

UTC Project Information	
Project Title	MPC-538 – Representative Testing of Expansive Soil Treatment Technologies for Transportation Earthworks
University	Colorado State University
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Funding Source(s) and Amounts Provided (by each agency or organization)	<p>USDOT, Research and Innovative Technology Administration \$17,935</p> <p>Two weeks of salary for Drs. Scalia and Bareither during the project, with the balance accounted for by Dr. Scalia’s start-up funds at CSU used towards development of laboratory apparatus. \$17,935</p>
Total Project Cost	\$35,870
Agency ID or Contract Number	69A3551747108
Start and End Dates	November 2, 2017 to July 31, 2022
Brief Description of Research Project	<p>The shrink-swell behavior of expansive soils reduces transportation infrastructure longevity in much of the Mountain Plains region (Colorado, North Dakota, South Dakota, Utah, and Wyoming). Roadways are particularly susceptible to the effects of expansive soils due the combination of low ground pressures and large surface areas. The pervasiveness of expansive soils in the continental U.S. is shown in Fig. 1. Current estimates for the annual cost of damage to transportation infrastructure from expansive soils are not readily available, but were estimated by U.S. Housing and Urban Development (HUD) to be approximately \$1.1 billion in 1973 (Jones & Holtz 1973) and \$4.3 billion in 1981 (Jones 1981; \$12 billion in 2017 dollars adjusting for inflation). Given the prevalence of expansive soils in the Mountain Plains region, economical solutions to mitigate damage to transportation infrastructure is necessary to enhance transportation system longevity throughout the Mountain Plains region.</p>

The current Mountain-Plains Consortium (MPC) project MPC-509 is aimed at evaluating expansive soil mitigation for transportation earthworks by polymer amendment. The goal of MPC-509 is to provide un-biased information on the effectiveness of commercially available polymer stabilizers. Testing to date has involved four commercially available polymer treatment technologies applied at different dosage rates to a highly expansive soil. Testing on the highly expansive soil has also been performed with varying dosages of Class-C fly ash, lime, and on untreated soil. Testing to date has included standard soil characterization, and tests of hydraulic conductivity (ASTM D5084), swelling potential (ASTM D4546), expansion index (ASTM D4829), and unconfined compressive strength (ASTM D5102). Results to date have shown that traditional stabilizers (lime and Class-C fly ash) are more effective at reducing swelling potential and expansion index than polymeric amendments. However, traditional stabilizers result in an order-of-magnitude increase in permeability, while polymer amendments result in reductions in permeability. Shrink-swell potential is mechanistically based on the addition of water, and the rate of ingress of water into soil is governed by the soil permeability. Thus, existing standard methods fail to provide a representative comparison of traditional and polymeric stabilizers (due to the ways these treatments modify the soils). An alternative method is needed to accurately compare traditional and polymeric stabilization of expansive soils, as well as other innovative materials proposed for use in treating expansive soils.

Research Objectives:

1. Develop and fabricate a lab-scale apparatus for comparative testing of traditional and polymeric expansive soil treatment technologies
2. Use the apparatus to compare traditional (lime and fly ash) and commercially-available polymer treatment technologies to natural (un-amended) expansive soils
3. Develop a standard methodology for testing of innovative expansive soil treatment technologies (e.g., use of different recycled materials)

The proposed study will develop and fabricate a lab-scale apparatus for comparative testing of traditional and polymeric expansive soil treatment technologies. The proposed apparatus will then be used to compare traditional (lime and fly ash) and commercially-available polymer treatment technologies to natural (un-amended) expansive soils. The proposed apparatus is necessary to effectively carrying out this comparative evaluation due the different mechanisms by which traditional stabilizers and polymeric stabilizers mitigate soil shrink-swell behavior. Finally, the procedures developed during the proposed study will be codified into a standard methodology for

	testing of innovative expansive soil treatment technologies (e.g., use of different recycled materials).
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	
Impacts/Benefits of Implementation (actual, not anticipated)	
Web Links <ul style="list-style-type: none">• Reports• Project Website	