

OFFICE MEMORANDUM



MICHIGAN
STATE HIGHWAY DEPARTMENT
JOHN C. MACKIE, COMMISSIONER

March 13, 1964

To: E. A. Finney, Director
Research Laboratory Division

From: M. H. Janson

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Subject: Fasson Reflective Sheeting (Fasson Products Co.). Research Project
R-63 NM-109. Research Report No. R-453.

At the December 10, 1963, meeting of the Committee for Investigation of New Materials, Fasson reflective sheeting was referred to the Research Laboratory Division for study, and samples were received from R. L. Greenman on January 3, 1964. The samples were of white, yellow, and red vinyl unbeaded sheeting ("Fascal"), and white and yellow reflective sheeting of the exposed bead type. The red vinyl unbeaded sheeting was fluorescent and not quite as smooth and glossy as the white and yellow Fascal. These materials were examined and tested by P. J. Chamberlain whose report follows.

Physical Structure

Exposed Bead White (64 MR-36B). The base material is a 3-mil mylar film. On one side is a pressure-sensitive adhesive; on the other is an extremely thin film of aluminum, with a monolayer of beads in a white-pigmented binder.

Exposed Bead Yellow (64 MR-36D). The base material is a 3-mil film of a vinyl chloride co-polymer. On one side is a gray pressure-sensitive adhesive composed of, or overlaid on, a layer of GRS rubber. On the other side is a monolayer of beads set in a yellow pigmented binder.

Unbeaded Vinyl (64 MR-36A, C, E). This consists of a gray, pressure-sensitive adhesive of GRS rubber, as above, upon a 3-mil film of polyvinyl chloride.

Color and Optical Characteristics

The yellow reflective sheeting exhibits very little yellow color when viewed at divergence angles close to 0° , most of the incident light being reflected only by the beads and not from the yellow colorant subjacent to the layer of beads.

Results of photometric tests are as follows:

Sample No.	Color	Material	Entrance Angle, deg	Specific Intensity, cp/ft/sq ft	
				1/5° Div.	1/2° Div.
64 MR-36A	White	Vinyl	0	3.1	2.0
			30	0.3	0.2
64 MR-36B	White	Exposed Bead	0	229.0	84.4
			30	6.9	2.7
64 MR-36C	Yellow	Vinyl	0	1.3	1.3
			30	0.4	0.2
64 MR-36D	Yellow	Exposed Bead	0	16.2	7.4
			30	4.9	2.5
64 MR-36E	Red	Vinyl	0	0.5	0.5
			30	0.2	0.2

The following values from other common reflective products are listed for comparison:

Silver	3M Flat-Top	0	105.0	51.8
		30	45.5	27.5
White	3M Exposed Bead (Wide Angle)	0	40.5	15.0
		30	9.9	3.6
White	Flexolite Beads on Paint	0	15.0	10.6
		30	10.5	7.6
Yellow	3M Flat-Top	0	61.0	28.7
		30	31.1	17.5

Beads in the reflective sheeting have a refractive index of 1.91+, which is optimum for maximum retroreflection. However, water on the surface of exposed bead sheeting destroys its retroreflective characteristics, making the material ineffective in heavy rains and dew.

The plain vinyl sheets, Fascal, are similar to 3M Scotchcal and are used for the same purpose. The white exposed bead reflective sheeting is very bright at normal incidence (0° entrance angle) but does not have wide-angle characteristics. The relatively high reflection values (0.5 to 3.1) of Fascal sheets at 0° entrance angle are due to specular reflection from the glossy surface. Diffuse reflectance would be only about one-tenth of these values.

OFFICE OF TESTING AND RESEARCH

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