

OFFICE MEMORANDUM



MICHIGAN
STATE HIGHWAY DEPARTMENT

August 8, 1966

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To: R. L. Greenman
Assistant Testing and Research Engineer

From: E. A. Finney

Subject: "Fiberglas" Reinforced Plastic Rods. Research Project 66 NM-155.
Research Report No. R-595.

In accord with your verbal request of July 21, 1966, the subject material has been evaluated for possible use in delineating highways. The "Fiberglas" reinforced plastic rod consists of individual continuous glass fiber strands held straight and under tension during the manufacturing process before being saturated with polyester resin. Samples submitted for evaluation by the fabricator (PlactiCo Division, Plastigage Corp., Jackson, Mich.) consisted of six 3/4-in. diam and six 5/8-in. diam rods, each 7 ft 9 in. long. The bottom end of each rod is tapered to a point in order to facilitate driving into the ground. The delineating effect is obtained by bonding a white 3M Flattop Reflective Sheet to the top 6 in. surface area of the rod. Rods can be furnished in diameters from 1/2 to 1-1/4 in. in any size increment.

In 1961, the Research Laboratory conducted a series of physical tests and investigated other pertinent properties of this material for the purpose of evaluating its use as dowel bars in concrete pavement joints (Research Project 61 NM-59). Results of that evaluation were transmitted to the Committee for the Investigation of New Materials in a letter dated January 25, 1962. It was the conclusion of this evaluation that "... the proposed usage of reinforced Fiberglas rods as a substitute for steel dowel bars in concrete pavement joints is not warranted." The present evaluation, therefore, did not include physical tests but was confined to a theoretical analysis using the 1961 test data where necessary.

Comparison of pertinent physical properties of a typical steel delineator post as currently specified to those of the plastic rods is as follows:

| Post Type | Moment of Inertia, in. ⁴ | Section Modulus, cu in. | Modulus of Elasticity, psi | Yield Strength, psi | Computed Flexural Stress, psi |
|-------------|-------------------------------------|-------------------------|----------------------------|---------------------|-------------------------------|
| Steel | 0.049 | 0.093 | 30×10^6 | 50,000 | 11,200 |
| 3/4-in. Rod | 0.0155 | 0.0414 | 4.2×10^6 | 42,000* | 6,300 |
| 5/8-in. Rod | 0.0075 | 0.0240 | 4.2×10^6 | 42,000* | 9,100 |

* The plastic rod has no yield point. The value shown is equal to 0.6 of the ultimate compressive strength.

The flexural stress was computed on the basis of a post length of 59 in. above ground level and wind load requirements for 80 mph wind, as prescribed in Tables 1 and 2 of the 1961 AASHO "Specifications for the Design and Construction of Structural Supports for Highway Signs." As can be seen in the preceding tabulation, computed stress for both rod sizes is well below their respective strength capacities. Thus, with respect to strength, the plastic rods would be satisfactory.

Another property of importance when selecting a delineator post is its flexural rigidity. For a steel post of the currently prescribed minimum cross-section, the flexural rigidity is 18 times greater than that of the 3/4-in. diam plastic rod, and 38 times greater than that of the 5/8-in. diam rod. The rigidity of the steel post could be met by increasing the plastic rod diameter to 1-9/16 in.

Because of the low rigidity of the plastic rods, elastic buckling occurred during a driving performance test conducted in the field. As a result, the surface area enclosed by the manual driving hammer was slightly marred during the installation. The top of the post showed no damage from the impact of the hammer.

Optical performance of the 3M Flattop Reflective Sheet was determined by means of a photometric test conducted in accordance with MDSH Standard Specifications. Since a true reflex area could not be calculated, the following results are relative specific intensity values using 100 as the average specific intensity of a square foot of reflective sheeting:

| <u>Material</u> | <u>Relative Specific Intensity</u> |
|-------------------------------|------------------------------------|
| Plastic Rod, 5/8-in. diam | 0.95 |
| Plastic Rod, 3/4-in. diam | 1.14 |
| Reflective Sheet, 3 by 12 in. | 25.0 |
| Sheet Delineator, 3 by 12 in. | 57.0 |
| Reflector Button, 3-in. diam | 70.0 |

The minimum relative specific intensity currently prescribed for the 3-in. diam reflector button would be about 42. Thus, the reflectance intensity of the plastic rods is only about 2.5 percent of the minimum requirement for reflector buttons and about 1.5 percent of the actual reflective intensity of the reflector button.

On the basis of this brief evaluation, and assuming that the reflective intensity of the presently used reflector button is necessary in delineating highways, the submitted Fiberglas reinforced plastic rods would be unsuitable for delineator purposes. However, it appears that a delineator post of this material having sufficient strength and rigidity

R. L. Greenman

- 3 -

August 8, 1966

could be developed. The problem of fastening a delineator button to a plastic post would need solving, and installation performance, especially in frozen ground, would need additional study if the Department wishes further investigation of the use of this material in delineator posts.

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