded from Flexible Thermoplastic Body.

C. Dimensions

Height: The marker height shall be a minimum of 180 mm.

Width: The marker width shall be a minimum 120 mm.

Body Thickness: Minimum of 6.5 mm.

Shank Length: Each of the shanks shall not be less than 20 mm and depth shall not be less than 30 mm.

Reflective Area: Shall not be less than 90 cm square.

D. Performance

Reboundability

The body of FMM shall bounce back to its original position after 750 numbers of hits using pendulum of 1.8 kg conforming to ASTM D 256.

Tensile Test

Adhesion between the body and outer casing body of FMM shall withstand 50 Kgf tensile loads conforming to ASTM D 638 method.

Application and placement

FMM shall be used for the illumination of median as well as Parapet wall structures etc. Recommended minimum application distance is 2 m in the case of urban areas, 5 m for interurban highways and expressways or as suggested by Engineer In-charge (Refer Fig. 8).

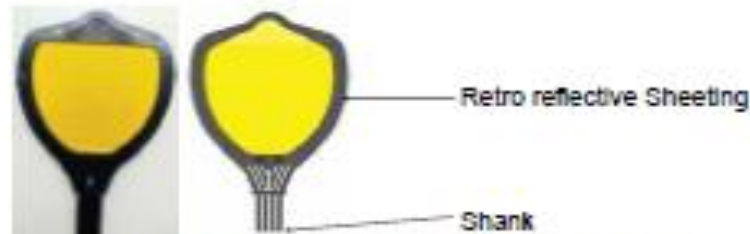


Fig. 7 Typical Illustration of Flexible Median Markers



Fig. 8 Typical Illustration of Utility of Flexible Median Markers during Day and Night Time

5. HAZARD MARKERS

Design

5.1 The following designs shall be adopted for hazard markers:

The striped markers consisting of alternating black and yellow stripes sloping downward at an angle of 45° towards the side of the obstruction on which the traffic is to pass (see Fig. 9). Hazard marker to be made with Type XI sheeting conforming to IRC:67.

Item no. 69:- Aluminum Backed Flexible PRismatic Sheeting (AFP) : Providing and fixing Aluminum backed flexible prismatic sheeting , consisting of yellow/black colored flexible prismatic sheet with non-mettalic prismatic lens as retro reflective elements and confirming to ASTM D4946 Type VI specifications for reboundable retro reflective sheeting. TheFlexible prismatic sheet shall be 30 cm width and laminated at the back with 50micron aluminum (Al) Foilwith presure sensitive adhesive and liner,Further this flexible prismatic sheeting shall have with screen printed arrow/slant line pattern in yellow/black color in a continuous roll format. The AFP sheeting,with the liner removed,shall be applied with neoprene product adhesive with a polychlopreme as base,viscosity of 200 450 cps and solid content of 20-30 % .Once applied , the edge of the sheeting shall be sealed all around with two-part epoxy based structural adhesive and shall be extremely resistant to pill-off.A test form institues like ARAI/CRRRI conffirming to above mentioned flexibility and ASTM 04956-09 Type VI retroreflectivity perfomance of the flexible prismatic sheeting used in AFP shall be submitted as directed by Engineer in Charge (SOR NEW IT NO-26165)

1. Specification Scope

The scope involves the preparation of the substrate, precision application of the aluminum-backed sheeting, and edge sealing to ensure the material remains "pill-off" proof. It includes the mandatory submission of test certificates (ARAI/CRRRI) to verify compliance with **ASTM D4956 Type VI** standards.

2. Materials

- **Sheeting:** A flexible prismatic sheet (30 cm width) with non-metallic lens elements. It must feature a screen-printed **yellow/black arrow or slant line pattern**.
- **Backing:** The sheet must be laminated with a **50-micron Aluminum (Al) foil** and a pressure-sensitive adhesive.
- **Primary Adhesive:** A neoprene-based product with a **polychloroprene base**, featuring a viscosity of **200–450 cps** and a solid content of **20–30%**.
- **Edge Sealer:** A **two-part epoxy-based structural adhesive** used to seal the perimeter of the applied sheet.
- **Performance Standard:** Must conform to **ASTM D4956 Type VI** for retroreflectivity and reboundability.

3. Workmanship

- **Surface Preparation:** The substrate must be thoroughly cleaned, dried, and free of grease or loose particles.
- **Application:** Once the liner is removed, the neoprene adhesive is applied. The AFP sheeting is pressed firmly onto the surface, ensuring the aluminum backing conforms to any contours without air pockets.
- **Edge Sealing:** The most critical step involves applying the two-part epoxy around all edges. This creates a structural bond that prevents the sheeting from being peeled off by vandals or environmental wear.
- **Quality Control:** The pattern (arrows/slants) must be aligned as per the traffic flow direction specified in the drawings.

4. Mode of Measurement

- **Unit of Measurement:** Typically measured in **Square Metres (Sqm)** or **Running Metres (Rm)** based on the 30 cm fixed width.

Item no. 70 :- Standard Delineator : Providing & Fixing Standard Metal Delineator consisting of minimum retro reflective unit exposed area of 330 cm² white color, full cube corner micro prismatic non-metallic retro reflective sheeting on each side conforming with IRC 672012 and meeting the coefficient of retro reflection value as per ASTM D 4956 Type XI table specification. The delineator shall be painted with power coat of minimum 40 microns thickness on top of which retro reflective sheeting shall be pasted on both sides. The structure shall be manufactured in roll forming process and shall have height not less than 800 mm above ground, width not less than 100 mm and shall extend not more than 300 mm below the ground while being installed. Height of sheeting less than 150 mm whereas width of sheeting should not less than 75 mm (should be placed every alternate 15 CM). The front and back faces of the delineator should be curved angle of curve (laying between 200 and 300 to increase the visibility of the delineator for vehicles moving in continuous curves). The delineator shall have grooves for across the length to make the reflective sheets vandal proof. The delineator meant for application on gaps in median, Traffic islands, Dangerous bends, roundabouts, narrow bridge etc as derived by site engineer (new SOR It.No-26166)

801.1 scope

The work shall cover supplying and fixing roadway indicators, hazard markers and object markers. Roadway indicators shall be properly installed to indicate the horizontal alignment and vertical profile of the roadway so as to outline the vehicle path for safe driving. Hazard markers shall be installed immediately ahead of obstruction of vehicular path such as just before a narrow bridge. Object markers shall be erected where obstruction within the roadway starts such as channelising island in approaches to intersections.

801.2 The design, materials to be used and the location of the road delineators (roadway indicators, hazard markers and object markers) shall conform to Recommended Practice for Road Delineators, IRC:79, and to relevant drawings or as otherwise directed by the Engineer. The steel drums such as empty bitumen drums shall not be used as they could pose safety hazards. The delineators shall be retro-reflectorised as shown on the drawings or as directed by the Engineer. The reflectors on the delineators shall be of retro-reflective sheeting with encapsulated lens and with the visibility of 300 m under clear weather conditions, when illuminated by the upper beam of the car headlights.

801.3 installation

The delineators shall be so installed that their posts do not change their orientation and the reflectorised faces are always perpendicular to the direction of travel.

801.4 Measurement for payments

The measurement shall be made in number of delineators supplied and fixed at site.

801.5 rates

The Contract unit rates of delineators shall be payment in full compensation for furnishing all labour, materials, tools, equipment including incidental costs necessary to complete the work to these Specifications.

Item no. 71 :- Solar Stud : Supplying of Solar Raised Pavement Markers made of polycarbonate molded body with circular shape, solar powered, LED self illumination in active mode, 360 degree illumination and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face in passive mode. The marker shall support a load of 20000 Kg tested in accordance to ASTM D 4250. The Marker Should be resistant to dust and water ingress according to IP 65 standards and should withstand temperatures in the range of 0 C to 70 C. Color of lighting could be provided in red or yellow (amber) as per requirement and typical frequency of blinking is 1Hz. There should be current losses of less than 20 micro-amperes at 2.4 V in sleep-charging mode to enhance the life of the marker and a full charge should provide for a minimum autonomy of 50 hours. The height, width and length of the marker shall not be less than 10 mm x 100 mm x 100 mm. Also, the surface diameter of the marker shall not be less than 100 mm respectively. The weight of the marker shall not exceed 0.5 Kilograms. 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 manufacturer's recommendation and complete as directed by the engineer (SOR NEW IT NO-26167)

scope

The work shall cover the providing and fixing of reflective pavement marker (RPM) or road stud, a device which

is bonded to or anchored within the road surface, for lane marking and delineation for night-time visibility, as specified in the Contract.

801.1 Material

801.1.1 Plastic body of RPM/road stud shall be moulded from ASA (Acrylic Styrene Acrylonitrile) or HIPS (Hi-impact Polystyrene) or Acrylonitrile Butadiene Styrene (ABS) or any other suitable material approved by the Engineer. The markers shall support a load of 13,635 kg tested in accordance with ASTM D 4280.

801.1.2 Reflective panels shall consist of 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 moulded of methyl methacrylate conforming to ASTM D 788 or equivalent.

801.2 design

The slope or retro-reflecting surface shall preferably be $35 \pm 5^\circ$ to base and the area of each retro-reflecting surface shall not be less than 13.0 sq.cm.

801.3 optical performance

801.3.1 unidirectional and Bi-directional studs

Each reflector or combination of reflectors on each face of the stud shall have a Coefficient of Luminous Intensity (C.I.L). not less than that given in Tables 800-13 or 800-14 as appropriate.

801.3.2 omni-directional studs

Each Omni-directional stud shall have a C.I.L. of not less than 2 mcd/lx.

table 800-13 : Minimum c.i.l. Values for category ‘a’ studs

entrance angle	observation angle	c.i.l. in mcd/lx		
		white	amber	red
0° U 5° L & R	0.3°	220	110	44

table 800-14 : Minimum c.i.l. Values for category ‘B’ studs

entrance angle	observation angle	c.i.l. in mcd/lx		
		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 :

- 1) 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.
- 2) The stud incorporating one or more corner cube reflectors shall be included in Category ‘A’. The stud incorporating one or more bi-convex reflectors shall be included in Category ‘B’.

801.4 tests

801.4.1 Co-efficient of luminance intensity can be measured by procedure described in ASTM E 809 “Practice for Measuring Photometric Characteristics” or as recommended in BS:873-Part 4: 1973.

801.4.2 Under test conditions, a stud shall not be considered to fail the photometric requirements if the measured C.I.L. at any one position of measurement is less than the values specified in Tables 800-13 or 800-14 provided that

- i) the value is not less than 80 percent of the specified minimum, and
- ii) the average of the left and right measurements for the specific angle is greater than the specified minimum.

801.5 solar powered road Markers (solar studs)

The solar studs shall be made of Aluminium alloy and poly carbonate material which shall be absolutely weather resistant and strong enough to support a load of 13,635 kg tested in accordance with ASTM D4280. Its colour may be white, red, yellow, green or blue or combination as directed by the Engineer. Its water resistance shall meet the requirements of IP 65 in accordance with IS:12063:1987 Category 2 for protection against water ingress. The dimensions of solar studs shall not be less than 100 mm x 100 mm x 10 mm. It shall have super bright LEDs so as to provide long visibility from a distance of more than 800 m. Its flashing rate shall not be less than 1 Hz. Its should be able to give the prescribed performance in the temperature range of -40°C to +55°C. Its life shall be not less than 3 years.

801.6 Fixing of Reflective Markers

801.6.1 requirements

The enveloping profile of the head of the stud shall be smooth and the studs shall not present any sharp edges to traffic. The reflecting portions of the studs shall be free from crevices or ledges where dirt might accumulate. Marker height shall not be less than 10 mm and shall not exceed 20 mm. and its width shall not exceed 130 mm. 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. All road studs shall be legibly marked with the name, trade mark or other means of identification of the manufacturer.

801.6.2 placement

The reflective marker shall be fixed to the road surface using the adhesives and the procedure recommended by the manufacturer. No nails shall be used to affix the marker so that they do not pose safety hazard on the roads. 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 until the surfacing has been opened to traffic for a period of not less than 14 hours. 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.

The adhesive shall be placed uniformly on the cleaned pavement surface or on the bottom of the of the marker in a quantity sufficient to result in complete coverage of the area of contract of the marker with no voids present and with a slight excess after the marker has been lightly pressed in place. 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.

801.6.3 warranty and durability

The contractor shall submit a two year warranty for satisfactory field performance including stipulated retro-reflectance of the reflecting panel, 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 carries 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.

801.7 Measurement for payment

The measurement of reflective road markers/solar powered road studs shall be in numbers of different types of markers supplied and fixed.

801.8 rate

The contract unit rate for reflective road markers/solar powered road studs 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 specification complete as per approved drawings or as directed by the Engineer.

Item no. 72:- Providing and laying of Plastirib - T or equivalent raised profile edge line marking (audible warning) with hot applied thermoplastic road marking compound according to IRC 35 - 2015, Clause 7.7, with 2mm thick base coat layer above that ribs profile size of length 40mm X width 140mm X Height 6 mm thick (Total 8 mm thick) at the distance of 500 mm between two ribs including reflectorizing glass beads @ 250 gm/ sq.mt area. The minimum and maximum width of raised profile should be 150 mm. The thickness of 8 mm profile should be exclusive of surface applied glass beads. The finished surface to be levelled, uniform and free from streaks and holes, to be applied on edge lines. The profile marking should be mark basic line and raise line at a time simultaneously.(SOR NEW IT NO-26169)

1. Scope

The scope involves the professional application of a dual-layered thermoplastic system on road edges. This includes surface preparation, the simultaneous application of a **2mm base coat** and **6mm high ribs**, and the immediate application of retro-reflective glass beads. The work must comply strictly with **IRC:35-2015, Clause 7.7** and **MORTH Section 803**.

2. Materials

- **Thermoplastic Compound:** High-quality, hot-applied material specifically formulated for "structured" or "profiled" markings to ensure the ribs maintain their shape under traffic load and high temperatures.
- **Base Coat:** 2 mm thick layer of the same thermoplastic compound.
- **Raised Ribs:** Profiles measuring **40mm (Length) x 140mm (Width) x 6mm (Height)**.
- **Glass Beads:** Reflectorizing glass beads conforming to **IS:4351** or **BS 6088**, applied at a rate of **250 gm/sq.mt**.
- **Primer:** A compatible primer must be used if the marking is applied on aged bituminous surfaces or cement concrete pavements.

3. Installation

- **Simultaneous Application:** The marking machine must be a specialized "profile applicator" capable of laying the **2mm base and the 6mm rib simultaneously**. This ensures a thermal bond between the layers, preventing the ribs from stripping off.
- **Dimensions:**
 - **Total Height:** 8 mm (2mm base + 6mm rib), excluding the height of surface-applied glass beads.
 - **Width:** Exactly **150 mm**.
 - **Spacing:** Ribs must be placed at a longitudinal distance of **500 mm** center-to-center.
- **Surface Preparation:** The road surface must be clean, dry, and free of dust, oil, and loose aggregate.
- **Finish:** The final markings must be uniform, level, and free from streaks, air holes, or physical deformities.

4. Mode of Measurement

- **Unit of Measurement:** NOS (Numbers).

Item no. 73:- Chevron sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 60x50 cm 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 Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality 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 blockof 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 10 years for the Retro reflective sheeting from originaa 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-C Type-11 Retro Reflective sheeting (SOR NEW IT CODE-26170) (A) For SH

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis

Item no. 74:- Chevron sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 60x50 cm 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 Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality 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 blockof 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 10 years for the Retro reflective sheeting from originaa 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-C Type-11 Retro Reflective sheeting (SOR NEW IT CODE-26171) (A) For MDR,ODR & VR

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis

Item no. 75:- Flood Guage Sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / size 43x200 cms. rectangular 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 reflectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 2.6mtr long stand post of Iron Angle 75 x 75 x 6mm as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality 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 blockof size 45 x 45 x 60 Cms. for each leg including excavation, curing etc.complete under the supervision of engineer in charge. (B) Class-B Type-4 Retro Reflective sheeting

Specifications should be as per Item no. 22 but with size and warranty as mentioned in the item description.
The Measurement & Payment shall be made of No. Basis

Item no. 76:- Traffic Cone (Provision of red fluorescent with white reflective sleeve traffic cone made of low density polyethylene (LDPE) material with a square base of 390 x 390 x 35 mm and a height of 770 mm, 4 kg in weight, placed at 1.5 m interval, all as per BS 873) (MR)

1. Scope

The scope covers the provision, transportation, and placement of high-visibility traffic cones for temporary traffic management, lane channelisation, and road safety during construction or maintenance.

- **Dimensions:** Height of 770 mm with a square base of 390 x 390 x 35 mm.
- **Weight:** Minimum 4 kg to ensure stability against wind and passing vehicle drafts.
- **Placement:** Placed at regular 1.5 m intervals or as directed by the engineer for effective lane tapering or hazard demarcation.

2. Materials

- **Body:** High-grade Low Density Polyethylene (LDPE) with UV stabilisers to prevent fading and cracking in extreme weather. The material must be flexible enough to withstand impacts without shattering.
- **Colour:** Fluorescent red or "safety" orange for maximum daytime visibility.
- **Reflective Sleeve:** Fitted with a high-intensity white reflective sleeve (Class R1 or R2) to ensure visibility during night-time or low-light conditions, complying with the photometric requirements of BS 873.

3. Workmanship

- **Consistency:** Cones must be manufactured with a uniform wall thickness (typically ~3 mm) and a smooth finish.
- **Stability:** The base should be heavy and integrated (often a sand-filled or rubber-weighted base) to prevent tipping.
- **Maintenance:** Workmanship includes the regular cleaning of reflective sleeves and the immediate replacement of damaged, faded, or non-reflective cones.
- **Placement Strategy:** Cones must be aligned accurately to provide a clear, visible line for motorists.

4. Mode of Measurement

In civil engineering projects, the mode of measurement typically follows standards like IS 1200 or specific Schedule of Rates (SOR) guidelines:

- **Unit of Measurement:** Measured by **Numbers (Each)** or **Running Metre (Rm)** depending on the contract.

Item no. 77:- Drum Delineator in Construction Zone (Provision of metal drum/empty bitumen drum delineator, 300 mm in diameter, 800 mm high, filled with earth for stability, painted in circumferential strips of alternate black and white 100 mm wide fitted with reflectors 3 Nos of 7.5 cm dia, all as per IRC:SP:55-2001) (MR)

Specifications should be as per Item no. 70 but with size and warranty as mentioned in the item description.

The Measurement & Payment shall be made of No. Basis

Item no. 78:- Providing and fixing synthetic Rubble Blend speed breaker of premium brand and approved make and of size 350 mm x 500 mm x 50 mm thick as directed (MR)

1. Scope

The scope includes the supply and installation of modular speed breakers. This covers surface preparation, layout marking, fixing of the modules using mechanical anchors, and ensuring the final installation is skid-resistant and highly visible.

2. Materials

- **Body:** Manufactured from a **Premium Synthetic Rubber Blend** (often a mix of EPDM and recycled rubber). The material must be UV-stabilised, weather-resistant, and capable of supporting heavy axle loads without deformation.
- **Dimensions:** Each module must be **350 mm (length) x 500 mm (width) x 50 mm (thickness)**.
- **Visibility:** The modules should be pre-coloured (typically black and yellow) or fitted with embedded **glass bead reflectors** or reflective tapes for night-time visibility.
- **Fixings:** Heavy-duty **galvanised steel expansion bolts** or anchor fasteners (typically 10–12 mm diameter) of sufficient length to ensure a deep grip in the asphalt or concrete road.

3. Workmanship

- **Surface Preparation:** The road surface must be cleaned of dust and debris. Any significant undulations should be levelled to ensure the rubber modules sit flush against the ground.
- **Layout:** The modules must be arranged in an alternating colour pattern (Yellow/Black) and aligned in a straight line across the width of the road.
- **Fixing:** Holes are drilled into the road surface through the pre-cast holes in the rubber modules. The anchors are then driven in and tightened to ensure the modules do not shift or rattle under traffic load.
- **End Caps:** The installation should ideally be finished with tapered end caps to prevent tripping hazards and damage to the edges.

4. Mode of Measurement

- **Unit of Measurement:** Usually measured by **Metre (Rm)** for the total width covered or by **Number (Nos)** for individual modules supplied and fixed.

Item no. 79:- Providing & Fixing Traffic Bollard swiss type Jumbo made out of 18 gauge MS sheet in conical shape having bottom diameter 30 cms and top diameter 22cms, height 155 cms; coated with white epoxy powder coating and three red retro reflective high intensity prismatic bends of 15 cms width applied in the body and circular reflector on front, protected with Fiber ring collar; as per the drawing using High Intensity Prismatic grade ASTM Type IV material, Fixed at site in M15 PCC as per the instruction of engineer in charge.

1. Scope

The scope includes the fabrication, supply, and fixing of heavy-duty MS bollards. This involves site preparation, ensuring correct vertical alignment, and secure grouting into the ground to withstand minor impacts and environmental exposure.

2. Materials

- **Body:** Fabricated from **18-gauge Mild Steel (MS) sheet**. The shape is conical with a **30 cm bottom diameter**, **22 cm top diameter**, and a total height of **155 cm**.
- **Coating:** Finished with a **white epoxy powder coating** for corrosion resistance and high visibility.
- **Reflectivity:** Three **15 cm wide red bands** made of **High Intensity Prismatic (HIP) grade (ASTM Type IV)** material. It also includes a circular reflector on the front.
- **Protection:** A **Fiber ring collar** is provided to protect the reflective surface/edges from wear and impact.
- **Foundation:** **M15 grade Plain Cement Concrete (PCC)** for fixing the bollard base into the ground.

3. Workmanship

- **Fabrication:** The MS sheet must be rolled and welded seamlessly to achieve the conical shape without sharp edges.
- **Surface Prep:** Before powder coating, the metal must be degreased and derusted to ensure the epoxy bond is permanent and chip-resistant.
- **Application:** Reflective prismatic bands must be applied smoothly, free of air bubbles or wrinkles, ensuring 360-degree visibility.
- **Installation:** A pit is excavated to the required depth. The bollard is placed perfectly plumb (vertical) and secured with M15 PCC. The finish around the base should be neat and flush with the ground level or as instructed by the Engineer-in-Charge.

4. Mode of Measurement

- **Unit:** The item is measured by **Numbers (Each/Nos)**.

Item no. 80:- Type - B, "THRIE" : Metal Beam Crash Barrier (Providing and erecting a "Thrie" metal beam 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, 150 x 75 x 5 mm spaced 2 m centre to centre, 2 m high with 1.15 m below ground level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a space of channel section 150 x 75 x 5 mm, 546 mm long complete as per clause 811) (NH SOR Item 8.23B)

2703.1. General

For concrete with steel reinforcement, specifications for the items of controlled concrete and reinforcement mentioned under relevant sections of these specifications shall be applicable.

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 type of railing/crash barrier to be constructed shall be as shown on the drawings and shall conform to IRC:6 and IRC:5. 1 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 vertical post of the barrier at intervals to ensure adequate visibility during night and foggy conditions.

Care shall be exercised in assembling expansion joints in the railings to ensure that they function properly. The railings shall be amenable to quick repairs.

Warrants: The longitudinal roadside barriers are basically meant to prevent the vehicles veering off the embankment.

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.

Bridge rail / crash ends, transition end and end treatment.

The end of the road side barrier can be hazardous if hit, therefore it should be formed an integral part of safety barrier end treatment should not spear vault or roll, a vehicle for head on as angled impacts.

The end treatment on approach shall be modified eccentric loader terminal (MELT) and departure sides shall be trailing terminal (TT) arrangement as per IRC: 119-2015 or as per the instructions of Engineer-in-charge.

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 long & continuous stretches. The distance between barrier & hazard should not be less than deflection of barrier by an impact of full size vehicle.

In case of embankments a minimum distance of 60 cm should be maintained between barrier and start of embankments - slope or hazard to prevent vehicle dropping.

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, posts, Thrie Metal Beam, Spacer, bolts, nuts, hardware and other steel fitting shall be galvanized.

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

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.

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.

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 conform to the confirming to IS 2062 IS 1367 and IS 1364.

2.2 All steel members shall be galvanized with coating thickness not less than 550 gm/m² (gsm). galvanizing shall be as per MORTH specification. Fasteners/bolts shall be of grade 4.6 and diameter 16mm dome head bolts. Thrie W-beam metal crash barrier shall conform 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 LS1364.

3.0 Construction Operation:

3.1 Installation of posts :

3.1.0. Workmanship

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

3.2.1 The Pit shall be back filled with M-250 as shown on drawing or as directed.

3.3 While fixing steel post shall be embedded in concrete at 2.0 mt C/C with necessary. 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.

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 Rmt. 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 Three beam Metal crash barrier complete in place in all respect as per these specification.