

Project Title: Rapid and non-destructive assessment of levees for strength and liquefaction resistance
Project Abstract (Brief Description): In 2013, the American Society of Civil Engineers (ASCE) gave the levee system in the United States an overall rating of D-. This rating is based in part on information from the National Levee Database (NLD) which is comprised of approximately 14,700 miles of levees operated by the U.S. Army Corps of Engineers (USACE). These levees are more than 55 years old on average and were originally designed to protect farmland from flooding; however, due to urban sprawl and changes in land use, over 14 million people now live or work behind these structures. Unfortunately, only 8% of these levees are found to be in acceptable condition, while about 69% are minimally acceptable, and 22% are rated as unacceptable. In the coming decades, continued deterioration, urban development, and an increase in extreme weather events will test these structures to and beyond their capacity, leading to a significant increase in risk. To prevent failures in these structures, ASCE estimates more than \$100 billion is needed to repair and rehabilitate the levee system.
Describe Implementation of Research Outcomes: This research developed a rapid, non-destructive geophysical testing program and probabilistic framework that can be used to proactively evaluate levees. There is a clear correlation between resistivity and the degree of saturation and bulk density of a soil. An increase in either parameter is associated with a decrease in electrical resistivity. The resistivity values were found to be highly dependent on the degree of saturation up to approximately 60%, at which point increasing saturation does not result in significantly different resistivity values. When the soil is close to saturation, the effect of density or water quality on resistivity diminishes which makes the task of identifying soil type easier.
Impacts/Benefits of Implementation: It was observed that an estimate of the degree of saturation in conjunction with electrical resistivity offers the best estimate of soil type. The methods were shown to be capable of detecting many common defects in levees and earthen dams including the location of soft layers, old river meanders, inclusions or utilities, and internal erosion, any of which could lead to failure of the levee during a high water event.
Web Links: martrec.uark.edu
Budget (Funding) Amounts & Source(s) (US DOT +Match(s) =Total Costs): \$109,469 MarTREC + \$128,670 U of A Start Up Funds = \$238,139
Project Start and End Dates: 01/01/2015-06/30/2017. Project complete.
Principal Investigator(s) and Contact Information: Clinton Wood Ph. D and Michelle Bernhardt Ph.D
Principal Investigator Institution (University): University of Arkansas