OFFICE MEMORANDUM

MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

December 16, 1974

To: L. T. Oehler
Engineer of Research

From: M A. Chiunti

Subject: Upson Laminated Cellulose Fiber Boards for Use as Roadside Sign Panels. Research Project 74 NM-418, Research Report No. R-950.

A sample of Upson fiber board panel was received November 8, for evaluation as a sign panel material. The sample was submitted by the Upson Company, Lockport, New York, and consisted of a section of panel 11-1/2 in. wide by 24 in. long by a nominal 3/4 in. thickness. Upson fiber board panels are a product formed by the combination of two nominal 3/8 in. thick boards of laminated cellulose fiber material bonded by the use of exterior grade adhesives. This product is presently being used as a trim material in the housing industry for such items as cornice, fascia, rake and corner boards, and soffits. The product is supplied primed on two sides and two edges and is claimed to be waterproof by the manufacturer.

Cost of the materials is approximately $12.00 per 4 by 8 ft sheet in carload quantities delivered to Michigan.

Determination of adequacy of the material for use as a sign panel was based on strength characteristics obtained by static bending tests performed in accordance with ASTM Designation D 1037 ("Evaluating the Properties of Wood Base Fiber and Particle Panel Materials").

Testing of the fiber board samples was performed using an Instron machine equipped with autographic printout. Load was applied through a rounded loading block attached to the movable head of the machine. The sample supports, located on the fixed load cell, were round-edged and adjustable to accommodate the prescribed 18-in. span for testing samples of 3/4 in. thickness. Load and deflection measurements were obtained directly from the output chart.

The sample size, as prescribed by ASTM Designation D 1037 was 20 by 3 by 3/4 in. Due to lack of material, testing was performed in the "machine direction" of the board only. Three samples were tested in a soaked condition. Soaking consisted of submerging the samples in water at approximately 68 F for 24 hr prior to testing as required by specification. Prior to soaking the samples, each one received two coats of a commercially available combination sealer and preservative applied with a brush and allowed to air dry overnight.

Moisture content and specific gravity of each sample at the time of test was determined from a coupon 1 in. by the width of the sample cut out immediately after testing. Each coupon was weighed and measured in its moist condition and then oven dried at a temperature of 100 C until approximately constant weight was attained.

Physical properties of the tested material computed from the results of the tests are shown in Table 1.

TABLE 1
PHYSICAL PROPERTIES OF UPSON FIBER BOARD PANELS

Sample No.	Moisture Content, Percent	Specific Gravity*	Stress at Proportional Limit, psi	Modulus of Rupture, psi	Modulus of Elasticity, psi
1	8.8	0.54	550	1,500	300,000
2	9.2	0.54	550	1,400	282,000
3	9.2	0.54	600	1,600	308,000
Avg Values	9.1	0.54	570	1,500	297,000

* Based on volumes at time of test and weight when oven dry.

In all cases, the ultimate failure was characterized by tension failure of the bottom fibers.

Soaking the static bending samples resulted in a 2.9 percent average increase in moisture content from that obtained on two samples checked after being stored under room conditions.

Although samples were tested only in the machine direction of the board, manufacturer's literature shows that the modulus of rupture of the board in the cross machine direction is reduced by approximately 35 percent.

In order to form criteria on which to base the evaluation of the fiber board, a theoretical stress analysis of a typical sign panel was performed. Based on a prescribed wind load of 28 psf as per AASHTO specifications and assuming non-yielding supports, the maximum fiber stress of a 3/4 in. thick panel was found to be 335 psi. Based on the average stress at the proportional limit as determined by the static bending tests, the fiber board provides a safety factor of 1.7 in the machine direction of the board, and assuming a 35 percent reduction in the cross machine direction, the safety factor would be only 1.1. As a comparison, plywood in a soaked condition

is eight times stronger than this material, based on stress at the proportional limit, and nearly five times stronger based on the modulus of rupture.[1]

Roadside signs must resist many forces other than wind load, such as plow-thrown snow, impacts from thrown debris, handling and erection, etc. Therefore, based on the relatively low strength characteristics, small cost savings (approximately $4.00 per 4 by 8 ft sheet) and other questionable properties such as possible swelling or delamination, long term weathering capabilities, overlay adhesion, etc., we recommend this material not be considered for use as an alternative to the present sign panel materials.

TESTING AND RESEARCH DIVISION

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[1] Simonsen, J. E., "Comparison of Fiber Board and Plywood for Use in Roadside Sign Panels," MDSHT Research Report R-565.