

Quarterly Progress and Performance Indicators Report:

Project Number and Title: Project C19.2020: Damage Modeling, Monitoring, and Assessment of Bridge Scour and Water Borne Debris Effects for Enhanced Structural Life

Research Area: Thrust 1 -Transportation Infrastructure Monitoring & Assessment for Enhanced Life

PI: Wei Zhang, Ph.D., P.E., Associate Professor, Department of Civil & Environmental Engineering, University of Connecticut

Co-PI(s): Ramesh B. Malla, Ph.D., F. ASCE, F. EMI, Professor, Department of Civil & Environmental Engineering, University of Connecticut; and Nalini Ravishanker, Ph.D., Professor, Department of Statistics, University of Connecticut

Reporting Period: Apr. 01, 2022 to Jun. 30, 2022

Submission Date: Jun. 30, 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.

An oral presentation was given at the Engineering Mechanics Institute (EMI) conference in Baltimore, MD, June 1, 2022.

- A journal manuscript draft is in preparation and will be submitted in the coming weeks.
- Work on Task 1 has continued and is near completion, while work on Tasks 2 and 3 has begun.

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.

- The conference presentation allowed us to disseminate the results from our research to other researchers in related fields, build connections for future collaboration, and receive feedback on the current work.
- The manuscript will lead to future publications in journal and will be widely available. This will add to the technical knowledge in the field as well as engineers/scientist and policy makers will be able to adopt/implement our work. Furthermore, the technical publication can be referenced by others to expand upon the work in the future
- The work on Tasks 1-3 will push toward meeting the project deadlines and deliverables.

Accomplishments:

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

- One paper published in one of the top journals in this field. Ma, X., Zhang, W. (2022) "Dynamic Amplification Effects of Scour and Debris Impacts for Short Span Bridges", Engineering Structures, 252(1), February 2022, 113644 <https://doi.org/10.1016/j.engstruct.2021.113644>
- One conference presentation at the Engineering Mechanics Institute. Hughes, W. and Zhang, W. (2022). "Prediction of Large Woody Debris Accumulations and Scour for Bridges in Flooding Events" Oral Presentation, Engineering Mechanics Institute, Baltimore, MD, June 1, 2022

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 progress row and include all tasks even if they have ended or have not been started)...

Table 1: Task Progress			
Task Number: Title	Start Date	End Date	% Complete
PHASE I			
Task 1: Literature Review and data collection.	Oct. 20, 2020	Jan. 31, 2021	100%
Task 2: Statistical Analysis	Dec. 1, 2020	Jun. 30, 2021	100%
Task 3: Debris Dimension analysis	Feb. 1, 2020	Sep. 30, 2021	100%
PHASE II			
Task 1: Data and feature extraction	Mar. 4, 2022	June. 30, 2022	75%
Task 2: Numerical modeling of bridges	July 1, 2022	Dec 31, 2022	20%
Task 3: Fragility analysis	Sep. 1, 2022	Mar. 31, 2023	10%
Task 4: Tool development	Apr. 1, 2023	Oct 31, 2023	0%
Overall Project:	<i>Oct. 20, 2020</i>	<i>Oct. 31, 2023</i>	
Phase 2 Overall	Mar. 3, 2022	Oct. 31, 2023	20%

Table 3: Budget Progress		
Project Budget	Spend – Project to Date	% Project to Date (include the date)
Phase 1: \$139,000 for 1 year (including 1:1 Cost share match)	(To be submitted separately by UConn Institutional Lead)	(To be submitted separately by UConn Lead)
Phase 2: \$261,000 for 2 years (including 1:1 Cost share match)	(To be submitted separately by UConn Institutional Lead)	(To be submitted separately by UConn Lead)

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.)

Due to unavailability of a common meeting time from our technical champions from VT and ME DOTs, we were not able to meet with them this quarter. However, we have kept them abreast on the project progress via e-mails and sharing our quarterly report and have sought their feedback and comments.

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 8th 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.)
N/A

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:

Table 4: Presentations at Conferences, Workshops, Seminars, and Other Events					
Type	Title	Citation	Event & Intended Audience	Location	Date(s)
Conference Presentation	Prediction of Large Woody Debris Accumulations and Scour for Bridges in Flooding Events	Hughes, W. and Zhang, W. (2022). “Prediction of Large Woody Debris Accumulations and Scour for Bridges in Flooding Events” <i>Oral Presentation, Engineering Mechanics Institute, Baltimore, MD</i>	Engineering Mechanics Institute, intended primarily for students and professors studying structural mechanics	Baltimore, MD	June 1, 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
N/A				

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.

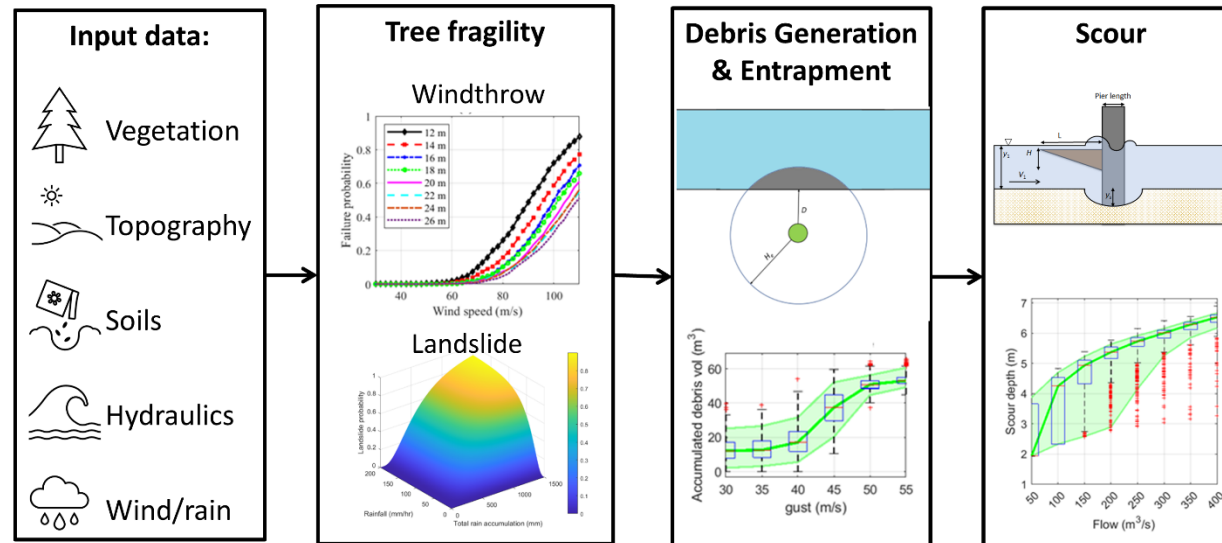


Figure 1. Example flowchart of process

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:

As we are moving into the 2nd phase of the work after one year of completion, there are no outputs from this project yet.

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:

As we are moving into the new phase of the work, there are no outcomes from Phase II of this project yet.

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:

Since only Phase I has been finished, it is still early stage to see any impacts from the project. However, the researchers a mindful of making the project as practically impactful as possible..

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
Dr. Wei Zhang, Associate Professor	Apr. 1 – Jun. 30, 2022	wzhang@uconn.edu	Civil & Environmental Engineering, University of Connecticut, Storrs	Principal Investigator (PI)
Dr. Ramesh B. Malla, Professor	Apr. 1 – Jun. 30, 2022	Ramesh.Malla@UConn.EDU	Civil & Environmental Engineering, University of Connecticut, Storrs	Co-Principal Investigator (PI)/ TIDC Institutional Lead, UConn
Dr. Nalini Ravishanker	Apr. 1 – Jun. 30, 2022	Ravishanker, Nalini	Statistics, University of Connecticut, Storrs	Co-Principal Investigator (PI)

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
William Hughes	Apr. 1, 2022	Jun. 30, 2022	Wei Zhang		P.D. student	Civil Engr.	Department of Education	Graduate Assistant
Steven Matile	Apr. 1, 2022	Jun. 30, 2022	Wei Zhang		Undergraduate student	Civil Engr.	unpaid	Undergraduate student
Yiannis Bagtzoglou	Apr. 1, 2022	Jun. 30, 2022	Wei Zhang		M.S. student	Civil Engr.	Partial US DOT UTC - TIDC	Graduate Assistant

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?
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			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
Vermont Agency of Transportation (Contact Person: Jeff DeGraff, P.E.,Hydraulics Project Engineer)	Barre, VT					X
Maine Department of Transportations (Contact person: Ben Foster, Deputy Chief Engineer,	Augusta, ME					X

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

Collaborator Name and Title	Contact Information	Organization and Department	Date(s) Involved	Contribution to Research
Benjamin Foster, State Bridge & Structures		Bureau of Maintenance & Operations, Maine	Technical Champion	Benjamin Foster, State Bridge & Structures

Maintenance Engineer/ Deputy Chief Engineer,		Department of Transportation (Maine DOT),		Maintenance Engineer/ Deputy Chief Engineer,
Mr. Jeff DeGraff, P.E., Hydraulics Project Engineer		Vermont Agency of Transportation (VTrans)	Technical Champion	Mr. Jeff DeGraff, P.E., Hydraulics Project Engineer

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 5122-001	Advanced Mechanics of Materials	Grad	Storrs, CT	Prof. R. Malla	Spring 2022	9
CE 4510	Foundation Design	Undergrad	Storrs, CT	W. Zhang	Spring 2022	60
STAT 5735	Linear Models II	Grad	Storrs, CT	Prof. N. Ravishanker	Spring 2022	11
STAT 6494	Seminar in Applied Statistics – Advanced Time Series	Grad	Storrs, CT	Prof. N. Ravishanker	Spring 2022	7

Changes:

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

We have difficulties to get more in-depth details of the bridges in this area. We are still working on getting more detailed data, such as the detailed parameters of the bridge structures and their environmental conditions and parameters.

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

N/A

Planned Activities:

List the activities planned during the next quarter.

- The research team will continue to maintain communication with DOTs and industry regarding potential future research topics so that the research will be relevant and of great importance to the DOTs and industry.
- With the new research phase, our team will work closely with our technical champions for waterborne debris analysis to get the tool ready for DOTs.