Test and Evaluation Report

Testing and Evaluation of the IA78 Bridge in Keokuk County

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Prepared For

Iowa Department of Transportation

Iowa Department of Transportation
Office of Bridges and Structures
800 Lincoln Way
Ames, IA 50010

Prepared By

BRIDGE ENGINEERING CENTER

Bridge Engineering Center
2901 South Loop Dr.
Suite 3100
Ames, IA 50010
(515) 294-8103

Introduction

On November 3, 2005, the IA 78 bridge in Keokuk County was tested using the Iowa Department of Transportation snooper truck which was driven from West to East at a crawl speed (2-5 mph). Testing consisted of driving the snooper truck along four different paths summarized below thought to capture the overall behavior of the bridge:

- Path 1 – passenger side wheel 2' from face of south curb
- Path 2 – truck centered on bridge
- Path 3 – passenger side wheel 12' from face of south curb
- Path 4 – driver side wheel 2' from face of north curb

Top and bottom flange strain data were collected at five cross-sections on the four bridge girders (Section 1 – 36" east of the west abutment bearing in west end span, Section 2 – midspan of west end span, Section 3 – 30" west of the west pier in west end span, Section 4 – midspan of west center span, and Section 5 – 54" west of the center steel pier in the west center span). The collected strain data are the basis of the results and conclusions made herein. For reference, the four girders are numbered 1 through 4 with Girder 1 (G1) being the northernmost and Girder 4 (G4) being the southernmost.

Test Results

Table 1 shows the peak bottom flange strain values measured during each of the four test runs at Sections 2 through 5 (Section 1 data were collected to investigate the level of rotational end restraint). As can be seen from these data, the maximum bottom flange strain values (units of microstrain) for the exterior and interior girders, respectively, are: Section 2 – 94 and 84; Section 3 – 64 and 57; Section 4 – 120 and 110; and Section 5 – 43 and 33. The maximum recorded strain (120 at Section 4) is equivalent to a stress of approximately 3.5 ksi. Using superposition to simulate two lanes loaded (i.e., Path 1 plus Path 3) the following maximum strains are calculated: Section 2 – 114 and 142; Section 3 – 91 and 95; Section 4 – 141 and 160; and Section 5 – 47 and 56. As with the single lane loaded case, the maximum two lane loaded strain of 160 is equivalent to a stress of approximately 4.5 ksi.

Table 2 summarizes the load fraction of a single truck carried by each girder for the cases of one lane loaded and two lanes loaded simultaneously. Note that the two lanes loaded case is calculated based upon superposition of single lane test results. Thus, for a single lane loaded it appears that a distribution factor of 0.51 for the exterior girders and 0.45 for the exterior girders is appropriate. For two lanes loaded, distribution factors of 0.59 and 0.72 for the exterior and interior girders, respectively, appear appropriate.

It appears that there is a non-negligible amount of rotational restraint occurring at the abutment that was monitored. Although non-negligible, the rotational restraint is not significant and much closer to a "pinned" condition than a "fixed" condition.

Table 1. Peak strain values (micro strain) – Sections 2 through 5

	Girder	Path 1	Path 2	Path 3	Path 4
Section 2	G1	12	38	49	85
	G2	40	78	84	78
	G3	80	76	62	36
	G4	94	34	20	10
Section 3	G1	6	28	41	62
	G2	30	51	57	54
	G3	50	47	45	25
	G4	64	28	27	7
Section 4	G1	13	52	66	120
	G2	50	104	110	104
	G3	90	80	66	40
	G4	109	46	32	10
Section 5					
	G1	4	21	2	43
	G2	13	30	33	30
	G3	31	25	25	12
	G4	34	18	13	0

Table 2. Maximum load fractions

	One Lane	Two Lanes
G1	0.51	0.51
G2	0.45	0.61
G3	0.38	0.72
G4	0.43	0.59