

Quarterly Progress Report:

Project Number and Title: C3.2018: Condition Assessment of Corroded Prestressed Concrete Bridge Girders

Research Area: Thrust 1: Transportation infrastructure monitoring and assessment for enhanced life

PI: Tzuyang Yu (UMass Lowell)

Co-PI(s): Susan Faraji (UMass Lowell), ChangHoon Lee (WNEU), Moochul Shin (WNEU)

Reporting Period: 04/01/2020 ~ 06/30/2020

Submission Date: 06/30/2020

Overview:

The objective of this project is to assess the condition of corroded prestressed concrete (PC) bridge girders in New England by performing multiphysical field inspection and developing an integrated assessment framework. Table 1 provides our progress on research tasks. Table 2 reports out budget progress. *Due to the impact of covid-19 pandemic in Massachusetts, our laboratory and field tasks were stalled in the last quarter since March 6, 2020.* We could not continue our artificially accelerated corrosion test (ACT) on reinforced concrete (RC) cylinders at UML, neither could we conduct any pull-out test on corroded RC cylinders at WNEU. Our research focus was shifted data processing and image analysis on the laboratory and field measurements collected prior to March 6, 2020.

Table 1: Task Progress			
Task Number	Start Date	End Date	Percent Complete
Task 1	3/1/19	9/31/19	100%
Task 2	9/1/19	2/28/20	80% (stalled)
Task 3	10/1/19	3/31/20	50% (stalled)

Table 2: Budget Progress		
Entire Project Budget	Spend Amount	Spend Percentage to Date
\$89,403 (UML)	\$84,932 (UML)	95%
\$85,000 (WNEU)	\$62,609.10 (WNEU)	73.5%

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events				
Title	Event	Type	Location	Date(s)

Table 4: Publications and Submitted Papers and Reports				
Type	Title	Citation	Date	Status

Figure 1 shows an intact and a damaged/corroded reinforced concrete (RC) cylinders used for radar imaging. Figure 2 shows the radar images reported in our 12/31/19 quarterly report. From Figure 1, we noticed that the damaged RC cylinder is only partially cracked. Figure 3 shows a close-up picture of damaged/corroded RC cylinder. When we inspected the radar image of damaged RC cylinder, we found that the circular geometry amplifies the scattering effect of surface cracks on a RC cylinder. Figure 4 compares two radar amplitude curves from two sides of the damaged RC cylinder.

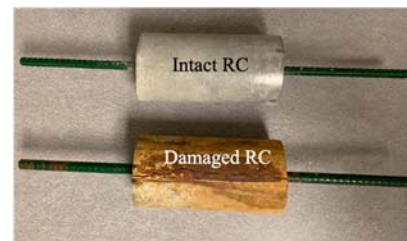


Figure 1. RC cylinders

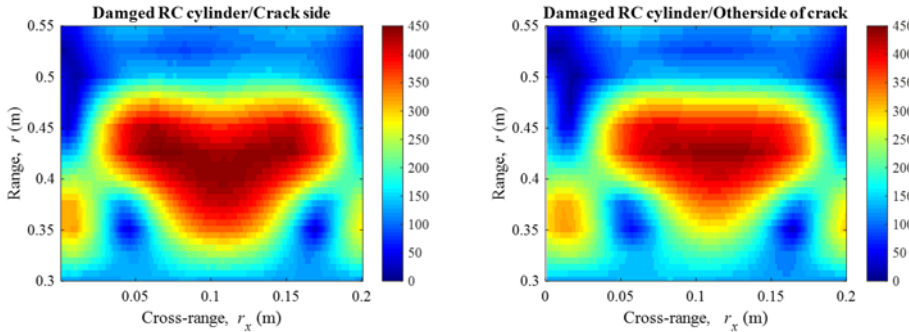


Figure 2: Radar images of intact and damaged RC cylinders



Figure 3: Close-up of damaged RC cylinder.

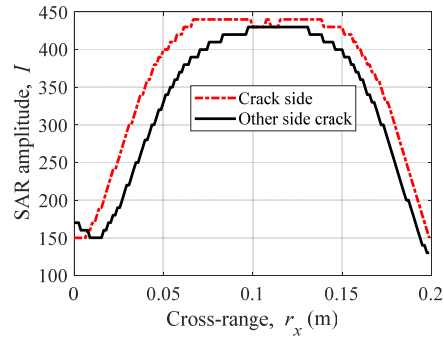


Figure 4: Radar images from two sides of damaged RC cylinder

Participants and Collaborators:

Table 7: Active Principal Investigators, faculty, administrators, and Management Team Members

Individual Name	Email Address	Department	Role in Research
Tzuyang Yu	Tzuyang_Yu@UML.EDU	Civil and Environmental Engineering	Project principle investigator and Institutional Lead at UML; overseeing all projects and working on radar imaging and interpretation
Susan Faraji	Susan_Faraji@UML.EDU	Civil and Environmental Engineering	Structural analysis and design of bridge girders
Chang Hoon Lee	Changhoon.Lee@WNE.EDU	Civil and Environmental Engineering	Development of degradation model and design concrete for pull out test specimen (Task 2)
Moochul Shin	Moochul.Shin@WNE.EDU	Civil and Environmental Engineering	Data analysis of the pull-out test results (Task 2)

Table 8: Student Participants during the reporting period

Student Name	Email Address	Class	Major	Role in research
Ahmed Alzeyadi		Ph.D.	Civil and Environmental Engineering	Design and manufacturing of laboratory specimens, field radar imaging of structures, data analysis and signal processing
Sanjana Vinayaka		Ph.D.	Civil and Environmental Engineering	Manufacturing of laboratory specimens, field radar imaging of structures, data analysis and signal processing

Jade Man		Sophomore	Civil and Environmental Engineering Civil and	Manufacturing of laboratory specimens
Ronan Bates		Junior	Environmental Engineering Civil	Manufacturing of laboratory specimens, laboratory radar imaging
Caleb Tourtelotte		Senior	Engineering Civil	Specimen manufacturing
Nicholas Pantorno		Junior	Engineering Civil	Specimen manufacturing
Cameron Cox		Junior	Engineering Civil	Specimen manufacturing
Andrew Masullo		Junior	Engineering	
Student Name		Role in Research	Degree	Graduation Date

Contribution to the Project			

Organization	Location	Financial Support	In-Kind Support	Facilities	Collaborative Research	Personnel Exchanges
Massachusetts Department of Transportation (MassDOT)	Boston, Massachusetts				X	X
City of Lowell	Lowell, Massachusetts			X	X	X

Changes:

Due to the significant impact of covid-19 pandemic in Massachusetts, we have been prohibited from accessing our research facility, equipment, and specimens since March 6, 2020. While the Massachusetts State Government has issued a four-phase plan in early May, the UML researchers working on Project C.3 still cannot resume our planned laboratory and field tasks until now (June 30, 2020). We have taken the following actions to prepare ourselves on getting ready to return to our laboratories in the past quarter:

1. Online covid-19 safety training on June 3, 2020 – We received a one-hour online training required by the UML administration for everyone prior to returning to campus. We are waiting for a covid-19 protocol to be issued by our administration for us to follow in the near future.
2. Acquisition of personal protection equipment (PPE) for all team members – We have ordered sufficient amount of PPE (e.g., face masks, latex gloves) in May 2020 such that we can resume our project tasks on campus and in the field.

We plan to submit a return-to-campus request in order to resume our research tasks on Project C.3 in the next quarter.

Planned Activities:

In the next reporting period, if we are allowed to return to our labs on campus (UML and WNEU), we plan to continue working on following tasks.

Task 2: (Meso-to-Macro Level) Development of Macro-Scale Mechanical Damage Model due to corrosion (WNEU: C.Lee and M. Shin)

Task 3. (System Level) Development of capacity reduction model for PC bridges due to corrosion (all members)