

MDT Quarterly Progress Report for April – June 2012

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

Reporting Period: April 1, 2012 – June 30, 2012
Fourth 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 prestressed 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

Mike Pardy at Cretex West was contacted toward the end of this reporting period about starting the concrete sampling and testing work for this project (Task 2). Mike responded that due to projected slow demand for bridge girders using the new cross-sections over the next year, the decision had been made to delay installing onsite concrete batch facilities at the Helena plant for at least a year. In light of this development, it is suggested that the MDT technical panel and project stakeholders meet to decide how to proceed. Sampling and testing work has been purposefully delayed so that this work could be done once Cretex began concrete production onsite. One possibility would be to proceed with this work using the concrete being supplied offsite by a local batch plant. This approach could be viable if the mixture designs, materials and batching processes being used at the offsite batch plant are similar to those Cretex intends to use onsite. In any event, following resolution of this issue, it may be time to amend the project contract to reflect changes in project tasks and scheduling that have resulted from the delays in initiating onsite concrete production.

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. An internal review of the work completed to-date and its documentation identified some matters that require further attention, delaying completion of this task and submission of the associated task report. These matters will be addressed 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, Cretex West does not expect to produce concrete onsite for at least another year. A decision is necessary on whether to proceed at this time and perform this work using concrete produced and delivered to the site by a local batch plant. Depending on this decision, concrete material sampling and testing protocols will be finalized in coordination with Cretex West, at which time they will be provided to MDT for review and comment.

The springs required for the creep test frames were ordered and received. Construction of these frames will be completed in the next reporting period.

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.

As part of the discussion of moving ahead in Task 2 and sampling and testing the concrete produced offsite, further discussion of specific bridge projects (and their timelines) that could be used for the this deflection monitoring work be useful for planning and scheduling purposes.

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. 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 June 30, 2012 are summarized in Table 1. If the decision is made to proceed and sample and test concrete from the local batch plant, this work is expected to start in the fall. The schedule below in Table 2 reflects this start date. This schedule also reflects the delay in completing the literature review as some remaining issues with it are addressed.

Table 1: Summary of Expenditures

Budget Category	Budgeted Funds	Spent This Period	Total Spent	Total Remaining
Salaries	\$49,180	\$869	\$2,546	\$46,634
Benefits	\$11,464	\$0	\$538	\$10,926
In-State Travel	\$2,666	\$0	\$107	\$2,559
Subcontracts	\$47,132	\$1,462	\$4,553	\$42,579
Contracted Svcs	\$0	\$0	\$600	-\$600
Supplies/Minor Eq/Main	\$0	\$0	\$0	\$0
Direct Costs	\$110,442	\$2,331	\$8,344	\$102,098
Indirect Costs	\$17,662	\$466	\$1,669	\$15,993
Total	\$128,104	\$2,797	\$10,013	\$118,091

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	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 Memo				Task 1	Task 1			Task 2 ^a		Task 3	Task 4		
Quarterly Report	X	X	X	X	X	X	X	X	X	X			
Draft Final Report											X		
Final Report												X	
Half Day Workshop												X	

^aTechnical memorandums and quarterly progress reports will be completed at the end of the month following completion of the appropriate task and/or quarter

^bShould unforeseen delays in girder casting occur, the research team can provide interim results from the previous three sampling periods to MDT.