



RTI Semi-Annual Progress Report

Fiscal Year 2008

Date of This Report: March 1, 2008 Project Number: TPF-5(116) / 9-1526 RMC: 5

Period Covered by This Report: September 1, 2007 – February 29, 2008

Project Title: Investigation of the Fatigue Life of Steel Base Plate to Pole Connections for Traffic Structures

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1. Requested Changes for Possible Project Modification

Project Personnel: No changes

Work Plan: The discussion from our previous progress report is shown below. Under the current work plan we will have no funds and time to complete the analytical work and the test additional specimens of the high mast poles.

We are behind in the testing and analysis phases of the project due to the time and effort taken in developing the design of the test specimens for the second round of testing and their fabrication. This delay was noted in our last semi-annual report. We have been without test specimens since the end of 2006. We spent the year designing the new specimens, dissecting the failed specimens and documenting the test results. It is expected that the next set of specimens will arrive in August. We hope to start testing as soon as the specimens arrive. We are currently modifying the test setup to accommodate the different bolt patterns incorporated in this second set of test specimens. The testing of the mast arm specimens is expected to take much longer than the previous specimens since they are expected to provide fatigue lives in excess of 2 million cycles over 20 times the life of the standard fillet welded socket connection. We will need an extension to March 2009, to finish with the analysis of the results of this set of specimens and to complete the FEA analysis of the connections.

If a third set of high mast specimens is included the study, the project will need to be extended to the August 2009 in order to have time to design, fabricate, test and analyze the results. These further high mast tests would examine the effect of pole diameter upon the results and refine the connection detail based upon the test results for the second set of specimens.

Deliverables Table: No changes.

Project Termination: As per our previous progress report, we still need an extension to the project. We have made extensive progress in the test of the mast arm specimens. Even with their long fatigue lives, we are about 80% finished with these specimens. The high mast tests are not progressing as fast due to failures in the reaction fixtures. As we noted in our previous progress report:

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Project Budget: As noted in our previous progress report, the project needs to extend into the next fiscal year with corresponding funding to allow the completion of the analysis of the results and the documentation of the results. The estimated budget for the 2008-2009 fiscal year is \$55,000. If an additional set of high mast specimens is tested, the estimated budgets must be increased by the cost of the specimens. Based upon the cost for the high mast specimens on order, the estimated cost for a pair of high mast test specimens is \$8,000. If eight pairs are included in the test program, the specimens cost of \$64,000 must be added to the \$120,000 for a total cost of \$184,000 for the current year, fiscal year 2008. In addition, the funding for the 2008-2009 fiscal year must be increased to \$120,000 in order to cover the additional effort required to complete the fatigue tests and analyze the results

2. Equipment

No new equipment was purchased in excess of \$5,000 during the reporting period.

3. Progress to Date, by Task

- 1) **Literature Review-** We continue to exchange data with the NCHRP project at Lehigh and with Prof. Connor at Purdue.
- 2) **Development of Test Plan-** The test plans for the phases 1 and 2 have been completed. A test plan for future specimens has not been considered and will possibly be a topic at the next project meeting subject to extension of the project and funding increase.
- 3) **Fatigue Testing** – The specimens from the first phase have been tested and master theses documenting the tests have been distributed to the sponsors. The testing of the second phase specimens is well underway. We have also included specimens from 3 additional manufacturers in the study: Pelco, Union Metal, and Ameron. We have tested about 80% of the mast arm specimens and only two sets of high mast pole specimens. The reaction fixtures in the high mast test frames have been failing in fatigue. We retrofitted the fixtures with larger swivel eyes with limited success. We are in the process of modifying the swivel eyes ourselves to improve their fatigue performance. We will machine a radius to the transition between the eye and the connecting thread andpeen the critical region. We expect to finish the mast arm test this spring. The high mast testing will likely extend into the summer. The fatigue performance of the mast arm specimens has been exceptional. The specimens with the Wyoming fatigue detail and a thick base plate have a fatigue life exceeding Category C. The peened specimens from Valmont have also provided very good fatigue behavior. The test specimens from the other suppliers have not provided fatigue performance as good as the Valmont specimens. The cause of the poorer fatigue performance is being investigated. The weld profile will be examined as well as the chemistry of the galvanizing. The testing speed of both test setups has been increased by retuning the closed loop control parameters.

- 4) **Analytical Studies-** No additional progress has been made on the analytical studies during this reporting period.
- 5) **Summary of Results-** An update of the mast arm test results was sent to the sponsors at the end of 2007.

4. Progress on Development of “Product” Deliverables

No products required for this project.

5. Meetings/Conferences

The results of the test mast arm tests was presented at the TRB Annual meeting during the subcommittee meeting of AFF10(1), Traffic Structures on January 15, 2008.

6. Possible Candidates for Formal Presentations at the Upcoming RMC Meeting

The results of the mast arm tests should be complete by the end of the spring and could be included in a RMC meeting if one occurs.

7. Miscellaneous

None

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