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| Title: | Develop a Combined Innovative Approach for Effective Characterization of Available Supplementary Cementing Materials (SCMs) in Texas |
| The Problem: | <p>Replacing a portion of cement by supplementary cementitious materials (SCMs) is the most common strategy to achieve required strength or durability of concrete in the state, as suggested by TxDOT Standard Specification Item 421, Hydraulic Cement Concrete. However, the high variability between different SCM sources has made the predictability of the performance challenging.</p> <p>There is considerable evidence to show that SCM sources which do not conform some of the specification limits are not only able to achieve their target 28-day compressive strength, but are also able to possess all the desirable performance characteristics. Also, the current durability test methods, particularly ASR, have several limitations.</p> <p>There is a need to take a more fundamental approach to better understand mineralogical and chemical composition of SCMs and its interaction with cement microstructure, overcome the problems associated with the current compositional classification of SCMs, develop a predictive tool, and eventually optimize locally available SCMs to mitigate performance issues. The combined innovative approach of this nature will serve as an effective tool for TxDOT to ensure effective utilization and formulation of case specific performance-based concrete mixtures using all locally available SCMs and make durable long lasting concrete.</p> |
| Technical Objectives: | <p>The researchers shall address the following:</p> <ol style="list-style-type: none"> 1. Develop a testing protocol that includes fast and insightful compositional/microstructural investigations to characterize SCM powder combined by mechanical and durability tests on concrete. 2. Find a link between the mineralogical and chemical characteristics of SCM and performance of concrete that contains SCM. Some of the suggested tests for powder characterization are, but are not limited to: XRD, SEM/EDS, NMR, XRF, mXRF, Computed Tomography (CT), laser particle size analyzing, and pore solution alkalinity measurement. 3. Use the appropriate testing protocol to characterize SCM. In addition to SCM powder examination, establish the connection between SCMs mineralogical/chemical composition and mechanical and durability performance. The tests on concrete should include the major issues/needs of the state, including ASR durability, mass transport properties, and strength development. <p>The expectation of this project is that the end product will obtain a TRL level 7.</p> |
| Desired Deliverables: | <ol style="list-style-type: none"> 1. Technical memorandum for each task completed. 2. Monthly progress reports. 3. Value of Research (VoR) that includes both qualitative and economic benefits, to be included in the final research report. 4. Research report documenting the findings of the research, including a reference guide for recommended technologies, material specifications, pros and cons each technology, and construction tips. 5. Project Summary Report. |
| Proposal Requirements: | <ol style="list-style-type: none"> 1. Utilize the "Proj/Agre" and "PA_Form" templates located at the TxDOT RTI website. 2. Proposals will be considered non-responsive and will not be accepted for technical evaluation if they are not received by the deadline or do not meet the requirements stated in RTI's University Handbook, which is also located at the RTI website. 3. Proposals should be submitted in PDF format, 1 PDF file per proposal. File name should include project name and university abbreviation. 4. This project will be tracked during the life of the project using a Technology Readiness Level (TRL) scale. For more information about the use of a TRL, click. |