

PERFORMANCE OF A FIBERGLASS REINFORCED PLASTIC  
EXPERIMENTAL OVERHEAD SIGN SUPPORT STRUCTURE

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Michigan State Highway Department  
John C. Mackie, Commissioner  
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## PERFORMANCE OF A FIBERGLASS REINFORCED PLASTIC EXPERIMENTAL OVERHEAD SIGN SUPPORT STRUCTURE

This report summarizes all inspections of a fiberglass reinforced plastic overhead sign support structure erected experimentally at the intersection of M 78 and US 16 (north of the Frandor Shopping Center) on May 7, 1958. It was removed July 10, 1961, after being damaged in a motor vehicle accident.

Before the experimental structure was installed, the Research Laboratory Division conducted extensive laboratory tests to determine the physical characteristics of this material and the structural adequacy of prototype structures of various sizes. This was reported in Research Report No. 293 (June 1958).

The structure was first inspected February 27, 1959, as reported in Test Report No. 32 (March 20, 1959). Cracks were found in three of the four joint fittings between the top horizontal member and the vertical tubes, and short longitudinal cracks were also discovered in the main chord members where sign clamps were mounted.

The second inspection was made June 1, 1960, and a third inspection on June 20 was prompted by a storm on June 16, when winds up to 60 mph were reported at the nearest weather station. These two inspections

were described in Research Report No. 341 (August 1960), in which it was concluded that although certain circumferential cracks in the main chord members were significant, their condition then did not impair the design capacity of the structure. It was recommended that the structure should either be inspected more frequently or removed to some location where possible structural failure would not endanger motorists.

Cracks found in these inspections are shown and described in Fig. 1 as Nos. 1 through 25.

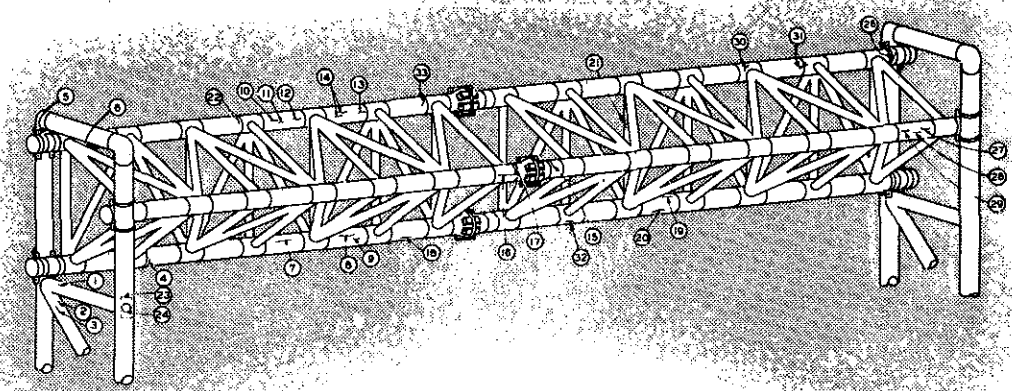
Frequent spot checks of the vertical trusses and lower chord members of the horizontal span unit between June 20, 1960, and May 19, 1961, showed little visible or apparent change in existing cracks. In the fourth thorough inspection, on May 19, it was found that cracks noted before were growing no longer or wider, but that eight new cracks had formed (Nos. 26 through 33 in Fig. 1).

Considered altogether, these inspections indicate the continuing formation of cracks in the plastic fiberglass tubes and joint connections subjected to normal in-service physical conditions. None of these cracks existed prior to erection of the structure, with the single exception of the split seam in the top strut of the vertical truss unit. As was mentioned previously, some cracks were considered of little consequence, while others, e.g., the circumferential cracks and joint-connection seam splits, were definitely significant.

Although no progressive lengthening or opening of these cracks seemed to take place, each successive inspection revealed newly formed cracks. It was also evident that some cracks occurred or at least started at points of non-uniformity in the fiberglass reinforcement and resin filler. The Research Laboratory emphasized this question of control of product uniformity as a major factor in its recommendation that general acceptance of reinforced plastic fiberglass structures was not warranted, in Research Report No. 293 (June 1958).

On July 7, 1961, following the accident damage to the structure, Robert Harp of the Office of Maintenance Sign and Signal Section requested investigation of the structure's condition. Major damage was concentrated in the impact area on the southwest vertical tube member (Figs. 2 and 3). The horizontal span unit was not inspected, but Mr. Harp was immediately advised that because of severe longitudinal splitting and the circumferential seam split extending halfway around the tube at its base, the structure should be taken down. It was removed on July 10.

This is the final report on this experimental structure. The Laboratory has been advised that the manufacturer has lost interest in this type of structural application as an outlet for his production of fiberglass reinforced plastic material.



Crack No.	Date* Observed	Length in.	Width, in.	Location
1	6-1-60	1.6	0.010	S column, middle horizontal member (longitudinal)
2	6-20-60	2.5	0.006	S column, top diagonal near SW tube (longitudinal)
3	6-20-60	3.0	0.011	Same as 2
4	6-20-60	2.5	hairline	Bottom chord, 1st joint from S column (circumferential)
5	2-27-59	---	seam split	Top horizontal member at junction with S column (SW tube)
6	2-27-59	---	seam split	Same as 5 (SE tube)
7	2-27-59	7.6	hairline	Bottom chord, at 2nd sign clamp from S column (longitudinal)
8	2-27-59	4.6	hairline	Bottom chord, at 3rd sign clamp from S column (longitudinal)
9	2-27-59	1.6	hairline	Same as 8
10	2-27-59	6.0	hairline	Top chord, at 2nd sign clamp from S column (longitudinal)
11	2-27-59	2.1	hairline	Same as 10
12	6-1-60	1.4	hairline	Top chord, between 2nd sign clamp and 5th vertical strut from S column (longitudinal)
13	6-1-60	3.4	hairline	Top chord, at 6th vertical strut from S column (longitudinal)
14	2-27-59	1.5 & 2.0	hairline	Top chord, at 3rd sign clamp from S column (longitudinal)
15	6-20-60	3.5	hairline	Back chord, in fillet north of center casting (circumferential)
16	6-20-60	---	seam split	Back chord, south of center casting (longitudinal)
17	6-20-60	11.0	hairline	Same as 15 (S casting)
18	2-27-59	3.0	hairline	Bottom chord, at 4th sign clamp from S column (longitudinal)
19	2-27-59	4.3	hairline	Bottom chord, top at 7th sign clamp from S column (longitudinal)
20	2-27-59	3.3	hairline	Same as 19 (chord bottom)
21	6-20-60	1.8, 1.0, 0.5	hairline	10th vertical strut from S column (group of 3, circumferential)
22	6-1-60	2.3	hairline	Top chord, at 4th vertical strut from S column (circumferential)
23	6-20-60	0.8	0.020	S column, top of fillet at junction of middle horizontal member & SE tube
24	6-20-60	0.8	0.015	Same as 23 (at bottom of fillet)
25	6-20-60	2.0	hairline	S column, bottom horizontal member
26	5-19-61	1.9	hairline	NW column, top of clamp to bottom chord (vertical)
27	5-19-61	2.5	hairline	Back chord between 1st & 2nd joint from N column (longitudinal)
28	5-19-61	2.4	hairline	Same as 27
29	5-19-61	1.1	hairline	Same as 27
30	5-19-61	1.0	hairline	Top chord, 3rd joint from N column (longitudinal)
31	5-19-61	5.5	hairline	Top chord, 1st sign clamp from N column (longitudinal)
32	5-19-61	11.5	seam split	Bottom chord, 6th joint from N column (longitudinal)
33	5-19-61	1.9	hairline	Top chord, S of center casting (circumferential)

\* Structure erected 5-7-58

Figure 1. Location and description of cracks. Sign clamps not shown. South column at left.

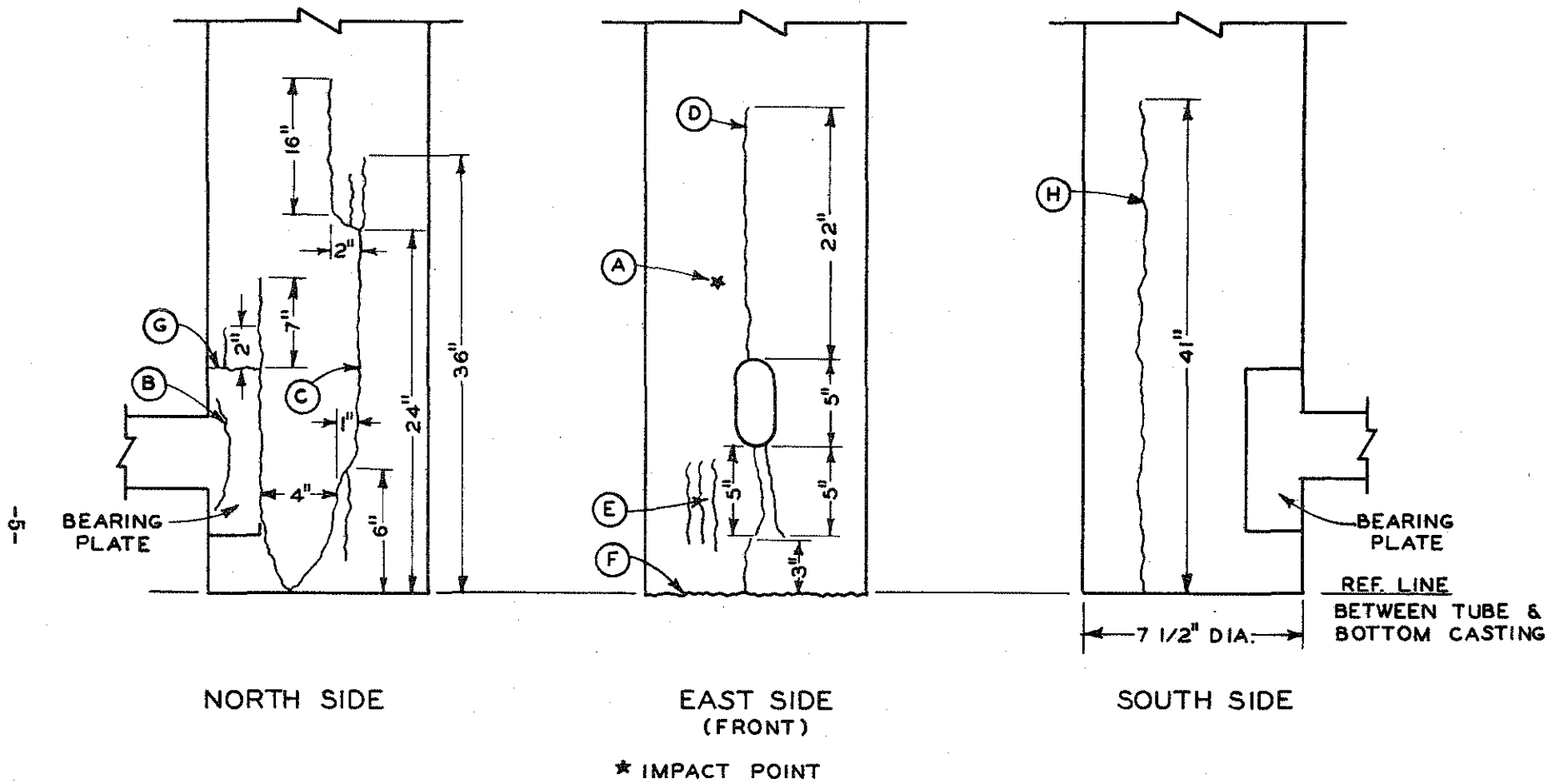


Figure 2. Damage to southwest vertical tube.

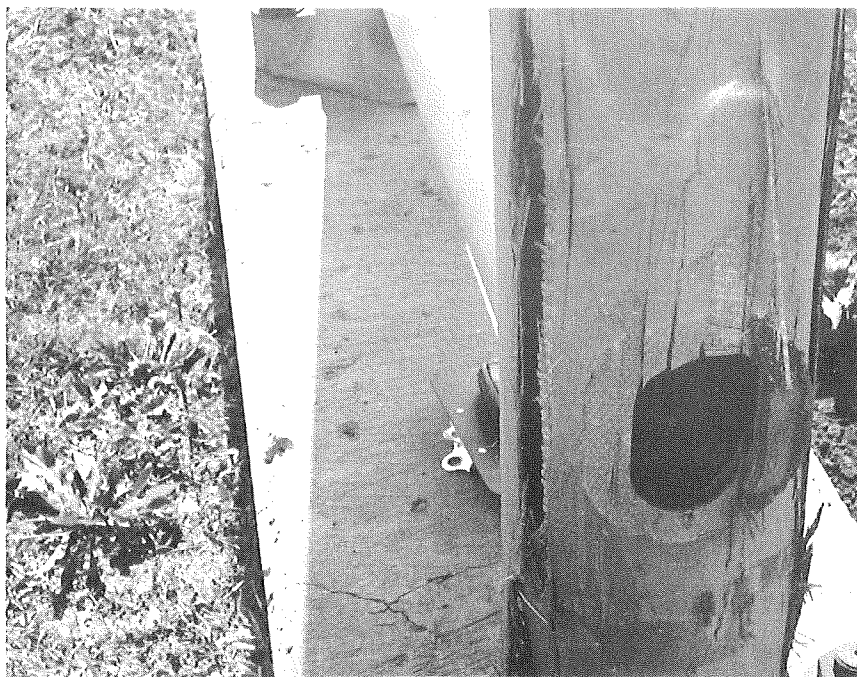
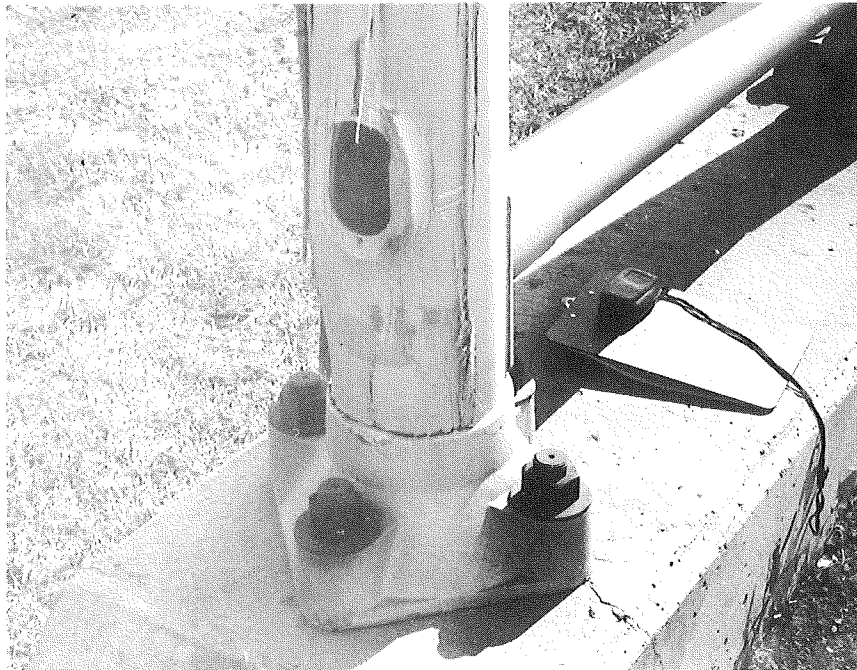


Figure 3. Accident damage to southwest vertical tube.