Research Project Statement

Fiscal Year: **FY2005**   **Project Statement Date:**   **March 5, 2004**

Project Number: **RMC Number:**   **5**

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

Developed By: Ronnie Medlock

TxDOT Project Personnel	Name	Office	Area Code/ Phone Number	Email	Fax Number
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Project Advisors (PAs) – Optional					

Duration (# of years): 3	**Total Budget:**	$ 400,000
First Year	**FY 2005**	$ 150,000 (est)
Second Year	**FY 2006**	$ 125,000 (est)
Additional FYs	**FY 2007**	$ 125,000 (est)

Project Description: The project is proposed to investigate what improvements can be made to the base plate to pole connections for traffic structures, such as socket welds, to improve their fatigue life. Recent research on the fatigue life of traffic signal mast arm to pole socket welded connections has shown that the fatigue category of this detail is E-prime and sometimes less. The addition of stiffeners did increase the fatigue performance, but not to the level predicted by the AASHTO Specifications. This research has also shown that small changes in various connection details, such as plate thickness, bolt pattern, and stiffener pattern, can improve the fatigue life of the connection. More research is needed to develop a better understanding of the effect of these changes, and to provide a systematic way that this knowledge can be incorporated into the design process and the AASHTO specifications for signal poles, high mast illumination poles, and other traffic structures.

Objectives
- Develop a comprehensive list of connection details that affect the fatigue life of various commonly used connection details.
- Determine which changes to these details could feasibly and most cost effectively be used to increase the fatigue life of base plate to pole connections, with and without stiffeners.
- Determine a quantitative relationship between the changes in the details and their effect on the fatigue life of the connection.
- Develop a fatigue design guide that would show designers how they could quantitatively use the various recommended changes for use in their fatigue designs.
- Develop language to incorporate the above guide into the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Phases
1) Literature review
A review of literature and recent research in the field of fatigue to provide a good idea of what kinds of tests have been performed, which ones are worth expanding on, and what factors affect the fatigue life of the connection.

2) Develop test plan
After a list of fatigue life influencing factors has been assembled, develop a test matrix. The matrix will show which factors or details are going to be tested, the range over which to test, the number of tests required, and any combination of factors or details that should be tested together. The matrices shall then be reviewed by

fabricators and contributing agencies to ensure that all tests are worthwhile and that other factors that may be important or useful will also be considered. This will help to ensure that the results from testing will yield feasible and cost effective solutions.

3) Testing
Since the number of tests required to develop an in depth understanding of the gamut of connection possibilities would be quite large, and the costs and time required for such tests also quite large, Finite Element Models (FEM) may be used. These models will be correlated with actual tests, and they will allow an increase in the number of combinations and changes that can be evaluated with a fixed budget and in a reasonable amount of time.

4) Summarize Results
The results should be summarized in three ways.

1. A final report detailing all of the tests, the test methods, literature review, results, and conclusions.

2. A fatigue design guide which outlines how to quantitatively include improvements in the connection detail in the design process.

3. A list of changes to the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals to recommend to the AASTHO T-12 Committee.

Deliverable Products And Reports:	**The following are minimum products and reports to be submitted:**
	Products
	P1 Recommended details and associated fatigue categories for design.
	P2 Language for inclusion into the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.
	Reports
	R1 Research report comprehensively documenting all work from Phases 1-4, including recommended details.
	PSR Project Summary Report

Implementation:	Implementation of results would ultimately be accomplished through revisions to the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Pre-proposal Meeting:	☐ **Yes** ☒ **No**

Sole Source Justification, if applicable: This will be contracted to the University of Texas, Austin, under Dr. Karl Frank, because this is a continuation of the work very effectively performed by this institution on a previous projects and because Dr. Frank is one of a small handful of noted academics nationwide who is accomplished in this field.

Additional Information:	This project is proposed as a Pooled Fund Study, with Texas as the lead state. Activation date of project will depend on receipt of financial commitments from other states which may participate in the project.

Proposal Submission:	• Proposals are required to be submitted in PDF format, 1 PDF file per proposal. Please name this file with the project number and university acronym.
	• The "Background and Significance" portion of the proposal should be limited to 10 pages.
	• All proposals from researchers should be sent directly to your university's Research Liaison for submission to RTI. The Research Liaison is TxDOT's official contact with the university.

Deadlines (for RTI use only)**:**