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National Science Foundation Soil-Bentonite cutoff Wall Award Abstract

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Field Testing and Monitoring of an Experimental Soil-Bentonite Cutoff Wall

NSF Org:	CMMI Div Of Civil, Mechanical, & Manufact Inn
Initial Amendment Date:	June 1, 2015
Latest Amendment Date:	June 1, 2015
Award Number:	1463198
Award Instrument:	Standard Grant
Program Manager:	Richard Fragaszy CMMI Div Of Civil, Mechanical, & Manufact Inn ENG Directorate For Engineering
Start Date:	June 1, 2015
End Date:	May 31, 2020 (Estimated)
Awarded Amount to Date:	$384,188.00
Investigator(s):	Jeffrey Evans evans@bucknell.edu (Principal Investigator) Michael Malusis (Co-Principal Investigator) Robert Jacob (Co-Principal Investigator)
Sponsor:	Bucknell University One Dent Drive LEWISBURG, PA 17837-2111 (570)577-3510
NSF Program(s):	Geotechnical Engineering and M
Program Reference Code(s):	036E, 037E, 1057, 172E, CVIS
Program Element Code(s):	1636

ABSTRACT

Soil-bentonite slurry trench cutoff walls are widely used for seepage control, levee repair, and pollutant containment. Their widespread use in these critical applications requires a better understanding of their as-built condition and long-term behavior. Regarding the as-built condition, the in-place permeability of cutoff walls is heavily influenced by the presence of defects and by the stress within the wall. Conventional construction quality control programs are insufficient to verify backfill homogeneity throughout the installation, and commercial technologies are not yet available for non-destructively detecting defects or verifying the absence of defects. Regarding long-term behavior, several factors may cause changes in permeability of the wall over time including changes in stress and wet-dry cycling. This project seeks to address these questions regarding both the short-term (as-built) and long-term integrity of cutoff walls through the design, construction, in-situ

testing, and monitoring of a fully instrumented cutoff wall to be installed near the Bucknell University campus. Society will benefit from better understanding and performance from our dams, levees and pollutant containment systems and from substantial teaching, training, and mentoring through the involvement of undergraduate and graduate students in the research, outreach to secondary students as part of the annual engineering summer camp, and exposure of students and practitioners to the state of the art/practice for cutoff walls via formal seminar presentations.

The cutoff wall will be fully instrumented to monitor in-situ conditions in the backfill (e.g., 3D state of stress, vertical and lateral deformations, and pore water pressures) as a function of time and location. Electrical resistance imaging will be investigated for locating defects placed within the wall at known locations and of known size, with the goal of developing a viable geophysical methodology for defect detection in SB walls. The monitoring will be complemented with lab tests and in-situ tests (e.g., cone penetration, vane shear, dilatometer, and standard penetration tests), also performed over time to reveal time-dependent behavior. Finally, numerical model simulations to predict the stress distribution within an SB cutoff wall will be performed and the results compared with the measured field stresses. All field and lab data will be managed within a geospatial information system framework that will be made accessible to the public via the web.

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Jeffrey C Evans and Daniel G. Ruffing. "Design and Construction of an Experimental Soil-Bentonite Cutoff Wall," *ASCE Geotechnical Frontiers 2017 ASCE GSP 277*, v.GSP 277, 2017, p. 164. doi:ASCE GSP 277

Jeffrey C. Evans, Yu-Ling Yang and Daniel G. Ruffing. "Vane Shear Tests to Evaluate In Situ Stress State of a Soil-Bentonite Slurry Trench Wall," *Juried Conference Paper Proceedings, 8th International Congress on Environmental Geotechnics (Hangzhao, China)*, 2018.

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