

Quarterly Progress and Performance Indicators Report:

Project Number and Title: 3.7 Development of general guidelines related to the effects of factors such as the bridge span range, range of pile length, roadway profile grade, and skew angle range on integral abutment bridges (IABs)

Research Area: Trust 3: New systems for longevity and constructability

PI: Susan Faraji, University of Massachusetts Lowell

Reporting Period: 7/1/2022 - 9/30/2022

Submission Date: 9/28/2022

Overview:

Brief highlights of activities performed during the reporting period.

- Started year four of the research project.
- Presenter and attendee at the VTrans innovation and research symposium on September 14th in Barre Vermont.
- Submitted a poster to the VTrans innovation and research symposium.
- Presentation to the Maine DOT on the TIDC research findings of IABs on September 1st.
- Presentation to VTrans on the TIDC research findings of IABs on August 17th.
- Continued my discussions of the findings of the ongoing research project with the project champion through phone discussions and email exchanges.
- Continued with the data analysis of the parameters impacting the design of steel piles for IABs. The first paper is ready to be published in the Journal of Bridge Engineering.
- Provided support for one doctoral student and one undergraduate student.

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 goal of this research project has been to transfer technology to the bridge engineers, general public, engineering audiences, and students by means of presentations and publications. All the above listed bullet points in the overview have done that.

Accomplishments:

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

- Technology transfer
- Progress made toward refined design guidelines and modeling techniques for IABs.

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	Start Date	End Date	% Complete
Task 1-1: Literature Review	1/1/2019	12/31/2020	100%
Task 1-2: Improved guidelines for modeling, design, and construction of IABs	11/1/2019	3/31/2021	100%
Task 1-3: General guideline creation	11/1/2019	6/30/2021	100%
Phase 1 Overall	1/1/2019	6/30/2021	100%
Task 2-1: Selection of Sample Bridges	1/1/2021	6/30/2022	100%

Task 2-2a: Modeling strategy and accuracy of analysis results	1/1/2021	6/30/2022	100%
Task 2-2b: Modeling and analysis guidelines	1/1/2021	6/30/2022	100%
Task 2-3: Design guidelines for skew IABs	1/1/2021	6/30/2022	100%
Phase 2 Overall	1/1/2021	6/30/2022	100%
Task 3-1: Templates for skewed single span and three span sample IABs	9/1/2021	9/30/2024	10%
Task 3-2: Templates for non-skew single span and three span IABs	9/1/2021	9/30/2024	70%
Task 3-3: Verification of the accuracy of finite element modeling analysis results	9/1/2021	9/30/2024	10%
Task 3-4: Design guideline creation	9/1/2021	9/30/2024	5%
Task 3-5: Presentations and final report	9/1/2021	9/30/2024	0%
Phase 3 Overall	9/1/2021	9/30/2024	20%
Full Project Overall	1/1/2019	9/30/2024	60%

Table 2: Budget Progress		
Project Budget	Spend – Project to Date	% Project to Date*
Phase 1: Year 1: \$138,832 (62,500 + 76,333) Year 2: \$137,502 (61,169 + 76,333)	100%	100% - 6/30/2021
Phase 2: Year 3: 125,625(62,500+63,125)*	100%	100% - 6/30/2022

*See the complete expenditure provided by UMass current to September 2022 below.

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.)
Yes. I presented a paper at the VTrans innovation and research symposium on September 14th.
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.)
Yes. I presented my research findings to VTrans and Maine DOT engineers on August 17th and September 30th.
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)
Presentation by Susan Faraji	The impact of the abutment wall height, the bridge span length range, and the roadway profile grade on the moment profile and lateral displacement profile of HP or W piles under thermal expansion in integral abutment bridges (IABs)		VTrans innovation and research symposium	2178 Airport Road Barre Vermont	September 14, 2022
Presentation by Susan Faraji	Optimization of design of HP or W piles in integral abutment bridges (IABs)		Maine DOT	Virtual	September 1, 2022
Presentation by Susan Faraji	Optimization of design of HP or W piles in integral abutment bridges (IABs)		VTrans	Wells Conference Center	August 17, 2022
Attendee	Welcome Dinner		TIDC Annual Conference	Wells Conference Center University of Maine Orono	August 9, 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/Site	Date	Status
Journal of Bridge Engineering	The impact of the abutment wall height, the bridge span length range, and the roadway profile grade on the moment profile and lateral displacement profile of HP or W piles under thermal expansion in integral abutment bridges (IABs)	ASCE	October, 2022	To be submitted for publication

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.

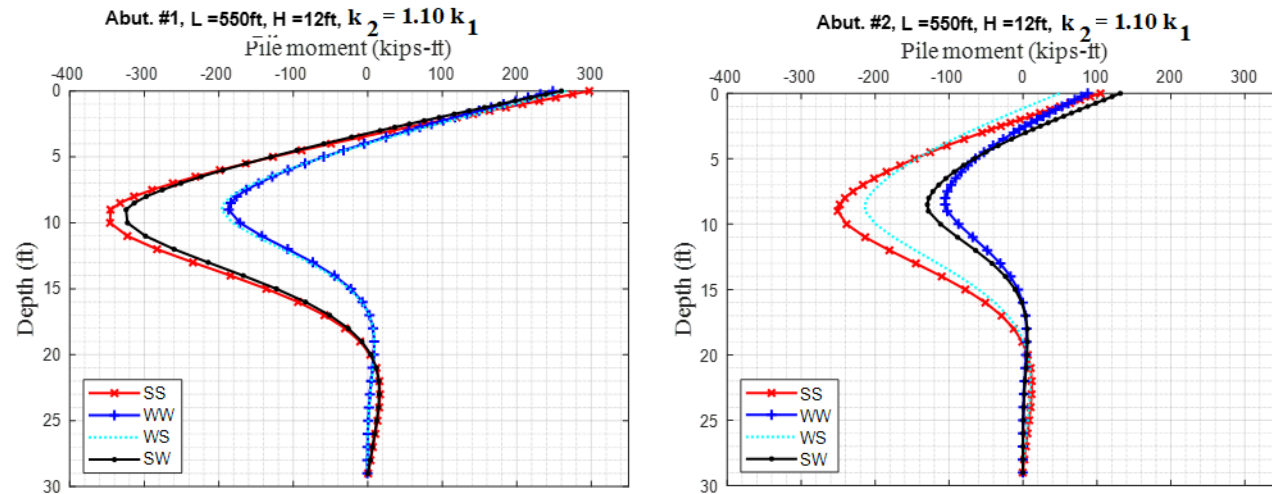


Fig.1 Impact of a 10% increase in the stiffness of the soil behind abutment wall #2 with respect to abutment wall #1 and of the orientation of the piles on the moment profile of the steel piles of a sample three span IAB (L=550 ft, H=12 ft) under thermal expansion.

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

Outputs:

- Listed above

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:

- Listed above

Impacts:

- Listed above

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
N/A				

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
Harsh Gandhi	7/1/2022	8/30/2022	Dr. Susan Faraji		PhD	Civil Engineering	TIDC	Soil modeling and data analysis of finite element modeling

Eoin Stack	7/1/2022	8/30/2022	Dr. Susan Faraji		Senior	Civil Engineering	TIDC	Data analysis
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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			

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	Vermont		*		x	(Design of IABS)
Hexagon PPM/Intergraph Corporation	Alabama		** Educational Grant to University			x (Technical support)
ENSOFTE Inc.	Texas		***			x (Technical support)

* Exchanged ideas and provided material related to the design of IABs.

** Provided technical support on the use of GTSTRUDL software for the research project.

*** Provided technical support on the use of the LIPE and GROUP software for the research project.

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
Technical Champion of the project: Mr. James Lacroix, PE, State Bridge Design Engineer		Vermont Agency of Transportation	1/1/2022-3/31/2022	Discussion of progress of the research project and exchange of ideas on design of IABs

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
N/A						

Changes:

No change

Planned Activities:

- Continuation of the parametric study and data analysis of the sample IABs.
- Study of the use of Geofoam as a backfill material for IABs
- Continued discussions of the findings of the ongoing research project with the champion of the project, and bridge engineers at the Maine DOT, through Zoom meetings, phone discussions, and email exchanges.

*Detailed budget expenditure-UMass Lowell:

	A	AI	AJ	AK	AL	AM	AN	AO	AP
1	UMass Lowell								
2	Cost Share Itemization								
3	Project: S51800000038472								
4	Cost Share Acct: R50190000042821								
5	Dept ID:L610300194								
6	Project Period: 06/05/19-09/30/23								
7		Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22		
8	CATEGORIES								TOTAL
9	Salaries - Course Releases								
10	Tzuyang Yu	5,937.77	6,207.93	6,207.93					111,679.92
11	Zhu Mao								31,569.28
12	Susan Faraji	6,602.90	6,903.33	6,903.33					63,131.22
13	Xingwei Wang	6,694.35	6,998.94	6,998.94					82,005.22
14	Total Course Releases								288,385.64
15									
16	Fringe	7,819.50	8,164.58	8,164.58					113,279.56
17									

18	RA Tuition & Fees								
19	Ahmed Al-Zeyadi (SP19 & SP20)								12,931.06
20	A. Sarrafi (FA18 & SP19)								22,749.80
21	Ahmed Al-Zeyadi (FA19) HOLD for Credit								-
22	Andres Biondi Vaccariello (FA19, SP20, FA20, SP21, FA21, SP22)	3,342.49	3,342.49	3,342.49					71,522.91
23	Celso Tadeu Do Cabo (FA19, SP20, FA20, SP21)								46,657.99
24	Hamed Abshari (FA19 & SP20)								22,960.24
25	Qixiang Tang (FA19)								701.66
26	Sanjana Vinayaka (FA19 & SP20)								23,778.04
27	Jianing Wang (SP20)								11,103.10
28	Harsh Gandhi (FA20, SP21, FA21, SP22)	3,342.49	3,342.49	3,342.49					43,744.86
29	Rui Wu (FA20, SP21, FA21)								34,374.91
30	Lidan Cao (FA21, SP22)	3,342.49	3,342.49	3,342.49					24,864.92
31	Aiyad Kadair Alshimaysawee (FA21, SP22)	3,342.49	3,342.49	3,342.49					24,364.92
32	Koosha Raisi (SP22)	6,747.48	3,373.74	(626.26)					9,494.96
33	Total Tuition/Fee Waivers								349,249.37
34									
35	Indirect Costs	15,285.80	15,975.25	15,975.25	-	-	-		226,940.81
36									
37	Total Cost Share	62,457.76	60,993.73	56,993.73	-	-	-		977,855.38