RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: 4th

Wisconsin Department of Transportation
DT1241 2009

Research, Development and Technology Transfer	
Program: (Choose One) ☐ **Policy Research** ☐ **Pooled Fund** **TPF #** ☒ **Wisconsin Highway Research Program** ☐ **Other**	
Project Title: Monitoring and Load Distribution Study for the Land Bridge	
Administrative Contact/Phone #: Peg Lafky	**WisDOT Project:** 0092-07-09
WisDOT Technical Contact/Phone #: Travis McDaniel	**Other Project ID:**
Project Investigator/Phone # (agency & contact): Dr. Al Ghorbanpoor 414-229-4962 (UW-Milwaukee)	**Approved Starting Date:** 10/1/2006
WisDOT Comments:	**Original End Date:** 10/1/2008 **Current End Date:** 12/31/2009
Sponsor: Wisconsin Department of Transportation	**Number of Extensions:** 1

Schedule Status:

☐ On schedule ☐ Ahead of schedule
☒ On revised schedule ☐ Behind schedule (Please explain below)

Total Project Budget	Expenditures Current Quarter	Total Expenditures	% Funds Expended	% Work Completed
$30,000.00	$1,000.00	$25,500.00	85%	90%

Project Description:

With funding provided through the USDOT's Innovative Bridge Research and Construction Program (IBRC), a study was conducted at the University of Wisconsin-Milwaukee that was entitled, "Fatigue Resistance and Monitoring of HPS Bridge Members" in the Land Bridge. The bridge is located in the Vernon County, Wisconsin and is constructed of a 270-foot long simple span curved double-tub girders made of high-performance steel (HPS) flanges. This project was identified as WISDOT Project ID # 1000-02-02 and it had a performance duration from June 2000 to August 2005. This study was completed in two phases. The Phase I study included a series of laboratory cyclic load tests of full size hybrid steel girders made of high-performance steel flanges and more commonly used weathering steel webs to establish their fatigue resistance and suitability for use in the Land Bridge. The Phase II study consisted of installation of various sensing devices (strain gages, LVDT's, vibration gages, and temperature gages) in the bridge and remote monitoring of the bridge elements responses due to loads from traffic and temperature fluctuations.

As a result of the Phase II study, the investigators were able to obtain results to document the response of the bridge girders during a full year cycle (from April 2004 to March 2005). It was found that thermal load cycles played a dominant role in causing stresses up to 8.0 ksi in the girders. The live stresses caused from the effect of routine traffic were not as severe. Since the documented bridge response at the time was only for a period of one year, it was uncertain that if it had offered a true representation based on the normal service conditions. Since all relevant sensing devices and supporting instrumentation were already installed at the bridge, it was proposed to extend the monitoring period for the Land Bridge for a longer period of time to obtain a more reliable representation of the bridge behavior. Also, the presence of the current instrumentation in the bridge was suitable for expanding the scope of the project to include an effort to better understand and document the distribution of truck wheel loads on the bridge girders based on the specific structural configuration of the Land Bridge.

The primary objectives of the current study are to continue to monitor the Land bridge until July 2010, to continue to document the load history, and to obtain the response of the bridge for a longer period of time. Also, it is intended to study the effects of truck wheel load distributions on the tub girders through field test preformed at the bridge using WisDOT trucks with known axle loads. An analysis of the bridge will be performed using a finite element computer program to correlate with the results of the load tests.

Progress This Quarter: (Includes project committee meetings, work plan status, contract status, significant progress, etc.)

The monitoring of the Land bridge due to traffic and thermal loads was continued during this quarter. Traffic data has been obtained from strain gages and LVDTs as shown in Figures 1 and 2. one site visit was made during this quarter to evaluate the status of the data acquisition system and download available data to a computer for storage and further analysis. Short presentations regarding this project were proposed to the TRB Committee on the Dynamic and Field Testing of Bridges for the January 2010 Annual Meeting of TRB.

The research team has continued the finite element analysis of the bridge structure under traffic load, known truck load from the field testing, and environmental (temperature) load. The FE results for wheel load applications to the bridge deck have been correlated to the field strain measurements to establish load distribution relationships. Good agreement has been reached for the field test and the FE results. The AASHTO values are slightly below the field and the FE results.

Anticipated Work Next Quarter:

The research staff will continue to monitor the Land bridge structure for service and thermal loads and will analyze the recorded data from the service loads as well as the field testing under known truck load. The research staff will continue the finite element analysis of the bridge to verify the load distribution pattern observed during the field testing. Short presentations will be made at the TRB Committee on the Dynamic and Field Testing of Bridges at the January 2010 Annual Meeting of TRB.

Circumstances Affecting Progress and/or Budget:

None.

Gantt Chart:

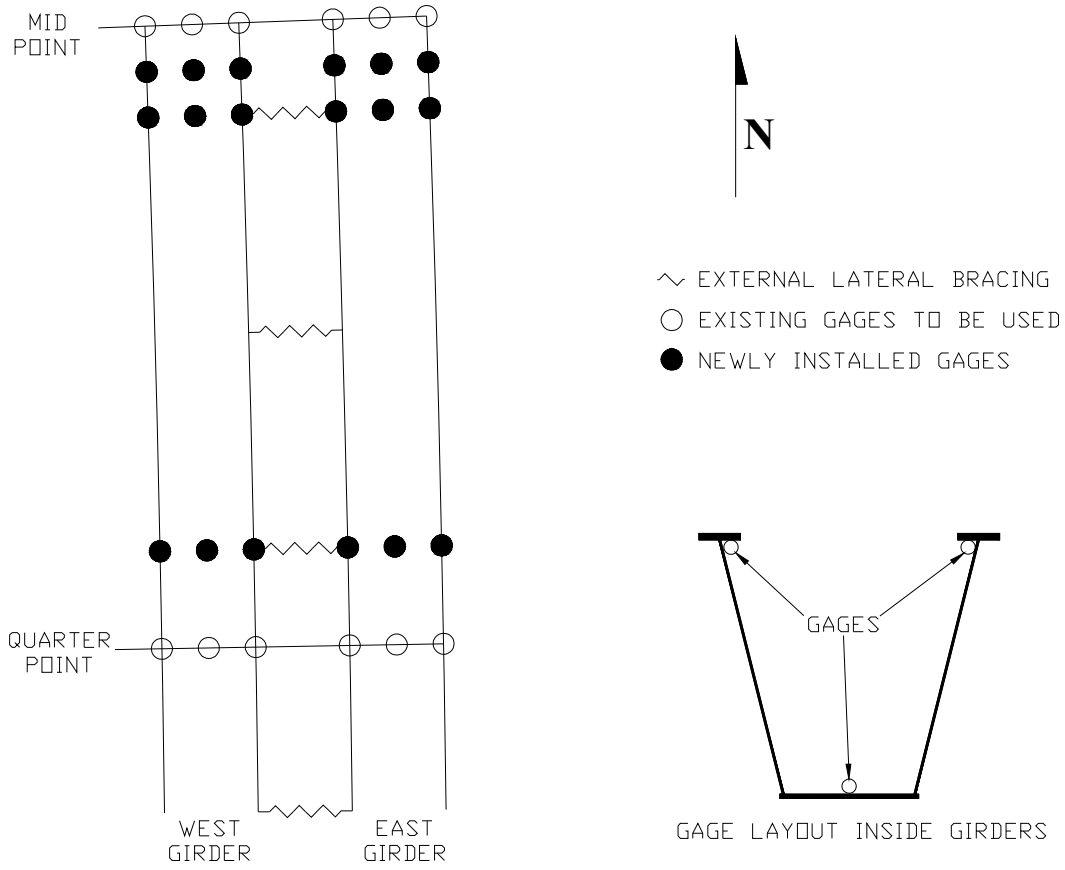


Figure 1: Strain Gage Locations Used for Load Distribution Testing

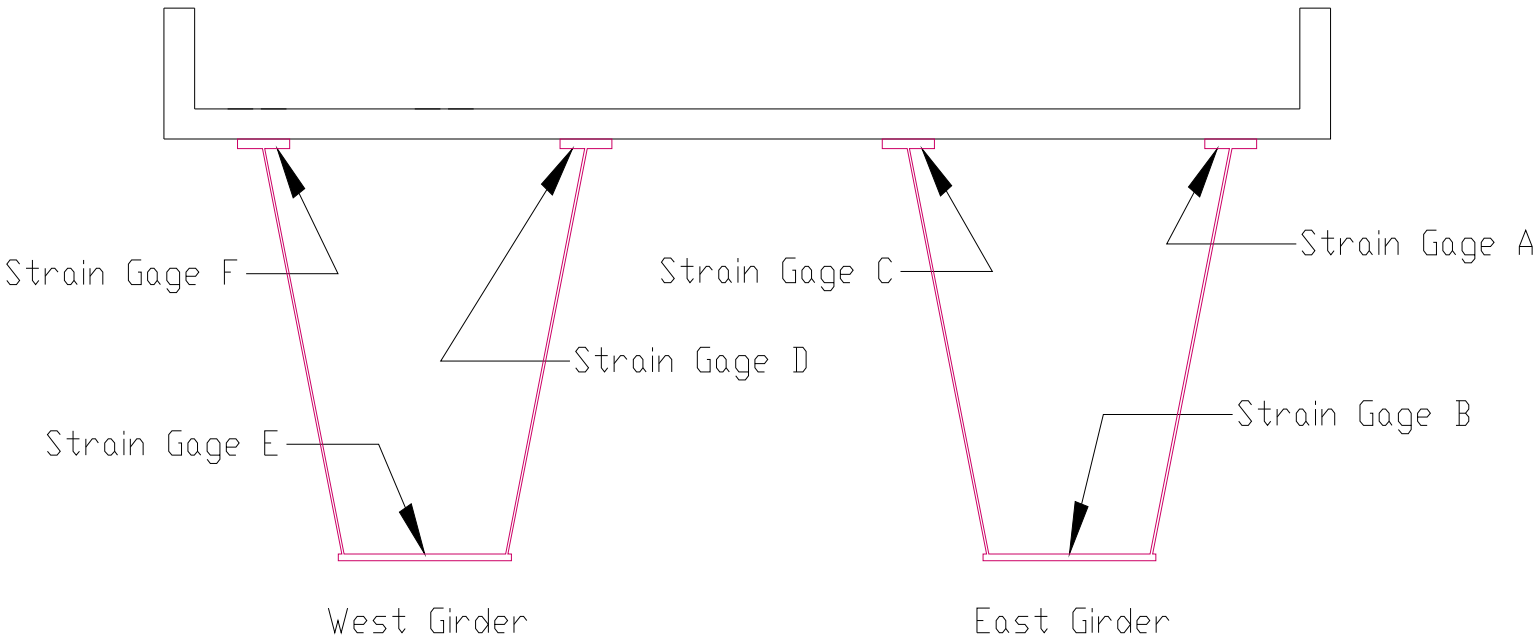
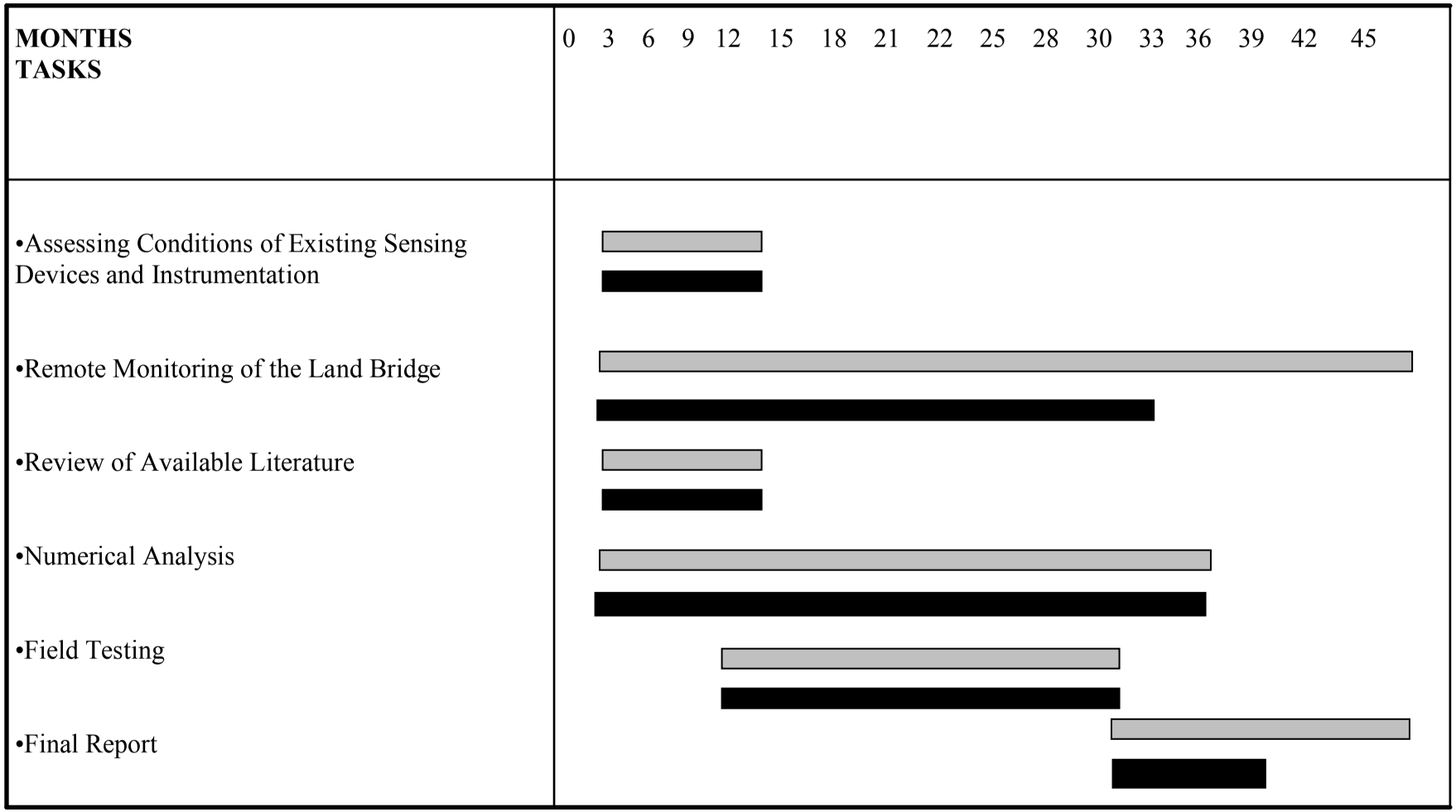


Figure 2: Strain Gage Identification As Used for Load Distribution Testing


MONTHS
TASKS
0 3 6 9 12 15 18 21 22 25 28 30 33 36 39 42 45
•Assessing Conditions of Existing Sensing Devices and Instrumentation
•Remote Monitoring of the Land Bridge
•Review of Available Literature
•Numerical Analysis
•Field Testing
•Final Report