TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Date: June 30, 2014

Lead Agency (FHWA or State DOT): Indiana DOT

INSTRUCTIONS:
Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* ***TPF 5-253***	**Transportation Pooled Fund Program - Report Period:** ☐ Quarter 1 (January 1 – March 31) X Quarter 2 (April 1 – June 30) ☐ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 1 – December 31)

Project Title: **Evaluation of Member Level Redundancy in Built-up Steel Members**		
Name of Project Manager(s): **Tommy E. Nantung**	**Phone Number:** **(765) 463-1521 ext. 248**	**E-Mail** tnantung@indot.in.gov
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:** 9/1/2011
Original Project End Date: 8/31/2014	**Current Project End Date:** 8/31/2014	**Number of Extensions:** None

Project schedule status:

☐ On schedule X On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$600,000	**$361,763**	**63%**

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$50,795	**8.4%**	**94.4%**

Project description:

The objective of this research project is to quantify the redundancy possessed by built-up members. For example, a riveted built-up member will not typically "fail" if one of the components fractures. However, there is very little experimental data which is available to quantify the remaining fatigue life or strength of a member in which one of the components has failed. Furthermore, if built-up members are located in bridges classified as fracture critical, when significant member redundancy can be shown the bridge may not need to be classified as FC. However, doing so would release these members from the more rigorous arms-length inspection currently required. As a result, should a component fail, it may go undetected for an extended interval. Thus, a portion of the project is devoted to setting rational inspection intervals for these members. Lastly, the advantages of using built-up members fabricated with HPS components fastened using HS bolts in new construction will also be explored.

Progress this quarter (includes meetings, work plan status, contract status, significant progress, etc.):

- After attempted fracture of bottom cover plate of Specimen 36-2 and subsequent fatigue test (with run-out value of 20,000,000 cycles at a stress range of 6.5ksi in the 'failed' condition, the upper cover plate was partially dismantled, notched, and then fractured (see Figure 1). At this stage of the test both cover plates were completely failed, and the resulting load to the girder was near the remaining net section yield stress. This fracture of the upper cover plate did not propagate into the flange angles or the web.
- In-house fabrication of new 36 inch deep girder specimen.
- In-house fabrication of new 30 inch deep girder specimen (see Figure 2).
- In-house fabrication of new flange angles, and cover plates for 3 new specimens.

Continued fatigue cycles on specimen 46-4 at stress range of 6.5ksi in the 'failed' state (with bottom cover plate fractured). Specimen reached runout value of 20,000,000 cycles with no cracks found in any other components (both flange angles, and web plate). See

- Figure 4.
- Conceptual design of load frame to test axial built-up members (such as truss members). See Figure 5.
- Continued work on FE analysis. FE models using built-up riveted plates have been created and are being compared with experimental data.

Anticipated work next quarter:

- Continue reviewing relevant literature.
- Fabrication of additional cover plates using thicker material (1", 1-1/2") to produce larger energy release at fracture event.
- Material testing on recently received flange angle and cover plate material.
- Instrumentation of remaining specimens.
- Design of axial load frame.
- Repair of MTS actuator (failed seals).
- Continue FE analysis.

Significant results:

During the past quarter, the major steps forward included:

1. Two additional specimens have been tested.
2. Specimen fabrication.
3. Axial load frame design.
4. Continue FE analysis.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, with recommended solutions to those problems).

Potential Implementation:

None at this time. Too early in the research.

Figure 1: Specimen 36-2 with wedge driven into fractured upper cover plate

Figure 2: Specimen 30-1 fabrication – track torch cutting web plate to size

Figure 3: Specimen 36-3 fabriction - riveting cover plates to flange angles

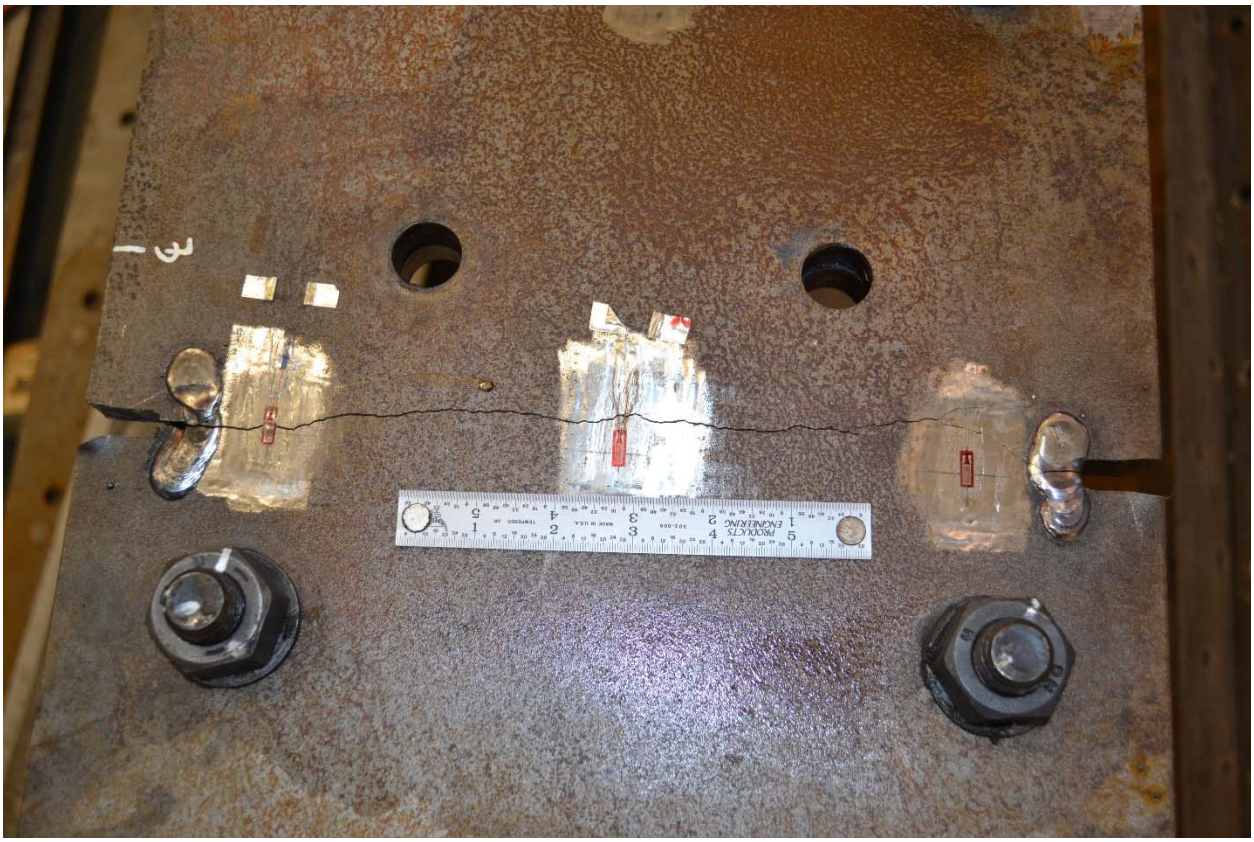

Figure 4: Fractured cover plate of specimen 46-4

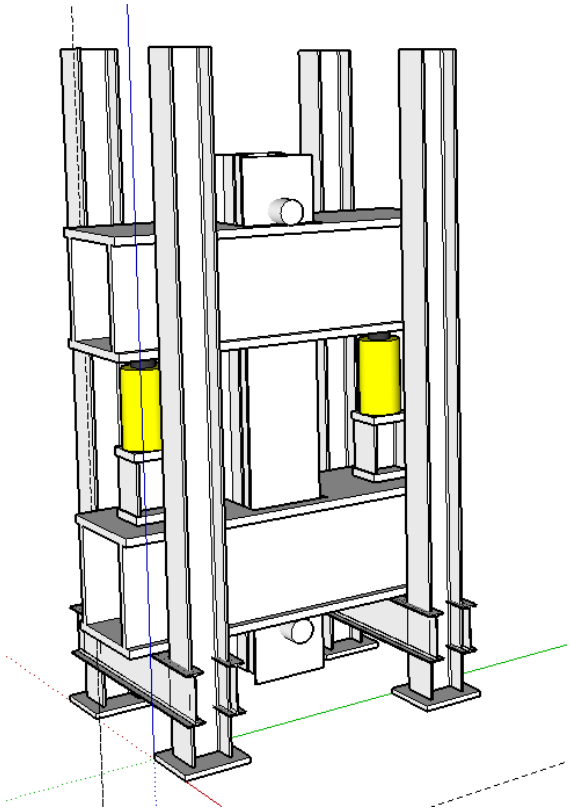

Figure 5: Axial load frame concept design