



MarTREC UTC Project Information Form
USDOT Tier 1 University Transportation Center
Agency ID or Contract Number 69A3551747130

Project Title: Effect of Permeability Variation of Expansive Yazoo Clay at the Maritime and Multimodal Transportation Infrastructure in Mississippi
Project Abstract (Brief Description): The existence of Yazoo clay soil in Mississippi frequently causes pavement distress in multimodal transportation infrastructure. Each year, fixing the pavement requires significant maintenance budget of MDOT. Also, many of the pavement is located over the levees, which is a major component of the maritime transportation infrastructures. Due to the shrinkage and swelling behavior of the Yazoo clay, the hydraulic conductivity varies over the different season and has higher vertical permeability during the dry season. With high vertical permeability, the rainwater can easily percolate in the pavement subgrade, which accelerates the failure. Moreover, for the existing pavements on top of Levee, changes in the hydraulic permeability opens the top of the levee, which creates an easy passage for rainwater to saturate the levees. However, no study is available on the change in hydraulic permeability of Yazoo clay soil. The current study intends to conduct basic research to investigate the change in unsaturated vertical and horizontal permeability and its effect on the maritime and multimodal infrastructures such as pavement subgrade’s moisture variation. Highly plastic Yazoo clay soil samples will be collected from pavement sites to investigate the soil properties. A test box will be fabricated to simulate the wet-dry cycles and concurrently measure the permeability of the Yazoo clay. Advanced numerical modeling using Finite Element Method will be conducted to evaluate the effect of different frequency and duration of rainfall (based on historical rainfall data of Mississippi) on the water percolation in the subgrade soil. Additional study will be performed with actual rainfall at the different scenario of fall, spring and summer time, to determine the critical condition of moisture infiltration in the subgrade soil. Further analysis will be performed on a pavement section on top of a levee section along Mississippi River, which is constructed using Yazoo clay. Finite element modeling using flow analysis will be performed at different rainfall period, similar to the pavement section, to evaluate the effect of the variation of the permeability at the pavement subgrade on top of the levee. The analysis results will be evaluated to determine the active zone at the Central Mississippi area. The analysis will help to improve the design of the undercut of the pavement, which is critical to control the deformation and continuous deterioration of the highway/roadway pavement in many miles of maritime and multimodal transportation infrastructure in Mississippi.
Describe Implementation of Research Outcomes (or why not implemented) - Place any photos here <i>To be determined upon conclusion of the project:</i>
Impacts/Benefits of Implementation (actual, not anticipated) <i>To be determined upon conclusion of the project:</i>
Web Links: martrec.uark.edu
Budget (Funding) Amounts & Source(s) (US DOT +Match(s) =Total Costs):): \$57,500 (USDOT) + \$28,750 (Matching funds) = \$86,250 (Total Cost)

Project Start and End Dates: 09.01.2018 to 08.31.2019

Principal Investigator(s) and Contact Information: Sadik Khan, Ph.D., P.E, Assistant Professor,
Department of Civil and Environmental Engineering, Jackson State University, 1400 J. R. Lynch Street,
Jackson, MS, 39217, email: J00797693@jsums.edu, phone: 601-979-6373, <https://orcid.org/0000-0002-0150-6105>

Principal Investigator Institution (University): Jackson State University