097. 13 DPWH
11-08-2013

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF RESEARCH AND STANDARDS
EDSA, QUEZON CITY

NOV 05 2013

DEPARTMENT ORDER)
No. 102)
Series of 2013 11.08.13)

SUBJECT: **DPWH Standard Specification for Item 605 – Road Sign**

In view of the updates prescribed under ASTM D 4956-11a - Standard Specification for Retroreflective Sheeting for Traffic Control, the existing specification under **Item 605 – Road Sign** of the DPWH Standard Specification for Highways, Bridges and Airports, Volume 11, 2012 Edition is hereby revised in order to be consistent with the latest edition of the above-mentioned ASTM standard.

As such, it is hereby directed that the attached modified standard specification for Item 605 - Road Sign shall be adopted effective immediately. In no case should any road sign be used in the project without conforming to the material and performance requirements as prescribed herein.

For strict compliance.

ROGELIO L. SINGSON
Secretary

Department of Public Works and Highways
Office of the Secretary
WIN3U00814

DPWH STANDARD SPECIFICATION FOR

ITEM 605 - ROAD SIGN

605.1 Description

This Item shall consist of furnishing and installing road signs in accordance with this Specification and to the details shown on the Plans, or as required by the Engineer.

605.2 Material Requirements

605.2.1 Sign Panels

Sign panels for warning, regulatory, and informatory signs shall be manufactured from aluminum sheeting at least 3 mm thick that conforms to the requirement of ASTM B 209 or 6061-T6 aluminum, or manufactured from aluminum composite panel.

Aluminum Composite Panel (ACP) used as sign panel is a sandwich construction with a thermoplastic core of "Low Density Polyethylene" (LDPE) between two thick skins/sheets of aluminum with overall thickness of 4mm, and aluminum skin thickness of 0.4mm on both sides. The retro –reflective sheeting must be applied on the top surface with aluminum surface with recommended surface preparation from sheeting manufacturer. A fluorocarbon coating may be applied over the exposed surface of aluminum to ensure corrosion resistant and weather proof and thus shall confirm to relevant ASTM. The mechanical properties of 4mm and that of its aluminum skin shall conform to the requirement given in the table below, when tested in accordance with the test methods mentioned against each of them.

Table 1. Properties of Aluminum Composite Panel

No.	Test Description	Standard Test	4mm ACP Acceptable Value
A	**Mechanical Properties of ACP**		
1	Peel off strength with retroreflective sheeting. (DRUM Peel Test)	ASTM D903	Min 4N/mm
2	Tensile Strength	ASTM D638	Min 40 N/mm^2
3	0.2% Proof Stress	ASTM D638	Min 34 N/mm^2
4	Elongation	ASTM D638	Min 6%
5	Flexural Strength	ASTM C393	Min 130 N/mm^2
6	Shear strength with punch shear test	ASTM D732	Min 18 N/mm^2
B	**Properties of Aluminum Skin**		
1	Tensile Strength (Rm)	ASTM E8	Min 150 N/mm^2
2	Modulus of elasticity	ASTM E8	Min 7000 N/mm^2
3	Elongation	ASTM E8	A_{50} Min 2%
4	0.2% Proof Stress	ASTM E8	Min 110 N/mm^2

605.2.2 Retroreflective Sheeting

The retroreflective sheeting shall conform to the requirements of ASTM D 4956-11.

The retroreflective sheeting used on the signs shall consist of white or colored sheeting having smooth outer surface which has the property of retroreflection over its entire surface. It shall be weather resistant and exhibit color fastness. It shall be new an unused or show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion.

A certificate of having the sheeting tested for coefficient of retro reflection, day time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these result shall be obtained from reputed International Laboratory by the manufacturer of retroreflective sheeting strictly as per ASTM D 4956-11.

A retroreflective sheeting typically manufactured as an unmetalized cube corner microprismatic retroreflective element material. The retroreflective surface after cleaning with soap and water and in dry condition shall meet or exceed the minimum coefficient of retroreflection as per Type VIII, IX and XI of ASTM D 4956-11 as indicated in the Table 2.

Table 2 - Minimum Coefficient of Retroreflection(R_A)

Sheeting Type	Minimum Coefficient of Retroreflection(R_A) cd/fc/ft2(cd·lx^{-1}·m^{-2})											
VIII	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	900	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
	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	5.0	3.5	92	69	35
IX	Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue		Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
	0.1°[B]	-4°	660	500	250	66	130	30		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
XI	Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
	0.1°[B]	-4°	830	620	290	83	125	37	25	660	500	250
	0.1°[B]	+30°	325	245	115	33	50	15	10	260	200	100
	0.2°	-4°	580	435	200	58	87	26	17	460	350	175
	0.2°	+30°	220	165	77	22	33	10	7.0	180	130	66
	0.5°	-4°	420	315	150	42	63	19	13	340	250	125
	0.5°	+30°	150	110	53	15	23	7.0	5.0	120	90	45
	1.0°	-4°	120	90	42	12	18	5.0	4.0	96	72	36
	1.0°	+30°	45	34	16	5.0	7.0	2.0	1.0	36	27	14

[A] Minimum Coefficient of Retroreflection(R_A) cd/fc/ft2(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.

605.2.3 Posts and Frames

Wide flange posts and frames shall be fabricated from structural steel conforming to ASTM A 283 Grade D. In lieu of wide flange steel posts, the Contractor may use tubular steel posts conforming to ASTM A 501. All posts shall be thoroughly cleaned, free from grease, scale and rust and shall be given two coats of international orange CMYK: 0, 72, 77, 24.

605.2.4 Bracket Railing/ Stiffener

Bracket railing/ stiffener shall be made of aluminum-alloy 6063 –T5 or higher that conforms to the requirement of ASTM B221, and other ASTM designation as applies.

605.2.5 Other Aluminum Materials

All other aluminum parts (nuts, bolts, washer, bracket, etc.) specified in the plan shall be made of 2024-T4 aluminum or 6061-T6 aluminum or higher conforms to the requirement of ASTM B221, and other ASTM designation as applies.

605.2.6 Double Sided Adhesive Tape

This is a viscoelastic, general purpose acrylic adhesive on a firm type foam tape consists of adhesive, carrier and liner.

605.2.6.1 Composition Requirement

1. Adhesive: acrylic adhesive
2. Carrier: acrylic foam
3. Liner: paper liner

Table 3. Physical Properties

Property Requirement	Values	Standard Test
Thickness: Adhesive + Foam	1.0 mm	ASTM D3652
Foam Density	800 kg/m^3	ASTM D792
90° Peel Adhesion (72 hrs dwell – 300 mm/min)	332N/100 mm	ASTM D 3330
Dynamic Shear (72 hrs dwell – 12.7 mm/min)	550 kPa	ASTM D1002
Static Shear	10,000 mins	ASTM D3654
Normal Tensile (72 hrs dwell – 50 mm/min)	760 kPa	ASTM D897
Temperature Short Term (240 mins) Long Term (10,000 mins)	 149°C 90°C	ASTM D3654

605.2.6.2 Application Technique

Bond strength is dependent upon the amount of adhesive-to-surface contact developed. Firm application pressure and moderate heat, will assist the adhesive in developing intimate contact with the bonding surface. To obtain optimum adhesion performance, the bonding surfaces must be clean, dry, free of grease oil and well unified.

605.2.7 Mounting

The bracket railing shall be mounted to the signboard using a double sided adhesive tape as shown on the plan.

Specification of tape shall conform to the requirement in Subsection 605.2.6 Adhesive Tape.

605.2.8 Concrete Foundation Blocks

The concrete for the foundation blocks shall be Class A, Structural Concrete and shall be of the size shown on the Plans.

605.3 Construction Requirements

605.3.1 Excavation and Backfilling

Holes shall be excavated to the required depth to the bottom of the concrete foundation as shown on the Plans.

Backfilling shall be carried out by using suitable material approved by the Engineer and shall be compacted in layers not exceeding 150 mm in depth. Surplus excavated material shall be disposed of by the Contractor as directed by the Engineer.

605.3.2 Erection of Posts

The posts shall be erected vertically in position inside the formwork of the foundation block prior to the placing of the concrete and shall be adequately supported by bracing to prevent movement of the post during the placing and setting of concrete. The posts shall be located at the positions shown on the Plans.

605.3.3 Sign Panel Fabrication/Installation

605.3.3.1 Fabrication of Sign

The sign panel shall be effectively prepared to receive the retroreflective sheeting. This sign panel 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 retroreflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, it should 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 sign panel to come in contact with grease, oil or other contaminants prior to the application of retroreflective sheeting. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cutouts to produce legends, letters and borders shall be bonded with the sheeting in the manner specified by the retroreflective sheeting manufacturer.

The messages (legends, letters, numerals, etc.) and borders shall be cutouts from the same type of reflective sheeting. Screen printing shall be processed and finished with materials and in a manner specified by the retroreflective sheeting manufacturer. For the informatory and other sign boards, the messages (legends/letters/numerals, etc.) and borders shall be strictly cutouts from the same reflective sheeting only except those in black which shall be of non reflective opaque film .

605.3.3.2 Installation

Sign panels shall be installed in accordance with the details shown on the Plans. Any chipping or bending of the sign panels shall be considered as sufficient cause to require replacement of the panels at the Contractor's expense.

All newly erected traffic road signs shall be covered until ordered removed by the Engineer.

605.4 Method of Measurement

The quantities shall be the number of such signs of the size specified, including the necessary posts and supports erected and accepted.

605.5 Basis of Payment

The quantities measured as determined in Subsection 605.4, Method of Measurement, shall be paid for at the contract unit price for the Pay Items shown in the Bid Schedule which price and payment shall be full compensation for furnishing and installing road signs, for excavation, backfilling and construction of foundation blocks, and all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
605	Road Sign	Each