A PROPOSAL
FOR EXTENDING THE
FIELD TESTING AND LONG-TERM MONITORING OF
SELECTED HIGH-MAST LIGHTING TOWERS

For

18 MONTHS

Prepared by:
Robert J. Connor (PI)
Purdue University S-BRITE Center
1040 S. River Road
West Lafayette, IN 47907

Wyoming DOT Champion:
Paul Cortez, P.E.
Asst State Bridge Engineer, Operations
Wyoming Department of Transportation
5300 Bishop Blvd, Cheyenne, WY 82009

December 2019

PROBLEM STATEMENT

In 2013, WYDOT Projects B139025 and B133026 installed a combined 21 high-mast light towers (HMLT) in District 1 and District 3. The HMLTs were fabricated by Valmont Industries according to WYDOT Standard Plan and were installed by Modern Electric of Casper, WY. In May 2016, after only three years of service, inspectors discovered fatigue cracks on two HMLTs located at the Wagonhound Rest Area of of I-80 near Exit 267. One of the HMLTs was missing a luminaire. Further inspection revealed that one more HMLT (also located at the Wagonhound Rest Area) had significant fatigue damage too. Weather data collected by a nearby weather station was reviewed by WYDOT officials showing high winds, rain and freezing temperatures. The cause of the fatigue cracking cannot be determined at this time.

Monitoring has been on-going at the selected locations for several months. Based on review of the data, one, and possibly two significant events have been observed at the Dwyer Junction site. The first occurred in April 2018, with very high stress ranges being observed. The ice sensor indicated the presence of ice during the event. The second event, in October of 2019 at the same location also occurred during a period when the sensors indicated icing on the pole. The measured stress ranges were not as high as the April 2018 event, but were still significant. To increase the likelihood of recording additional an events to better characterize the conditions under which such events are produced, it is proposed to extend the monitoring for an additional 18 months beyond the end date of March 2020. This proposal summarizes this work.

OBJECTIVE OF THIS EXTENSION

Continue to monitor four high-mast light towers (HMLT) at locations already instrumented in order to determine the cause of severe fatigue damage in the pole-to-base plate weld observed in the three HMLTs at the Wagonhound Rest Area. The outcome of this research is intended to determine what accelerated the fatigue failure of the HMLTs enabling WYDOT to take corrective action on existing and future HMLT installations in order to ensure the public safety. It is noted this extension includes a full maintenance trip since all of the systems have been in place for several years. Batteries, strain gages, and the overall data questions systems need maintenance. Known issue include an inoperative cellular modem and selected strain gage failures. Funds have been included for a new modem, strain gages and miscellaneous repair items.

RESEARCH TEAM

Dr. Robert J. Connor will serve as the Principal Investigator throughout the duration of the project. Jason B. Lloyd will be the Co-Investigator. Dr. Kinsey Skillen, Research engineering will assist with the maintenance trip to replace damaged strain gages and other maintenance items on site.

PROJECT BUDGET

The total estimated cost for extending the monitoring for 18 months, including labor costs and travel for an assumed maintenance trip, is $68,553, as summarized in the table below.

Labor & Benefits*		Approx. Percentage of Overall Budget
Professional Salary	$30,002	44%
Hourly Student	$2,516	4%
Subtotal Time (Labor)	**$32,518**	**48%**
Direct Costs		
DAQ Systems (four systems & incl. 1 new modem)	$2,047	3%
Misc. costs (i.e. cell data plan, shipping, misc. consumable materials)	$3,020	4%
Travel costs (i.e. vehicle, lodging, meals)	$6,643	10%
Subtotal Travel & Material	$11,710	17%
University Overhead (Mat. & Labor)	$24,325	35%
Total	$68,553	

*Includes all Purdue University employee benefits.