

**Quarterly Progress and Performance Indicators Report:**

**Project Number and Title:** 2.2 Concrete Systems for a 100-year Design Life

**Research Area:** New Materials for Longevity and Constructability

**PI:** Eric Landis, UMaine

**Reporting Period:** 7/1/2-22 – 9/30/2022

**Submission Date:** 4 Oct 2022

**\*\*\*IMPORTANT:** Please fill out each section fully and reply with N/A for questions/sections with nothing to report. For ease of reporting to the USDOT, please do not remove, or change the order of, any sections/text. You may remove/add each rows in tables as needed. Thank you! \*\*\*  
The report is due on the last day of the reporting period in .doc format to tidc@maine.edu.

**Overview:**

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

- [Little to report this quarter. Retooling with new project personnel new project phase]
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**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.

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**Accomplishments:**

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

- Developed a preliminary model to predict cracking in concrete bridge decks during cold weather construction
- Conducted an outreach program was implemented in collaboration with UMaine’s Upward Bound program, to introduce (in this case) basic materials and structural engineering concepts to underprivileged high school students.

**Task, Milestone, and Budget Progress:**

Complete the following tables to document the work toward each task and budget (add rows/remove rows as needed, make sure you complete the Overall Project progress row and include all tasks even if they have ended or have not been started)...

<b>Table 1: Task Progress</b>			
<b>Task Number: Title</b>	<b>Start Date</b>	<b>End Date</b>	<b>% Complete</b>
Task 1.1: Inventory early age cracking problems	03/01/2020	12/31/2022	95
Task 1.2: Inventory longer-term cracking problems	03/01/2020	12/31/2022	95

Task 1.3: Develop solutions using alternative mixes	09/01/2020	12/31/2022	95
Task 1.4: Examine new technologies	09/01/2020	12/31/2022	95
Task 2.2: Effects of differential temperature during construction	07/01/2022	06/30/2023	15
Task 2.2: Improved aggregate grading	07/01/2022	06/30/2023	5
Task 2.3: Potential for fiber enhancements	07/01/2022	06/30/2023	5
Phase 1 Overall	03/01/2022	12/31/2022	95
Phase 2 Overall	07/01/2022	06/30/2022	10

**Table 2: Milestone Progress**

Milestone #: Description	Corresponding Deliverable	Start Date	End Date
Milestone 1:			
Milestone 2:			
Milestone 3:			
Milestone 4:			
Milestone 5:			
Milestone 6:			
Milestone 7:			
Milestone 8:			
etc.			

**Table 3: Budget Progress**

Project Budget	Spend – Project to Date	% Project to Date (include the date)

**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? (i.e. The research team provided an in the field training for the SAR technology for 3 maintenance crew members of the MassDOT on 3/31/2021. The members learned how to use the technology and interrupt the data.) *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? (i.e. The research team held a meeting with MaineDOT to update them on the progress of the research findings and how the findings can be implemented on 3/31/2021. 15 DOT maintenance members were present at the meeting.) *N/A*
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? (i.e. 25 8<sup>th</sup> graders and 2 teachers visited the concrete lab and created small concrete trinkets like Legos on 3/31/2021. They learned about the different types of fibers that can be used in the concrete.) .

*During two sessions held July 11 and 18, 20 high school “Upward Bound” students participated in an outreach program intended to introduce students to some basic materials concepts through some brief classroom discussions about portland cement concrete. Then students went to the lab to prepare their own batches, with different groups producing different types of mixes. Students were tasked with evaluating properties of freshly mixed material, while casting test cylinders. One week later, students returned to learn about concepts of stress and strength and how those properties are used in engineering design. Students then measured compressive strength of their concrete (often with a satisfying bang at failure), and discussed how the fresh properties they evaluated the week before affected the strength of the material.*

*The Upward Bound program is intended “To provide fundamental support to participants in their preparation for college entrance. The program provides opportunities for participants to succeed in their precollege performance and ultimately in their higher education pursuits. Upward Bound serves: high school students from low-income families; and high school students from families in which neither parent holds a bachelor’s degree. The goal of Upward Bound is to increase the rate at which participants complete secondary education and enroll in and graduate from institutions of postsecondary education.”*

**Technology Transfer:**

*Complete all of the tables below and provide additional information where requested. Please provide ALL requested information as this is one of the most important sections for reporting to the USDOT. ONLY provide information relevant to this reporting period.*

*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:*

<b>Table 4: Presentations at Conferences, Workshops, Seminars, and Other Events</b>					
<b>Type</b>	<b>Title</b>	<b>Citation</b>	<b>Event &amp; Intended Audience</b>	<b>Location</b>	<b>Date(s)</b>

*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

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 it 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.*











*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:*

- Examples: New sensing technology was developed. This technology will... A UAV was created to hold new monitoring technology. This will allow maintenance crews to... A new college course was created based on the research findings. This will train future transportation professionals to...

**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:*

- Example: The developed sensing technology was installed in Bridge A in town, state on 1/1/2021. This installation will... The UAV was successfully used by \_\_\_ Organization to inspect \_\_\_ Bridge in in town, state on 1/1/2021... The newly created college course was taken/completed by \_\_\_ students in the 2021 fall semester.

**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. NOTE: The U.S. DOT uses this information to assess how the research and education programs (a) improve the operation and safety of the transportation system; (b) increase the body of knowledge and technologies; (c) enlarge the pool of people trained to develop knowledge and utilize technologies; and (d) improves the physical, institutional, and information resources that enable people to have access to training and new technologies. List any outcomes accomplished during this reporting period:*

- Example: The developed sensing technology’s successful deployment resulted in the adoption of the technology by the StateDOT. The technology will be installed in all new bridge installments of this type. This adoption will... The new UAV monitoring technology was adopted by \_\_\_ organization to be used for \_\_\_ bridges inspections. This will allow inspectors to... The college course has been adopted by another member university...

**Participants and Collaborators:**

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

<b>Table 6: Active Principal Investigators, faculty, administrators, and Management Team Members</b>				
<b>Individual Name &amp; Title</b>	<b>Dates involved</b>	<b>Email Address</b>	<b>Department</b>	<b>Role in Research</b>
Eric Landis, Professor	3/2020 – present	<a href="mailto:landis@maine.edu">landis@maine.edu</a>	Civil & Env. Engineering	PI
Hossain Haddad Kolour, Post doc	3/2020 – 7/2022	<a href="mailto:hossain.haddad@maine.edu">hossain.haddad@maine.edu</a>	Civil & Env. Engineering	Lead researcher, concrete laboratory work

*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.) **ALL FIELDS ARE REQUIRED.***



**Table 7: Student Participants during the reporting period**

Student Name	Start Date	End Date	Advisor	Email Address	Level	Major	Funding Source	Role in research
Maedeh Orouji	7/1/2022	Present	Eric Landis		PhD	Civil Engineering	TIDC	Concrete modeling and laboratory work

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 (i.e. the student is now working at MaineDOT) or if they are continuing their students through an advanced degree (list the degree and where they are attending).

**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?
			Please list the organization or degree

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?
			Please list the organization or degree

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

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.

*(List your technical champion(s) in this table. This also includes collaborations within the lead or partner universities who are not already listed as PIs; especially interdepartmental or interdisciplinary collaborations.)*

**Table 11: Other Collaborators**

<b>Collaborator Name and Title</b>	<b>Contact Information</b>	<b>Organization and Department</b>	<b>Date(s) Involved</b>	<b>Contribution to Research</b>
Taylor Clark		Maine D.O.T.	3/2020 – present	Technical Champion

*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**

<b>Course Code</b>	<b>Course Title</b>	<b>Level</b>	<b>University</b>	<b>Professor</b>	<b>Semester</b>	<b># of Students</b>
CIE 110	Materials	Undergrad	UMaine	Eric Landis	Fall 2022	108

**Changes:**

*Project made only incremental progress during the reporting period. With the departure of Hossain Haddad Kolour, and his delayed replacement, work focused on the single problem of temperature differentials.*

**Planned Activities:**

*List the activities planned during the next quarter.*

- *Bring new hire, Dr. Linfei Li up to speed, and turn much of the day-to-day operations to him.*
- *Meet with MDOT collaborators will be organized during the next quarter to discuss progress with the differential shrinkage model and its implications for upcoming deck placements, also bring remainder of project tasks up to full speed.*
- *Close out phase I segment of project.*