

## **MDT Quarterly Progress Report for January –March 2012**

**Project Title:**           **Determination of Material Properties and Deflection Behaviors for Contemporary Prestressed Beam Design**

**Reporting Period:** January 1, 2012 – March 31, 2012  
Third Quarter of State Fiscal Year 2012

**Submitted By:**       **Jerry Stephens**, PI, Western Transportation Institute, Montana State University

**Michael Berry**, Co-PI, Western Transportation Institute, Montana State University

**Brian Kukay**, Co-PI, Western Transportation Institute, MT Tech

**Submitted to:**       **Craig Abernathy**, Project Manager Research Programs, Montana Department of Transportation

**Date Submitted:**    May 2012

---

### **Background**

The primary goal of this project is to provide guidance specific to Montana design and construction practices that will result in more efficient prestress concrete bridge structures. In this regard, the project is focused on providing improved concrete material properties in conjunction with a better understanding of girder deflection behaviors.

Specific objectives consist of:

- 1) determining through tests and analyses appropriate values for the elastic and non-elastic properties of the typical concrete used in MDT prestress concrete bridge girders; and
- 2) measuring the deflections through time experienced by girders in an actual bridge structure, comparing these deflections to those estimated analytically, and suggesting appropriate modifications in the analysis process to produce better deflection predictions.

These objectives will be accomplished through the six tasks reported on below.

### **Task 0: Project Management**

During this reporting period, Mike Pardy at Cretex West confirmed that Cretex should be producing concrete onsite at its Helena facility in the beginning of August 2102.

Correspondingly, concrete sampling and testing work (Task 2) is now expected to begin in late summer or early fall, rather than late spring of 2012. A revised project schedule reflecting this change is provided in this report. Once Cretex begins concrete production in Helena and work begins in earnest on Task 2, it should be possible to establish a firm schedule for the remaining project tasks. The project contract will need to be amended to reflect this schedule.

### **Task 1: Literature Review**

The purpose of this task is to review the available research on, and the state-of-the-practice relative to determining the concrete material properties and deflection behaviors of prestressed concrete bridge girders. Work on this task includes directly contacting agencies that have been actively pursuing these issues.

During this reporting period work continued on this task. This work includes identifying and speaking with state department of transportation (DOT) bridge personnel, documenting these conversations, and writing up initial literature review results. Twenty-two state DOTs have been successfully contacted thus far, with 18 percent reporting they have conducted research on material properties, 73 percent commenting they have encountered issues with camber, and 23 percent commenting they have had problems with phased construction.

This task will be completed during the next quarter, and a Task Report summarizing all findings will be submitted to MDT (submission expected in late May/early June).

### **Task 2: Material Properties Measurement**

This task consists of laboratory work to establish elastic and non-elastic concrete property estimates that can be used in design. These estimates will be determined by measuring the properties of an appropriate sampling of the specific concrete mixture typically used in MDT prestressed beams. This work will be done using concrete from the Cretex West facility in Helena, MT.

As stated above, material sampling for Task 2 will commence in late summer/early fall of 2012, as Cretex West plans to begin to produce concrete on-site at this time. Material sampling and testing protocols will be prepared and coordinated with Cretex West prior to commencement of this work. It is anticipated that these protocols will be formalized by the end of June, at which time they will be provided to MDT for review and comment. It may be appropriate at this time to have a meeting of the research team, Cretex West, and MDT to finalize these protocols.

### **Task 3: Measure Immediate and Long Term Girder Deflections**

Deflection monitoring will be performed on one of MDT's phased bridge construction projects. Deflection measurements will be collected for a selection of the girders from a single bridge. Measurements will be made immediately after strand release, and then prior to transport, after erection (prior to deck placement), and after deck placement for both Phase 1 and Phase 2 of construction. It is anticipated that this work will be performed in state fiscal year 2013, following identification by MDT of an appropriate project for this purpose. Deflection measurement protocols will be prepared prior to beginning this work.

### **Task 4: Analysis of Results**

The results of the research program will be thoroughly analyzed in this task. Analyses will be conducted as possible and appropriate to provide concrete material properties and measures of their variability, and measured and predicted girder deflections will be compared using relevant codes and potential computer model(s). Work on this task will begin as results are obtained.

### **Task 5: Final Report, 1/2-Day Workshop and Dissemination of Results**

The research team will prepare a final report documenting the methodologies used, data collected, and complete findings of this investigation. The research team will also conduct a 1/2-day workshop at MDT in Helena on this study and the implications of the results on design and construction practices. Although this task cannot be completed until all the preceding tasks are done, the research team will document all aspects of the work performed as it is completed for inclusion in the final report and workshop, as appropriate.

### Budget and Schedule

Expenditures on this project through March 31, 2012 are summarized in Table 1. As mentioned above, start of the concrete sampling and testing effort (Task 2) has been shifted to late summer/early fall of 2012, and revised schedules reflecting this change are presented below.

**Table 1: Summary of Expenditures**

Budget Category	Budgeted Funds	Spent This Period	Total Spent	Total Remaining
Salaries	\$49,180	\$542	\$1,678	\$47,502
Benefits	\$11,464	\$166	\$538	\$10,926
In-State Travel	\$2,666	\$107	\$107	\$2,559
Subcontracts	\$47,132	\$3,091	\$3,091	\$44,041
Contracted Svcs	\$0	\$0	\$600	-\$600
Supplies/Minor Eq/Main	\$0	\$0	\$0	\$0
Direct Costs	\$110,442	\$3,906	\$6,013	\$104,429
Indirect Costs	\$17,662	\$781	\$1,203	\$16,459
Total	\$128,104	\$4,687	\$7,216	\$120,888

**Table 2: Schedule of Tasks**

Task	2011			2012				2013				2014			
	Jul	Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul	Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul	Sep	Oct-Dec	Jan-Mar	Apr-Jun
Project Management	X	X		X	X	X	X		X	X	X	X		X	
Literature Review	X	X		X											
Measure Matl Prop						X	X		X	X	X				
Girder Deflections							X		X	X	X	X			
Analysis of Results						X	X		X	X	X	X		X	
Report/Wkshp												X		X	X

**Table 3: Schedule of Deliverables**

Task	2011			2012				2013				2014			
	Jul	Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul	Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul	Sep	Oct-Dec	Jan-Mar	Apr-Jun
Kickoff Meeting	X														
Technical Memoa					Task 1					Task 2 <sup>b</sup>	Task 3		Task 4		
Quarterly Reporta	X	X		X	X	X	X		X	X	X	X			
Draft Final Report														X	
Final Report															X
Half Day Workshop															X

<sup>a</sup>Technical memorandums and quarterly progress reports will be completed at the end of the month following completion of the appropriate task and/or quarter

<sup>b</sup>Should unforeseen delays in girder casting occur, the research team can provide interim results from the previous three sampling periods to MDT.