

CONCRETE BARRIER MARKER STUDY

by

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CONCRETE BARRIER MARKER STUDY

Introduction -

Concrete barrier markers provide permanent or temporary night-time delineation along concrete barriers. The Oregon State Highway Division (OSHD) has qualified two basic types of barrier markers, a prismatic lens type and a retroreflective tape type. Both types meet the minimum requirements of OSHD's roadside delineation specifications, however several field personnel have commented on the apparent superiority of prismatic over tape reflectors.

The objective of this study is to compare the different types of barrier markers for reflectivity and durability through laboratory testing.

Testing -

Six brands of markers by five manufacturers were evaluated. Three brands had both white (silver-white) and yellow (amber) samples and all brands had two duplicate samples (see table 1 for a listing of the different markers used).

All markers were tested for reflectivity prior to weathering. The markers were then exposed to 1000 hours in a weatherometer conforming to ASTM G 26. The markers were then retested for reflectivity and examined for color change, deformation and loss of pliability.

Discussion -

The weatherometer is a device for direct comparison of product to product. Some calibration can be done to determine comparison between length of time in weatherometer and corresponding time in the environment but at best it is still an educated guess. For purposes of our study we did not attempt to make that determination.

The prismatic reflectors typically were much brighter than the tape reflectors (except one Astro Optics B1). Prismatic reflectors were 3 to 10 times more reflective, depending on the brand and color. Even after losing 50 to 60 percent of their reflectivity, they were still brighter than the new tape reflectors. Prismatic reflectors did not show many signs of weathering, although the acrylic faces over the prismatic lenses did tend to dull a little. The field personnel probably observed the prismatic as superior over the tape type because of their high reflectivity.

TABLE 1 : CONCRETE BARRIER MARKER WEATHEROMETER TESTING

PRODUCT NAME	TYPE	COLOR	SIZE (SR. IN.)	AVERAGE SPECIFIC INTENSITY*								% REFLECT REMAINING	COLOR CHANGE	DEFORMATION	PLIABILITY
				0 degrees				20 degrees							
				NEW	AGED	% REMAINING	NEW	AGED	% REMAINING	NEW	AGED				
ASTRO OPTICS B1	PRISMATIC	WHITE	6.5	30	20	66	2	2	2	2	100	NC	NC	NC	
	PRISMATIC	YELLOW	6.5	50	90	180	2	2	2	2	100	NC	NC	NC	
ASTRO OPTICS JD1	PRISMATIC	WHITE	9.0	2850	1400	49	1660	860			52	NC	NC	NC	
	PRISMATIC	YELLOW	9.0	2100	780	37	1200	480			40	NC	NC	NC	
DAVIDSON PCB	TAPE	WHITE	13.1	900	330	37	530	230			43	NC	NC	NC	
	TAPE	YELLOW	13.1	510	160	31	430	130			30	SC	NC	NC	
FLEXX 2020	TAPE	WHITE	9.0	290	170	59	270	160			59	NC	1	NC	
REFLEXITE 660	TAPE	WHITE	12.7	1170	580	50	730	400			55	NC	NC	NC	
	TAPE	YELLOW	12.7	750	150	20	530	110			21	SC	NC	NC	
STIMSONITE 965	PRISMATIC	YELLOW	7.7	1350	550	41	1210	450			37	NC	NC	NC	
STIMSONITE 967	PRISMATIC	WHITE	7.1	2900	1400	48	1180	680			58	NC	NC	NC	

* AVERAGE SPECIFIC INTENSITY (2 SAMPLES) IN UNITS OF CANDELAS PER SQ. FT PER FOOT-CANDLE AT 0.2 DEGREES OBSERVATION ANGLE AND GIVEN ENTRANCE ANGLE (SIDE 1 ONLY)

1 = MARKER DEFORMED VISIBLY, CURLED DOWNWARD FROM TOP CORNERS.

NC = NO CHANGE

SC = SLIGHT CHANGE, DARKER

% REFLECTIVITY REMAINING = AGED SI/NEW SI * 100

The yellow tape reflectors lost the most reflectivity and actually turned darker during testing. The white tape markers performed fairly well losing from 40 to 60 percent of their reflectivity while still maintaining a high degree of reflectivity. The tape reflectors had small cracks and small irregularities resembling 'water spots'. Also the Flexx 2020 reflector deformed, the upright portion bent over slightly and the top corners curled downward.

The reflectors were tested at angles other than the OSHD specifications for reflective sheeting on flexible roadside delineators, which call for a minimum specific intensity of the following:

<u>Entrance Angle</u>	<u>Observation Angle</u>	<u>Specific Intensity per Unit Area</u>	
		<u>White</u>	<u>Yellow</u>
- 4°	0.2°	250	170
+40°	0.2°	120	80

The entrance angle of -4° is sufficiently close to 0° that a comparison can be made. Attached are the original laboratory test results showing that the qualification data of both the Davidson product and the Reflexite product. This data corresponds well with this study. None of the products fell below 80% of specification value after exposed to 1000 hours in the weatherometer.

Cost estimates from the manufacturers place the prismatic reflectors from \$1.90 to 2.40 a piece for single sided and from \$2.10 to 3.00 a piece for double sided. Cost estimates for the tape reflectors vary from \$1.25 to \$1.50 for single and from \$1.75 to \$2.00 for double sided.

Conclusions -

- The Prismatic type reflectors are generally much brighter than the tape type.
- The yellow tape type reflectors lost 70-80% of their reflectivity while exposed in the weatherometer.
- All reflectors except one met the minimum requirements for flexible delineator specifications.
- The tape reflectors are about 2/3 the cost of prismatic reflectors.

Recommendations -

Specifications should be developed based on the needed performance of these products on the roadway. The prismatic may be brighter but is it necessary? Especially considering the added expense.

LABORATORY RECORD

REFLECTIVE BARRIER MARKERS

PROJECT NEW PRODUCT EVALUATION		LABORATORY NO. 89-04836	
HIGHWAY		COUNTY	DATA SHEET NO. NONE
CONTRACTOR		F.A. PROJECT NO.	EXP. ACCT. SUB JOB C0005802-000-940
PROJECT MANAGER		AGY.—ORG. UNIT	DATE RECEIVED 1-23-89
SUBMITTED BY DOUGLAS W BISH		AGY.—ORG. UNIT 02-8212	DATE REPORTED June 1
SOURCE OF MATERIAL SUPPLIERS/MANUFACTURERS		QUANTITY REPRESENTED	TEST NO. 553X VAR <input checked="" type="checkbox"/> LAB CHARGE 576⁰⁰
SAMPLED AT	SAMPLED BY	TO BE USED	BID ITEM NO.
			DATE SAMPLED

**PHOTOMETRIC TEST RESULTS FOR SAMPLES BEFORE AND AFTER ACCELERATED WEATHERING TEST
(ASTM G26, 1000 HOURS)**

Specific Intensity

Product	color	Side 1						Side 2					
		0°		Xaged/new	20°		0°		20°		Xaged/new	20°	
		new	aged		new	aged	new	aged	new	aged		new	aged
Astro Optics B1	white	0.67	0.72	107.5	0.07	0.07	100.0						
		1.95	0.99	50.8	0.14	0.08	57.1						
	yellow	2.78	4.57	164.4	0.06	0.05	83.3						
		1.78	3.40	191.0	0.13	0.17	130.8						
Astro Optics JD1	white	185.9	87.7	47.2	111.5	55.0	49.3	169.8	83.0	48.9	102.4	50.9	49.7
		172.7	91.1	52.8	96.4	54.1	56.1						
	yellow	143.7	52.1	36.3	82.2	32.0	38.9	135.1	55.5	41.1	80.5	34.2	42.5
		122.8	45.4	37.0	67.6	27.6	40.8						
Davidson PCB	white	78.9	26.5	33.6	45.2	18.5	40.9						
		87.7	34.2	39.0	50.9	24.3	47.7						
	yellow	46.6	16.8	36.1	36.6	13.7	37.4	24.7	12.3	49.8	16.9	10.8	63.9
		47.7	11.1	23.3	41.8	11.1	26.6	27.9	10.6	38.0	17.3	8.7	50.3
Flex 2020	white	18.1	11.4	63.0	17.4	10.6	60.9						
		18.7	10.7	57.2	16.8	9.6	57.1						
Reflexite 660	white	101.5	45.0	44.3	66.2	30.2	45.6						
		104.6	56.7	54.2	64.8	42.1	65.0						
	yellow	66.3	10.5	15.8	44.7	7.2	16.1						
		66.7	15.6	23.4	48.4	11.8	24.4						
Stinsonite 965	yellow	76.4	32.8	42.9	67.5	26.1	38.7						
		70.2	26.4	37.6	62.4	22.3	35.7						
Stinsonite 967	white	136.9	62.9	45.9	54.0	24.2	44.8	148.7	82.8	55.7	68.8	47.0	68.3
		148.1	73.8	49.8	61.3	42.9	70.0	141.9	59.5	41.9	70.8	30.3	42.8

Note: Specific intensity in units of candelas/foot-candle at 0.2° observation angle and the given entrance angles.

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NOTE: For information only.

RON NOBLE

W. J. Quisenberry

Engineer of Materials

LABORATORY RECORD

LABORATORY NO. 87 0961	
DATA SHEET NO. None	
EXP. ACCT. SUB JOB C0005801-940	
F.A. PROJECT NO.	BID ITEM NO.
AGY.—ORG. UNIT	DATE RECEIVED 1-30-87
AGY.—ORG. UNIT	DATE REPORTED 5-20-87
TEST NO.	VAR
552X	✓
553X	✓
LAB CHARGE	DATE SAMPLED 1-30-87
117 ⁰⁰	
78 ⁰⁰	

PROJECT New Product Evaluation	
HIGHWAY	COUNTY
CONTRACTOR	
PROJECT MANAGER	
SUBMITTED BY Doug Bish	
SOURCE OF MATERIAL Davidson Plastics Co.	
SAMPLED AT	SAMPLED BY
TO BE USED Conc. barrier marker	

CONCRETE BARRIER MARKERS WERE TESTED FOR BRIGHTNESS OF REFLECTIVE SURFACE BY FEDERAL TEST METHOD STANDARD 370.

OBSERVATION ANGLE	0.2°	0.2°	0.5°	0.5°	
ENTRANCE ANGLE	-4°	40°	-4°	40°	
SILVER SAMPLE	713	349	174	80	CANDELS/FT. CANALS SQ. FT.
YELLOW SAMPLE	369	171	171	32	"
SILVER SPECIFICATION	250	120			"
YELLOW SPECIFICATION	170	80			"

THE SAMPLES WERE WEATHERED FOR 1106 HOURS IN THE WEATHEROMETER (ASTM G26). WEATHERING DID NOT CAUSE ANY CHANGE IN PLIABILITY OR COLOR OF THE BASE MATERIAL. SAMPLES WERE AGAIN TESTED FOR BRIGHTNESS.

OBSERVATION ANGLE	0.2°	0.2°	0.5°	0.5°	
ENTRANCE ANGLE	-4°	40°	-4°	40°	
SILVER SAMPLE	303	183	110	50	CANDELS/FT. CANALS SQ. FT.
YELLOW SAMPLE	117	63	43	22	"

MEETS FLEXIBLE DELINEATOR SPECIFICATIONS 711.03(a-7) AND 711.04 FOR WEATHEROMETER AND REFLECTIVE SHEETING.

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NOTE: Material represented by this sample does, does not comply with specifications.
FOR INFORMATIONAL PURPOSES ONLY.

NOTED
George

W J Quinn

LABORATORY RECORD

PROJECT New Product Evaluation		LABORATORY NO. 87 0959	
HIGHWAY		COUNTY	DATA SHEET NO. None
CONTRACTOR		EXP. ACCT. SUB JOB C0005801-940	BID ITEM NO.
PROJECT MANAGER		F.A. PROJECT NO.	DATE RECEIVED 1-30-87
SUBMITTED BY Doug Bish		AGY.-ORG. UNIT 02-8212	DATE REPORTED 5-20-87
SOURCE OF MATERIAL Reflexite Corp.		AGY.-ORG. UNIT	TEST NO. VAR LAB CHARGE
SAMPLED AT		QUANTITY REPRESENTED	552X V 78 ⁰⁰
SAMPLED BY		TO BE USED Conc. barrier marker	553X V 39 ⁰⁰
			DATE SAMPLED 1-27-87

CONCRETE BARRIER MARKERS WERE TESTED FOR BRIGHTNESS OF REFLECTIVE SURFACE, BY FEDERAL TEST METHOD STANDARD 370.

OBSERVATION ANGLE	0.2°	0.2°	0.5°	0.5°
ENTRANCE ANGLE	-4°	40°	-4°	40°
SILVER SAMPLE	810	450	90	187
SPECIFICATION 711.04	250	120		

CANDELAS/FOOT-CANDE
SQ. FT.
CANDELAS/FOOT-CANDE
SQ. FT.

THE SAMPLES WERE WEATHERED FOR 1106 HOURS IN THE WEATHER O METER (ASTM G26). THE SAMPLES WERE AGAIN TESTED FOR BRIGHTNESS.

OBSERVATION ANGLE	0.2°	0.2°	0.5°	0.5°
ENTRANCE ANGLE	-4°	40°	-4°	40°
SILVER SAMPLE	306	188	108	52

CANDELAS/FOOT-CANDE
SQ. FT.

WEATHERING DID NOT CAUSE ANY CHANGE, IN PLIABILITY OR COLOR OF THE BASE MATERIAL.

PASSES FLEXIBLE DELINEATOR SPECIFICATIONS 711.03 (a-7) AND 711.04 FOR WEATHEROMETER AND REFLECTIVE SHEETING.

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