

Quarterly Progress and Performance Indicators Report:

Project Number and Title: Wireless Joint Monitoring System (w-JMS) for Safety of Highway Bridges

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

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Co-PI(s): *Song Han, Ph.D., Department of Computer Science & Engineering, University of Connecticut; and*

Ramesh B. Malla, Ph.D., F. ASCE, F. EMI; Professor, Department of Civil & Environmental Engineering University of Connecticut

Reporting Period: *10/1/2021 – 12/31/2021*

Submission Date: *12/31/2021*

*****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. This summary should be written in lay terms for a general audience to understand. This should not be an extensive write up of findings (those are to be included in the final report), but a high-level overview of the activities conducted during the last three months **no more than 3 bullet points at no more than 1 sentence each**

- To do thorough literature search and review of bridge joint monitoring cases and to gather & analyze information on the current practices of bridge expansion joint monitoring in New England states.
- The research team created a set of survey questions and sent as a Google form to all six New England Department of Transportations (DOTs), and all six DOTs responded with reporting their current practices and their willingness to participate in our research.
- The research team summarized the survey results and drafted a brief report. The research team also met with technical champion and other engineers/ manager at CT DOT on 10/7/2021 and 11/22/2021.

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 survey results from the DOTs on bridge expansion joint monitoring has been helpful in the process of identifying and selecting a few candidate testbed bridges and joint types.
- Meetings and working with CTDOT has helped us in the currently on-going effort of identifying and selecting the testbed bridge(s) for the joint monitoring sensor deployment planned in the late Spring or Summer 2022.
- Report drafting is helpful to the research team to formulate and direct their effort of the RT and provide motivation and justification of the projects.

Accomplishments:

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

- Recruitment: graduate assistant (P. Fils) and undergraduate research assistant (Daisy Ren) are placed in the project..
- Products: bridge expansion joint monitoring practice questionnaire, survey results, and a draft report
- Meetings: held 2 meetings with CTDOT and bi-weekly meeting with research team.

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)...

Table 1: Task Progress			
Task Number: Title	Start Date	End Date	% Complete
Task 1.1: Creating questionnaire to DOTs	10/1/2021	10/15/2021	100 %
Task 1.2: Gathering inputs from New England DOTs	10/16/2021	11/18/2021	100 %
Task 1.3: Drafting a report regarding inputs	11/16/2021	12/31/2021	100 %
Task 1.4: Quarterly Progress Report 1 submission	12/15/2021	12/31/2021	100 %

Table 2: Milestone Progress			
Milestone #: Description	Corresponding Deliverable	Start Date	End Date
Milestone 1: Creating questionnaire to DOTs	Questionnaire to DOTs for feedback	10/1/2021	10/15/2021
Milestone 2: Gathering inputs from New England DOTs	Raw input files and meeting memos	10/16/2021	11/15/2021
Milestone 3: Drafting a report regarding inputs	Report on the state-of-the-art joint monitoring practice and factors of NE DOTs	11/16/2021	12/31/2021
Milestone 4: Quarterly Report 1	Progress report		12/31/2021

Table 3: Budget Progress		
Project Budget	Spend – Project to Date	% Project to Date (include the date)
To be provided separately by UConn PI/Lead	To be provided separately	To be provided separately

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.)

- The research team held a meeting with CTDOT to provide them an overview of the project work and to receive feedback and comments on 10/7/2021. Four (4) DOT engineers and managers were present at the meeting.
- We also held the subsequent meeting with CTDOT to discuss bridge selection on 11/22/2021. 4 DOT experts were present at the meeting.

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)
DOT Presentation	Wireless joint monitoring system for safety of highway bridges	Presentation during the kick-off meeting with CTDOT	Project kick-off meeting with CTDOT	Online using Microsoft Teams	10/7/2021

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
Conference paper	Technical survey and literature review on bridge joint monitoring practices	Ren, D., Fils, P. Jang, S., Malla, R. M. (2022). “Technical survey and literature review on bridge joint monitoring practices.” <i>American Society of Engineering Education Northeast Conference 2022</i>	12/2/2021	Abstract submitted and accepted on 12/17/2021 Currently manuscript in preparation (deadline 2/3/2022)

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.

Insert figures here

N/A

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

N/A

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...

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:

- 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.

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. 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...

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
Shinae Jang, Ph.D., P.E.; Associate professor in residence; Department of Civil & Environmental Engineering, University of Connecticut	10/1/2021 – 12/31/2021	Shinae.jang@conn.edu	Civil & Environmental Engineering	PI
Song Han, Ph.D.; Associate Professor; Department of Computer Science & Engineering, University of Connecticut	10/1/2021 – 12/31/2021	Song.han@uconn.edu	Computer Science and Engineering	Co-PI

Ramesh Malla, Ph.D., F. ASCE; F. EMI; Professor; Department of Civil & Environmental Engineering, University of Connecticut	10/1/2021 – 12/31/2021	Ramesh.malla@uconn.edu	Civil & Environmental Engineering	Co-PI
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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
				<i>Email is not included in the external report and is only used for internal purposes.</i>	<i>(i.e. UG, MS, PhD)</i>		<i>(i.e. TIDC, Other university funds, , unpaid intern, etc.</i>	<i>What work are they conducting? Please be descriptive. Student research assistant is not enough info.</i>
Pierredens Fils	10/1/2021	12/31/2021	Shinae Jang		Ph.D.	Civil & Environmental Engineering	GAANN	Edited survey questionnaire, created Google form, drafting a survey report, finding the links for sensor parts
Daisy Ren	10/1/2021	12/31/2021	Shinae Jang		B.S.	Civil & Environmental Engineering	TIDC	Conducting literature review, drafting a conference paper, searching

								existing sensing systems
Jiachen	10/1/2021	12/31/2021	Song Han	_____	Ph.D.	Computer Science & Engineering	Unpaid student participant	Lab sensor systems and data communication demos and support
Zelin	10/1/2021	12/31/2021	Song Han	_____	Ph.D.	Computer Science & Engineering	Unpaid student participant	Lab sensor systems and data communication demos and support
Celso de Oliveira	10/1/2021	12/31/2021	Ramesh Malla		Ph.D.	Civil & Environmental Engineering	Unpaid student participant	Lab sensor system demos and testing support

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?
			<i>Please list the organization or degree</i>

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
		<i>List the amount</i>	<i>List the amount</i>	<i>Mark with an "x" where appropriate</i>		
Connecticut Department of Transportation	Newington, CT		X (comments/advice; monetary value not known)		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
	<i>For internal use only</i>			<i>(i.e. technical champion, technical advisory board, test samples, on-site equipment, data, etc.)</i>
Bao Chuong, P.E.; Transportation Supervising Engineer ; Connecticut DOT – Bridge Design	Connecticut DOT – Bridge Design E-mail: bao.chuong@ct.gov	Connecticut Department of Transportation, Newington, CT	October 01, 2021- December 31, 2021	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						
Course Code	Course Title	Level	University	Professor	Semester	# of Students
i.e. CE 123		Grad or undergrad?	Where was the course taught?	Who taught the course?	Enter Spring, Fall, Summer, Winter and the year	How many students were enrolled in the class?
CE 2110-001	Applied Mechanics I	undergraduate	University of Connecticut, Storrs, CT	Shinae Jang (PI)	Fall 2021	117
CE 2110-010	Applied Mechanics I		University of Connecticut, Storrs, CT	Shinae Jang (PI)	Fall 2021	120
CE 2110-020	Applied Mechanics I	undergraduate	University of Connecticut, Storrs, CT	Ramesh B. Malla (Co-PI)	Fall 2021	120

Changes:

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

- No specific problems or delays are identified.

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

- The project is on track and no change has been requested.

Planned Activities:

List the activities planned during the next quarter.

- Literature search on available wireless communication systems
- Sensor system development with performance validation tests in the lab