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KERAJAAN MALAYSIA
JABATAN KERJA RAYA MALAYSIA

STANDARD SPECIFICATION FOR ROAD WORKS

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~~ADDENDUM NO. 1~~ Dibatalkan

This Addendum shall be made part of the 'JKR Standard Specification For Road Works'

1. **Table 4.8** - Gradation Limits For Asphaltic Concrete Clause 4.2.4.2, page S4 - 21 should read as follows:

Mix Type	Wearing Course	Binder Course
Mix Designation	ACW 20	ACB 28
B.S. Sieve	% Passing by weight	
37.5 mm		100
28.0 mm	100	80 - 100
20.0 mm	76 - 100	72 - 93
14.0 mm	64 - 89	58 - 82
10.0 mm	56 - 81	50 - 75
5.0 mm	46 - 71	36 - 58
3.35 mm	32 - 58	30 - 52
1.18 mm	20 - 42	18 - 38
425 um	12 - 28	11 - 25
150 um	6 - 16	5 - 14
75 um	4 - 8	3 - 8

2. **Table 4.9** - Design Bitumen Contents Clause 4.2.4.3, page S4 - 23 should read as follows:

ACW 20 - Wearing Course	4.5 - 6.5 %
ACB 28 - Binder Course	4.0 - 6.0

ADDENDUM NO. 2

This Addendum shall be made part of the 'JKR Standard Specification For Road Works'

6.2.5.5 Sign Faces

Sign faces for permanent traffic signs shall be as shown on the Drawings and shall comply with the Malaysian Standard Specification for Reflective Sign Face Materials (MS 1216).
All retroreflective sheeting shall be fixed in accordance with the manufacturer's instructions.

Unless otherwise agreed by the S.O., sign faces shall be formed from a single piece of retroreflective sheeting.

Where, with the agreement of the S.O., more than one retroreflective sheeting is used, the number of sheets shall be kept to a minimum. All faces up to 1 m in size shall be produced with a single sheet and no joint will be accepted.

Only vertical and horizontal joints shall be permitted and all joints in retroreflective sheeting shall be overlapped by not less than 6 mm. The overlap in the horizontal joints shall be from the top and the vertical joints shall be from the left; butt joints will only be accepted for prismatic retroreflective sheeting.

Retroreflective sheeting shall be applied evenly over the whole surface of the sign plate and shall adhere fully. It shall be free from twists, cracks, folds or cuts, air bubbles and other blemishes.

All retroreflective sheetings used on the same sign shall be carefully matched for colour to produce a uniform appearance both by day and by night. Non-uniform shades of colour on any one sign will not be accepted.

The edges of all the retroreflective sheeting shall be properly fitted to ensure no delimination of the sheeting from the base substrate.

Where sheeting is applied to extruded sections by pressure roller, it shall extend over the top and bottom edges of these sections by not less than 3 mm.

Any cut-out letters, numerals, symbols and borders shall be of material compatible with the sheeting to which they are applied. They shall be applied in accordance with the sheeting manufacturer's instructions.

The finish of all sign faces shall be capable of passing the tests described in MS 1216, and the standards of fabrication and workmanship shall be such that under normal conditions of service and proper maintenance, the sign faces shall last not less than 5 years without any serious blemishes or defects for Engineering Grade retroreflective sheeting and 8 years for High Intensity and prismatic retroreflective sheeting.

The Contractor shall furnish to the S.O. a letter of warranty for the specified period for all sign faces from the manufacturer of the sheeting or the sign fabricator.

The retroreflective sheeting manufacturer shall furnish to the S.O. written warranty that the fluorescent colours shall be durable for a minimum 7 years for permanent signs and a minimum 3 years for temporary signs.

ADDENDUM NO. 3

This Addendum shall be made part of the 'JKR Standard Specification For Road Works'

6.2.6.1 FLUORESCENT ORANGE WIDE ANGLE PRISMATIC RETROREFLECTIVE SHEETING FOR THE WORK ZONE

6.2.6.1.1 Description

The fluorescent orange wide angle prismatic retroreflective sheeting is specifically designed for use on rigid substrate work zone signs to provide high visual impact under nighttime and daytime driving conditions, including low visibility periods such as dawn, dusk, and overcast days. The sheeting shall consist of prismatic lenses formed in a transparent fluorescent orange synthetic resin, sealed, and backed with an aggressive pressure sensitive adhesive protected by a removable liner. The sheeting shall have a smooth surface with a distinctive interlocking diamond seal pattern and orientation marks visible from the face.

6.2.6.1.2 Requirements

i) Photometric - Coefficient of Retroreflection RA

When the sheeting applied on aluminum test panels is measured in accordance with ASTM E 810, it shall have minimum coefficient of retroreflection values as shown in Table I. The rotation angle shall be *90°, the observation angles shall be 0.2° and 0.5°, the entrance angles (component ßl) shall be -4°, +30°, and +50°, and the entrance angle component ß2 = 0°.

TABLE I
Minimum Coefficient of Retroreflection RA
(Candelas per footcandle per square foot)
(90° Rotation Angle*)

Observation Angle (°)	Entrance Angle (°)	Orange
0.2	-4	200
0.2	+30	120
0.2	+50	50
0.5	-4	80
0.5	+30	50
0.5	+50	20

* The datum mark (arrow) imprinted on the face of the sheeting shall be the datum mark for test purposes. For the specified 90° rotation angle, the sheeting shall be positioned on the goniometer so that the direction of this datum mark is perpendicular to the observation plane (this geometry is equivalent to a 90° orientation angle with a presentation angle of 0° in the measurement geometry described in Fed. Test Method Standard 370).

ii) Daytime Color

Color shall conform to the requirements of Tables II. Daytime color and maximum spectral radiance factor (peak reflectance) of sheeting mounted on aluminum test panels shall be determined instrumentally in accordance with ASTM E 991. The values shall be determined on a HunterLab Labscan 6000 0/45 Spectrocolorimeter with option CMR 559 [or approved equal 0/45 (45/0) instrument with circumferential viewing (illumination)]. Computations shall be done in accordance with ASTM E 308 for the 2° observer.

TABLE II
Color Specification Limits** (Daytime)

Color	1		2		3		4		Reflectance Limit Y (%)	
	X	Y	X	Y	X	Y	X	Y	Min.	Max.
Orange (New)	.583	.416	.523	.397	.560	.360	.631	.369	30	-
Orange (Weathered)	.583	.416	.523	.397	.560	.360	.631	.369	20	45

Maximum spectral radiance factor, new: 110%, min.
weathered: 60%, min.

** The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 standard colorimetric system measured with standard illuminant D65.

iii) Nighttime Color.

Nighttime color of the sheeting applied to aluminum test panels shall be determined instrumentally in accordance with ASTM E 811 and calculated in the u', v' coordinate system in accordance with ASTM E 308. Sheeting shall be measured at 0.33° observation and -4° entrance at 90° rotation. Color shall conform to the requirements of Table III.

TABLE III

Color Specification Limits** (Nighttime)

Color	1		2		3		4	
	u'	v'	u'	v'	u'	v'	u'	v'
Orange (new and weathered)	.400	.540	.475	.529	.448	.522	.372	.534

iv) Resistance to Accelerated Weathering.

The retroreflective surface of the sheeting shall be weather resistant and show no appreciable cracking, blistering, crazing, or dimensional change after 1 year's unprotected outdoor exposure in south Florida, south-facing and inclined 45° from the vertical, or after 1500 hours' exposure in a xenon arc weatherometer in accordance with ASTM G 26, Type B, Method A. Following exposure, panels shall be washed in a 5% HCL solution for 45 seconds, rinsed thoroughly with clean water, blotted with a soft clean cloth and brought to equilibrium at standard conditions. After cleaning, the coefficient of retroreflection shall be not less than 100 when measured as in D.2, below, and the color is expected conform to the requirements of Tables II and III for weathered sheeting. The sample shall:

a) Show no appreciable evidence of cracking, scaling, pitting, blistering, edge lifting or curling or more than 1/32 inch (0.08 cm) shrinkage or expansion.

b) Be measured only at angles of 0.2° observation, -4° entrance and 90° rotation. Where more than one panel of a color is measured, the coefficient of retroreflection shall be the average of all determinations.

v) Impact Resistance.

The retroreflective sheeting applied according to the sheeting manufacturer's recommendations to a test panel of alloy 6061-T6, 0.040" (0.10 cm) by 3" (7.6 cm) by 5" (12.7 cm) and conditioned for 24 hours, shall show no cracking outside the impact area when the face of the panel is subjected to an impact of 100 inch-pounds (11.3 Nm) using a weight with a 5/8 in. (15.8 mm) diameter rounded tip dropped from a height necessary to generate an impact of 100 inch-pounds, at test temperatures of both 32° F (O° C) and 72° F (22 ° C) .

vi) Resistance to Heat.

The retroreflective sheeting, applied to a test panel as in E., above, and conditioned for 24 hours, shall be measured in accordance with paragraph. A. at 0.2° observation and -4° entrance angles at 90° rotation and exposed to 170 + 5° F (77 + 3° C) for 24 hours in an air circulating oven. After heat exposure the sheeting shall retain a minimum of 70% of the original coefficient of retroreflection.

vii) Field Performance.

Retroreflective sheeting processed and applied to sign blank materials in accordance with the sheeting manufacturer's recommendations, is expected to perform effectively for a minimum of 3 years. The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retroreflection is less than 100 when measured at 0.2° observation and -4° entrance at 90° rotation. All measurements shall be made after sign cleaning according to the sheeting manufacturer's recommendations.

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