

## TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Date: July 18 2012

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.*

<b>Transportation Pooled Fund Program Project #</b> <i>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i>  <u><b>TPF 5(253)</b></u>	<b>Transportation Pooled Fund Program - Report Period:</b> <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input checked="" type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31)	
<b>Project Title:</b> <b>Evaluation of Member Level Redundancy in Built-up Steel Members</b>		
<b>Name of Project Manager(s):</b> Tommy E. Nantung	<b>Phone Number:</b> 765-463-1521 ext. 248	<b>E-Mail:</b> tnantung@indot.in.gov
<b>Lead Agency Project ID:</b>	<b>Other Project ID (i.e., contract #):</b>	<b>Project Start Date:</b> 9/1/2011
<b>Original Project End Date:</b> 8/31/2014	<b>Current Project End Date:</b> 8/31/2014	<b>Number of Extensions:</b> None

Project schedule status:

On schedule     
  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
<b>\$600,000</b>	<b>\$40,624</b>	<b>20%</b>

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
<b>\$17,840 (3%)</b>	<b>3.8%</b>	<b>33.3%</b>

**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.):**

- The literature review continues.
- Test setup has been designed. Specimen dimensions including load frame, and actuator placement were investigated.
- Fixtures for loading have been designed and are currently in fabrication.
- Out-of-plane bracing for both the load frame and test specimens has been designed. Drawings have been sent to several fabricators to obtain quotes.
- Programming for the synchronization of two hydraulic actuators has been completed. The two actuators will be used simultaneously to produce maximum stresses over a constant moment region in both the fatigue and fracture testing.
- Calculations and testing have been performed to size all required hydraulic equipment (valves, manifolds, and hose) to handle the elevated demand required for the fracture tests. Multiple quotes have been solicited for the required hydraulics and are being evaluated.
- The Research Team has been in discussions with various owners to secure riveted built-up members from existing bridges to be used in the large-scale testing program. Built-up riveted floor beams from a bascule bridge in Alabama have been promised. The bridge is currently in demolition and the members are expected to arrive at the Bowen Lab in the next 3 weeks.
- Initial quotes for fabricated built-up members using HS bolts for new construction have been obtained. Plate material for the built-up members has been recently donated by Arcelor Mittal.
- Preliminary FE work has begun. Basic fracture mechanics models (i.e., a plate with a center crack or plate with a hole crack) are being created and validated with known solutions.

**Anticipated work next quarter:**

- Continue to refine the testing plan.
- Take delivery of the large-scale testing fixtures.
- Assemble test fixtures, bracing, and actuators.
- Take delivery of retired bridge members.
- Preliminary fatigue and fracture testing with retired bridge members for proof-of-concept.
- Place order for all required bracing.
- Place order for all required hydraulic equipment.
- Continue to work with DOT's to obtain specific existing riveted built-up members.
- Once reliable results are obtained from the preliminary FE studies, more complex models will be created to investigate cracks in built-up members.

**Significant results:**

During the past quarter, the major steps forward included:

1. Programming of the actuator control program to synchronize two actuators.
2. Sizing of all required hydraulic equipment.
3. Design of the fixture and specimen bracing.
4. Initial FE work has commenced.

**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, along with recommended solutions to those problems).**

None this quarter

**Potential Implementation:**

None at this time. Too early in the research.