**Quarterly Progress and Performance Indicators Report:**
**Project Number and Title:** 4-2 Future-Proof Transportation Infrastructure Through Proactive, Intelligent, and Public-involved Planning and Management
**Research Area:** Thrust 4 Connectivity for enhanced asset and performance management
**PI:** *Jin Zhu, Ph.D. Assistant Professor, University of Connecticut*
**Reporting Period:** *December 202-March 2022*
**Submission Date:** *March 31, 2021*

## Overview:

*Provide **BRIEF** highlights of activities performed during the reporting period.*

During the past three months, we focused on the following activities:

1. Finalizing a computational model to future-proof transportation infrastructure
2. Working on the revision of a journal article as a product of the project
3. Working on the final report

## 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.*

- Activity 1 helps to complete the major research tasks of the project;
- Activity 2 helps to disseminate the findings from this research project;
- Activity 3 helps to generate the final product and deliverables of the project.

## Accomplishments:

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

1. A journal article titled "Development of a Future-Proofed Transportation Infrastructure Planning Framework Using Topic Modeling and Association Rule Mining" was submitted to ASCE Journal of Computing in Civil Engineering and the manuscript has finished the first round review.
2. The computational model and interactive tool were under construction

**Task, Milestone, and Budget Progress:**

*Complete the following tables to document the work toward each task and budget*

| Table 1: Task Progress | | | |
|---|---|---|---|
| **Task Number: Title** | **Start Date** | **End Date** | **% Complete** |
| Task 1: Identify future risks and opportunities in transportation infrastructure durability planning and management. | October 1, 2018 | September 30, 2019 | 100% |
| Task 2: Model the effects of future-proofing transportation durability planning and management strategies. | October 1, 2019 | December 30, 2021 | 100% |
| Task 3: Develop a decision-support system for durability planning and management. | Jan 1, 2021 | June 30, 2022 | 60% |
| Overall Project: 4-2 Future-Proof Transportation Infrastructure Through Proactive, Intelligent, and Public-involved Planning and Management | October 1, 2018 | June 30, 2022 | 85% |

| Table 2: Milestone Progress | | | |
|---|---|---|---|
| **Milestone #: Description** | **Corresponding Deliverable** | **Start Date** | **End Date** |
| N/A | N/A | N/A | N/A |

| Table 3: Budget Progress | | |
|---|---|---|
| **Project Budget** | **Spend – Project to Date** | **% Project to Date (include the date)** |
| $241,250 | $205,491 | 85.18% |

**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?

   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?

   N/A

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:**

*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 | N/A | N/A | N/A | N/A | 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 |
|---|---|---|---|---|
| Peer-reviewed Journal | Development of a Future-Proofed Transportation Infrastructure Planning Framework Using Topic Modeling and Association Rule Mining | N/A | N/A | Under review |

*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?

   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

*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. List any outcomes accomplished during this reporting period:*

The research results can aid DOTs in assessing their transportation infrastructure under the impacts of multiple stressors with high level of uncertainty and re-evaluating their plans of design, construction, and maintenance. The results could provide useful data for decision making in multiple sectors including the Asset Management Group, Sustainability & Resiliency, and Highway Operations.

**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** |
| Jin Zhu, Assistant Professor | October 1, 2018 | jzhu@uconn.edu | Civil and Environmental 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.)*

| Table 7: Student Participants during the reporting period | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Student Name** | **Start Date** | **End Date** | **Advisor** | **Email Address** | **Level** | **Major** | **Funding Source** | **Role in research** |
| Sudipta Chowdhury | Oct 1, 2018 | - | Jin Zhu | | PhD | Transportation Engineering | TIDC/UConn CEE Department TA | Conducting literature review, model development, and report writing |
| Kaitlyn Kondos | Sep, 1, 2021 | - | Jin Zhu | | Undergraduate | Civil Engineering | TIDC and UConn CEE Undergraduate Research Initiative | Conduct literature review |

*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 | N/A | N/A | 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 | 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** |
| | | List the amount | List the amount | Mark with an "x" where appropriate | | |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A |

*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** |
| Mostafa Batouli, Assistant Professor | | The Citadel, Civil Engineering Department | December 2021 | Research idea discussion |
| Karen Riemer, Principal Engineer | | CTDOT | June 2019 | 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** |
| CE 4220 | Principles of Construction II | Undergrad | University of Connecticut | Jin Zhu | Spring 2022 | 60 |
| CE 4999 | Independent Study Civil Engineering | Undergrad | University of Connecticut | Jin Zhu | Spring 2022 | 2 |

**Changes:**

*List any actual or anticipated problems or delays and actions or plans to resolve them*

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

**Planned Activities:**

*List the activities planned during the next quarter.*

1. Finish the model and simulation experiments
2. Finish final report writing
3. Complete the journal article revision