

## **MDT Quarterly Progress Report for October – December 2011**

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

**Reporting Period:** October 1, 2011 – December 31, 2011  
Second Quarter of State Fiscal Year 2012

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### **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**

A coordination meeting was held between WTI, Cretex West (Mike Parady), and MDT on December 12 in Helena, MT to review project objectives, tasks, and schedule. One major item discussed at the meeting was the concrete to be used in the material properties investigation. Cretex Concrete Products West (Cretex West) recently built a new prestress concrete facility in Helena, MT. While a local ready-mix concrete company currently supplies the concrete used by Cretex West at this facility, Cretex West is planning to batch and mix their own concrete on site in the near future. Initially, Cretex West expected to batch concrete onsite in the fall of 2011. At this meeting, Cretex West indicated that onsite concrete production would be delayed until Spring 2012. In light of this discussion, a decision was made to delay concrete sampling and testing work until Spring 2012 in order to conduct the material properties evaluation using the specific concrete Cretex West will use on future MDT projects. A revised project schedule

reflecting these changes is provided in this report. Material sampling and beam deflection measurement protocols were also discussed at the meeting.

**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 will include directly contacting agencies that have been actively pursuing these issues. During this reporting period work began on this task. This initial work included identifying and contacting agency contacts, documenting these conversations, and writing up initial literature review results. Work will continue on this task during the next reporting period. The results of this task will be summarized and submitted to MDT upon completion of this task.

**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, this work will commence in Spring 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 effort.

**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, ½-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 ½-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 December 31, 2011 are summarized in Table 1. As mentioned above, start of the concrete sampling and testing effort (Task 2) has been shifted to Spring 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	\$401	\$1,135	\$48,045
Benefits	\$11,464	\$119	\$373	\$11,091
In-State Travel	\$2,666	\$0	\$0	\$2,666
Contracted Svcs	\$47,132	\$0	\$600	\$46,532
Supplies/Minor Eq/Main	\$0	\$0	\$0	\$0
Direct Costs	\$110,442	\$520	\$2,108	\$108,334
Indirect Costs	\$17,662	\$104	\$422	\$17,240
Total	\$128,104	\$624	\$2,529	\$125,575

**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.