Quarterly Progress and Performance Indicators Report:
Project Number and Title: 4-10- Road Salt Impact Assessment (Safety Study)
Research Area: Thrust Area 4
PI: Jonathan Rubin, Ph.D., Professor, University of Maine
Co-PI: Mohammadali Shirazi, Ph.D., Assistant Professor, University of Maine
Reporting Period: 10/1/2021 to 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** ….*

- We developed crash severity models for four facility types: minor collectors, major collectors, minor arterials, and Interstates.
- We investigated the impact of different driver, roadway, and weather factors on severity of crashes.
- We continued documenting our results. We also drafted another paper.

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.

- A major modeling task was analyzing crash severities which has been accomplished in this period.
- We can now calculate the odds of crash severities based on different factors
- We are documenting the results to share them with the DOT.

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

- We finalized the crash severity models.
- The impact of different factors on odds of crash severities was determined.
- A paper on crash severity was drafted.

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**
1. Literature Review	08/15/2020	12/31/2020	95%
2. Data Collection	08/15/2020	12/31/2020	95%
3. Statistical Analysis	01/01/2021	10/31/2021	90%
4. Hotspots (cost of crashes)	10/15/2021	11/15/2021	90%
5. Final Report	11/15/2021	12/31/2021	65%
Overall Project:	08/15/2020	12/31/2021	85%

Table 2: Milestone Progress			
Milestone #: Description	**Corresponding Deliverable**	**Start Date**	**End Date**
1. Literature Review	Brief Summary of literature review	08/15/2020	12/31/2020
2. Data Collection	Brief summary about the data collection process	08/15/2020	12/31/2020
3. Statistical Analysis	Brief summary about the statistical analysis results	01/01/2021	10/31/2021
4. Hotspots (cost of crashes)	Brief summary about the hotspots	10/15/2021	11/15/2021
5. Final Report	Final Report	11/15/2021	12/31/2021 (delayed)

Table 3: Budget Progress*		
Project Budget*	**Spend – Project to Date**	**% Project to Date (include the date)**
Full Budget	$66,435.14*	

* This is the UTC budget (It did not include the cost share).

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.)

- We are working on documenting our results to share them with the DOT, before meeting with them. We plan to meet with DOT as soon as the results are documented and shared, and they have feedback for us.

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)**
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**
Journal	Exploring the Impact of Seasonal Weather Factors on Frequency of Rural Lane Departure Crashes in Maine	Sawtelle, A, Shirazi M, Garder, P, and Rubin, J (2021)	8/15/2021	Under review.
Journal	(Tentative Title) Driver, Roadway and Weather Factors on Severity of Lane Departure Crashes in Maine	Sawtelle, A, Shirazi M, Garder, P, and Rubin, J (2021)	12/31/2021	Ready for Submission

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).

- This research supports a project from Maine DOT (road salt assessment). The budget from that project was used a cost share.

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:

- No changes in policies, etc., but our results can provide safety analysts and practitioners at Maine DOT insights about factors that influence the severity of crashes in Maine at different facilities. These results can help the state in providing improved maintenance strategies, or enhance safety using proper safety countermeasures, or increase awareness across the state.

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:

- No specific changes in policies, etc., but the outcomes of this study can provide insights to the safety analysts and practitioners at the department of transportation in Maine to better understand the factors impacting crash severities in Maine, at four rural facility types (i.e., minor collectors, major collectors, minor arterials, principal arterials- Interstates), to allocate necessary funds or develop countermeasures or improve safety across the state.

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**
Dr. Jonathan Rubin	08/15/2020	rubinj@maine.edu	School of Economics	PI
Dr. Mohamamdali Shirazi	08/15/2020	shirazi@maine.edu	Civil and Environmental Engineering	Co-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**
Alainie Sawtelle	9/1/2020		Dr. Shirazi		Master Student	Civil Engineering (Transportation)	TIDC	Graduate Research Assistant

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**
Maine Department of Transportation (Maine DOT)	Augusta, ME	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**
Mr. Robert A Skehan	robert.skehan@maine.gov	Maine DOT	08/ 15/ 2020	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 521	Civil Engineering Systems and Optimization	Grad	UMaine	Dr. Shirazi	Fall 2021	3

Changes:

- We conducted explanatory analysis about multi-vehicle and truck crashes, but the sample size was not sufficient for statistical models; we decided to mainly focus on total and single vehicle crashes.
- We tried to use the EB method to identify hotspots, but weather data was not sufficient for modeling. Instead, we calculated the cost of crashes, which can provide some insights about hotspots, although it is not as accurate as the EB method. Hotspot identification with the EB method is recommended for future research.
- We revised the project information page.

Planned Activities:

- We are working on documenting the results.
- Results will be shared with the DOT and their comments will be addressed before finalizing the project.