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LOAD DEFLECTION AND TENSILE TESTS

ON STANDARD TYPE STEEL BEAM GUARD RAIL

By

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LOAD DEFLECTION AND TENSILE TESTS ON STANDARD TYPE STEEL BEAM GUARD RAIL

This is a summary report setting forth the results of a recent series of load deflection and strength tests on samples of the new standard type steel beam guard rail supplied by five different manufacturers. This study is a continuation of a series of load deflection and tensile tests that were made on various types of steel beam guard rail, and reported in Report No. 232 dated July 7, 1955.

Early in 1956 certain steel fabricators agreed to manufacture only one type of steel beam guard rail in accordance with a mutually approved standard design. It was the purpose of the Research Laboratory tests to check the new standard product against manufacturer's specifications and also to develop data to revise Michigan's specifications in order to conform with the new unit. The manufacturers submitting test samples include:

1. United Steel Fabricators, Inc.
2. Syro Steel Company
3. Bethlehem Steel Company
4. Armco Drainage and Metal Products Co.
5. American Steel & Wire Corporation

In each case, three samples (12-gage only) from each manufacturer were tested. For load deflection tests, two specimens were tested in the traffic face up position, and one was tested in the traffic face down position. The testing procedure that was followed is the same as that reported in Report No. 232. The ends of the load deflection test specimens were cut off and used for tensile test purposes.

Test Results

Load deflection curves for each of the manufacturers' guard rail, loaded traffic face up, and traffic face down, are shown in Figure 1.

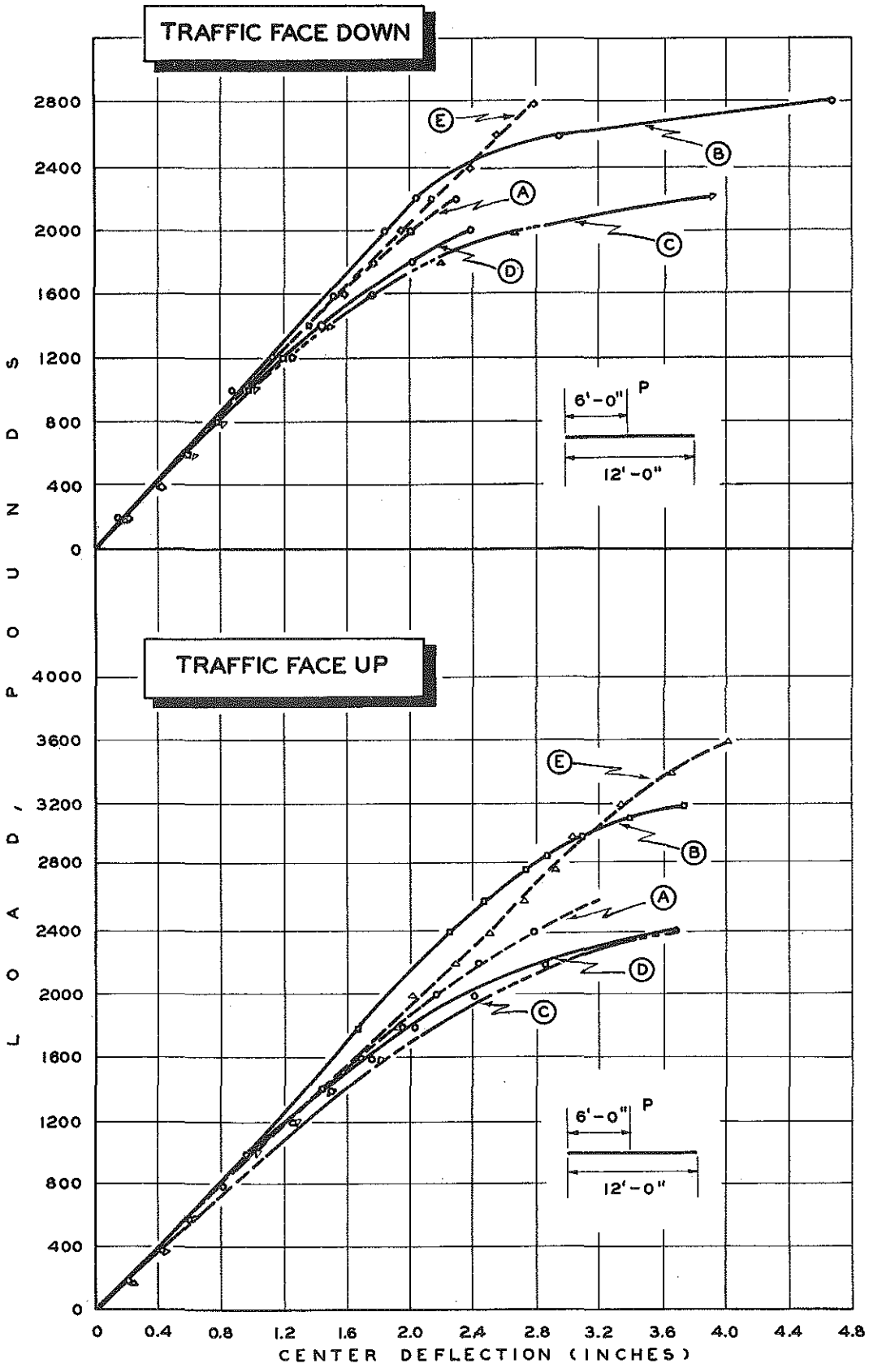

FIGURE 1. GUARD RAIL STIFFNESS

Table 1 lists the dimensions and physical properties for each guard rail.

The ultimate flexural loads, obtained from the load deflection tests, are tabulated in Table 2.

Table 3 shows the ultimate tensile load for each guard rail splice and Figure 2 shows a typical rail splice at failure.

Summary

It can be seen from the results of these tests that there are variations in the tested physical behavior between each of the five manufacturers' standard guard rails. These differences can be attributed, in part, to variation in plate thickness and cross section existing between each of the guard rails and to variation in the shape of the cross section throughout the length of any one guard rail.

All of the guard rails tested, except those submitted by Bethlehem Steel Company, met the criteria for beam deflection and rail splice tensile load requirements specified in the present MSHD specifications on deep beam type guard rail. The guard rails from Bethlehem Steel Company failed to meet the minimum tensile load of 80,000 pounds required for the guard rail splice.

There is substantial agreement in load deflection data for individual specimens when tested either traffic face up or traffic face down. This indicates a well balanced cross section design.

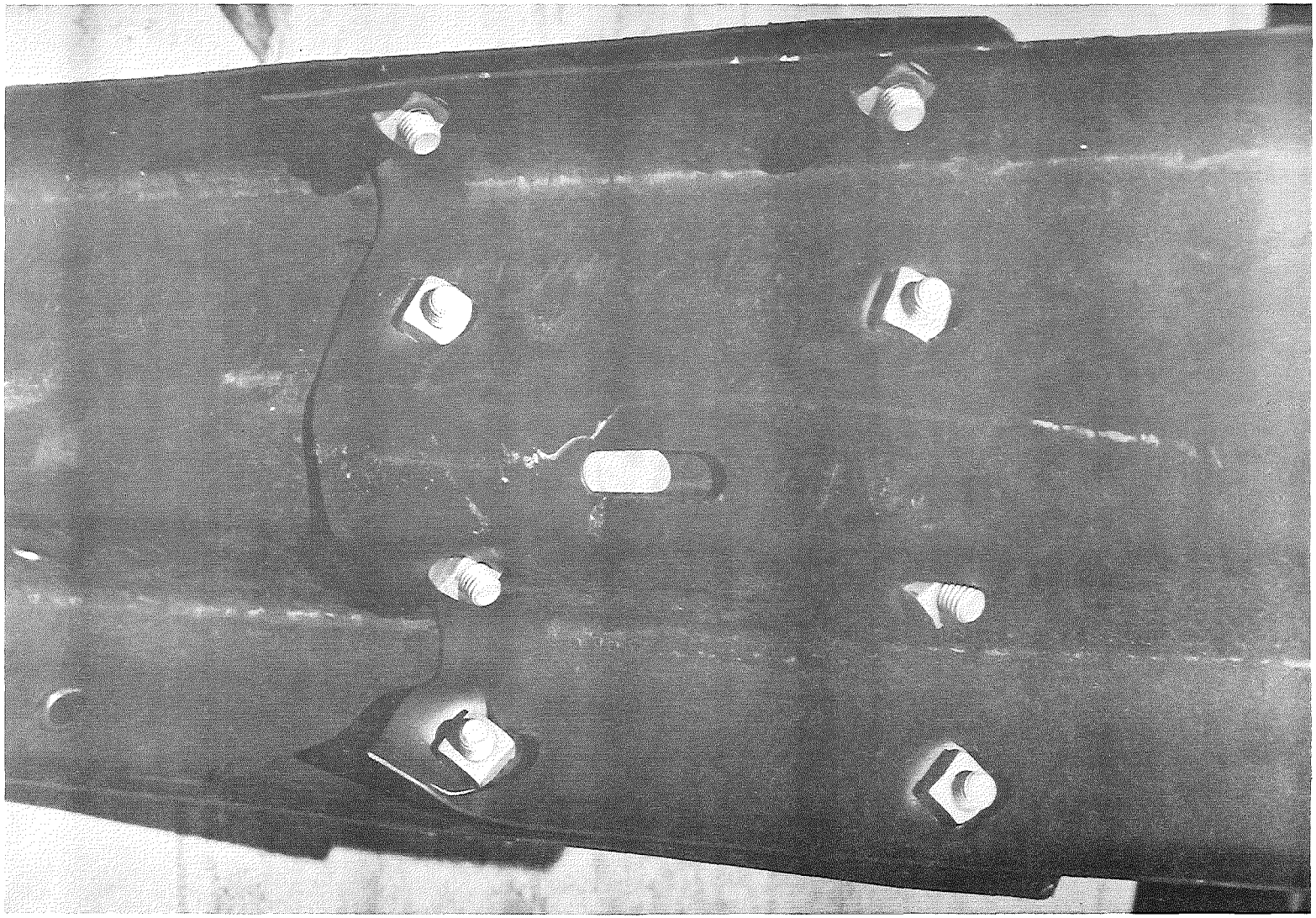

FIGURE 2. TYPICAL FAILURE OF GUARD RAIL SPLICE.

TABLE 1

DIMENSIONS AND PHYSICAL PROPERTIES

Mfgr.	Specimen No.	Length (ft.-in.)	Wt. Per Linear Ft. (lbs./Ft.)	Section Modulus* ($in.^3$)	Moment of Inertia* ($in.^4$)	Test Position**
A	1	13'-7-1/4"	6.95	1.20	1.92	TFU
	2	13'-7-3/8"	6.96	1.24	1.92	TFU
	3	13'-7-1/4"	6.96	1.41	2.08	TFD
B	1	13'-6-1/2"	6.85	1.31	2.24	TFU
	2	13'-6-1/2"	6.85	1.31	2.24	TFU
	3	13'-6-1/2"	6.87	1.31	2.24	TFD
C	1	13'-6-1/2"	6.38	1.34	1.90	TFU
	2	13'-6-1/2"	6.34	1.21	1.73	TFU
	3	13'-7-1/2"	6.20	1.21	2.01	TFD
D	1	13'-7"	6.54	1.27	1.91	TFU
	2	13'-7-1/4"	6.76	1.32	2.08	TFU
	3	13'-7"	6.55	1.31	1.95	TFD
E	1	13'-7-1/2"	6.89	1.34	2.01	TFU
	2	13'-7-1/2"	6.77	1.29	1.97	TFU
	3	13'-7-1/2"	6.92	1.42	1.96	TFD

* These values were determined experimentally

** TFU - Traffic Face Up
TFD - Traffic Face Down

TABLE 2

ULTIMATE FLEXURAL LOAD

Mfgr.	Specimen No.	Test Position*	Max. Load (Lbs.)
A	1	TFU	3000
	2	TFU	2800
	3	TFD	2370
B	1	TFU	3250
	2	TFU	3320
	3	TFD	2820
C	1	TFU	2590
	2	TFU	2550
	3	TFD	2200
D	1	TFU	2520
	2	TFU	2740
	3	TFD	2180
E	1	TFU	3940
	2	TFU	3760
	3	TFD	2960

* TFU - Traffic Face Up
TFD - Traffic Face Down

TABLE 3

ULTIMATE TENSILE LOAD OF RAIL SPLICE

Mfgr.	Specimen No.	Ult. Tensile Load (Lbs.)	Avg. Ult. Tensile Load (Lbs.)
A	1	82100	
	2	86000	83600
	3	82700	
B	1	110000	
	2	106400	107600
	3	106400	
C	1	77100	
	2	77100	76700
	3	75900	
D	1	83000	
	2	82500	85000
	3	89500	
E	1	123400	
	2	127000	125500
	3	126200	