OFFICE MEMORANDUM

MICHIGAN
STATE HIGHWAY DEPARTMENT

June 1, 1965

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

From: H. C. Brunke

Subject: Structural Evaluation of Steel Snow Fence Posts.
Research Project 65 F-83. Research Report No. R-522.

On April 8, 1965, snow fence posts received from the Franklin and Pollak Steel Companies were inspected at the Laboratory by S. F. Cryderman, Office of Maintenance, and R. L. Greenman, Office of Testing and Research. This inspection was believed necessary due to Office of Maintenance restrictions regarding use of T-shaped posts, and to recent difficulties in purchasing posts for snow fence installation, as stated in R. L. Greenman's letter to H. J. Rathfoot dated March 11, 1965.

It was decided at the April 8 meeting to conduct a series of field tests in sand to determine the comparable stability of five types of posts. The five types involved are noted in Table 1 and were tested by a method similar to that described in Research Report No. R-303 (January 1959) by S. L. DeLeeuw and G. R. Cudney. A standard embedment depth of 1 ft 6 in. was used for three samples of each type of post. Each post was loaded so that the cross-section flange would be in tension. The test site was located approximately 3 miles east of Okemos Rd in the median of I 96. Average physical properties of the posts tested and average ultimate loads to cause soil failure in the field tests are shown in Table 1.

Since the heavier (2.07 lb/ft) Franklin Steel posts provided three methods of attaching snow fence (Fig. 2)--notched on the edge flange, center-notched, and with center projecting clips--an additional flexural test was conducted in the laboratory to determine if the section reduction due to these features would cause any significant differences in the structural properties.

Based on the average test results, the following statements may be made:

Field Tests

1. The standard embedment depth (1 ft 6 in.) is not sufficient to develop the strength of the post in sand, since all tests resulted in soil failures rather than post failures.

2. As shown in the load-deflection curves (Fig. 1), average test loads at points of equal deflection showed an insignificant difference in stiffness between the 1.33 lb/ft T-shaped Pollak and the 1.43 lb/ft hat-shaped type currently in use by the Department. The stiffness of the 1.49 lb/ft hat-shaped Franklin Steel post was approximately 10 percent less and the ultimate load about 20 percent less than the other two sections just mentioned.

3. The 2.07 lb/ft hat-shaped Franklin Steel post, with greater soil contact area, was approximately 10 percent stiffer and the ultimate load about 11 percent greater than the 1.33 lb/ft T-shaped Pollak and the 1.43 lb/ft hat-shaped section currently in use.

4. As shown in the load-deflection curves (Fig. 1) the 1.33 lb/ft T-shaped Pollak Steel post with a ground plate required approximately 42 percent more load to cause failure, than the same post section without the ground plate.

Laboratory Tests

1. As shown in the load-deflection curves (Fig. 2), the relative stiffness of the 2.07 lb/ft hat-shaped Franklin Steel post with weld clips was approximately 7 percent greater than the section with punched clips and approximately 14 percent greater than the section with notches on the edge flanges. While the method of attachment provided by the manufacturer has a slight effect on the structural stiffness of the section, this difference is small and the convenience of attachment of one method over another may warrant adoption of any one of the three.

Summary

For short embedment lengths in noncohesive sandy soils, the load deflection characteristics and ultimate transverse loads on posts are governed by the surface contact area of the section. For embedment in cohesive soils, load-deflection and ultimate loads will be governed by physical properties of the post section. Table 1 lists the moments of inertia and section moduli of the post sections involved in the test. Based on these section moduli, the elastic strengths of the 2.07 lb/ft Franklin hat-section and the currently used hat-section compared to the Pollak T-section are respectively approximately 3.7 and 1.8 times as strong. Table 2 shows the relative elastic strength and stiffness of the five test sections for embedment in cohesive soils, as well as the relative ultimate strength and elastic stiffness for embedment in noncohesive soils.

OFFICE OF TESTING AND RESEARCH

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TABLE 1
PHYSICAL PROPERTIES

Section	Length	Weight, lb/ft	Moment of Inertia (I_{x-x}), $in.^4$	Minimum Section Modulus (S_{x-x}), $in.^3$	Average Ultimate Test Load, lb
Franklin Hat	6' - 0"	1.49	0.05	0.09	83
MSHD Hat(1)	7' - 0"	1.43	0.08	0.13	100
Pollak T	7' - 0"	1.33	0.07	0.07	103
Franklin Hat	6' - 0"	2.07	0.20	0.26	113
Pollak T (with ground plate)	7' - 0"	1.33	0.07(2)	0.07(2)	143

(1) One type of section currently in use by Department
(2) Moment of inertia and minimum section modulus are those of post excluding ground plate

TABLE 2
STRENGTH AND STIFFNESS

	Section	Relative Elastic Stiffness	Relative Ultimate Strength
Noncohesive Soil	1.43 lb/ft MSHD Hat-Section	1.00	1.00
	1.33 lb/ft Pollak T-Section	1.00	1.00
	1.33 lb/ft Pollak T-Section (with ground plate)	1.05	1.43
	1.49 lb/ft Franklin Hat-Section	0.90	0.79
	2.07 lb/ft Franklin Hat-Section	1.10	1.11
	Section	**Relative Elastic Stiffness**	**Relative Elastic Strength**
Cohesive Soil	1.43 lb/ft MSHD Hat-Section	1.00	1.00
	1.33 lb/ft Pollak T-Section	0.88	0.54
	1.33 lb/ft Pollak T-Section (with ground plate)	0.88	0.54
	1.49 lb/ft Franklin Hat-Section	0.63	0.69
	2.07 lb/ft Franklin Hat-Section	2.50	2.00

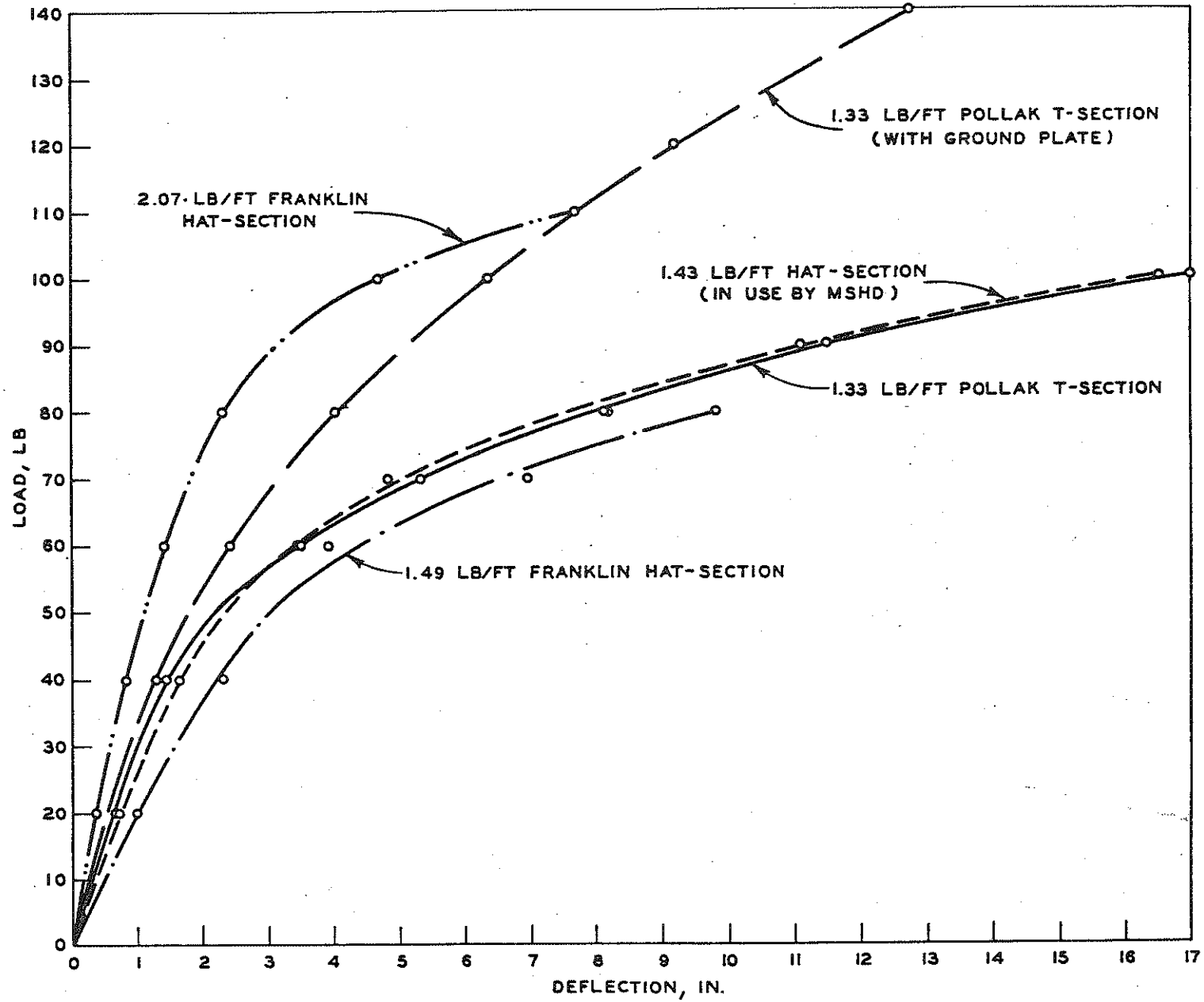

Figure 1. Load-deflection curves for five types of posts tested in the field.

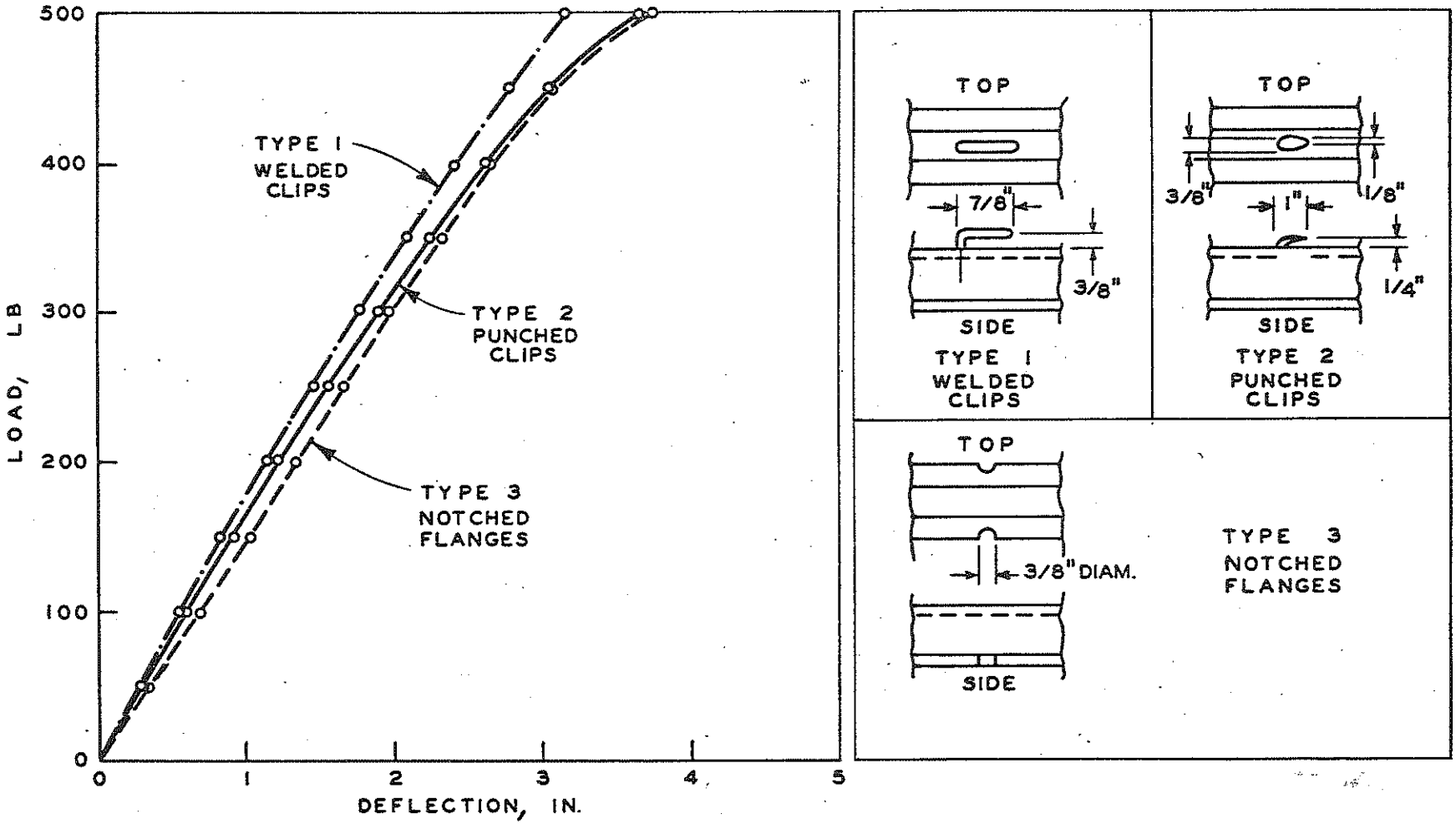

Figure 2. Load-deflection curves for three sections of the 2.07 lb/ft Franklin Steel post.