January 2009 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, Stephen Pessiki, Richard Sause, and Ian Hodgson

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 December 16, 2008 to January 20, 2009.

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). Brandon Sullivan continues to work as an engineering assistant.

Project Tasks

In the past month work has progressed in three areas. The PennDOT visual inspection report was completed and submitted to Lehigh. Non-destructive inspections of the beams were conducted by a total of four firms. The half-cell inspections were completed and the destructive forensic plans were initiated.

PennDOT Visual Inspection

The visual inspection report was completed and submitted to Lehigh University. The beams were situated in the North Bay of the ATLSS Center in an inverted position. As a consequence of the orientation and the location of the beams only the beam soffit was examined. As noted in the report, loss of camber, differential deflection between the adjacent beams, and the condition of the transverse tie rods were not examined. The beams were rated in accordance with PennDOT strike-off letter issued in September of 2007. The results of the rating are summarized in Table 1. Three of the beams were rated a 2 or critical condition. The inspection report is included as an appendix to this update. It will also be included in the final project report.

The final in-service rating of the superstructure is summarized in the table for comparison. Inspections on these bridges prior to the 2007 recommendation were based on the overall condition of the bridge beams and not on an individual beam. As a consequence the Lakeview Drive and Main Street Bridges had a less severe rating during their final in-service inspection. Clearfield Creek was inspected six months after the Lakeview Drive collapse. Longitudinal cracking of a majority of the Clearfield bridge beams and the separation of the beams due to the corrosion of the tie rods resulted in the lower in-service rating.

Table 1:PennDOT Beam Rating

Bridge	Beam	Span	Section Length	Cross Section	Lehigh PennDOT Rating	In-Service Inspection Date	In-Service Rating
Clearfield	3	1	15ft	42x36	5	06/13/06	2
Clearfield	4	2	15ft	42x36	4	06/13/06	2
Lakeview	7	1	15ft	48x27	2	03/25/04	4
Lakeview	16	2	12ft	48x42	4	03/25/04	4
Lakeview	19	3	12ft	48x42	2	03/25/04	4
Main St	2	3	15ft	48x42	2	01/04/06	3
Main St	3	3	15ft	48x42	4	01/04/06	3

NDE Methods

To date we have had four NDE contractors conduct inspections of the beams. The NDE methods deployed include magnetic flux leakage, thermography, and radar. We have not yet received final reports from the contractors, but those final reports will be included as appendices in our final report. At this time we do not have any of their data to include in this progress report. One additional NDE contractor may visit in late January. The company is Vector Corrosion Technologies with offices throughout the US and Canada.

Half Cell Measurements and Forensic Studies

The half cell maps of the beams were completed and correlated with crack locations and corrosion regions. The half cell measurements are useful in determining locations for destructive evaluation. The crack sizes are being measured and the destructive plan will be initiated in February 2009.

Upcoming Schedule

- The final NDE method will be completed on the beams staged at Lehigh University.
- The forensic plan will be finalized and submitted for review.
- Feb.23 (10am - noon) in-person meeting at the ATLSS Center Lehigh University

The overall schedule is included below. The schedule represents the current status of the project. Start and end dates of completed and future tasks have been modified to represent the work completed to date. The project is progressing well and is expected to be completed on schedule.

UPDATE 1/20/09
NTP: Dec.20, 2007

		Months Relative to Notice to Proceed																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		2008												2009											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Task 1	Literature Search				a		a1		a2		a3														
Task 2	Method Evaluation																								
2a	ID and Beam Prep.							b	b1																
2b	Visual and Material Eval.					c			c	c1	c1	c2													
2d	NDE Evaluation								e1	e1	e1	e2	e2	e2				f							
2e	Destructive Eval. Of Beams														d	d	d	d							
Task 3	T-18 Reporting															g			g				g		g
Task 4	Inspection Training																					h			
Task 5	Draft Final Report																				i				
Task 6	Final Report																								j
Task 7	Invoicing	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

ID	Est. Due Date	Deliverable
a	Month 4	Synthesis report of findings submitted to PennDOT including database.
a1	Month 6	Draft Literature Review Report submitted awaiting Review
a2	Month 8	Receive Review on Literature Review
a3	Month 10	Submited Literature Review Report
b	Month 7	Locate, prepare, and deliver beam specimens of varying condition for evaluation
b1	Month 8	Beams Delivered and Staged at Lehigh University
c	Month 8	Visual Inspections of Beams
c1	Month 10	Half Cell potential mapping of beams
c2	Month 11	PennDOT type inspection of beams
e1	Month 10	Identification of NDE methodologies
e2	Month 11-13	NDE evaluation of available technologies
d	Month 13-16	Destructive testing of beams to validate visual inspection, NDE, and other inspections.
f	Month 17	Task Report ranking the candidate methods, including basic operating principles, advantages and disadvantages, operator expertise required, and the degree of qualitative versus quantitative results will be submitted to PennDOT. Visual inspection procedures will be recommended.
g	Bi-Annual	Presentation to AASHTO T-18 Subcommittee and others.
h	Month 21	A written Training Plan, and Specifications and Sample Bid Documents will be provided to PennDOT.
i	Month 20	Draft Final Report will be submitted to PennDOT.
j	Month 24	Final Report submitted to PennDOT.
x	Months 1 - 24	Monthly Invoices to PennDOT.

March 2009 Project Update

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Project Tasks

In the past month work has progressed in three areas. The PennDOT Literature Review Report was compiled into a CD with all of the references in PDF form linked to the main report PDF. The coring plan was finalized and an additional NDE vendor was identified and invited to the ATLSS Center.

Linked Literature Review

The initial literature review report was modified to be a linked document. In the new PDF version of the report the titles of each document listed is hot linked to the original referenced PDF. A copy of this CD has been sent to Bonnie Fields at PennDOT. She will ensure that PennDOT has the rights to all the documents linked in the report prior to distributing the report internally at PennDOT.

Destructive Evaluation of Beams

A destructive plan was finalized. The initial step involves a series of 4-in. and 2-in. cores taken from the beam bottom flange. The 2-in. cores will be used for strength evaluation of each beam. The 4 in. cores will be used to assess strand condition, chloride levels, carbonation, and to conduct petrography on the concrete.

Final NDE Vendor

An additional NDE vendor has become available and will be performing an examination of the beams during March 16-18, 2009. The name of the company is: *Vector Construction Group.*

Upcoming Schedule

- Coring will commence and chloride, strength, and petrography will be conducted.
- A comparison of the completed NDE studies will be conducted.

The overall schedule is included below. The schedule represents the current status of the project. Start and end dates of completed and future tasks have been modified to represent the work completed to date. The project is progressing well and is expected to be completed on schedule.

UPDATE 3/16/09

NTP: Dec.20, 2007

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