

OFFICE MEMORANDUM



MICHIGAN
STATE HIGHWAY DEPARTMENT

JOHN C. MACKIE, COMMISSIONER

288

July 8, 1960

To: W. W. McLaughlin
Testing and Research Engineer

From: E. A. Finney

Subject: Granco Steel Guard Rail Post (6-1/2 x 3-1/2 x 8.64 "S" Section)
Research Project 55 F-39, Report No. 338.

In accordance with your request of May 24, 1960, an evaluation has been made of a steel "S" section guard rail post, manufactured by the Granco Steel Products Company of St. Louis, Missouri. Included also, is a comparison of this post with the two presently approved posts: the 6 x 4 wide flange and 6 x 4 Zee section.

A cross-section of this "S" post is shown in Figure 1. The moments of inertia about the principal axes (u, v) and about the x, y axes are tabulated in Table 1, along with similar information for the wide flange and Zee sections.

In order to point out the variation of the maximum stress occurring in each post, when treated as fixed end cantilever beams, with loads applied at various angles to the post, the relative strengths of the sections with respect to various planes of applied loading are shown in Figure 2.

Remarks

For embedment in a cohesive soil where the load resistance of the post depends upon the individual post section rather than the soil, the "S" section post would be stronger than the wide flange section except for loads applied in planes greater than 85° from the direction of the line of the guard rail. For loads applied in planes up to about 80° with respect to the direction of the guard rail, the "S" post would not be as strong as the Zee section.

For embedment in a soil such as sand where the ultimate resistance of the post is controlled by the soil resistance, the ultimate load capacity of the "S" section would be about 85 percent of that of the wide flange post, since the resistance of the post varies linearly with the bearing width in contact with the soil for the same depth of embedment (The flange width of the "S" section is 3-11/32 in. as compared to 3.94 in. for the wide flange post).

W. W. McLaughlin

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Comparison of the shearing stresses of the "S" and wide flange sections, when treated as fixed end cantilever beams subjected to pure torsion, indicates that the "S" section would have about 90 percent of the maximum shearing stress for the same applied torque as the wide flange section.

Based on this analysis, and considering the strength of the "S" post for angles of loading and soil conditions ordinarily anticipated for guard rail posts, the proposed "S" section post is essentially comparable to the standard wide flange post, and we recommend that it may be considered as an alternate to the 6 x 4 wide flange section.

OFFICE OF TESTING AND RESEARCH

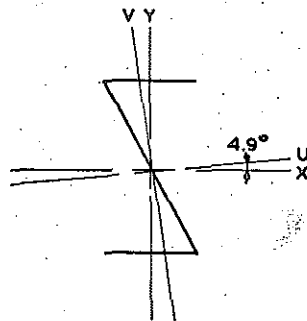
E. A. Finney, Director
Research Laboratory Division

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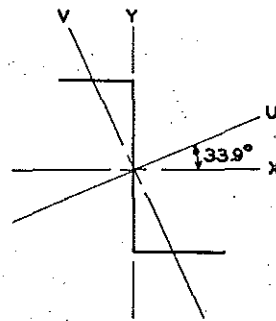
TABLE 1
STEEL SECTION PROPERTIES

Section	Weight, lb/ft	Thickness, in.	I_x , in. ⁴	I_y , in. ⁴	I_u ,* in. ⁴	I_v ,* in. ⁴
S	8.64	3/16	15.48	2.31	15.58	2.22
Z	8.50	3/16	15.71	8.32	21.82	2.22
W	8.50	3/16	14.80	1.89	14.80	1.89

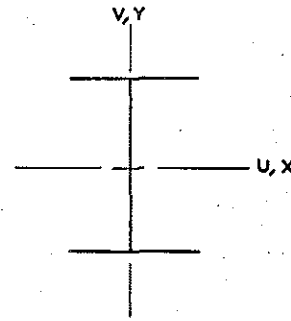
* u and v are the principal axes



S Section
6-1/2 x 3-1/2
(Granca Steel Products Co.)



Zee Section
6 x 4
(Syro Steel Co.)



W Section
6 x 4 W

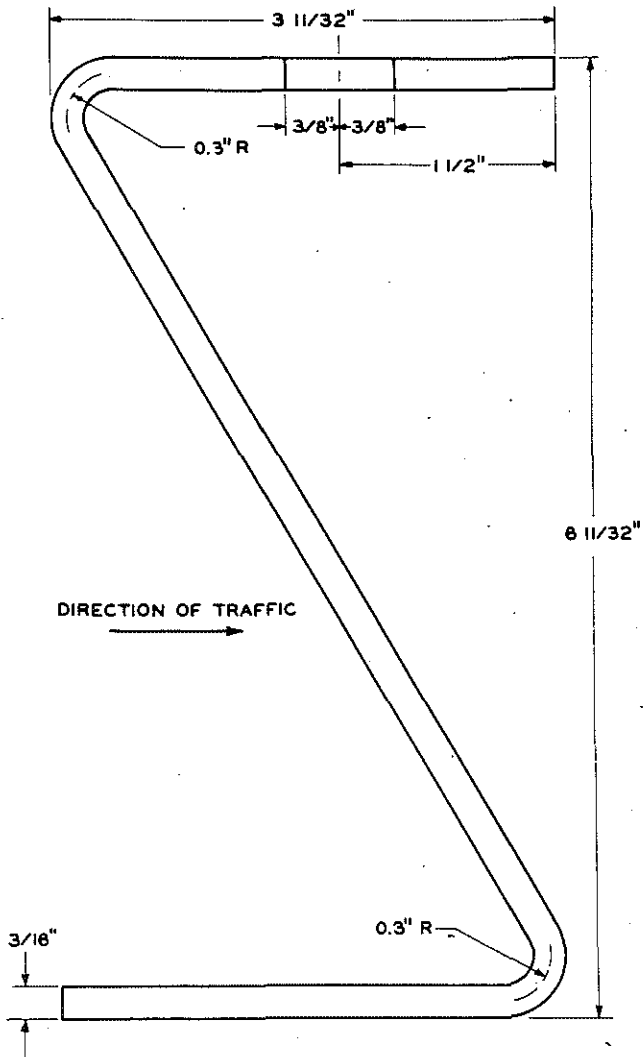


Figure 1. Cross-section of "S" post.

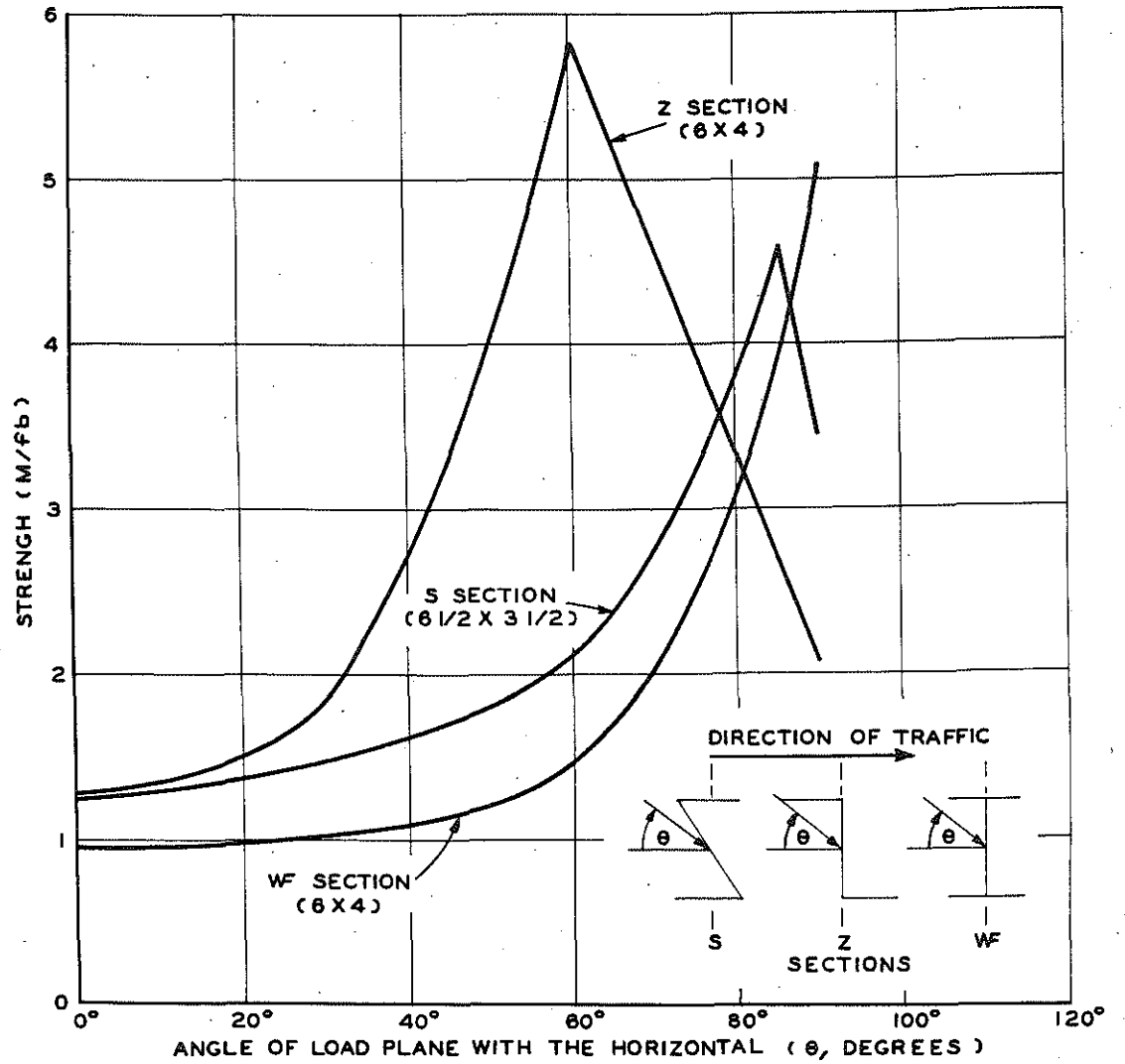


Figure 2. Relative strength for various planes of loading.