



TPF Excellence Awards

Member-level Redundancy in Built-up Steel Members TPF-5(253)
Indiana Department of Transportation (DOT)

2024
Recipient



TPF-5(253) ushered in a new family of structural steel members that take advantage of modern fabrication methods to cost effectively improve reliability and bridge performance. Now, engineers have an accepted design approach to facilitate use of these members, thereby reducing in-service inspection costs and traffic disruptions.

—Ronnie Medlock, PE
High Steel Structures LLC

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Figure 1. Full-scale testing of a mechanically fastened built-up steel member.

For more than 45 years, the Federal Highway Administration's (FHWA) Transportation Pooled Fund (TPF) Program has enabled State DOTs and other public and private entities to collaboratively conduct cutting-edge transportation research. Through the TPF Program, participants can pool funds and expertise to develop innovative solutions at a lower cost while extending the reach and impact of their research.

FHWA has partnered with the American Association of State Highway and Transportation Officials (AASHTO) to administer

the biennial TPF Excellence Awards to recognize outstanding TPF studies that have made significant impacts toward advancing national research efforts in the areas of safety, economic growth, equity, and/or transformative climate solutions. To highlight the importance of meaningful collaboration and partnership in transportation research, the TPF Excellence Awards will recognize two exemplary TPF studies every 2 years.

FHWA and AASHTO are proud to announce that the Indiana DOT's Member-level Redundancy in

Built-up Steel Members TPF study is one of the winners of the inaugural 2024 TPF Excellence Awards.⁽¹⁾ This study, selected from a competitive field of 11 applicants, advanced research that addressed the analysis, design, evaluation, and safety inspection of internal redundant built-up steel bridge members (figure 1). As a result of extensive collaboration and research, the study team created two new AASHTO guide specifications.^(2,3) Transportation agencies around the country already use the guides to evaluate existing steel bridges and inform new designs.



Project Description

The Member-level Redundancy in Built-up Steel Members TPF study helped address the analysis, design, evaluation, and safety inspection of internally redundant built-up steel bridge members.⁽¹⁾ Typically, built-up members will not fail if one of the components fails (whether through fatigue or fracture); however, before this study, very little experimental data existed quantifying the remaining fatigue life and strength of a member in which one of the components has failed. The project was primarily based on testing full-scale specimens to gain a deeper understanding of the energy release, load redistribution, and subsequent fatigue resistance of damaged sections and ultimately develop code-ready assessment methodologies.

Partnership

This TPF project required extensive public-private sector collaboration, including participating agencies, AASHTO committees, the U.S. Army Corps of Engineers, and the steel industry. The steel industry provided specimens and fixtures for testing at reduced or no cost. Industry support was also essential to conduct the project’s large number of full-scale tests needed to fully develop improved specifications. This collaboration resulted in two new AASHTO guide

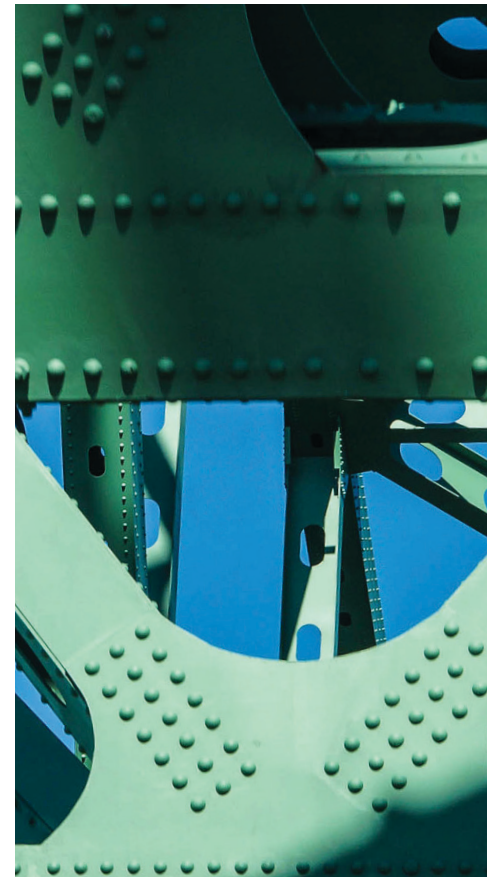
The TPF-5(253) research work, which resulted in the new *AASHTO Guide Specification for Internal Redundancy of Mechanically Fastened Built-up Steel Members*, has been one of the more significant contributions to the steel bridge industry in recent history. This work and codified publication, recognized by FHWA, filled a major industry gap, and now gives bridge engineers and owners the ability to recognize internal redundancy, exploit their advantages in strength and resistance to actual failure, and provide a more reasonable hands-on in-service inspection interval for these types of members, which improves the safety of our bridge inspectors.

—Brandon Chavel
Technical Director, Steel Bridges
Michael Baker International

specifications: *Guide Specifications for Internal Redundancy of Mechanically-Fastened Built-Up Steel Members* and *Guide Specifications for Analysis and Identification of Fracture Critical Members and System Redundant Members*.^(2,3)

Impact on the Transportation Industry

This TPF project supported the U.S. Department of Transportation’s strategic goal of advancing safety by developing the first integrated fracture control plan and increasing knowledge of the reliability and safety of mechanically fastened steel bridges.⁽⁴⁾ The project also paved the way for incorporating and integrating risk-based inspection strategies into existing AASHTO specifications. The project has allowed designers



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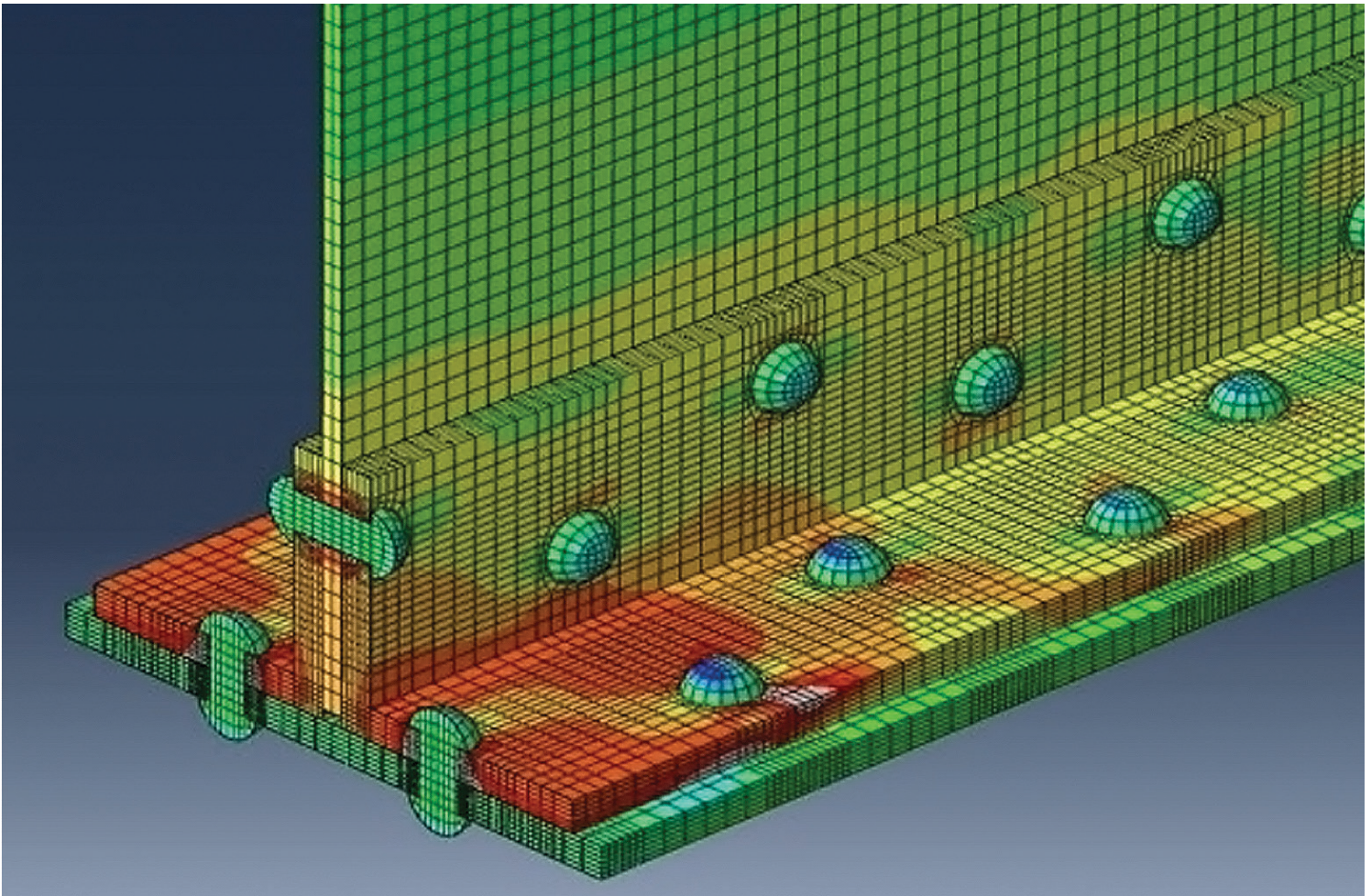


Figure 2. Finite element software modeling a mechanically fastened built-up steel member.

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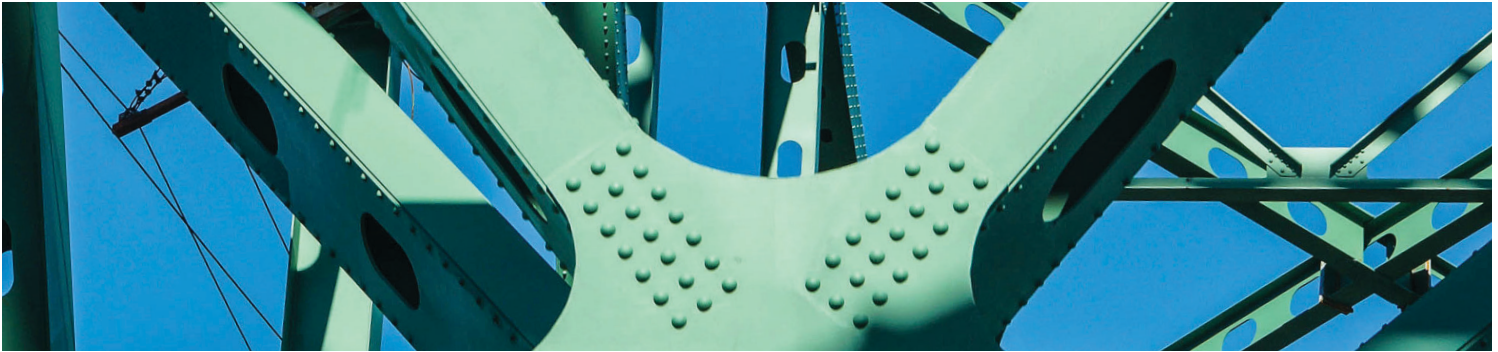
to use economical and innovative designs that have a high level of internal redundancy and reliability (figure 2). Finally, transportation partners have benefited from this study’s activities that encourage the transition from calendar-based bridge inspection strategies to more efficient risk-based approaches. This pooled fund study has strengthened the bridge and steel industries and serves as a success story for similar initiatives across the Nation.

Give Innovation the Green Light

The TPF Program provides the foundation for collaboration and innovation. The Member-level Redundancy in Built-up Steel Members TPF study exemplifies partners coming together to address a common problem: bridge infrastructure safety. The TPF Program includes a broad range of transportation research areas, such as pavements, bridges, design, safety, administration, environment,

security, and maintenance. If you want to get involved with innovative research projects advancing transportation, consider joining one of the many open TPF Program studies.⁽⁵⁾ If you have a novel research idea, consider starting a TPF study today! Your participation and collaboration fuel the TPF Program. Together, agencies can lead the Nation by creating transportation solutions for tomorrow!

Learn more at the TPF Program website, www.pooledfund.org.⁽⁶⁾



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Make an Impact Through a TPF Study!

The TPF Program is a great resource to combine limited funds to address important transportation issues. Learn more about initiating a TPF study and browse the list of open solicitations on the TPF website at <https://www.pooledfund.org/>.

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