

Quarterly Progress and Performance Indicators Report:

Project Number and Title: 3.21 GBeam Bridge Girder Pultrusion: Section Design and Optimization

Research Area: Thrust Area 3

PI: W. Davids, UMaine

Co-PI(s): NA

Reporting Period: 6/1/22 – 9/30/22

Submission Date: 9/30/22

*****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.

- In collaboration with UMaine, AIT composites created definitions and limits for a pultruded GBeam cross-section
- UMaine developed designs for pultruded GBeam cross sections which adhered to the previously defined limits

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.

- Definition of cross-sections and design constraints limits the design space, allowing future designs’ feasibility to be evaluated
- Cross-section design allows the feasibility of pultrusion and die commissioning to be evaluated, informing future manufacturing decisions

Accomplishments:

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

- Definitions and limits for pultruded GBeam cross-sections were created
- Potential pultruded GBeam cross-sections were designed for three span lengths, two cross-sectional shapes, and two optimization goals (12 total cross-sections)

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: <i>Define Cross-Sectional Characteristics</i>	6/1/2022	8/31/2022	100%
Task 2: <i>Detailed Design of Pultruded GBeam Cross-Section</i>	9/1/2022	12/31/2022	50%

Table 2: Milestone Progress

Milestone #: Description	Corresponding Deliverable	Start Date	End Date
1: Cross-Section Definition	Cross-sectional characteristics	6/1/2022	8/31/2022
2: Cross-Section Design	Cross-sectional design	9/1/2022	12/31/2022

Table 3: Budget Progress

Project Budget	Spend – Project to Date	% Project to Date (include the date)
\$79,866	X	X

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):

- 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
- 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
- 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)
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 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 is 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?

Details of the 12 cross-section designs were provided to AIT Bridges for review in August, 2022. A meeting was subsequently held with AIT Bridges during which the UMaine section designs were reviewed. Of the 12 sections, several were structurally infeasible, and it was mutually agreed that AIT would assess the potential for pultruding the most feasible section, which would be appropriate for a 50 foot span with a reasonable girder spacing and span:depth ratio. In early September, AIT concluded that they will not be able to pultrude this section due to pulling capacity limitations and physical space needed for fabrics and pre-forms. As a result, UMaine will shift efforts to improving infusion efficiency through targeted automation of fabric placement and the use of fabric pre-forms.

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).
Advanced Infrastructure Technologies has provided in-kind support

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

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:

- 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:

- 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:

- 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
W. Davids	11/1/21-present	william.davids@maine.edu	Civil Engineering	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
				Email is not included in the external report and is only used for internal purposes.	(i.e. UG, MS, PhD)		(i.e. TIDC, Other university funds, , unpaid intern, etc.	What work are they conducting? Please be descriptive. Student research assistant is not enough info.
N/A								

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			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?
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
		List the amount	List the amount	Mark with an "x" where appropriate		
AIT Bridges	Brewer, ME	See budget	See budget	X	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
	For internal use only			(i.e. technical champion, technical advisory board, test samples, on-site equipment, data, etc.)
David Rodriguez		AIT Bridges	7/1/2022-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 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?
N/A						

Changes:

No changes to the original project scope have been made. However, the results of cross-section design have shown GBeam pultrusion to be infeasible at this time, and alternative concepts for accelerating GBeam infusion are being explored.

Planned Activities:

List the activities planned during the next quarter.

- Explore additional concepts for GBeam manufacturing acceleration