Quarterly Progress and Performance Indicators Report:
Project Number and Title: 3.17 Assessment of CT Girder Load Distribution and Web Buckling through Field Load Testing and Finite-Element Analysis
Research Area: Thrust Area 3
PI: W. Davids, UMaine
Co-PI(s): N/A
Reporting Period: 7/1/2022 - 9/30/2022
Submission Date: 9/30/2022

******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. 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** ….*

- Diagnostic live load testing was completed on the Hampden Grist Mill Bridge, the first of its kind CT tub girder bridge in Hampden Maine, with the help of the Maine Department of Transportation (MaineDOT).
- Data was analyzed and compared between the live load test performed on Hampden Grist Mill Bridge on 12/20 and 7/22.
- A finite element model was used to compare with the test data and confirm the validity of the finite element model method for analysis.

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.

- Rosette strain gauges were included in the 7/22 test to provide shear strain data to provide more information on shear distribution and girder web behavior which is important for developing the live load distribution factor.
- Data comparison between tests showed where bridge behavior changed and stayed the same after an initial 1.5-year service period.
- Finite element model for one bridge was calibrated to confirm the validity that the similar models can be used to run parametric studies.

Accomplishments:

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

- One of the two live load tests to be performed was completed, the focus area of task 1
- Finite element model calibration progresses the goal to developing a suite of models, task 2, which will then be used for a parametric study to develop live load distribution factors, task 3.
- Started investigating parametrizing code to efficiently develop suite of FE models for task 2.

Task Progress and Budget:

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: Field Live-Load Test Two CT-Girder Bridges	6/1/2022	3/31/2023	40
Task 2: Develop FE Models of a Range of CT Girder Bridges	1/1/2023	8/31/2023	10
Task 3: Develop Simplified Live Load Distribution Factors	6/1/2023	5/31/2024	5
Task 4: Quantify Girder Web Buckling Limits	6/1/2020	5/31/2024	20
Overall Project:	6/1/2022	5/31/2024	20

Table 2: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date (include the date)**
$327,410		

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.)*

Professional Development/Training Opportunities:

Describe any opportunities for training/professional development that have been provided. Did you provide a training to a State DOT/AOT or industry organization? What was the training? When was it offered? How many people attended? Did you meet with a State DOT/AOT or industry organization to inform them of your findings and how these findings could help their organization? When? How many attended the meeting?

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 3: Presentations at Conferences, Workshops, Seminars, and Other Events					
Type	**Title**	**Citation**	**Event**	**Location**	**Date(s)**
N/A					

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 4: Publications and Submitted 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. Were any industrial contracts awarded base on furthering planned research and development activities as a result of findings from this work? If so, when? How much was awarded? Who awarded the contract?

   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.

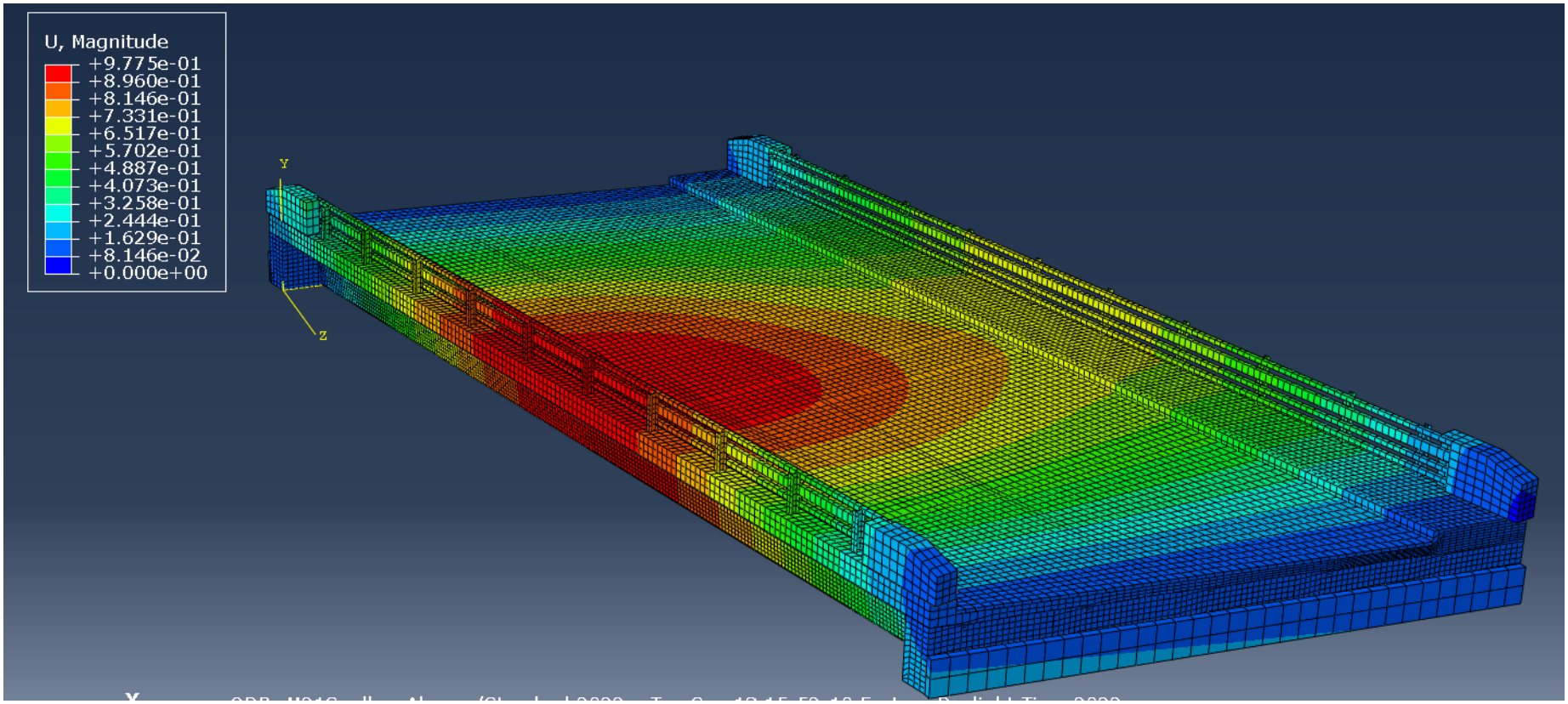

Figure 1: Deflections from test run M_2_1 loading input into the Finite Element Model in ABAQUS

Figure 2: MaineDOT Wheeler Dump Trucks in Position for Load Test of Hampden Grist Mill Bridge 7/13/2022

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:

- No outputs have yet been produced

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:

- No outcomes have yet been produced

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:

- Having very recently started, the project has not yet had significant impact

Participants and Collaborators:

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

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members				
Individual Name & Title	**Dates involved**	**Email Address**	**Department**	**Role in Research**
William Davids	6/1/2022 – Current	william.davids@maine.edu	Civil and Environmental Engineering	Principal Investigator
Andrew Schanck	6/1/2022 – Current	andrew.schanck@maine.edu	Civil and Environmental Engineering	Coordinate live-load testing, modeling, analysis

*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 6: Student Participants during the reporting period								
Student Name	**Start Date**	**End Date**	**Advisor**	**Email Address**	**Level**	**Major**	**Funding Source**	**Role in research**
Jon Pinkham	6/1/2022	-	William Davids		M.S.	Civil Engineering	TIDC	Testing, analysis, modeling

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 (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 7: 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:

Table 8: 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.*

Table 9: Research Project Collaborators during the reporting period						
Organization	**Location**	**Contribution to the Project**				
		Financial Support	**In-Kind Support**	**Facilities**	**Collaborative Research**	**Personnel Exchanges**
MaineDOT	Augusta, Maine	X	X	X		

*Use the table below to list **individuals** that have been involved as partners on this project and their contribution to the project.*
*(**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 10: Other Collaborators				
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Date(s) Involved**	**Contribution to Research**
Anthony Diba		Advanced Infrastructure Technologies – AIT Bridges	5/31/2022-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:

Table 11: Course List						
Course Code	**Course Title**	**Level**	**University**	**Professor**	**Semester**	**# of Students**
N/A						

Changes:

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

The field LL test of the second Hampden bridge that was originally scheduled for all/summer of 2022 will not be conducted until the spring or summer of 2023 due to construction delays. This is not expected to impact project completion, since work can continue on Tasks 2 - 4.

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

No significant changes to approach have arisen

Planned Activities:

List the activities planned during the next quarter.
Results of the HGMB will continue to be analyzed to assess bridge behavior. Critical assessment of live load distribution will be ongoing as will development of suite of parametric studies needed to develop LL DFs.