

Project Title: Development of Rapid Setting Soil-Cement Mixture Designs and Performance Testing

Project Abstract (Brief Description): The maintenance and repair of maritime infrastructure is critical to maintaining important shipping channels and preventing unnecessary loss of life or economic impact after storms. The fastest repair, reconstruction, and maintenance techniques may become more desirable as labor costs increase and delays become costlier. The objective of this research is to identify the properties and proportioning of Belitic Calcium Sulfoaluminate (BCSA) soil-cement mixtures most effective for use in waterway structures. BCSA cement is a rapid setting, low-shrinkage cement which can be used in a similar fashion to portland cement (PC). The main advantage of BCSA over PC is that it gains strength extremely quickly, meaning it can be used for rapid repairs and accelerated construction. This project builds upon findings from a previous MarTREC project that proved that BCSA could be applied to soil-cement mixing (in place of PC), speeding up strength gain significantly. The proposed work would narrow down the design and appropriate use of this material, developing mixture proportioning guidelines and investigating its durability with an emphasis on its use in waterway applications (e.g., levee construction and repair, slope protection, erosion protection, seepage reduction). In addition to standard soil and soil-cement properties determination, strength testing, freeze-thaw testing, wetting and drying testing, permeability testing, and erosion testing will be performed. The result will be new guidance on how to effectively use BCSA soil cement for rapidly deployable, long lasting repairs to soil structures. This knowledge could also be used any time faster construction of stabilized soil structures is needed.

Describe Implementation of Research Outcomes - As discussed throughout, the previous project was limited in terms of its focus on soilcement. While varying the mixing parameters outlined in the previous sections, performance metrics will be measured. In particular, unconfined compressive strength, freeze-thaw resistance, wetting-and-drying resistance and additional performance tests will be performed (washout resistance, hole erosion testing). The goal of this testing will be to evaluate the influence of mixture parameters on these important performance measures. At the end of the project the interrelated effects of moisture content, cement content, retarder dosage, and soil mixture on the performance of the resulting soilcement will be better understood. The final report will provide recommendations on how to proportion the best fast-setting soil cement mixture to provide good performance relative to the existing standards developed for PC. The team will also discuss the findings and developed mixtures with engineers from the US Army Corps of Engineers to consider the feasibility of future full-scale implementation and any additional suggested research efforts.

Impacts/Benefits of Implementation - The budget includes funding for a graduate student (and additional GA help) who will be the primary researcher on the project. Their involvement should be continuous throughout the award period. They will be responsible for developing and testing mixtures, writing portions of the reports, and participating in any field visits. Undergraduate honors researchers

(not a part of project budget) may also assist in parts of this work, potentially yielding undergraduate honors theses and furthering the impact of the research

Web Links: martrec.uark.edu

Budget (Funding) Amounts & Source(s) (US DOT +Match(s) =Total Costs): MarTREC 150,000 and UA 75,000 = 225,000

Project Start and End Dates: 09/01/21-12/30/23
Complete

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