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Load Rating, Analysis, and Monitoring of the Sagging Fascia Girder of I287 Bridge over US202/206

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Background

Recently, it was reported a sagged posture of the east fascia girder in the center span of the I287 bridge.


Objectives

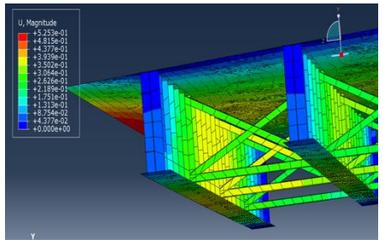
Identify the potential causes of the sagging of the girder.

- Develop a detailed finite element model (FEM)
- Install Weigh-in-Motion (WIM) and structural health monitoring (SHM) sensors to monitor the site-specific live load and response of the bridge.
- Load rating for the bridge based on the site-specific live load model developed using the collected WIM data.
- Develop recommendations for the future actions

Preliminary Analysis: Load Rating and 3D FEM

Preliminary load rating shows deficient RF for the Service Limit State II.

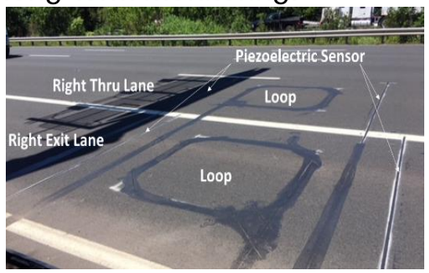
RFs	Inventory (HL-93)	Operating (HL-93)
Flexure	1.07	1.39
Shear	1.69	2.19
Service	0.95	1.24

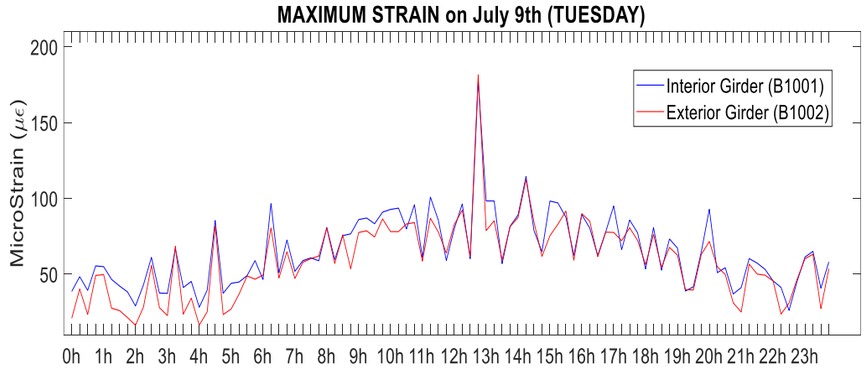


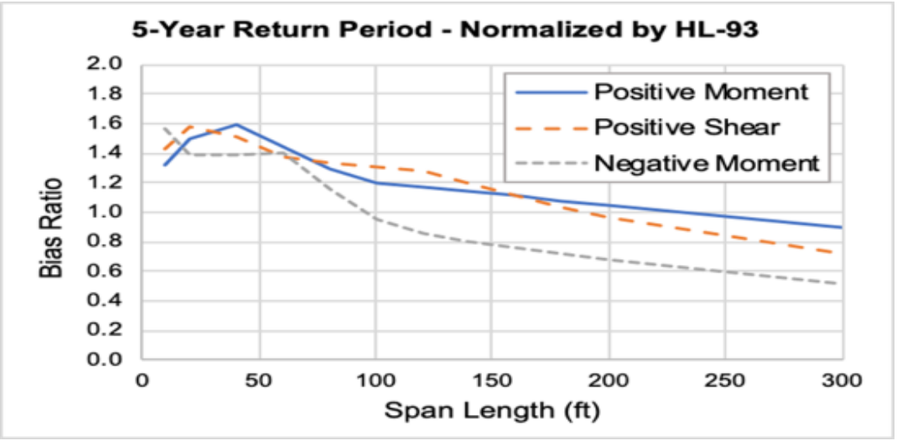
The tensile dead load stress in the fascia girder midspan increased 38% due to the extended overhang. The stresses do not reach the yielding stress, however the site-specific truck traffic is needed.

Weigh-in-Motion (WIM) and Structural Health Monitoring (SHM) Systems

WIM System was installed to monitor the traffic. It was found that 8.5% trucks was OW and 13% trucks violated FBF. SHM was installed for diagnostic load tests and long-term monitoring.







Return Period	Site-specific Bias Ratio	National Average
1-Year (for Service II)	1.50 (Mom.)	1.35
5-Year	1.59 (Mom.)	1.41
	1.59 (Shear)	1.58
75-Year	1.73 (Mom,)	1.46
	1.72 (Shear)	1.63

RFs	Inventory (HL-93)	Operating (HL-93)
Flexure	0.91	1.23
Shear	1.43	1.95
Service	0.87	1.12

Conclusions

- Large overhang causes overstress in the fascia girder.
- 8.5% are overweight trucks and 13% do not follow FBE B.
- The exceedance of 1.3*HL93 moment effect is 5 times higher than the national average.
- Bending moment of 1.24*HL93 causes yielding in the fascia girder. It happened 11 times within 1 year.

Recommendations

- Add steel cover plate in the bottom flange of the fascia girder.
- Add new girder or add new supplemental support
- Replace the existing parapet by a light-weight parapet.

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