**TRANSPORTATION POOLED FUND PROGRAM**

**QUARTERLY PROGRESS REPORT**

Lead Agency (FHWA or State DOT): Oklahoma Department of Transportation

**INSTRUCTIONS:**

*Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.*

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| **Transportation Pooled Fund Program Project #**  *TPF-5(448)* | | **Transportation Pooled Fund Program - Report Period:**  O Quarter 1 (January 1 – March 31)  O Quarter 2 (April 1 – June 30)  X Quarter 3 (July 1 – September 30)  O Quarter 4 (October 1 – December 31) | |
| **Project Title:**  **Integrating Construction Practices and Weather Into Freeze Thaw Specifications** | | | |
| **Name of Project Manager(s):**  **Tyler Ley** | **Phone Number:**  **405-744-5257** | | **E-Mail**  Tyler.ley@okstate.edu |
| **Lead Agency Project ID:**  **TPF-TPF5(448)** | **Other Project ID (i.e., contract #):**  AA-1-501021 | | **Project Start Date:**  August 30, 2020 |
| **Original Project End Date:**  August 30, 2023 | **Current Project End Date:**  **August 30,2023** | | **Number of Extensions:**  0 |

Project schedule status:

X On schedule On revised schedule □ Ahead of schedule □ Behind schedule

Overall Project Statistics:

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| **Total Project Budget** | **Total Cost to Date for Project** | **Percentage of Work**  **Completed to Date** |
| $660,000 | $0 | 2% |

***Quarterly*** Project Statistics:

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| **Total Project Expenses**  **and Percentage This Quarter** | **Total Amount of Funds**  **Expended This Quarter** | **Total Percentage of**  **Time Used to Date** |
| $2,500 | $2,500 | 2% |

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| **Project Description**:  Concrete can be damaged when it is 1) sufficiently wet (has reached a critical degree of saturation) and 2) is exposed to temperature cycles that enable freezing and thawing. The damage that occurs due to freezing and thawing can lead to premature deterioration, costly repairs, and premature replacement of concrete infrastructure elements. Current specifications for frost durability are largely based on work completed in the 1950s, and while this work included many landmark discoveries (Kleiger 1952, 1954). This work from the 1950s may not be representative of materials used in modern concrete mixtures.  The ultimate goal of this work is to build on previous research efforts to produce improved specifications and advance existing test methods; while, improve the underlying understanding of freeze thaw damage. This work will specifically focus on construction practices and the impact of weather.  The objectives are:   1. Quantify how different weather conditions impact the freeze thaw performance of concrete with low-cost data loggers. This work has been started under this existing project but these samples should be distributed in the field and used to quantify the combination of saturation and freeze thaw cycles in different states. 2. Investigate the freeze thaw performance of existing structures in different climates with different air void qualities. In combination with quantifying the weather in different environments, structures should be found in these structures with different quality of air void systems to determine how they perform. This will provide true case studies of field performance in a quantified exposure. 3. Expand the freeze thaw model to a larger range of mixtures to see if the trends still hold. 4. Further evaluation of the accuracy of the modeling predictions for determining the matrix saturation and the relationship between the secondary sorption and formation factor. 5. Better understand the damage propagation after critical saturation is reached. 6. Extension of this work to include salts such as those that result in calcium oxychloride to further improve the computational modeling predictions. 7. Determine how air void filling impacts the durability of concrete from freeze thaw cycles. 8. Develop freeze thaw specifications based on concrete quality, air void system, and local weather conditions. 9. Determine how construction methods such as pumping, mixing time, paving vibration, and hand held vibrators impact the air void spacing within concrete 10. Improve the SAM by making the measurement more consistent through developing a semi-automated testing procedure and improving reliability prediction. 11. Further refine a rapid test method that measures the uptake and fluid and resistivity of the concrete to determine the freeze thaw durability of concrete |

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| **Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**  A kickoff meeting was held for the project to share our ideas with the sponsoring states. We received good feedback and continue to collect data from the weather boxes.  The research team is starting to have meetings every two weeks to discuss our progress. |
| **Anticipated work next quarter**:  Start the work on the different tasks. |

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| **Significant Results:** |
| **Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that**  **might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).** |

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| **Potential Implementation:** |