

No.RW/NH-33023/31/88-DO III**Dated, the 4th December, 1995**

To

The Secretaries, PWD of all States/UTs, Chief Engineers (dealing with National Highways and other Centrally Sponsored Schemes), Public Works Department of all States and Union Territories, Director General, (Border Road), Director General (Works), Central Public Works Department, Chairman, National Highways Authority of India

Subject: Policy regarding installation of Road Signs using Retro-reflective Sheetings on National Highways

The Ministry vide its Circular No. RW/NH-33023/31/88-DO III dated 2.5.94 had brought out guidelines for use of retro-reflective sheetings for road signs with two types of materials namely 'High Intensity Grade' and 'Engineering Grade' (Annex-I). While encapsulated lens type retro-reflective sheetings signs only were specified earlier for high intensity grade, it has now been decided to include micro-prismatic type materials also, for providing high intensity grade road signs. The guidelines earlier circulated have accordingly been modified to facilitate use of these materials for road signs along National Highways (Annex-II).

2. A typical warranty supplied by the known manufacturers of micro-prismatic materials for road signs is enclosed at Annex-III. It is suggested that a feedback regarding their performance at site may be sent to this Ministry wherever these are installed.

Enclosure with letter No.RW/NH-33023/31/88-DO III dated, the 4th December, 1995

Annex I

801.3. Traffic Signs having retro-reflective sheeting:

801.3.1. General Requirements:

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

801.3.2. High Intensity Grade Sheetting:

801.3.2.1. Encapsulated Lens Type:

This sheeting shall be of encapsulated lens type consisting of spherical glass lens elements, adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard E:810) as indicated in Table 800-1 (a).

Table 800-1 (a)

**ACCEPTABLE MINIMUM CO-EFFICIENT OF RETRO-REFLECTION FOR HIGH INTENSITY GRADE
(ENCAPSULATED LENS TYPE) SHEETING (CANDELAS PER LUX SQUARE METRE)**

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

801.3.2.2. Micro-prismatic Type:

These sheetings shall be of unmetallised micro-prismatic material with high density of microscopic prism elements 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 standard E-810 as indicated in Table 800-1 (b)

Table 800-1 (b)

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

Observation angle (in degrees)	Entrance Angle (in degrees)	White	Yellow	Orange	Green/Red	Blue
0.1	-4	400	270	160	56	32
0.2	-4	250	170	100	35	20
0.2	+30	80	64	34	9	5
0.5	-4	135	100	64	17	10
0.5	+30	55	37	24	6.5	3.5

801.3.2.3. When totally wet, the sheeting shall not show less than 90% of the values of retro-reflectance indicated in Table 800-1(a) and 800-1(b) respectively. At the end of 7 years, the sheeting shall retain at least 80% of its original retro-reflectance except for orange colour.

801.3.3. Engineering Grade Sheeting:

This sheeting shall be of enclosed lens type consisting of microscopic lens elements embedded beneath the surface of a smooth, flexible, transparent, water-proof plastic, resulting in a non-exposed lens optical reflecting system. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM Standard : E-810) as indicated in Table 800-2.

Table 800-2

ACCEPTABLE MINIMUM CO-EFFICIENT OF RETRO-REFLECTION FOR ENGINEERING GRADE SHEETING (CANDELAS PER LUX PER SQUARE METRE)

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

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

801.3.4. Messages/Borders:

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

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

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

801.3.7. Colour:

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

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

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

801.3.8. Adhesives:

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

801.3.9. Refurbishment:

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

Alternatively, the aluminium blank shall be re-cycled to a finished condition and new sheetings put on, in an approved manner.

801.3.10. Fabrication:

801.3.10.1. 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.

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

801.3.11. Warranty and Durability:

For each lot of sheetings procured, the contractor shall obtain from the manufacturer a 7 years warranty for satisfactory field performance including stipulated retro-reflectance of the sheetings of high intensity grade and a 5 years warranty for the engineering grade and submit the same to the Engineer. In addition, a 7 years and a five years warranty for satisfactory in-field performance of the finished sign with retro-reflective sheeting of high intensity grade and engineering grade respectively, inclusive of the screen printed or cut-out letters/legends and their bonding to the retro-reflective sheeting shall be obtained from the contractor/supplier and passed on to the Engineer. The contractor/supplier shall also furnish a certification that the signs and materials supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty. 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.

801.4. Installation:

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

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

801.4.3.

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

801.5. Measurements for Payment:

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

Annex II

GUIDELINES ON THE USE OF RETRO-REFLECTIVE SHEETINGS FOR ROAD SIGNS ON 2-LANE AND 4-LANE NATIONAL HIGHWAY SECTIONS

1. Retro-reflective sheetings of "High Intensity Grade" shall be used for -
 - (i) All Road Signs (viz. regulatory/mandatory, cautionary/warning and informatory) on 4-lane National Highway (NH) sections;
 - (ii) Mandatory/regulatory and cautionary/warning signs on 2-lane NH sections;
 - (iii) Mandatory/regulatory, cautionary/warning and informatory signs on the existing 2-lane NH stretches which are to be widened to 4-lane carriageway in the next 2-3 years;
 - (iv) All overhead signs.
2. Retro-reflective sheeting of "Engineering Grade" shall be used for informatory signs for 2-lane NH sections.
3. **COLOUR SCHEME :**
 - (i) Colour Scheme for mandatory/regulatory and cautionary/warning signs shall conform to IRC:67-1977 "Code of Practice for Road Signs".
 - (ii) Direction, destination and place identification signs shall have green background, white messages (legends, letters, numerals, etc.) and borders instead of white background, black messages and borders.
 - (iii) Colour Scheme for facility information signs, other useful information signs and parking signs shall continue to conform to the provisions contained in IRC:67-1977 "Code of Practice for Road Signs".
4. In respect of informatory signs, the messages/borders shall either be screen-printed or of cut-out, while for warning and regulatory signs, these shall be screen-printed.
5. Clustering and proliferation of road signs shall be avoided for enhancing their effectiveness.
6. **PRIORITY FOR REPLACEMENT :**

Existing road signs with retro-reflective sheetings shall be replaced with signs adopting the above criteria only if they are damaged, worn out or have outlived their useful service life.
7. **TRANSPORTATION & STORAGE :**
 - (i) While transporting the road signs for field installation, they should be secured vertically in racks to prevent them from rubbing against one another.
 - (ii) All signs should be kept dry at all times and should not normally be stored in the open.
 - (iii) The finished signs, if required, shall be stored in an upright position with space in between for air circulation.

8. **INSPECTION & UPKEEP :**

- (i) Periodic inspection of road signs shall be carried out on a regular basis. During inspection, the following aspects shall be checked in particular and appropriate corrective measures adopted :
 - (a) Condition of sign face - major cracking, blistering, missing message, etc.
 - (b) Orientation and structural stability of the post(s).
 - (c) Discolouration, streaking or fading of the sign.
 - (d) Visibility of sign, roadside plantation or a structure may be hiding the sign.
 - (e) Dirt or other substance on sign.
 - (f) Damages/removal of the sign due to accident or vandalism.
 - (g) Retro-reflectance properties.
- (ii) Sometimes, dirt, fungus or mildew can cause the signs to lose their retro-reflective properties. In case the dirt accumulation is severe and/or signs are in heavy industrial areas, washing of signs with a mild non-abrasive detergent free of solvents or alcohols should be carried out periodically.
- (iii) Sometimes, paper posters are pasted on the face of the road signs making them invisible. These should be immediately removed, apart from taking preventive action to avoid their recurrence.

Annex-III

WARRANTY FOR INDIA
STIMSONITE HIGH PERFORMANCE GRADE RETRO-REFLECTIVE SHEETING
Series # 4200

1. STIMSONITE Corporation (USA) warrants that the STIMASONITE High Performance Grade retro-reflective sheeting (STIMSONITE Sheeting) as supplied new, meets the values set forth in the India Ministry of Surface Transportation Specification for Traffic Sign Retro-Reflective Sheeting, Table 800-0.

2. STIMSONITE warrants that subject to conditions stated herein, for a period of at least seven years from the documented date of sign fabrication, the STIMSONITE Sheeting will retain its effectiveness as a component of traffic control and guidance signs, that it will continue to adhere to the sign substrate, that it will retain effective daytime colour, that it will continue to provide effective nighttime retro-reflectivity and that it will meet the minimum retro-reflectivity values set forth in Table 1 below.

Table 1 Minimum Retained Retro-reflectivity
(Candela/Lux/Meter²)
@ Observation Angle = 0.2°

	@ 5-Year	@ 7-Years
White	212	200
Red	29	28
Yellow	144	136
Blue	17	16
Green	29	28
Brown	6	5.5

Orange*

75 *NOTE : Warranty period for Orange is 3-years

All values tested at -4 degrees Entrance Angle.

STIMSONITE WARRANTY - INDIA

3. Signs made with STIMSONITE Sheeting which is screen printed using approved STIMSONITE Transparent Colours are covered under this WARRANTY. Such signs shall have reflectivity values not less than 75% of the above values for the same colour. Signs made using inks of other manufacturers are not covered by this WARRANTY unless a written, signed and dated ADDENDUM to this WARRANTY is obtained from STIMSONITE which expressly extends the STIMSONITE sheeting WARRANTY to include the use of that brand of colour (ink) and in the specifically stated colour(s). The ADDENDUM will not extend the STIMSONITE sheeting WARRANTY to the adhesion or durability of the other brand of colour itself over which STIMSONITE has no control.

4. Signs made with STIMSONITE Sheeting which is overlaid with STIMSONITE Coloured Overlay Films or Opaque Black Lettering Film are covered by this WARRANTY. Signs using overlay films of other manufacturers are not covered by this WARRANTY unless a written, signed and dated ADDENDUM to this WARRANTY is obtained from STIMSONITE which expressly extends the STIMSONITE sheeting WARRANTY to include the use of that specific brand and colour of overlay film. The ADDENDUM will not extend the STIMSONITE sheeting WARRANTY to the adhesion or durability of the other overlay film itself over which STIMSONITE has no control.

5. Signs made with STIMSONITE Sheeting which is direct-applied as copy (legend) over another brand of reflective sheeting or which is mounted as the sign background over which is direct-applied another brand of reflective sheeting as copy (legend) are not covered by this WARRANTY unless a written, signed and dated ADDENDUM to this WARRANTY is obtained from STIMSONITE which expressly extends the STIMSONITE sheeting WARRANTY to include the use of that specific brand of reflective sheeting in combination with STIMSONITE sheeting and only if applied by a method approved by STIMSONITE. The ADDENDUM will not extend the STIMSONITE sheeting WARRANTY to the adhesion, performance, or durability of the other reflective sheeting itself over which STIMSONITE has no control.

6. The user-agency agrees to require that all signs be dated at time of sign fabrication and that reliable records be kept of the fabrication date for each warranted sign. Such records shall be available for review and verification by Stimsonite. If within 7 years of the verified date of sign fabrication, the sign becomes ineffective for its intended purpose when viewed from a moving vehicle, or its retro-reflectivity values fail to meet the minimum average values as given in Table 1, the sign contractor and STIMSONITE shall jointly and severally agree to replace or repair the sign (at their option) restoring its surface to the guaranteed retro-reflective efficiency, according to the following schedule :

a.	For years 1 through 5:	AT NO COST to the user.
b.	For years 6 and 7:	(If the user is prepared to pay the balance of the cost as indicated).
	Cost of Sign Replacement or Repair Paid by STIMSONITE and the Contractor	Cost of Take-down Old and Erect New Paid by STIMSONITE and the Contractor
Year 6:	75%	20%
Year 7:	50%	15%

The new sign which replaced a prior sign under these warranty conditions is covered under the same terms and conditions of the original sign, but only for the remaining balance of the warranty period applicable to the original sign. Both markings on replacement signs and the supporting documentation shall clearly establish original fabrication date (Warranty base date) of the sign which was replaced.

8. The sign repair or replacement shall take place within a reasonable period of time after receipt of written notice.

9. This warranty shall NOT extend to signs to which any of the following applies :

9.1 If the mounting of the STIMSONITE sheeting to the sign substrate was not according to STIMSONITE's written recommendations, if the STIMSONITE sheeting was mounted on a substrate material which is not approved, or if the sign surface was not properly and thoroughly cleaned.

9.2 If the fabrication, storage, screening, handling, or cleaning of the sheeting or sign have not been in conformance with STIMSONITE's written recommendations.

9.3 If the sign or sheeting have been exposed to extreme climatic or environmental conditions, (i.e. heavy hail, volcanic eruption, industrial pollutants, splashed solvent) or vandalism, which can reasonably be expected to have affected sign or sheeting performance.

9.4 Any failure of or damage to the sign substrate.

November 1995

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