

UTC Project Information	
Project Title	MPC-687 – Enhancing the Resiliency of Pavement Infrastructure Built on Sulfate-Rich Expansive Soil Subjected to Climate Change
University	South Dakota State University
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Funding Source(s) and Amounts Provided (by each agency or organization)	USDOT, Office of the Assistant Secretary for Research and Technology \$151,404 South Dakota State University \$159,123
Total Project Cost	\$310,527
Agency ID or Contract Number	69A3551747108
Start and End Dates	February 10, 2022 to July 31, 2024
Brief Description of Research Project	The resilient modulus of bases and subgrade is one of the most important parameters used in the design of flexible pavement. In Region 8, there is an abundance of expansive soil from the Pierre Shale formation, which is known to be often rich in gypsum which is a major source of sulfate in soils. Traditional soil treatment methods like chemical stabilization using lime or cement may not work in such soils due to sulfate-induced heave. Very limited research has been conducted on the studying the variation of resilient modulus of such sulfate-rich expansive soils. The effects of climate change may induce additional distress on the pavement infrastructure including embankments on which they are built which needs to be analyzed to ascertain the resiliency of the pavement infrastructure in the region. In the proposed study, a series of repeated load triaxial tests and suction-controlled triaxial tests will be conducted on a newly fabricated advanced triaxial setup to study the response of such problematic soils before and after treatment to evaluate the resiliency of such materials to potential cycles of extreme precipitation and drought-like conditions. Additional studies will be conducted to investigate the volume change during the wetting and drying cycles.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The findings have been shared with South Dakota Department of Transportation (SDDOT). The importance of identifying sulfate concentration in soils in the region has been highlighted. The SDDOT have planned not to use soil stabilization for construction projects where sulfate content is high to avoid such issues. The implementation using

	<p>biopolymers as a co-additive is at its infancy. Due to the critical nature of embankments, pilot studies are needed before actual full-scale field implementation. Long term laboratory studies are needed to study the behavior of such treated soils. Minnesota DOT and their pooled fund group NRRRA will be contacted and this report will be shared to seek support for pilot studies within the next 3 to 5 years.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>The issues with volume changes in cement-stabilized sulfate-rich soils have been demonstrated. This will highlight the risk of using traditional stabilizers for soils with more than 10,000 ppm sulfate concentration. This may be applied to reduced distress on pavements and better ride comfort. The anticipated stresses due to climate change have been demonstrated in the study. A 23% increase in the maximum daily precipitation and a 31% increase in the number of extreme precipitation events for SSP5-8.5 scenario. This may reduce the factor of safety of embankments built with expansive soils by nearly 30%, which may be catastrophic.</p>
<p>Web Links</p> <ul style="list-style-type: none"> • Reports • Project Website 	<ul style="list-style-type: none"> • MPC Final Report – Enhancing the Resiliency of Pavement Infrastructure Built on Sulfate-Rich Expansive Soil Subjected to Climate Change