

September 2008 Project Update

PennDOT Project #070202

Project Title: Inspection Methods & Techniques to Determine Non Visible Corrosion of Prestressing Strands in Concrete Bridge Components (LU ID 541671)

Contract #: 355I01

Lehigh University / ATLSS Research Center

Clay Naito, PI, Richard Sause, Co-PI, Stephen Pessiki, Co-PI

Overview

This interim report provides an update on the progress of PennDOT Project: Inspection Methods & Techniques to Determine Non Visible Corrosion of Pre Stressing Strands in Concrete Bridge Components. The project initiated in December 20, 2007 and is scheduled to be completed on December 19, 2009. This report covers the time period from the August 1, 2008 to September 15, 2008.

Organizational Modifications

The project has continued to operate with the original upper level staff. The project is being conducted by Clay Naito (PI), Stephen Pessiki (co-PI), Richard Sause (co-PI), and Ian Hodgson (co-PI). As noted in the budget the project also makes use of an assistant research engineer. Trevor Williamson was initially hired for this position but he has since decided to leave Lehigh University. As an interim support we plan to hire Brandon Sullivan to assist with the project. He will be on a part-time status through December 31, 2008. The supporting paperwork will be forwarded to Tony Laratonda at PennDOT for approval.

Project Tasks

In the past month work has progressed in three areas. These include the literature survey, forensic evaluation of the beams, and initiation of NDE methods. A summary of the progress on each facet is discussed in detail.

Literature Survey

The literature survey was submitted to PennDOT for review. The reviews were received by Lehigh University and the document was completed. The literature survey provides background on methods of inspection and causes of corrosion of steel in concrete members. A brief review of NDE techniques is included; however, a more in-depth background will be developed in the coming months. The final literature review reference is listed below. The document has been submitted to PennDOT along with the September Update (LiteratureReview-final.pdf).

Naito, C., Warncke, J., "Inspection Methods & Techniques to Determine Non Visible Corrosion of Prestressing Strands in Concrete Bridge Components Task 1 – Literature Review," ATLSS Report No. 08-06, Sept. 2008, pp.71.

Forensic Evaluation

As noted in the previous update three bridges were identified for further study. Seven beams from these bridges were chosen. A summary of the beams is presented once again in Table 1.

Table 1:Beam Samples					
Bridge	Beam	Span	Section Length	Cross Section	Condition Description
Clearfield	3	1	15ft	42x36 Box	Longitudinal cracking with rust staining.
Clearfield	3	2	15ft	42x36 Box	Large longitudinal crack with spalling visible.
Lakeview	7	1	15ft	48x27 Box	Heavily damaged section with spalls and cracks. The section was full of water. Examine potential for delamination
Lakeview	16	2	12ft	48x42 Box	No cracking or corrosion visible on section however other areas of beam have significant corrosion.
Lakeview	19	3	12ft	48x42 Box	Longitudinal crack with heavier corrosion. Hairline and larger distributed cracks Use for visual assessment.
Main St	2	3	15ft	48x42 Box	Heavy corrosion on bottom flange without longitudinal cracking. Large patches. Determine if corrosion adjacent to patch exists using NDE methods.
Main St	3	3	15ft	48x42 Box	Longitudinal crack with heavy splitting. Examine damage formation and NDE study.

All beams have been sectioned and delivered to Lehigh University. The beams are being staged at the rear of the research facility. They are supported on concrete dunnage blocks at approximately 4ft off of the ground as shown in Figure 1. They are supported at their ends in the same orientation that they would be found in service. This will allow for a realistic inspection during the NDE portion of the study. The beams are ready for initiation of the NDE phase of the research.

To assist potential NDE companies with their assessment of the beams a document is being developed which describes the layout and conditions of the beams. A draft of the document has been submitted for discussion (NDE.pdf).



Figure 1: Beam layout at ATLSS Center

The beam sections have been thoroughly examined. The strand locations have been measured at the section cut to determine the as-built cover provided. The section geometry and the crack pattern on the bottom flange have been documented to provide a record of the physical condition of each beam. The results of this portion of the study are being summarized in a forensic evaluation report. A rough draft of this document has been provided along with the September update for discussion (ForensicEvaluation-EarlyDraft.pdf).

NDE Methods

The first type of non-destructive evaluation consists of half-cell potential study of the bottom flanges. The basis for this testing method is ASTM C876. This has been conducted on one of the beam sections acquired. The testing will continue on the remaining beams in the next month. The goal of this portion of the study is to find if there is a reasonable means to acquire repeatable potential readings.

Other NDE methods are being investigated by Stephen Pessiki. This work is underway.

Upcoming Tasks

Alternate methods of NDE investigation are being identified.

The half cell potential study will be completed.

Recommendations for the destructive phase of the forensic investigation will be developed.