

## **MDT Quarterly Progress Report for July – September 2011**

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

**Reporting Period:** July 1, 2011 – September 30, 2011  
First 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

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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**

The project kick-off meeting with the MDT Technical Panel occurred on September 15, 2011 in Helena, MT. 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. Recent communications with Cretex West indicated that onsite concrete production would be delayed until Spring 2012. Pending confirmation of Cretex West's concrete production plans, the decision was made at the project kickoff meeting to delay concrete sampling and testing work until Spring 2012. The technical panel indicated that it was desirable to conduct the material properties evaluation using the specific concrete Cretex

West will use on future MDT projects. It was subsequently confirmed by Cretex West that they do intend to begin producing their own concrete at the Helena facility this spring, so the material properties investigation will begin after that time. A revised project schedule will be generated during the next reporting period. The technical panel also indicated that in light of the nature of the project, Cretex West, MDT and the WTI researchers should meet this fall to review the project objectives and tasks. This meeting will be scheduled by WTI during the next reporting period.

#### **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 identifying specific agency contacts and the information to be solicited from them. Work will continue on this task during the next reporting period.

#### **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 the spring of 2012, as Cretex West plans to begin to produce concrete on-site at this time.

#### **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.

#### **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 September 30, 2011 are summarized in Table 1. The original task and deliverable schedules are shown in Tables 2 and 3, respectively. As mentioned above, start of the concrete sampling and testing effort (Task 2) has been shifted to Spring 2012, and a revised schedule reflecting this change will be generated during the next reporting period. The project is on schedule.

**Table 1: Summary of Expenditures**

<b>Budget Category</b>	<b>Budgeted Funds</b>	<b>Spent This Period</b>	<b>Total Spent</b>	<b>Total Remaining</b>
Salaries	\$49,180	\$734	\$734	\$48,446
Benefits	\$11,464	\$254	\$254	\$11,210
In-State Travel	\$2,666	\$0	\$0	\$2,666
Contracted Svcs	\$47,132	\$600	\$600	\$46,532
Supplies/Minor Eq/Main	\$0			
Direct Costs	\$110,442	\$1,587	\$1,587	\$108,855
Indirect Costs	\$17,662	\$317	\$317	\$17,345
<b>Total</b>	<b>\$128,104</b>	<b>\$1,905</b>	<b>\$1,905</b>	<b>\$126,199</b>

**Table 2: Schedule of Tasks**

<b>Task</b>	<b>2011</b>		<b>2012</b>				<b>2013</b>				<b>2014</b>
	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar
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	X	X			
Girder Deflections					X	X	X	X	X		
Analysis of Results			X	X	X	X	X	X	X	X	
Report/Wkshp										X	X

**Table 3: Schedule of Deliverables**

<b>Deliverable</b>	<b>2011</b>		<b>2012</b>				<b>2013</b>				<b>2014</b>
	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar
Kickoff Meeting	X										
Technical Memo <sup>a</sup>			Task 1			Task 2 <sup>b</sup>		Task 3		Task 4	
Quarterly Report <sup>a</sup>	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.