

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण

(पोत परिवहन, सड़क परिवहन और राजमार्ग मंत्रालय)

National Highways Authority of India

(Ministry of Shipping, Road Transport and Highways)

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Dated: 03.03.2010

POLICY MATTERS : TECHNICAL (50/ 2010)

(Decision taken on TIC division's file No. NHA/Tech/Genl/2009)

Sub.: Specifications for Traffic Signs having Retro-Reflective Sheeting.

IRC:67-2001 "Code of Practice for Road Signs" provide specifications for Retro-reflective Sheeting. Clause 5.8 of IRC:67 specifies general requirements of Retro-reflective Sheeting. These requirements are as under:

(i) The retro-reflective sheeting used on the signs 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 exhibit colourfastness. 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. The reflective sheeting can be either of Engineering Grade material with enclosed lens or high Intensity Grade with encapsulated lens. The type of the sheeting to be used would be dependent upon the type, functional hierarchy and importance of the road.

2. In the 5th Revision of "Specification for Road and Bridge Works", detailed specifications for traffic signs having Retro-Reflective Sheeting have been incorporated. These specifications prescribe requirements of sheeting and applications of various grades of sheeting. These specifications have incorporated various types of sheeting such as Engineering grade sheeting, Super engineering grade sheeting, High intensity grade, High intensity micro-prismatic grade sheeting, Super high intensity micro-prismatic grade sheeting and Very high intensity micro-prismatic grade sheeting. The general requirements and applications of various types of sheeting, as prescribed in the 5th revision of "Specification for Road and Bridge Works", are summarized in brief here under:

(i) **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/night time 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, 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.

(ii) **Engineering grade sheeting**: This medium intensity retro reflective sheeting shall be typically enclosed lens glass-bead sheeting. Typical applications for this material are on Rural Roads.

(iii) **Super engineering grade sheeting**: This medium-high intensity retro reflective sheeting shall be typically enclosed lens glass-bead sheeting. Typical applications for this material are on Rural Roads.

(iv) **High intensity grade**: 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. Typical applications for this material are on Rural Roads and on Major District Roads.

(v) **High intensity micro-prismatic grade sheeting** : This sheeting shall be of high intensity retro-reflective sheeting made of unmetallized micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. Typical applications for this material are for traffic signs of National Highways and State Highways. The retro-reflective surface shall have the minimum co-efficient of retro-reflection as under.

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1°	-4°	500	380	200	70	90	42	25	400	300	150
0.1°	+30°	240	175	94	32	42	20	12	185	140	70
0.2°	-4°	360	270	145	50	65	30	18	290	220	105
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22

(vi) **Super high intensity micro-prismatic grade sheeting:** This sheeting shall be of super high intensity retro-reflective sheeting made of unmetallized micro prismatic retro-reflective element material having highest retro reflectivity characteristics at long and medium road distances as determined by the Ra values of Table given below at 0.1 and 0.2 observation angles. Typical applications for this material are cautionary, mandatory signs and for delineators on National Highways and State Highways expressways and Urban Arterials.

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1°	-4°	1000	750	375	100	200	45	800	600	300
0.1°	+30°	570	430	215	57	115	26	460	340	170
0.2°	-4°	750	560	280	75	150	34	600	450	230
0.2°	+30°	430	320	160	43	86	20	340	260	130
0.5°	-4°	240	180	90	24	48	11	190	145	72
0.5°	+30°	135	100	80	14	27	6.0	110	81	41

(vii) **Very high intensity micro-prismatic grade sheeting:** This sheeting shall be of very high intensity retro-reflective sheeting made of unmetallized micro-prismatic retro-reflective element material having highest retro-reflectivity characteristics at short road distances as determined by the RA values of Table given below at 0.1 and 0.2 observation angles. Typical applications for this material are for overhead signs on National Highways, State Highways, expressways and on Urban Arterials.

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1°	-4°	660	500	250	66	130	30	530	400	200
0.1°	+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

3. These proposed revised specifications also specify the requirement of Warranty & durability. These requirements are as under:

Warranty and durability: The Contractor shall obtain from the manufacture a ten year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of micro-prismatic sheeting, a seven - year warranty for high intensity

grade and a five year warranty for the sheeting of engineering grade and submit the same to the Engineer. In addition, a ten year, seven year and a five year warranty for satisfactory in-field performance of the finished sign with retro-reflective sheeting of micro prismatic, high intensity grade and engineering grade respectively, inclusive of the screen printed or cut letters/legends and their bonding to the retro-reflective sheeting shall be obtained from the contractor/supplier and submitted to the Engineer. 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 have passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

4. A copy of the detailed specifications to be followed as downloaded from IRC web-site is enclosed for information and compliance.

5. It has also been decided that all informatory board shall be trilingual (English, Hindi and vernacular language) as applicable.

6. This issues with the approval of Chairman.

AKS
3/3/2010

(A.K.Singh)
General Manager (PQ)

To:
All NHAI

Copy to :
Library/Hindi Officer

Traffic Signs, Markings and
Other Road Appurtenances

800

**Traffic Signs, Markings
and Other Road
Appurtenances**

801 TRAFFIC SIGNS**801.1 General**

801.1.1 The colour, configuration, size and location of all traffic signs for highways (other than Expressways for which the size of the signs, letters and their placement shall be as specified in the drawings and relevant Specifications or as directed by the Engineer) and for other roads, shall be in accordance with the Code of Practice for Road Signs, IRC:67:2001, or as shown on the drawings. In the absence of any details or for any missing details (for example, chevron signs etc.), the signs shall be provided in accordance with international standards and/or as directed by the Engineer.

801.1.2 Unless otherwise specified, the signs shall be reflectorised as shown on the drawings or as directed by the Engineer. They shall be of retro-reflectorised type and made of enclosed lens / encapsulated lens / micro-prismatic type reflective sheeting vide Clause 801.3, fixed over a substrate vide Clause 801.2.5 of these Specifications.

801.1.3 In general, cautionary and mandatory signs shall be fabricated through process of screen printing. In regard to informatory signs with inscriptions or cut letters of, coloured retroreflective sheeting comprising unmetallised microprismatic element material vide Clause 801.3 or durable transparent, coloured overlay film shall be used which must be bonded well on the base sheeting, as directed by the Engineer.

801.2 Materials

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

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

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

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

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

801.2.5. Substrate : Sign panels may be fabricated on aluminium sheet, aluminium composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum 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 Panel and other materials shall meet the relevant ASTM (D903, E8, E393, E732)/BS/BIS requirements.

801.2.6 Signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5 mm thick made of aluminium and shall not be less than 4 mm thick made out of other materials vide Clause 801.2.5. All others shall be at least 2 mm thick made of aluminium and shall not be less than 4 mm thick made out of other materials vide Clause 801.2.5. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under the prevailing wind and other loads.

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

801.3 Traffic Signs having Retro-Reflective Sheeting

801.3.1 General requirements : The retro-reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having tested the sheeting for co-efficient of retro-reflection, day/night time 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, 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.

801.3.2 Engineering grade sheeting : This medium intensity retro reflective sheeting shall be typically enclosed lens glass-bead sheeting. Typical applications for this material are on Rural Roads The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard D: 4956-07) as indicated in Table 800-1.

Table 800-1 Acceptable Minimum Coefficient of Retro Reflection^A for Engineering Grade Sheeting (Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.2°	-4°	70	50	25	9.0	14.5	4.0	1.0
0.2°	+30°	30	22	7	3.5	6.0	1.7	0.3
0.5°	-4°	30	25	13	4.5	7.5	2.0	0.3
0.5°	+30°	15	13	4	2.2	3.0	0.8	0.2

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

When totally wet, the sheeting shall show not less than 90 percent of the values of retro-reflection indicated in Table 800-1. At the end of 5 years, the sheeting shall retain at least 50 percent of its original retro-reflectance.

801.3.3 Super engineering grade sheeting : This medium-high intensity retro reflective sheeting shall be typically enclosed lens glass-bead sheeting. Typical applications for this material are on Rural Roads. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard D: 4956-07) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-Reflection^A for Super Engineering Grade Sheetting
(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.2°	-4°	140	100	60	30	30	10	5
0.2°	+30°	60	36	22	10	12	4	2
0.5°	-4°	50	33	20	9	10	3	2
0.5°	+30°	28	20	12	6	6	2	1

^AMinimum Coefficient of Retro reflection (R_A) cd/ft²(cd-lx⁻¹.m²).

When totally wet, the sheeting shall show not less than 90 percent of the values of retro-reflection indicated in Table 800-2. At the end of 5 years, the sheeting shall retain at least 65 percent of its original retro-reflectance.

801.3.4 High intensity grade : 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. Typical applications for this material are on Rural Roads and on Major District Roads. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard D: 4956-07) as indicated in Table 800-3.

801.3.5. High intensity micro-prismatic grade sheeting : This sheeting shall be of high intensity retro-reflective sheeting made of unmetallized micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. Typical applications for this material are for traffic signs on National Highways and State Highways. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard :D: 4956-07) as indicated in Table 800-4.

Table 800-3 Acceptable Minimum Coefficient of Retro-reflection for High Intensity Grade Sheeting (Encapsulated Lens Type) (Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1 ^{oB}	-4°	300	200	120	54	54	24	14
0.1 ^{oB}	+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

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

^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 Table 800-3. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

Table 800-4 Acceptable Minimum Coefficient of Retro-Reflection for High Intensity Micro-prismatic Grade Sheeting (Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow -Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^{oB}	-4°	500	380	200	70	90	42	25	400	300	150
0.1 ^{oB}	+30°	240	175	94	32	42	20	12	185	140	70
0.2°	-4°	360	270	145	50	65	30	18	290	220	105
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22

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

^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 Table 800-4. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

801.3.6 Super high intensity micro-prismatic grade sheeting : This sheeting shall be of super high intensity retro-reflective sheeting made of unmetallized micro-

prismatic retro-reflective element material having highest retro reflectivity characteristics at long and medium road distances as determined by the R_A values of Table 800-5 at 0.1° and 0.2° observation angles. Typical applications for this material are cautionary, mandatory signs and for delineators. On National Highways and State Highways expressways and Urban Arterials. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard : D: 4956-07) as indicated in Table 800-5.

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Super High Intensity Micro-prismatic Grade Sheeting Type A (Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^{ab}	-4°	1000	750	375	100	200	45	800	600	300
0.1 ^{ab}	+30°	570	430	215	57	115	26	460	340	170
0.2°	-4°	750	560	280	75	150	34	600	450	230
0.2°	+30°	430	320	160	43	86	20	340	260	130
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

^A Minimum Coefficient of Retro reflection (R_A) cd/lx-ft²(cd-lx⁻¹.m²).

^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 Table 800-5. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

801.3.7 Very high intensity micro-prismatic grade sheeting : This sheeting shall be of very high intensity retro-reflective sheeting made of unmetallized micro-prismatic retro-reflective element material having highest retro-reflectivity characteristics at short road distances as determined by the R_A values of Table 800-6 at 0.1° and 0.2° observation angles. Typical applications for this material are for overhead signs on National Highways, State Highways, expressways and on Urban Arterials. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard : D: 4956-07) as indicated in Table 800-6.

801.3.8 Messages/borders : The messages (legends, letters, numerals etc.) and borders shall either be screen-printed or of cut-outs from durable transparent overlay or cut-out from same type of reflective sheeting (excluding for black colour) for the cautionary/mandatory signs. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the information and other signs, the

messages (legends, letters, numerals etc.) and borders shall be cut-out from durable transparent overlay film or cut out from same reflective sheeting only. Cut-outs shall be bonded with the sheeting in the manner specified by the manufacturer. Both the screen printed areas and cut-out messages sheetings and cut-out durable transparent overlay film shall be covered under the warranty period of the sheeting type, issued by the sheeting manufacturer

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Very High Intensity Micro-prismatic Grade Sheeting (Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow -Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^a	-4°	660	500	250	66	130	30	530	400	200
0.1 ^a	+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

^A Minimum Coefficient of Retro reflection (R_A) $cd/lx/ft^2(cd-lx^{-1}.m^2)$.

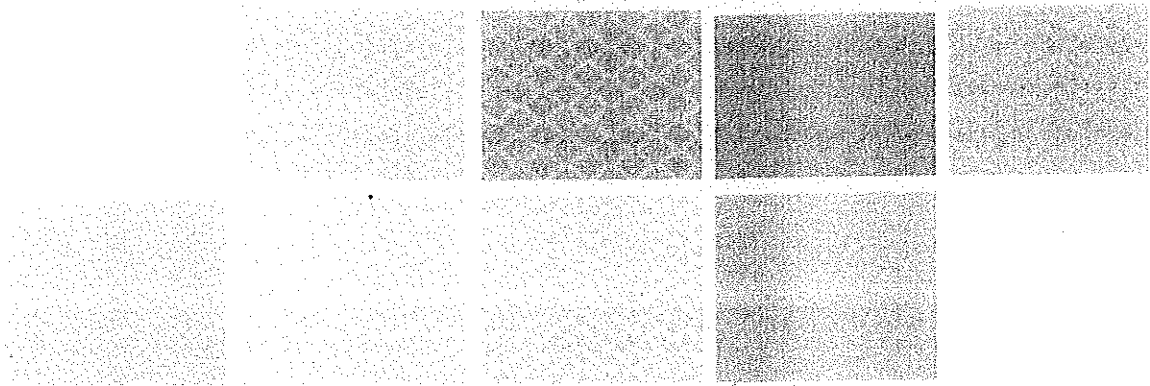
^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

When totally wet, the sheeting shall show not less than 90 percent of the values, of retro-reflection indicated in Table 800-6. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

801.3.9 For screen-printed transparent coloured areas on white sheeting, the coefficient of retro-reflection shall not be less than 50 per cent of the values of corresponding colour in Tables 800-1, 800-2, 800-3, 800-4, 800-5 and 800-6, as applicable.

801.3.10 Cut-out messages and borders, wherever used, shall be made out of retro-reflective sheeting (as per Clauses 801.3.2/801.3.3/801.3.4/801.3.5/801.3.6/ 801.3.7) as applicable), except those in black which shall be of non-reflective sheeting.

801.3.11 Colour : Unless otherwise specified, the general colour scheme and properties shall be as stipulated in ASTM 4956-07. The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night and in inclement weather conditions. The indicative pictorial depiction is given in Table 800-7.

Table 800-7 Indicative Pictorial Depiction of Colours of Sheetings

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

801.3.13 Refurbishment : Where existing signs are specified for refurbishment, the sheeting shall have a semi-rigid aluminium backing or materials as per Clause 801.2.5, pre-coated with aggressive-tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the sign and should thoroughly bond with that material.

801.3.14 Fabrication

801.3.14.1 Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The sheeting of the material as per Clause 801.2.5, shall be de-greased either by acid or hot alkaline etching and all scale/dust/ coating of any type removed/ scrubbed 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 the substrate to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting.

801.3.14.2 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 jointing shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

801.3.15 Warranty and durability : The Contractor shall obtain from the manufacture a ten year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of micro-prismatic sheeting, a seven-year warranty for high intensity grade and a five year warranty for the sheeting of engineering grade and submit the same to the Engineer. In addition, a ten year, seven year and a five year warranty for satisfactory In-field performance of the finished sign with retro-reflective sheeting of micro prismatic, high intensity grade and engineering grade respectively, inclusive of the screen printed or cut out letters/legends and their bonding to the retro-reflective sheeting shall be obtained from the contractor/supplier and submitted to the Engineer. 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 have passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

801.4 Installation

801.4.1 The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS:1239, 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.

801.4.2 All components of signs (including its back side) and supports, other than the reflective portion and G.I. 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.

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

801.5 Measurements for Payment

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

801.6 Rate

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

802 OVERHEAD SIGNS

802.1 General

802.1.1 Overhead signs may be used in lieu of, or as an adjunct to, kerb mounted signs where the situation so warrants for proper information and guidance of the road users. The following conditions may be considered while deciding about the provision of overhead signs:

- Traffic volume at or near capacity
- Complex interchange design
- Three or more lanes in each direction
- Restricted sight distance
- Closely spaced interchanges
- Multi-lane exits
- Large percentage of commercial vehicles
- High speed traffic