

SECTION-5

**TECHNICAL SPECIFICATION**

**Item No.1 Cautionary Warning Sign (with Post):**Providing and fixing Retro-Reflective type sign board of size 90x90x90cm of steel structure to be provided as per drawing and design given by Engineer in charge. The road sign board steel to be provided as per drawing and design of equilateral Triangle as per the below size fixed with 01 no. of S.S. 304 grade pipe 63 mm OD Size /2 mm thick total 3.3 mt. in length with a foundation CC of 0.45 x 0.45 x 0.60 mt. in M- 15 grade fixed with VHB Tape of suitable grade as per dimension given in drawing. The sign board face fully covered with Retro reflective sheeting confirming to Type-XI of ASTM D-4956-09 and IRC 67-2022, on 4 mm thick Aluminum Composite Material (ACP), over which symbols and numerals are made using either Screen Printing / UV resistance durable overlay Filmas recommended by sheeting manufacturer in approved color pasted on substrate by pressure sensitive adhesive with suitable size of VHB Tape with back support frame of SS 304 grade square pipe 32x32x1 mm as per drawing by vertical support as per drawing mounted on SS pipe 63 mm OD (2 mm thick). Fixed with S.S. cleat 6 mm thick as per drawing etc. including all fixtures,materials, Labours, SS polishing and transportation as per drawing and as directed by 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 with his own expensis. The contractor should also submit SS Material test report from NABL Laboratory. (A) Class-C Type-11 Retro Reflective sheeting

#### **801.0 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:67-2022.

#### **801.1 Materials**

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

##### **801.1.1Concrete**

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.

##### **801.1.2Reinforcing Steel**

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

##### **801.1.3Bolts, Nuts, Washers**

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

##### **801.1.4Stainless Steel (SS)**

All the square or Round pipes for the back support frame and vertical post shall be made from Stainless Steel of 304 grade only.

**SS304 (AISI 304 / UNS S30400)**

- Composition: ~18–20% Chromium, ~8–10.5% Nickel
- Corrosion resistance suitable for outdoor applications
- Yield strength: ~215 MPa
- Tensile strength: ~505 MPa

### 801.1.5 Plates and Supports

Plates and support sections for the signposts shall conform to IS:226 and IS:2062 or any other relevant IS Specifications.

### 801.1.6 Substrate

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

The mechanical proportion of ACM and that of aluminium 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: Specifications for Aluminium Composite Material (ACM)**

S. No.	Description	Specification	
		Standard Test	Acceptable Value
<b>A</b>	<b>Mechanical Properties of ACM</b>		
1)	Peel off strength with retroreflective sheeting (Drum Peel Test)	ASTM D903	Min. 4 N/mm
2)	Tensile strength	ASTM E8	Min. 40 N/mm <sup>2</sup>
3)	0.2% Proof Stress	ASTM E8	Min. 34 N/mm <sup>2</sup>
4)	Elongation	ASTM E8	Min. 6%
5)	Flexural strength	ASTM 393	Min. 130 N/mm <sup>2</sup>
6)	Flexural modulus	ASTM 393	Min. 44.00 N/mm <sup>2</sup>
7)	Shear strength with Punch shear test	ASTM 732	Min. 30 N/mm <sup>2</sup>
<b>B</b>	<b>Properties of Aluminum Skin</b>		
1)	Tensile strength (Rm)	ASTM E8	Min. 65 N/mm <sup>2</sup>
2)	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm <sup>2</sup>
3)	Elongation	ASTM E8	A50 Min. 2%
4)	0.2% Proof Stress	ASTM E8	Min. 10 N/mm <sup>2</sup>

**801.1.7Plate Thickness**

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 2 mm thick with Aluminium and 3 mm thick with Aluminium Composite Material. All other signs be at least 2 mm thick with Aluminium and 4 mm thick with Aluminium Composite Material. 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 prevailing wind and other loads.

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

## 802 Traffic Signs having Retro-Reflective Sheeting

### 802.1 General Requirements

The retro-reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having tested the sheeting for co-efficient of retro-reflection, day/nighttime colour luminous, shrinkage, flexibility, linear removal, adhesion, impact resistance, specular gloss and fungus resistance and its having passed these tests shall be obtained from a Government Laboratory/Institute, by the manufacturer of the sheeting. The retro-reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-prismatic Grade retro-reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC:67.

### 802.2 High Intensity Grade Sheeting

#### 802.2.1 High Intensity Grade (Type III)

This high intensity retro reflective sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent waterproof plastic having a smooth surface or as an unmetallized micro prismatic reflective material element. 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 D:4956-09) as indicated in Table 800-2.

**Table 800-2: Acceptable Minimum Co-efficient of Retro-Reflection for High Intensity Grade Sheeting (Type III) (Encapsulated Lens Type) (Candelas Per Lux Per Square**

**Metre)**

Observation Angle Degrees in	Entrance Angle in Degrees	White	Yellow	Orange	Green	Red	Blue	Brown
$0.1^{\circ}$ B	$-4^{\circ}$	300	200	120	54	54	24	14
$0.1^{\circ}$ B	$+30^{\circ}$	180	120	72	32	32	14	10
$0.2^{\circ}$	$-4^{\circ}$	250	170	100	45	45	20	12
$0.2^{\circ}$	$+30^{\circ}$	150	100	60	25	25	11	8.5
$0.5^{\circ}$	$-4^{\circ}$	95	62	30	15	15	7.5	5.0
$0.5^{\circ}$	$+30^{\circ}$	65	45	25	10	10	5.0	3.5

A Minimum of Coefficient of Retro-reflection (RA) cd/fc/ft<sup>2</sup> (cd-lx-1m<sup>2</sup>).

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 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its Original retro-reflectance.

### 802.3 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV)

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. 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 D:4956-09) as indicated in Table 800-3.

**Table 800-3: Acceptable Minimum Co-efficient of Retro-Reflection for High Intensity Micro-Prismatic Grade Sheeting (Type IV) (Candelas Per Lux Per Square Metre)**

Observation	Entrance	White	Yellow	Orange	Green	Red	Blue	Brown
0.1 <sup>0</sup> B	-4 <sup>0</sup>	500	380	200	70	90	42	25
0.1 <sup>0</sup> B	+30 <sup>0</sup>	240	175	94	32	42	20	12
0.2 <sup>0</sup>	-4 <sup>0</sup>	360	270	145	50	65	30	18
0.2 <sup>0</sup>	+30 <sup>0</sup>	170	135	68	25	30	14	8.5
0.5 <sup>0</sup>	-4 <sup>0</sup>	150	110	60	21	27	13	7.5
0.5 <sup>0</sup>	+30 <sup>0</sup>	72	54	28	10	13	6	3.5

A Minimum Coefficient of Retro reflection (RA) 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 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

### 803 Prismatic Grade Sheeting

#### 803.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. 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 E 810) as indicated in Table 800-4.

#### 803.2 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 cleaning 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 800-5.

**Table 800-4: Acceptable Minimum Co-efficient of Retro-Reflection for Prismatic Grade Sheeting (Type VIII) (Candelas Per Lux per Square Metre)**



Obser vationAngle	Entrance Angle	White	Yellow	Orange	Gree n	Red	Blue	Brown	Fluor- escent Yellow/ Green	Fluor- escent Yellow	Fluor- escent Orange
0.1 <sup>0</sup> B	-4 <sup>0</sup>	1000	750	375	100	150	45	30	800	600	300
0.1 <sup>0</sup> B	+30 <sup>0</sup>	460	345	175	46	69	21	14	370	280	135
0.2 <sup>0</sup>	-4 <sup>0</sup>	700	525	265	70	105	32	21	560	420	210

0.2 <sup>0</sup>	+30 <sup>0</sup>	325	245	120	33	49	15	10	260	200	95
0.5 <sup>0</sup>	-4 <sup>0</sup>	250	190	94	25	38	11	7.5	200	150	75
0.5 <sup>0</sup>	+30 <sup>0</sup>	115	86	43	12	17	5	3.5	92	69	35

A Minimum Coefficient of Retro reflection (RA) 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 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

**Table 800-5: Acceptable Minimum Co-efficient of Retro-Reflection for Prismatic Grade Sheeting (Type IX) (Candelas Per Lux per Square Metre)**

Observation	Entrance	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow/Green	Fluorescent Yellow	Fluorescent Orange
0.1 <sup>0 B</sup>	-4 <sup>0</sup>	600	500	250	66	130	130	530	400	200
0.1 <sup>0 B</sup>	+30 <sup>0</sup>	370	280	140	37	74	17	300	220	110
0.2 <sup>0</sup>	-4 <sup>0</sup>	380	285	145	38	76	17	300	230	115
0.2 <sup>0</sup>	+30 <sup>0</sup>	215	162	82	22	43	10	170	130	65
0.5 <sup>0</sup>	-4 <sup>0</sup>	240	180	90	24	48	11	190	145	72
0.5 <sup>0</sup>	+30 <sup>0</sup>	135	100	50	14	27	6.0	110	81	41
1.0 <sup>0</sup>	-4 <sup>0</sup>	80	60	30	8.0	16	3.6	64	48	24
1.0 <sup>0</sup>	+30 <sup>0</sup>	45	34	17	4.5	9.0	2.0	36	27	14

A Minimum Coefficient of Retro reflection (RA) cd/fc/ft2 (cd-lx-1m2).

B Values for 0.10 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 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

#### **803.2.1.1 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 cleaning 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 Co-efficient of Retro-Reflection for Prismatic Grade Sheeting Type A (Type XI) (Candelas Per Lux per Square Metre)**

Observation	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow/Green	Fluorescent Yellow	Fluorescent Orange
0.1 <sup>0B</sup>	-4 <sup>0</sup>	830	620	290	83	125	37	25	660	500	250
0.1 <sup>0B</sup>	+30 <sup>0</sup>	325	245	115	33	50	15	10	260	200	100
0.2 <sup>0</sup>	-4 <sup>0</sup>	580	435	200	58	87	26	17	460	350	175
0.2 <sup>0</sup>	+30 <sup>0</sup>	220	165	77	22	33	10	7.0	180	130	66
0.5 <sup>0</sup>	-4 <sup>0</sup>	420	315	150	42	63	19	13	340	250	125
0.5 <sup>0</sup>	+30 <sup>0</sup>	150	110	53	15	23	7.0	5.0	120	90	45
1.0 <sup>0</sup>	-4 <sup>0</sup>	120	90	42	12	18	5.0	4.0	96	72	36
1.0 <sup>0</sup>	+30 <sup>0</sup>	45	34	16	5.0	7.0	2.0	1.0	36	27	14

A Minimum Coefficient of Retro-reflection (RA) cd/fc/ft<sup>2</sup> (cd-lx-1m<sup>2</sup>).

B Values for 0.10 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 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

### **803.2.2Adhesives**

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent other preparation for adhesion to a smooth clean surface, 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. The sheeting shall be applied in accordance with the manufacturer's specifications.

### **803.2.3Fabrication**

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium 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. Where screen printing with transparent colours is proposed, only butt joint 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.

#### **803.2.4 Messages/Borders**

The messages (legends, letters, numerals etc.) and borders shall either be screen-printed or 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.

#### **803.2.5 Colour for Signs**

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

**803.2.5.2** 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.

**803.2.5.3** 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	0.300	0.368	0.366	0.340	0.393	0.274	0.329	15	- -
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	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	0.210	0.190	0.255	0.065	0.216	1	10
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404	12	30
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390	1	6
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540	60	- -
Fluorescent Yellow	0.479	0.520	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	- -
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The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

**803.2.5.4** 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.

**803.2.5.5** The colours chosen for informatory 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.

### **803.2.6 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.

### **803.2.7 Sizes of Letters**

**803.2.7.1** Letter size should be chosen with due regard to the speed, classification and 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.

**803.2.7.2** 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.

- 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.

Warranty and Durability  
The Contractor shall obtain from the manufacturer a ten year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of micro-prismatic sheeting and a seven-year warranty for high intensity grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro-reflective sheeting. The Contractor/supplier shall also furnish the LOT numbers and certification that the signs and materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty and that the contractor/supplier is the authorized converter of the particular sheeting.

All signs shall be dated during fabrication with indelible markings to indicate the start of warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro-reflective efficiency.

A certificate in original shall be given by the sheeting manufacturer that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro-reflection, day/night time colour and luminance, shrinkage, flexibility, linear removal, adhesion, impact resistance, specular gloss and fungus resistance; the tests shall be carried out by a Government Laboratory in accordance with various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

### **803.2.7.3 Installation**

- The traffic signs shall be mounted on support posts, which may be of SS 304 grade pipes conforming to IS: **17875 : 2022** for seamless pipes and **IS 17876 : 2022** for welded pipes, Rectangular Hollow Section conforming to IS:4923 or Square

Hollow Section conforming to IS:3589. 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. 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.

- All components of signs (including its back side) and supports, other than the reflective portion and SS posts shall be thoroughly de-scaled, cleaned, primed and painted with two coats of epoxy/ fibre glass/ powder coated paint. Any part of support post below ground shall be painted with protective paint.
- The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

#### **803.2.7.4 Measurement 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 in Nos.

#### **803.2.7.5 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 furnishing of necessary test certificates, warranty and incidentals to complete the work in accordance with these 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. Measurement shall be taken and **paid on number**.



## **Item No. 2**

**Mandatory Warning Sign (with Post):-** Providing and fixing 600mm Dia Retro-Reflective type sign board of steel structure to be provided as per drawing and design given by Engineer in charge. The road sign board steel to be provided as per drawing and design of 600mm Circle fixed with 01 no. of S.S. 304 grade pipe 63 mm OD Size/ 2 mm thick total 3.3 mt. in length with a foundation CC of 0.45 x 0.45 x 0.60 mt. in M- 15 grade fixed with VHB Tape of suitable grade as per dimension given in drawing. The sign board face fully covered with Retro reflective sheeting confirming to Type-XI of ASTM D-4956-09 and IRC 67-2022, on 4 mm thick Aluminum Composite Material (ACP), over which symbols and numerals are made using either Screen Printing / UV resistance durable overlay Filmas recommended by sheeting manufacturer in approved color pasted on substrate by pressure sensitive adhesive with suitable size of VHB Tape with back support frame of SS square pipe 32x32x1 mm as per drawing by vertical support as per drawing mounted on SS pipe 63 mm OD (2 mm thick). Fixed with S.S. cleat 6 mm thick as per drawing etc. including all fixtures, materials, Labours, SS polishing and transportation as per drawing and as directed by 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 with his own expensis. (A) Class-C Type-11 Retro Reflective sheeting 801.      801.      Traffic Signs

### **803.3      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:67-2022.

### **803.4      Materials**

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

#### **803.4.1 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.

#### **803.4.2 Reinforcing Steel**

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

#### **803.4.3 Bolts, Nuts, Washers**

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

#### **803.4.4 Stainless Steel (SS)**

All the square and Round pipes for the back support frame and vertical post shall be made from Stainless Steel of 304 grade only.

**SS304 (AISI 304 / UNS S30400)**

- Composition: ~18–20% Chromium, ~8–10.5% Nickel
- Corrosion resistance suitable for outdoor applications
- Yield strength: ~215 MPa
- Tensile strength: ~505 MPa

### 803.4.5 Plates and Supports

Plates and support sections for the signposts shall conform to IS:226 and IS:2062 or any other relevant IS Specifications.

### 803.4.6 Substrate

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

The mechanical proportion of ACM and that of aluminium 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: Specifications for Aluminium Composite Material (ACM)**

Sr. No.	Description	Specification	
		Standard Test	Acceptable Value
<b>A</b>	<b>Mechanical Properties of ACM</b>		
1)	Peel off strength with retroreflective sheeting (Drum Peel Test)	ASTM D903	Min. 4 N/mm
2)	Tensile strength	ASTM E8	Min. 40 N/mm <sup>2</sup>
3)	0.2% Proof Stress	ASTM E8	Min. 34 N/mm <sup>2</sup>
4)	Elongation	ASTM E8	Min. 6%
5)	Flexural strength	ASTM 393	Min. 130 N/mm <sup>2</sup>
6)	Flexural modulus	ASTM 393	Min. 44.00 N/mm <sup>2</sup>
7)	Shear strength with Punch shear test	ASTM 732	Min. 30 N/mm <sup>2</sup>
<b>B</b>	<b>Properties of Aluminum Skin</b>		
1)	Tensile strength (Rm)	ASTM E8	Min. 65 N/mm <sup>2</sup>
2)	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm <sup>2</sup>
3)	Elongation	ASTM E8	A50 Min. 2%
4)	0.2% Proof Stress	ASTM E8	Min. 10 N/mm <sup>2</sup>

### **803.4.7 Plate Thickness**

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 2 mm thick with Aluminium and 3 mm thick with Aluminium Composite Material. All other signs be at least 2 mm thick with Aluminium and 4 mm thick with Aluminium Composite Material. 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 prevailing wind and other loads.

**803.5** In respect of sign sizes not covered by IRC:67, the structural details (thickness, etc.) shall be as per the approved drawings or as directed by the Engineer. Traffic Signs having Retro-Reflective Sheeting

### **803.5.1 General Requirements**

The retro-reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having tested the sheeting for co-efficient of retro-reflection, day/nighttime colour luminous, shrinkage, flexibility, linear removal, adhesion, impact resistance, specular gloss and fungus resistance and its having passed these tests shall be obtained from a Government Laboratory/Institute, by the manufacturer of the sheeting. The retro-reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-prismatic Grade retro-reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC:67.

### **803.5.2 High Intensity Grade Sheeting**

#### **803.5.2.1 High Intensity Grade (Type III)**

This high intensity retro reflective sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent waterproof plastic having a smooth surface or as an unmetallized micro prismatic reflective material element. 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 D:4956-09) as indicated in Table 800-2.

**Table 800-2: Acceptable Minimum Co-efficient of Retro-Reflection for High Intensity Grade Sheeting (Type III) (Encapsulated Lens Type) (Candelas Per Lux Per Square Metre)**

Observation Angle Degrees in	Entrance Angle in Degrees	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° B	-4°	300	200	120	54	54	24	14
0.1° B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

C minimum of Coefficient of Retro-reflection (RA) cd/fc/ft2 (cd-lx-1m2).

D 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 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

**803.5.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV)** This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. 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 D:4956-09) as indicated in Table 800-3.

**Table 800-3: Acceptable Minimum Co-efficient of Retro-Reflection for High Intensity Micro-Prismatic Grade Sheeting (Type IV) (Candelas Per Lux Per Square Metre)**

Observation	Entrance	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° B	-4°	500	380	200	70	90	42	25
0.1° B	+30°	240	175	94	32	42	20	12
0.2°	-4°	360	270	145	50	65	30	18
0.2°	+30°	170	135	68	25	30	14	8.5
0.5°	-4°	150	110	60	21	27	13	7.5
0.5°	+30°	72	54	28	10	13	6	3.5

C Minimum Coefficient of Retro reflection (RA) cd/fc/ft<sup>2</sup> (cd-lx-1m<sup>2</sup>).

D 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 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

### **803.5.3 Prismatic Grade Sheeting**

#### **803.5.3.1 Prismatic Grade Sheeting (Type VIII)**

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. 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 E 810) as indicated in Table 800-4.

#### **803.5.3.2 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 cleaning 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 800-5.

**Table 800-4: Acceptable Minimum Co-efficient of Retro-Reflection for Prismatic**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow/Green	Fluorescent Yellow	Fluorescent Orange
0.1° B	-4°	1000	750	375	100	150	45	30	800	600	300
0.1° B	+30°	460	345	175	46	69	21	14	370	280	135
0.2°	-4°	700	525	265	70	105	32	21	560	420	210

**Grade Sheeting (Type VIII) (Candelas Per Lux per Square Metre)**

0.2°	+30°	325	245	120	33	49	15	10	260	200	95
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35

C Minimum Coefficient of Retro reflection (RA) cd/fc/ft<sup>2</sup> (cd-lx-1m<sup>2</sup>).

D 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 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

**Table 800-5: Acceptable Minimum Co-efficient of Retro-Reflection for Prismatic Grade Sheeting (Type IX) (Candelas Per Lux per Square Metre)**

Observation	Entrance	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow/Green	Fluorescent Yellow	Fluorescent Orange
0.1° B	-4°	600	500	250	66	130	130	530	400	200
0.1° B	+30°	370	280	140	37	74	17	300	220	110
0.2°	-4°	380	285	145	38	76	17	300	230	115
0.2°	+30°	215	162	82	22	43	10	170	130	65
0.5°	-4°	240	180	90	24	48	11	190	145	72
0.5°	+30°	135	100	50	14	27	6.0	110	81	41
1.0°	-4°	80	60	30	8.0	16	3.6	64	48	24
1.0°	+30°	45	34	17	4.5	9.0	2.0	36	27	14

C Minimum Coefficient of Retro reflection (RA)  $\text{cd}/\text{fc}/\text{ft}^2$  ( $\text{cd}\cdot\text{lx}^{-1}\text{m}^2$ ).

D Values for 0.10 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 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

#### **803.5.3.3 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 cleaning 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 Co-efficient of Retro-Reflection for Prismatic Grade Sheeting Type A (Type XI) (Candelas Per Lux per Square Metre)**

Observation	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow / Green	Fluorescent Yellow	Fluorescent Orange
0.1 <sup>0B</sup>	-4 <sup>0</sup>	830	620	290	83	125	37	25	660	500	250
0.1 <sup>0B</sup>	+30 <sup>0</sup>	325	245	115	33	50	15	10	260	200	100
0.2 <sup>0</sup>	-4 <sup>0</sup>	580	435	200	58	87	26	17	460	350	175
0.2 <sup>0</sup>	+30 <sup>0</sup>	220	165	77	22	33	10	7.0	180	130	66
0.5 <sup>0</sup>	-4 <sup>0</sup>	420	315	150	42	63	19	13	340	250	125
0.5 <sup>0</sup>	+30 <sup>0</sup>	150	110	53	15	23	7.0	5.0	120	90	45
1.0 <sup>0</sup>	-4 <sup>0</sup>	120	90	42	12	18	5.0	4.0	96	72	36
1.0 <sup>0</sup>	+30 <sup>0</sup>	45	34	16	5.0	7.0	2.0	1.0	36	27	14

C Minimum Coefficient of Retro-reflection (RA) cd/fc/ft<sup>2</sup> (cd-lx-1m<sup>2</sup>).

D Values for 0.10 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 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

#### **803.5.4Adhesives**

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent other preparation for adhesion to a smooth clean surface, 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. The sheeting shall be applied in accordance with the manufacturer's specifications.

#### **803.5.5Fabrication**

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium 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. Where screen printing with transparent colours is proposed, only butt joint 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.

#### **803.5.6 Messages/Borders**

The messages (legends, letters, numerals etc.) and borders shall either be screen-printed or 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 informatory 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 co-efficient 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.

#### **803.5.7 Colour for Signs**

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

**803.5.7.2** 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 be ground shall be in black.

**803.5.7.3** 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	0.300	0.368	0.366	0.340	0.393	0.274	0.329	15	- -
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	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	0.210	0.190	0.255	0.065	0.216	1	10
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404	12	30
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390	1	6
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540	60	- -
Fluorescent Yellow	0.479	0.520	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	- -

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

**803.5.7.4** 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.

**803.5.7.5** The colours chosen for informatory 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.

#### **803.5.8 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.

#### **803.5.9 Sizes of Letters**

**803.5.9.1** Letter size should be chosen with due regard to the speed, classification and 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.

**803.5.9.2** 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.

**803.5.9.3** 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.

#### **803.5.10 Warranty and Durability**

The Contractor shall obtain from the manufacturer a ten year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of micro-prismatic sheeting and a seven-year warranty for high intensity grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro-reflective sheeting. The Contractor/supplier shall also furnish the LOT numbers and certification that the signs and materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty and that the contractor/supplier is the authorized converter of the particular sheeting.

All signs shall be dated during fabrication with indelible markings to indicate the start of warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro-reflective efficiency.

A certificate in original shall be given by the sheeting manufacturer that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro-reflection, day/night time colour and luminance, shrinkage, flexibility, linear removal, adhesion, impact resistance, specular gloss and fungus resistance; the tests shall be carried out by a Government Laboratory in accordance with various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

### **803.5.10.1 Installation**

- The traffic signs shall be mounted on support posts, which may be of SS 304 grade pipes conforming to IS: **17875 : 2022** for seamless pipes and **IS 17876 : 2022** for welded pipes, Rectangular Hollow Section conforming to IS:4923 or Square

Hollow Section conforming to IS:3589. 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. 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.

- All components of signs (including its back side) and supports, other than the reflective portion and SS posts shall be thoroughly de-scaled, cleaned, primed and painted with two coats of epoxy/ fibre glass/ powder coated paint. Any part of support post below ground shall be painted with protective paint.
- The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

### **803.5.10.2 Measurement 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 Nos.

### **803.5.10.3 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 furnishing of necessary test certificates, warranty and incidentals to complete the work in accordance with these 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. Measurement shall be taken and paid on number.

#### **Item No. 3**

**Place identification Signage: Providing and fixing of Place identification signage size 900x1500mm Made from Retro-Reflective type made of steel structure to be provided as per drawing and design given by Engineer in charge. Each signage to be fixed on Single or Double S.S. 304 grade pipe 63 mm OD Size /2 mm thick with a foundation with CC of 0.45 x 0.45 x 0.60 mt. in M- 15 grade for each post & fixed with VHB Tape of suitable grade as per dimension given in drawing. The sign board face fully covered with Retro reflective sheeting confirming to Type-XI of ASTM D-4956-09**

and IRC 67-2022, on 4 mm thick Alluminum Composite Material (ACP), over which symbols and numerals are made using Latex/UV Digital Printing Technology and over laminated with UV resistant Lamination Film as recommended by sheeting manufacturer in approved color pasted on substrate by pressure sensitive adhesive with suitable size of VHB Tape with outer frame of SS 304 grade pipe 31.75 mm size/ 1.2 mm thick and SS 304 grade support rectangle pipe frame 25 x 12 x 1 mm as per drawing by vertical support as per drawing mounted on SS pipe 63 mm OD (2 mm thick). Fixed with S.S. cleat 6 mm thick as per drawing etc. including all necessary fixture, materials, labours, machineries, SS polishing, transportation and fastening etc. complete as per drawing and as directed by 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 with his own expensis. (A) Class-C Type-11 Retro Reflective sheeting

- 1) Relevant specifications of **Item No. 2** shall apply to this item. Work shall be carried out according to the description of the item.
- 2) The measurement of payment shall be per number board.
- 3) The rate includes all materials, labour, plant, formwork, curing etc. & everything required to complete this item.

**Mode of Payment:** Payment shall be made on No. Basis of work done.

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. Measurement shall be taken and paid on number.

#### Item No.4

Sign board per Sq.Mtr : Providing and fixing Sign board sign 1000mm x 1000 mm Retro- Reflective type sign board of SS steel structure to be provided as per drawing and design given by Engineer in charge. The road sign board steel to be provided as per drawing and design fixed with 02 nos. of S.S. pipe 63mm outer dia. Size 2mm thick total 3.6mt. in length (each post) with a foundation CC of 0.45 x 0.45 x 0.6 mt. in M- 20 grade fixed with M.S. plates and M.S. cleats as per dimension given in drawing. The sign board face fully covered with Retro reflective sheeting confirming to Type-XI of ASTM D-4956-09 The sign board face fully covered with Retro reflective sheeting confirming to Type-XI of ASTM D-4956-09 and IRC 67-2022, on 4 mm thick Aluminum Composite Material (ACP), over which symbols and numerals are made using Latex/UV Digital Printing Technology and over laminated with UV resistant Lamination Film as recommended by sheeting manufacturer in approved color pasted on substrate by pressure sensitive adhesive with suitable size of VHB Tape with back support frame back support frame of SS Round pipe of 32x1.2mm and SS rectangle pipe 25 x 12 x 1 mm as per drawing by vertical support as per drawing mounted on SS pipe 63 mm outer dia (2mm thick) having Pipe Cap at Top. Fixed with M.S. cleat 6 mm thick as per drawing etc. including foundation as per drawing and as directed by 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. The contractor should also submit SS Material test report from NABL Laboratory. (A) Class-C Type-11 Retro Reflective sheeting.

1. Relevant specifications of **Item No. 2** shall apply to this item. Work shall be carried out according to the description of the item.
2. The measurement of payment shall be per number board.
3. The rate includes all materials, labour, plant, formwork, curing etc. & everything required to complete this item.

**Mode of Payment:** Payment shall be made on Square Meter Basis of work done.

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. Measurement shall be taken and paid on number.



## Item No.5

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 shall 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.

### 803. ROAD MARKINGS

803.1. General The color, width and layout of road markings shall be in accordance with the Code of Practice for Road Markings with paints, IRC : 35, and as specified in the drawings or as directed by the Engineer.

803.2. Materials Road markings shall be of ordinary road marking paint, hot applied thermoplastic compound, or reflectorised paint as specified in the item and the material shall meet the requirements as specified below.

#### 803.3. Ordinary Road Marking Paint

803.3.1. Ordinary paint used for road marking shall conform to. Grade I as per IS: 164.

803.3.2. The road marking shall preferably be laid with appropriate road marking machinery.

803.3.3. Laying thickness of road marking paint shall be as specified by the Engineer.

### 803.4. HOT APPLIED THERMOPLASTIC ROAD MARKING

#### 803 .4. 1. General:

803 The work under this section consists of marking traffic stripes using a thermoplastic compound meeting the requirements specified herein.

804 The thermoplastic compound shall be screened / extruded on to the pavement surface in a molten state by suitable machine capable of controlled preparation and laying with surface application of glass beads at a specific rate. Upon cooling to ambient pavement temperature, it shall produce an adherent pavement marking of specified thickness and width and capable of resisting deformation by traffic.

805 The color of the compound shall be white or yellow (IS color No. 356) as specified in the drawings or as directed by the Engineer.

806 Where the compound is to be applied to cement concrete pavement, a scaling primer is recommended by the manufacturer, shall be applied to the pavement in advance of placing of the stripes to ensure proper bonding of the compound. On new concrete surface any laitance and/or curing compound shall be removed before the markings are applied.

## 806.4.2. Thermoplastic Material

**806.4.2.1. General:** The thermoplastic material shall be homogeneously composed of aggregate, pigment, resins and glass reflectorising beads.

### 806.4.2.2. Requirements

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

<b>TABLE 900-3 PROPORTIONS OF CONSTITUENTS OF MARKING</b>		
<b>(Percentage by weight)</b>		
<b>Component</b>	<b>Whit</b>	<b>Yellow</b>
Binder	18.0 min.	18.0 min.
Glass Beads	30-40	30-40
Titanium Dioxide	10.0 Min.	- - - .. -
Calcium Carbonate and		
Inert Fillers	42.0 Max.	See
Yellow Pigments	- .. - - -	Note

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

**(II) Properties:** The properties of thermoplastic material, when tested in accordance with ASTM D36/BS-3262- (Paint 1), shall be as below:

#### **(a) Luminance:**

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

Yellow: Daylight luminance it 45 degien-45 per cent min. as per AASHTO M 249

**(b) Drying time:** When applied at a temperature specified by the manufacturer and to the required thickness, the material shall set to been traffic in not mom than 15 minutes.

**(c) Skid resistance:** not less than 45 as per BS 6044.

**(d) Cracking resistance at low temperature:** The material shall show no cracks on application to concrete blocks.

**(e) Softening point:** 102.5 ± 9.50 C as per AASTM D 36.

**(f) Flow resistance:** Not more than 25 per cent as per AASHTO M 249.

**(g) Yellowness Index (for white thermoplastic paint):** not more than 0.12 as per AASHTO M 249

**(III) Storage life:** The material shall meet the requirements of these Specifications for a period of one year. The thermoplastic material must also melt uniformly with no evidence of skins or unmelted particles for the one year storage period. Any material not meeting the above requirements "I am replaced by the manufacturer/ supplier/ Contractor.

**(iv) Reflectorisation:** Shall be achieved by incorporation of beads. the grading and other properties of the bonds shall be as specified in Clause 803.4.3.

**(v) Marking:** Each container of the thermoplastic material shall be clearly and indelibly marked with the following information:

1. The name, trade mark or other means of identification of manufacturer, 2. Batch number, 3. Date of manufacture, 4. Color (white or yellow) & 5. Maximum application temperature and maximum safe beating temperature.

**(vi) Sampling and testing:** The thermoplastic material shall be sampled and tested in accordance with the appropriate ASTM/BS method. The Contractor shall furnish to the Employer a copy of certified test reports from the manufacturers of the thermoplastic material showing results of all tests specified herein and shall certify that the material meets all requirements of this Specification.

#### **806.4.3. Reflectorising glass beads**

803.4. 3.1. General: This Specification covers two types of glass beads to be used for the production of reflectorised pavement markings.

Type I beads -are those which are a constituent of the basic thermoplastic compound vide Table 800-3 and Type 2 beads are those which are to be sprayed on the surface vide Clause 803.6.3.

803.4.3.2. The glass beads shall be transparent, colour less and free from milkiness, dark particles and excessive air inclusions.

These shall conform to the requirements spelt out in Clause 803.4.3.3.

#### **803.4.3.3. Specific requirements**

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

1.18 mm	0 to 3	-----
850 micron	5 to 20	0 to 5
600 -do-		5 to 20
425 -do•	65 to 95	-----

300 -do-	-----	30 to 75
180 -do•	0 to 10	10 to 30
below 180 micron	-----	0 to 15

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

803.4.3.4. Test methods: The specific requirements shall be tested with the following methods:

- (i) Free-flow test: Spread 100 grams of beads evenly in a 100 mm diameter glass dish. Place the dish in a 250 mm inside diameter desiccators which is filled within 25 mm of the top of a desiccator's plate with sulphuric acid water solution (specific gravity 1.10). Cover the desiccators and let it stand for 4 hours at 20 to 29 degree C. Remove sample from desiccators, transfer beads to a pan and inspect for lumps or clusters. Then pour beads into a clean, dry glass funnel having a 100 mm stem and 6 mm orifices, if necessary initiate flow by lightly tapping the funnel. The glass spheres shall be essentially free of lumps and clusters and shall flow freely through the funnel.
- (ii) The requirements of gradation, roundness and refractive index of glass beads and the amount of glass beads in the compound shall be tested as per BS 6088 and BS 3262 (Part 1).
- (iii) The Contractor shall furnish to the Employer a copy of certified test reports from the manufacturer of glass beads obtained from a reputed laboratory showing results of all tests specified herein and shall certify that the material meets all requirements of this Specification. However if so required these tests may be carried out as directed by the Engineer.

#### 806.4.4. Application properties of thermoplastic material

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

806.4.4.2. The material upon heating to application temperatures shall not exude fumes, which are toxic, obnoxious or injurious to persons or property.

#### 806.4.5. Preparation:

(i) The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic material to avoid local overheating. The temperature of the mass shall be within the range specified by the manufacturer, and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer.

7be molten material should be used as expeditiously as possible and for thermoplastic material which has natural binders or is otherwise sensitive to

prolonged heating, the material shall not be maintained in a molten condition for more than 4 hours.

(ii) After transfer to the laying equipment, the material shall be maintained within the temperature range specified by the manufacturer for achieving the desired consistency for laying.

#### 806.4.6. Properties of finished road marking

(a) The stripe shall not be slippery when wet.

(b) The marking shall not lift from the pavement in freezing weather.

(c) After application and proper drying, the stripe shall show no appreciable deformation or discoloration under traffic and under road temperatures up to 60 degree centigrade.

(d) The marking shall not deteriorate by contact with sodium chloride, calcium chloride or oil drippings from traffic.

(e) The stripe or marking shall maintain its original dimensions and position. Cold ductility of the material shall be such as to permit normal movement with the road surface without chopping or cracking.

(f) The color of yellow marking shall conform to IS Color No. 356 as given in IS: 164.

#### 803.5. Reflectorised Paint

Reflectorised paint, if used, shall conform to the Specification by the manufacturers and approved by the Engineer. Reflectorising glass beads for reflectorising paints where used shall conform to the requirement of Clause 803.4.3.

#### 803.6. Application

803.6.1. Marking shall be done by machine. For locations where painting cannot be done by machine, approved manual methods shall be used with prior approval of the Engineer. The Contractor shall maintain control over traffic while painting operations are in

progress so as to cause minimum inconvenience to traffic compatible with protecting the workmen.

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

803.6.3. The pavement temperature shall not be less than 10C during application. All surfaces to be marked shall be thoroughly cleaned of all dust, dirt grease, oil and all other foreign matter before application of the paint.

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

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

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

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

#### 803. 7. Measurements for Payment

803. 7. 1. The painted markings shall be measured in **sq. metre** of actual area marked (excluding the gaps, if any).

#### 803.8. Rate

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

## Special Requirement for Hot Applied Thermoplastic Marking and Audible Vibratory Profile

### Marking Application on Road

1. The application of Hot Applied Thermoplastic and Audible Vibratory marking must be done with Either Fully Automatic or Semi-Automatic Application Machine only. No Manual Machine is allowed to use for the application of the Thermoplastic marking.
2. The Applicator must have their own machines for Thermoplastic profile Marking, and the proof of ownership to be submitted to the Authority for source approval.
3. The Applicator should be either Manufacturer or authorized by the original manufacturer of the Material. The applicator should submit such authorization certificate to the Authority for the approval before commencing the work.
4. The manufacture should be ISO certified organization and the copy of the certificate should be submitted to the Authority.
5. Performance Criteria: Material should be confirming to MoRTH specification and test Certificate should be submitted as per the IRC 35-2015 for the reflectivity and luminance test time to time.
6. The Applicator should organize onsite testing for the reflectivity performance with reflectometer initially at 7 days and afterwards at interval of every 6 months up to 2 Years and performance should meet IRC 35-2015 criteria.
7. The Applicator should submit in original warranty for satisfactory in field performance as laid down in IRC 35-2015 for the period of 2 years. The warranty should be in original and jointly signed by the original manufacture and Authorized applicator.

#### Item No. 6

**Standard Delineator: Providing and fixing of Standard Metal Delineator consisting of minm retro reflective unit exposed area of 330 cm<sup>2</sup> white color, full cube corner micro prismatic non-metallic retro reflective sheeting on each side conforming with IRC 67 2012 and meeting the coefficient of retro reflection values as per ASTM D 4956 Type XI table specification. The delineator shall be painted with powder 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 the ground, width not less than 100 mm and shall extend not more than 300mm below the ground while being installed. height of sheeting should be minimum 150mm whereas width of sheeting should not be less than 75mm (should be placed every alternative 15cm). The front and back faces of the delineator should be curved with a radius of not more than 200 mm and with delta angle (or central angle of curve) lying between 20o and 30o, to increase the visibility of the delineator for vehicles moving in continuous curves. The delineator shall have grooves across the length to make the reflective sheets vandal-proof. The delineator is meant for application on gaps in median, traffic islands, dangerous bends, roundabouts, narrow bridges etc. or as desired by site engineer**

### 806 ROAD DELINEATORS

#### 806.1 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 chennelising island in approaches to intersections.

#### 806.2 Materials

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.

#### **806.3 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.

#### **806.4 Measurement for Payments**

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

#### **806.5 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.7: STOP Sign:-Providing and fixing STOP sign size 900mm Octagonal Retro-Reflective type sign board of steel structure to be provided as per drawing and design given by Engineer in charge. The road sign board steel to be provided as per drawing and design of 600x800mm Rectangular fixed with 01 no. of S.S. 304 grade pipe 63 mm OD Size /2 mm thick total 3.6 mt. in length with a foundation CC of 0.45 x 0.45 x 0.60 mt. in M- 15 grade fixed with VHB Tape of suitable grade as per dimension given in drawing. The sign board face fully covered with Retro reflective sheeting confirming to Type-XI of ASTM D-4956-09 and IRC 67-2022, on 4 mm thick Aluminum Composite Material (ACP), over which symbols and numerals are made using either Screen Printing / UV resistance durable overlay Filmas recommended by sheeting manufacturer in approved color pasted on substrate by pressure sensitive adhesive with suitable size of VHB Tape with back support frame of SS square pipe 32x32x1 mm as per drawing by vertical support as per drawing mounted on SS pipe 63 mm OD (2 mm thick). Fixed with S.S. cleat 6 mm thick as per drawing etc.including all necessary fixture, labours, SS polishing, transportation and fastnieng as per drawing and as directed by 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 with his own expensis. The contractor should also submit SS Material test report from NABL Laboratory (A) Class-C Type-11 Retro Reflective sheeting**

1. Relevant specifications of **Item No. 2** shall apply to this item. Work shall be carried out according to the description of the item.
2. The measurement of payment shall be per number board.
3. The rate includes all materials, labour, plant, formwork, curing etc. & everything required to complete this item.

**Mode of Payment:**

Payment shall be made on Square Meter Basis of work done.

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. Measurement shall be taken and **paid on number**.

**Item No. 8**

**Providing & Fixing Traffic Bollard Swiss type Jumbo made out of 18 gauge MS Sheet in Conical shape having Dia 30 cms and top dia. 20 cms, Top Circular plate of 45 cms dia. For arrow, total height 188 cms and coated with black epoxy powder coating and three yellow retroreflective high intensity prismatic bands of 15 cms width applied in the body and blue and white circular reflector on top plate, as per the drawing using High intensity prismatic grade ASTM Type 4 material, Fixed at site in M15 PCC having size 45 x 45 x 60 CM including all material, labour, transport, fixing etc. complete as per directed by engineer in charge.**

**Description:**

- **Type:** Swiss Type Bollard with Direction Plate.
- **Material:** Cold Rolled Close Annealed (CRCA) Sheet, **1.5 mm thick**.

**1. Dimensions:**

- **Height:** 188 cm.
- **Base Diameter:** 30 cm.
- **Top Diameter:** 20 cm.
- **Direction Plate Diameter:** 45 cm (circular).

**2. Fabrication & Surface Treatment:**

- Fabricated strictly **as per approved drawings**.
- Pre-treated using **phosphating process** for enhanced corrosion resistance.
- **Paint Finish:** Coated with high-durability **epoxy paint**.
- **Reflectorisation:** Applied with **retro-reflective sheeting** as per **MORTH latest specifications** for night visibility and safety.

**3. Installation:**

- **Foundation Size:** 45 cm x 45 cm x 60 cm (L x W x D).
- **Concrete Grade:** M15 (1:2:4 mix — 1 part cement, 2 parts fine sand, 4 parts coarse aggregate).
- Bollard to be properly embedded and aligned **as directed by the Engineer-In-Charge**.

#### **4. Compliance:**

- All materials and workmanship shall conform to **relevant IS codes** and **MORTH specifications**.
  - Direction plate and reflective sheeting to meet visibility and durability standards.
- Measurement:** Nos.

Item No. 9

**Supply o & Fixing of Speed Breaker made of ABS plastic, Size: 250mm(L) x 350mm (W) x50mm (H) duly filled with the Concrete and installed with Epoxy and fastners.etc. complete as per directed by engineer in charge.**

**Scope of work:**

The scope covers the comprehensive end-to-end execution for installing heavy-duty, modular plastic speed breakers. This includes:

- Procuring and supplying heavy-duty Acrylonitrile Butadiene Styrene (ABS) plastic modular segments (alternating safety yellow and black) with built-in reflective elements.
- Cleaning, preparing, and marking the asphalt or concrete road surface alignment.
- Mixing and filling the internal hollow structural cavities of each ABS module with high-strength concrete core reinforcement.
- Drilling anchor bolt holes into the existing road pavement to the specified depth.
- Supplying and applying structural-grade epoxy adhesive at the base interface for a permanent, watertight seal.
- Inserting, driving, and torqueing mechanical heavy-duty anchor fasteners to securely lock the modules down.
- Managing traffic control during installation and keeping the zone closed until the bonding materials cure completely, as directed by the Engineer-in-Charge

- **Material Specifications**

**ABS Plastic Speed Breaker Modules**

- **Material Composition:** Premium virgin Acrylonitrile Butadiene Styrene (ABS) thermoplastic polymer. The material must be high-impact resistant, UV-stabilized (to prevent fading or brittleness), and highly resistant to oils, chemicals, and extreme

weather.

- **Module Dimensions:**

- Length: 250 mm(along the direction of traffic flow; tolerance (2mm).
- Width: 350 mm(transverse to the road width; tolerance (5 mm).
- Height: 50 mm (profile height; tolerance.(2 mm).
- Color Configuration: Alternating high-visibility Safety Yellow and Jet Black modules to form a highly visible checkered pattern.
- Night Visibility: Each module must feature integrated retro-reflective elements (such as PMMA reflectors or embedded cat-eyes) on both the approach and exit slopes to ensure long-range visibility at night.
- Surface Texture: The top surface must feature a molded, non-skid, diamond-tread or ribbed pattern to prevent vehicle tyres from skidding in wet weather.

- **Concrete Core Filling**

- Concrete Grade: Nominal mix equivalent to M20 / M25 grade or a non-shrink high-strength grout mix.
- Aggregate Size: Fine sand and micro-aggregates ( $6\text{ mm}$ ) down size) to ensure smooth flow into the complex interior rib structure of the plastic modules.
- Performance: The concrete must completely fill the hollow underside cavity. This creates a solid, unyielding composite block that prevents the plastic shell from crushing, flexing, or cracking under heavy axle loads.

- **Fixing System:** Dual-bonding utilizing high-strength epoxy grout

on the base surface combined with mechanical anchor fasteners.

- Also Relevant specifications of **Item No. 2** shall apply to this item. Work shall be carried out according to the description of the item.
- The measurement of payment shall be per number board.
- The rate includes all materials, labour, plant, formwork, curing etc. & everything required to complete this item.

- **Mode of Payment:**

Payment shall be made on Square Meter Basis of work done.

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. Measurement shall be taken and paid on Per Number (Each / Per Set) basis.

- **Compliance:**

- All materials and workmanship shall conform to **relevant IS codes** and **MORTH specifications**.
- Direction plate and reflective sheeting to meet visibility and durability standards.

**Measurement:** Rmt.

#### **Item No. 10**

**Providing and Fixing inbuilt battery Solar Blinkers on existing pole and Solar Panel after removing required existing Solar Blinkers accessory battery 12.8V, 6 Ah, LIFEPRO 4 with suitable charge controller maintenance free Colour- Amber, with 200 mm Dia. 24 Hours flashing Blinker Aspect as per MoRTH Standards in accordance to IRC:93 and IS 7537 and as shown in the drawings in the code.**

#### **1. Scope of Work**

The scope covers the complete replacement, integration, and deployment of a retrofitted, high-efficiency solar-powered traffic alerting system. This work includes:

- Dismantling and removing the designated old/damaged/obsolete existing solar blinker assemblies, including degraded external battery systems, legacy enclosures, damaged wiring harnesses, and related obsolete mounting accessories.
- Inspecting and evaluating the structural stability of the existing support poles and verifying the electrical output parameters of the existing solar PV panels.
- Procuring, supplying, and installing an advanced inbuilt battery Solar Blinker system featuring an integrated Lithium Iron Phosphate (LiFePO<sub>4</sub>) energy pack, smart charge controller, and a high-brightness LED optical lens aspect.
- Rewiring, interfacing, and testing the new integrated blinker assembly to the existing solar panel framework.
- Commissioning, final orientation alignment, and a 24-hour cycle test to satisfy the design directives of the Engineer-in-Charge.

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## 2. Material Specifications

### Blinker Aspect & Optical Assembly

- Blinker Housing & Outer Shell: Precision injection-molded Polycarbonate or ABS plastic. The structure must be UV-stabilized, impact-resistant, dust-proof, and completely water-tight, carrying a minimum environmental protection rating of IP65.
- Aspect Diameter: 200 mm nominal lens profile.

- Lens: High-transmission, UV-stabilized, impact-resistant transparent polycarbonate lens. It must incorporate an integrated anti-glare sun visor dipped at an angle of ( 5 to 3degree) to the horizontal to mitigate sun-phantom reflections, strictly conforming to IS 7537 and IRC:93 guidelines.
- Color Configuration: Amber (Yellow) signaling wavelength ( $(590 \pm 5\text{nm})$ ).
- LED Configurations: Minimum of 95 to 140 ultra-bright, water-clear, high-flux InGaN LEDs arranged in a concentric or matrix pattern to deliver a visibility radius exceeding 500 meters under bright noon daylight conditions. The individual LED viewing angle must be calibrated around (23-24degree).

- Also Relevant specifications of **Item No. 2** shall apply to this item. Work shall be carried out according to the description of the item.
- The measurement of payment shall be per number board.
- The rate includes all materials, labour, plant, formwork, curing etc. & everything required to complete this item.

- **Mode of Payment:**

Payment shall be made on Square Meter Basis of work done.

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. Measurement shall be taken and paid on Per Number (Each / Per Set) basis.



- **Compliance:**

- All materials and workmanship shall conform to **relevant IS codes** and **MORTH specifications**.
- Direction plate and reflective sheeting to meet visibility and durability standards.

**Measurement:** per Nos..

**Item No. 11**

**Facia Replacement for overhead signs: Sign board per Square Meter :-Providing and fixing sign boards made out of 4mm ACP (Aluminum composite Panel); size as per design of IRC-67- 2012. Pre treated with phospheting process & acid etching;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; for each board shall be as per the instruction 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 with contractor's own expanses for the product offered shall be submitted by contractor with his own expensis including all necessary fixture, labours,lifting,machinery, transportation and fastening etc complete as directed by Engineer incharge. (A) Class-C Type-11 Retro Reflective sheeting.complete as per directed by engineer in charge.**

1. Relevant specifications of **Item No. 2** shall apply to this item. Work shall be carried out according to the description of the item.
2. The measurement of payment shall be per number board.
3. The rate includes all materials, labour, plant, formwork, curing etc. & everything required to complete this item.

- **Mode of Payment:**

Payment shall be made on Square Meter Basis of work done.

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. Measurement shall be taken and paid on **square meter**.

#### **Item No. 12**

**Supply and fixing of Convex Mirror made from Polycarbonate or acrylic lens, with 1000mm Dia, having viewing angle of 130-160 degree. The convex mirror should be weather proof, impact resistant, and anti corrosion. The mirror should be mounted on 65 NB poles with necessary fixtures or grouting in the ground with CC of 1:2:4 complete as directed by Engineer-in-charge complete as per directed by engineer in charge.**

#### **1. Scope of Work**

The scope covers the comprehensive end-to-end execution for installing outdoor safety mirrors. This includes:

- Procuring and supplying a premium 1000 diameter convex mirror.
- Fabricating and supplying a 65NB heavy-duty steel mounting pole.
- Excavating, structural anchoring, and cast-in-situ concrete grouting (M15 / 1:2:4) grade) of the pole into the ground.
- Assembling, aligning, and securely locking the mirror housing to the pole with heavy-duty anti-theft hardware.
- Clearing the site, handling debris, and maintaining traffic safety protocols during installation under the guidance of the Engineer-in-Charge

#### **2. Material Specifications**

##### **Convex Mirror Assembly**

- Lens Material: Pure imported Polycarbonate (PC) or optical-grade Acrylic sheet. Polycarbonate is preferred for its high impact resistance (virtually unbreakable under stone-pelting or vandalism).
- Lens Diameter: Exactly 1000mm (tolerance 5mm)

- **Curvature & Field of View:** Precision engineered to provide a wide-angle viewing field between 130° and 160°. It must deliver a crisp, undistorted reflection without blind spots.
- **Protective Coatings:** Complete front-face stabilization against UV radiation (preventing yellowing, clouding, or chalking under direct sunlight), along with scratch-resistant and anti-misting properties.
- **Backing Rim / Housing:** Heavy-duty, vacuum-molded Acrylonitrile Butadiene Styrene (ABS) or Fiber-reinforced Plastic (FRP). It must feature an integrated protective sun-shade brim and be colored in highly visible, UV-stabilized signaling orange or yellow.
- **Reflective Elements:** The perimeter must feature high-intensity retro-reflective strips (Class-A/Type-IV micro-prismatic sheeting) to remain visible to motorists at night.

#### support Post & Mounting Hardware

- **Mounting Pole:** Heavy-duty Medium Class Galvanised Iron (GI) or Mild Steel (MS) pipe conforming to IS:1239 (Part-1). Nominal Bore (NB) must be 65 mm (approximate Outer Diameter of 76.1 mm).
- **Pole Height:** Total length of 3.5 meters, allowing for 3.0 meters of clearance above ground level and a 0.5 meter embedment depth.
- **Surface Protection (for MS poles):** Hot-dip galvanized coating (as per IS:4736) OR coated with two coats of anti-corrosion epoxy zinc-phosphate primer, finished with two coats of premium outdoor-grade PU gloss paint in alternating black and white bands.
- **Base Anchor:** A 12mm thick MS base plate 200 mm \* 200mm welded to the bottom of the pole, or two perpendicular 12 mm diameter MS holdfast bars driven through the embedded base section.
- **Brackets & Fasteners:** Heavy-gauge, hot-dip galvanized steel clamp brackets. All nuts, bolts, and washers must be stainless steel (Grade SS-304) or hot-dip galvanized to completely prevent corrosion and rusting.

#### Grouting Materials

- **Cement:** Ordinary Portland Cement (OPC-43/53 grade) conforming

to IS:269 / IS:12269.

- Fine Aggregate: Clean, coarse river sand or approved crushed stone sand conforming to IS:383.
- Coarse Aggregate: Clean, hard, crushed angular granite stone ballast 20 mm nominal down size) conforming to IS:383.
- Concrete Mix Proportions: Nominal volumetric mix of 1:2:4 (1 Part Cement : 2 Parts Sand : 4 Parts Coarse Aggregate), yielding a nominal strength equivalent to M15 concrete. Water-cement ratio must be strictly monitored to prevent bleeding.

- **Installation:**

- Excavate a neat, square pit measuring 400 mm\* 400 mm wide and 600 mm deep into the ground. If the ground consists of loose soil, the sides must be properly rammed and stabilized before placing concrete. Position the 65NB mounting pole vertically inside the center of the pit. Use a magnetic spirit level to ensure the pole is perfectly plumb along both vertical axes. Brace the pole temporarily with wooden or steel struts to keep it stable during concrete pouring. Mix the 1:2:4 concrete thoroughly on a clean, non-porous platform. Pour the wet mix into the pit around the pole in 150 mm thick layers. Compact each layer thoroughly using a steel tamping rod to eliminate all air voids. Bring the concrete up to ground level, then finish it into a neat, sloped, smooth circular or square concrete collar (coping) extending 50 mm above the ground. This sheds rainwater away from the base of the metal pole. Keep the concrete continuously wet by ponding or covering it with damp gunny bags for a minimum curing period of 7 days. Do not subject the pole to any mechanical load or bracket installation during this curing window. Once curing is complete, remove the protective film from the mirror face. Secure the heavy-duty clamp brackets around the top section of the 65 NB pole. Mount the convex mirror housing onto the bracket assembly.
- Also Relevant specifications of **Item No. 2** shall apply to this item. Work shall be carried out according to the description of the item.
- The measurement of payment shall be per number board.

- The rate includes all materials, labour, plant, formwork, curing etc. & everything required to complete this item.

- **Mode of Payment:**

Payment shall be made on Square Meter Basis of work done.

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. Measurement shall be taken and paid on Per Number (Each / Per Set) basis.

**Deputy Executive Engineer**  
**Capital Project Sub Division 26**  
**Gandhinagar**

**Executive Engineer**  
**Capital Project Division 1**  
**Gandhinagar**

