Quarterly Progress and Performance Indicators Report:
Project Number and Title: 2.14 - Implementation of UHPC Technology into the New England Construction Industry

Research Area New materials for longevity and constructability
PI: Kay Wille, Ph.D., Associate Professor, University of Connecticut, Department of Civil & Environmental Engineering, Storrs, CT
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Reporting Period: 01/01/2022– 03/31/2022
Submission Date: 03/31/2022

Overview:

*Provide **BRIEF** highlights of activities performed during the reporting period.*

- Emphasis has been placed on measuring electrical surface resistivity, freeze-thaw resistance and shrinkage in newly developed New England UHPC
- Completed all the remaining mixes that we thought to be the best New England UHPC based on preliminary test results

Meeting the Overarching Goals of the Project:

How did the previous items help you achieve the project goals and objects? Please give one bullet point for each bullet point listed above.

- As the overall goal of the project is to implement the UHPC technology in the New England area, investigation of durability properties will help to assure that newly developed New England UHPC will be sufficiently durable.

Accomplishments:

List any accomplishments achieved under the project goals in bullet point form…

- Electrical surface resistivity values are measured more than 200 K-Ohm-cm in every UHPC mixture.
- Relative dynamic modulus of freeze thaw beams even after 600 cycles did not decrease.
- Total shrinkage values in the beams are found to be comparable to other UHPC mixtures. After more than 120 days the shrinkage has almost stopped.

Task, Milestone, and Budget Progress:

Complete the following tables to document the work toward each task and budget

Table 1: Task Progress			
Task Number	**Start Date**	**End Date**	**% Complete**
Task 1.1: Mixing and Air Content Test	10/01/2021	03/31/2022	90%
Task 1.2: Freeze Thaw and Shrinkage Testing	11/01/2021	03/31/2022	40%
Task 1.3: Resistivity Testing	11/01/2021	03/31/2022	40%

Table 2: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date***
$173,844.88	$23,300	13.40%

Is your Research Project Applied or Advanced?

☒ **Applied** (*The systematic study to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.)*

☐ **Advanced** *(An intermediate research effort between basic research and applied research. This study bridges basic (study to understand fundamental aspects of phenomena without specific applications in mind) and applied research and includes transformative change rather than incremental advances. The investigation into the use of basic research results to an area of application without a specific problem to resolve.)*

Education and Workforce Development:

Answer the following questions (N/A if there is nothing to report):

1. Did you provide any workforce development or training opportunities to transportation professionals (already in the field)? If so, what was the training? When was it offered? How many people attended?

   N/A

2. Did you hold meetings with any transportation industry organizations or DOTs? If so, what was the meeting's purpose? When was it offered? How many people attended?

   The research team held a virtual meeting with ConnDOT to update them on the progress of the research findings and how the findings can be implemented on 3/31/2022. 3 DOT maintenance members were present at the meeting including the 2 technical champions for this project.

3. Did you host/participant in any K-12 education outreach activities? If so, what was the activity? What was the target age/grade level of the participants? How many students/teachers attended? When was the activity held?

   Our lab, Advanced Cementitious and Composites (ACMC) lab is supporting two high school students in their science fair project since Dec. 15, 2021 and ended roughly in mid of February 2022. In support of their science fair project we mixed a few UHPC mixes to understand the strength development of steam curing versus curing at standardized conditions.
   Also, ACMC is supporting one of the undergraduate student in her concrete research. She is using powdered recycled plastics in concrete to see the changes in compressive strength.

Technology Transfer:

Use the table below to complete information about conference sessions, workshops, webinars, seminars, or other events you led/attended where you shared findings as a result of the work you conducted on this project:

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events

Title	Event	Type	Location	Date(s)
Development and Testing of High / Ultra-High Early Strength Concrete for Durable Bridge Components and Connections	Annual Poster Competition, UConn School of Engineering	Poster Presentation	University of Connecticut	Mar. 08, 2022

Use the table below to report any publications, technical reports, peer-reviewed articles, newspaper articles referencing your work, graduate papers, dissertations, etc. written as a result of the work you conducted on this project. Please list only completed items and exclude work in progress.

Table 5: Submitted/Accepted Publications, Technical Reports, Theses, Dissertations, Papers, and Reports

Type	Title	Citation	Date	Status
Peer-reviewed journal	The Effects of Resonant Acoustic Mixing on the Microstructure of UHPC			Currently working on it
Peer-reviewed journal	Performance of Newly Developed UHPC based on locally available material			Currently working on it

Answer the following questions (N/A if there is nothing to report):

1. Did you deploy any technology during the reporting period through pilot or demonstration studies as a result of this work? If so, what was the technology? When was it deployed?

   N/A

2. Was any technology adopted by industry or transportation agencies as a result of this work? If so, what was the technology? When was is adopted? Who adopted the technology?

   N/A

3. Did findings from this research project result in changing industry or transportation agency practices, decision making, or policies? If so, what was the change? When was the change implemented? Who adopted the change?

   N/A

4. Were any licenses granted to industry as a result of findings from this work? If so, when? To whom was the license granted?

   N/A

5. Were any patent applications submitted as a result of findings from this research? If so, please provide a copy of the patent application with your report.

   N/A

6. Did industry organizations or DOTs provide cost-share (cash or in-kind) to your research during the reporting period? Who was the organization? Please provide an in-kind support invoice from the organization with your report (this is kept confidential and used for record keeping purposes only).

   N/A

Please add figures/images that can be included on the website and/or in marketing/social media materials to further clarify your research to the general public. This is very important to our Technology Transfer initiatives.

Fig:- 0.75 liter air meter

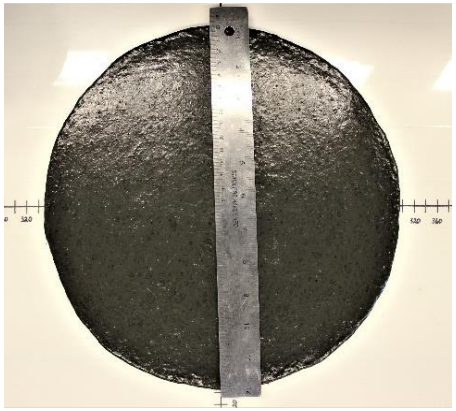

Fig:- Spread test with flow cone

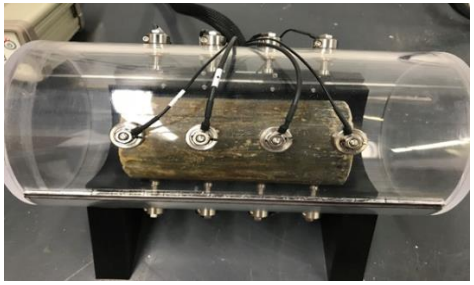

Fig:- Electrical surface resistivity test setup

Fig:- Freeze thaw table

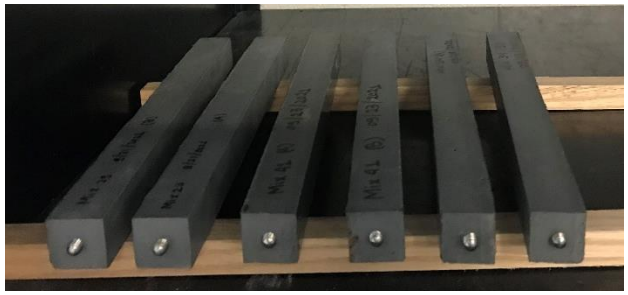

Fig:- Shrinkage beams

Describe any additional activities involving the dissemination of research results not listed above under the following headings:

Outputs:
Definition: Any new or improved process, practice, technology, software, training aid, or other tangible product resulting from research and development activities. They are used to improve the efficiency, effectiveness, and safety of transportation systems. List any outputs accomplished during this reporting period:

N/A

Outcomes:
Definition: The application of outputs; any changes made to the transportation system, or its regulatory, legislative, or policy framework resulting from research and development activities. List any outcomes accomplished during this reporting period:

N/A

Impacts:
Definition: The effects of the outcomes on the transportation system such as reduced fatalities, decreased capital or operating costs, community impacts, or environmental benefits. The reported impacts from UTCs are used for the assessment of each UTC and to make a case for Federal funding of research and education by demonstrating the impacts that UTC funding has had on technology and education. List any outcomes accomplished during this reporting period:

N/A

Participants and Collaborators:

Use the table below to list individuals (compensated or not) who have worked on the project other than students.

Table 6: Active Principal Investigators, faculty, administrators, and Management Team Members				
Individual Name & Title	**Dates involved**	**Email Address**	**Department**	**Role in Research**
Kay Wille, Ph.D., Associate Professor	Oct. 2021-Present	kay.wille@uconn.edu	Civil Engineering	Principal Investigator
Ramesh Malla, Ph.D., F. ASCE, Professor	Oct. 2021-Present	ramesh.malla@uconn.edu	Civil Engineering	Co-Principal Investigator

*Use the table below to list **all** students who have participated in the project during the reporting period. (This includes all paid, unpaid, intern, independent study, or any other student that participated in this project.)*

Table 7: Student Participants during the reporting period								
Student Name	**Start Date**	**End Date**	**Advisor**	**Email Address**	**Level**	**Major**	**Funding Source**	**Role in research**
Bijaya Rai	Jan. 2019	TBD	Kay Wille		PhD	Civil Engineering	TIDC	Lead
Dominic Parciasepe	Summer 2019	TBD	Kay Wille		Undergrad	Environmental Engineering	Work-study and ACMC	Undergrad-RA
Nicholas Olmo	Fall 2021	Dec. 2021	Kay Wille		Undergrad	Mechanical Engineering	ACMC	Undergrad-RA
Nathan Comment	Fall 2021	TBD	Kay Wille		Undergrad	Civil Engineering	ACMC	Undergrad-RA

Use the table below to list any students who worked on this project and graduated or received a certificate during this reporting period. Include information about the student's accepted employment during the reporting period

Table 8: Students who Graduated During the Reporting Period			
Student Name	**Degree/Certificate Earned**	**Graduation/Certification Date**	**Did the student enter the transportation field or continue another degree at your university?**
N/A	N/A	N/A	N/A

Use the table below to list any students that participated in Industrial Internships during the reporting period:

Table 9: Industrial Internships			
Student Name	**Degree/Certificate Earned**	**Graduation/Certification Date**	**Did the student enter the transportation field or continue another degree at your university?**
N/A	N/A	N/A	N/A

*Use the table below to list **organizations** that have been involved as partners on this project and their contribution to the project during the reporting period.*

Table 10: Research Project Collaborators during the reporting period						
Organization	**Location**	**Contribution to the Project**				
		Financial Support	**In-Kind Support**	**Facilities**	**Collaborative Research**	**Personnel Exchanges**
N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Use the table below to list **individuals** that have been involved as partners on this project and their contribution to the project during the reporting period.*

Table 11: Other Collaborators				
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Date(s) Involved**	**Contribution to Research**
N/A	N/A	N/A	N/A	N/A

Use the following table to list any transportation related course that were taught or led by researchers associated with this research project during the reporting period:

Table 12: Course List						
Course Code	**Course Title**	**Level**	**University**	**Professor**	**Semester**	**# of Students**
CE	Advanced Reinforced Concrete	Grad	UConn	Kay Wille	Spring 2022	10

Changes:

List any actual or anticipated problems or delays and actions or plans to resolve them (list no-cost extension requests here)…

Still research work continues under the COVID19 rules and regulations, social distancing has been maintained while performing the experiments.

List any changes in approach and the reasons for the change…

There are no changes in the research approach in this reporting period.

Planned Activities:

List the activities planned during the next quarter.

In this reporting period, the research has been primarily focused on mixing the promising New England UHPC and investigation of the durability properties of the promising New UHPCs

In future, emphasis will be placed on continue studying the durability properties of UHPC mixes and preparing for large scale mixing and testing in the field.