OFFICE MEMORANDUM

MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

February 26, 1976

To: L. T. Oehler
Engineer of Research

From: M. A. Chiunti

Subject: Fiberglass Reinforced Pultrusions.
Research Project 75 NM-446. Research Report No. R-990.

Samples of fiberglass reinforced pultrusions along with a Type I and a Type II barricade fabricated from the pultrusions were received for evaluation by the Research Laboratory from the New Materials Committee during the summer of 1975. The pultrusions are manufactured by Creative Pultrusions, Bedford, Pennsylvania and distributed in this area by Arthur Thureson of West Bloomfield, Michigan.

Lack of an earlier response to this matter has been due to previous commitments to summer construction projects and other scheduled work; also, there was a lack of information on the cost of the pultrusions which has recently been received.

Manufacturer's literature describes fiberglass pultrusions as follows: "Pultrusion is a composite which consists of a thermosetting resin matrix and permanently bonded fiberglass reinforcement. The fibers are first pulled through the resin bath and then through a heated die, where the resin saturated fibers are polymerized. The configuration of the heated die determines the configuration of the end product." The two configurations supplied to the Department as samples are shown in Figure 1.

Originally, the manufacturer submitted a request for approval of the material when used in the manufacturing of barricades to be used on state trunklines by utilities, contractors, counties, etc. Subsequently, the supplier has requested that the fiberglass pultrusions also be considered for use as sign post material.

The 'Michigan Manual of Uniform Traffic Control Devices," paragraph 6C-6, Barricade Construction, makes allowance for constructing barricades from materials other than lumber or metal. Since fiberglass pultrusions appear to offer some definite advantages over other materials, such as lightness and durability, we can see no reason why use of this material should not be allowed for construction of barricades, provided they are made in such a manner as to be structurally sound.

The Type I barricade submitted by the manufacturer, appears satisfactory. It is made up of two "A" frames and a horizontal member. The frames are constructed from 1-3/4 by 3-3/4 in. fiberglass pultrusions approximately 36 in. long. A steel gusset riveted to the two legs completes the "A" frame assembly. The steel gusset is notched to accept the horizontal member which consists of a 1 by 9-1/2 in. fiberglass section, 7-1/2 ft long. The height of the barricade when assembled is approximately 39 in.

The Type II barricade submitted meets the material and dimensional requirements set forth by the Manual, except that it is in our opinion not structurally sound. The legs for the "A" frame are made up of a 3/4 by 1 in. material which would probably perform adequately, however, the horizontal members are 1/8 by 4 in. strips which are not sufficiently rigid. The lack of rigidity in the cross members allows large deflections which tend to crack the reflective material. Also, the barricade is extremely light which makes it susceptible to being blown over by traffic-induced wind blasts. Due to the lack of rigidity in the cross members, the barricade cannot be readily ballasted to prevent its being overturned.

For use as sign posts, the manufacturers representative for fiberglass pultrusions offers the following comments:

1. The fiberglass pultrusion section can break off clean upon impact, thus eliminating the use of break-off holes.

2. Sections of pultrusions used as sign posts can be replaced by sawing out a section of the damaged post, making the cuts square, inserting wood plugs as stiffeners and regluing the sections together with an epoxy glue.

3. Wood posts can be replaced with smaller sections of fiberglass pultrusions and still give the same performance.

Fiberglass posts probably would shatter on impact, as the vendor claims. With regard to repairing rather than replacing sections used as sign posts, it is doubtful that an effective enough repair can be made that would reestablish the original integrity of the material since the major tensile strength is derived from the fibers. In addition, due to relatively large labor costs, it may be just as cheap to replace a wooden post as it would be to repair a fiberglass pultrusion.

It is true that due to the higher modulus of rupture of fiberglass pultrusions as compared to wood, a smaller section than those now required could be used as far as static strength is concerned. Deflection and vibration might present problems. However, in order to make a comprehensive comparison of sizes required and therefore costs involved, additional information concerning the physical dimensions of the larger sections would be needed.

The table below shows comparative costs of wood and fiberglass pultrusion sections of the same outside dimensions.

COMPARATIVE COSTS/LINEAL FOOT

	2 by 6	4 by 6	6 by 8
Wood Posts	0.25	0.92	1.91
Fiberglass Pultrusions	1.25	2.50	5.00

From the point of view of static strength, the subject material is suitable as a substitute for wood. Service life evaluations would be required to determine whether the additional cost is warranted. Since many wood posts or components serve adequately until broken by an impacting vehicle, the additional cost of fiberglass may be unnecessary.

In general, we believe that if wooden barricades and posts are serving satisfactorily, then their lower cost should justify continued use of wood. If other Divisions of the Department have knowledge of needs that are not presently fulfilled by wood, they may wish to use this product experimentally. Otherwise, it appears that the cost of the pultrusions would preclude their use by the Department.

TESTING AND RESEARCH DIVISION

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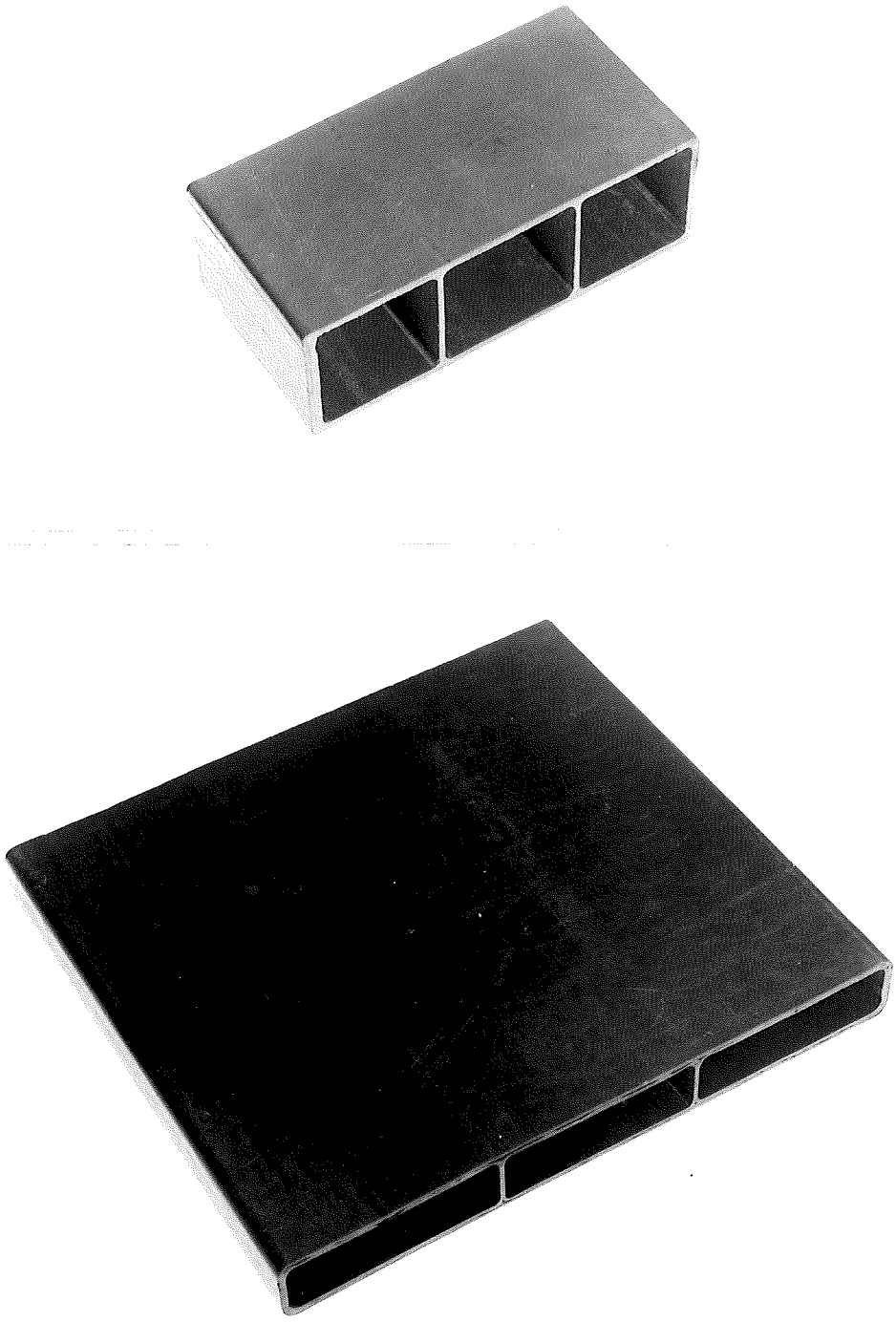

Figure 1. Two configurations of fiberglass pultrusions.