Combining and Updating the Vacuum Consolidation Technology

Presented at Soil Improvement Committee Meeting
GeoCongress 2022, Charlotte NC, March 21, 2022

JIE HUANG, THE UNIVERSITY OF TEXAS AT SAN ANTONIO

LISHENG SHAO, MALCOLM DRILLING

Project team

Principal Investigators

Jie Huang, Ph.D., P.E., The University of Texas at San Antonio

Lisheng Shao, Ph.D., P.E., Malcolm Drilling Company, Inc.

Special Counsel

Tony Marinucci, Ph.D., P.E., V2C Strategists

Prabir Kolay, Ph.D., P.E., Southern Illinois University Carbondale

Advisory Panel (alphabetical order)

José LM Clemente, Jie Han, Vernon R. Schaefer, Armin Stuedlein, and Chris Woods

Objectives

- Combine the two existing technologies in GeoTechTools:

  "Hydraulic Fill with Geocomposite and Vacuum Consolidation" & "Vacuum Preloading with and without Prefabricated Vertical Drains"

- Update the newly combined technology with most recent advances in practice

Tasks

Task 1: Perform a comprehensive review

Task 2: Develop a plan to combine these two technologies into one

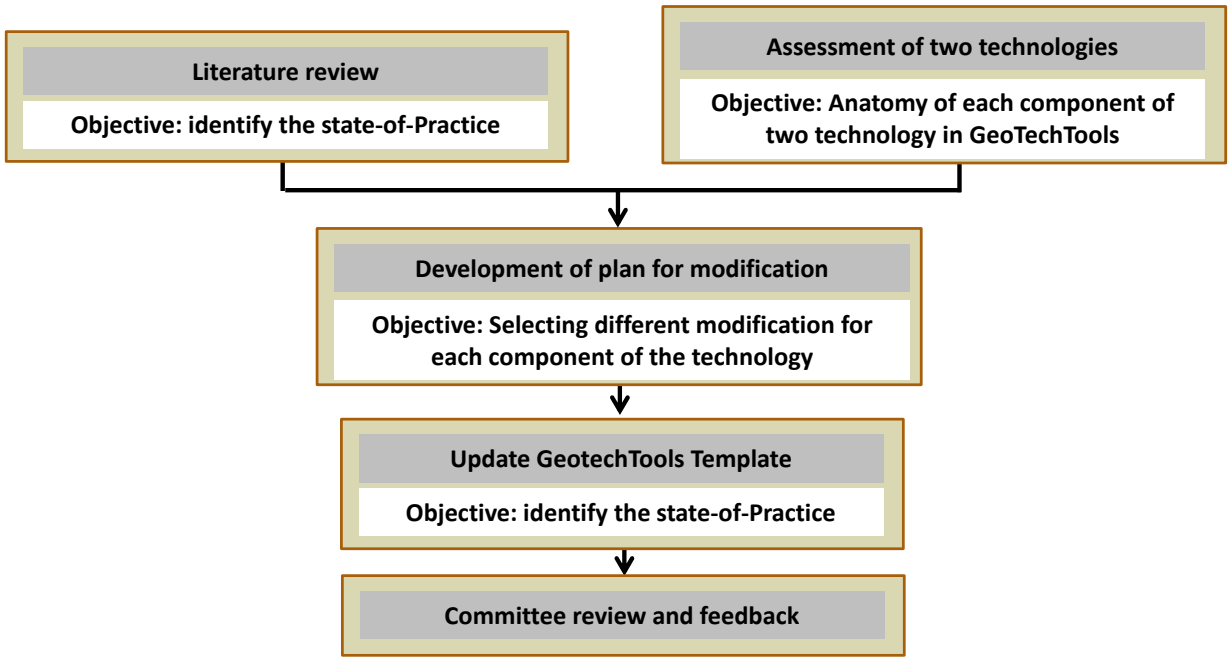
Task 3: Combine the information of these two technologies in the existing GeoTechTools.

Task 4: Update the combined technology entitled ‘Vacuum consolidation” with the available information in the China Scan Tour Report and additional information available in the literature.

Task 5: Prepare a draft report

Task 6: Finalize the report and submit it to G-I

Our Approach



Timelines

11/03/2020 Technical Coordination Council (TCC) approved this project

11/16/2020 Jie Huang and Lisheng Shao were selected to lead the project, Tony Marinucci and Prabir Kolay as the special counsels.

11/30/2020 Project was initiated and then all the tasks were performed on time.

03/01/2021 Provided a project update to TCC

05/19/2021 Submitted an introduction of this project to GEOSTRATA

08/2021 Preliminary report submitted to Committee Chair

10/2021 Final report submitted after addressing review comments

Summary of major updates

Design methodology

- Adding design method without PVD
- Adding a method to estimate settlement based on field observation
- Adding design chart that can consider smear effect of PVD installation

References

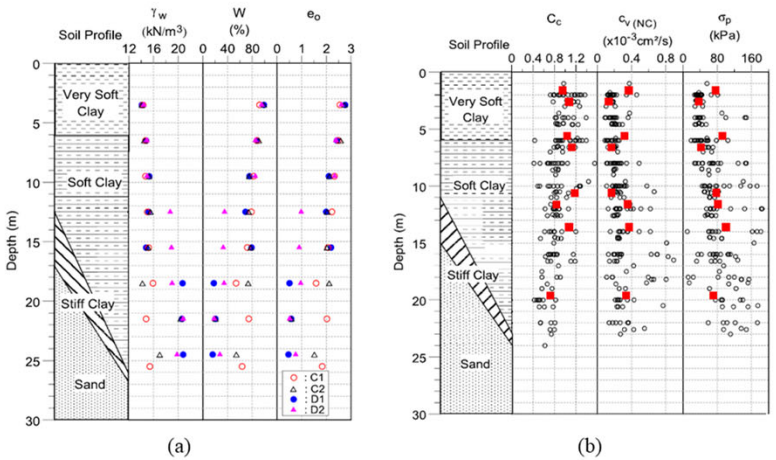
Adding more than 40 publications

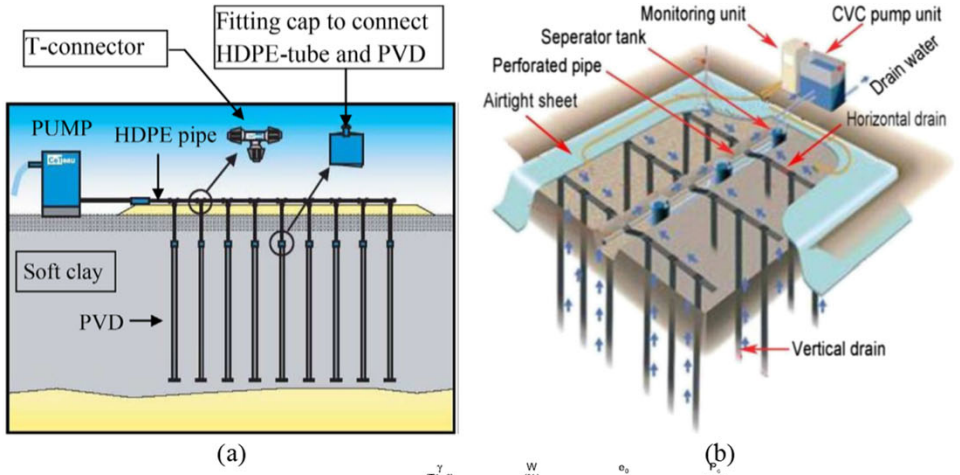
Case histories

Adding case histories

- ✓Direct vacuum loading without airtight layer
- ✓Using clay slurry to replace membrane
- ✓Air-boosted vacuum preloading

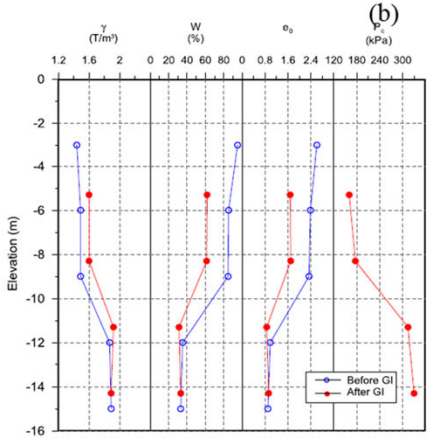
Case history examples



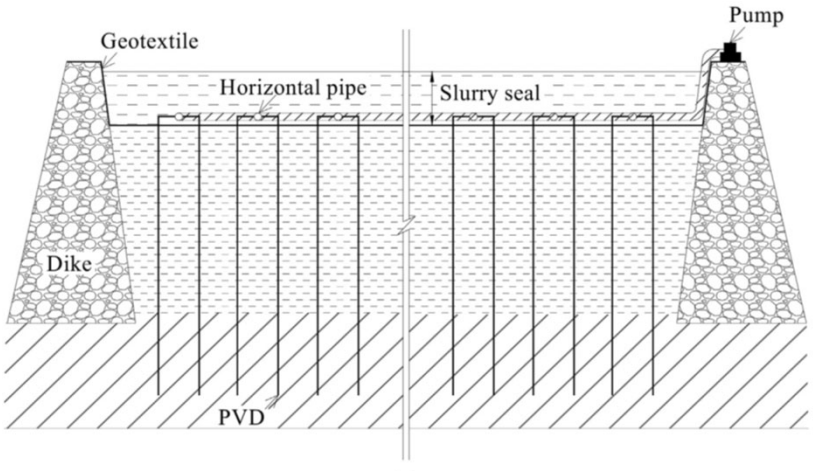


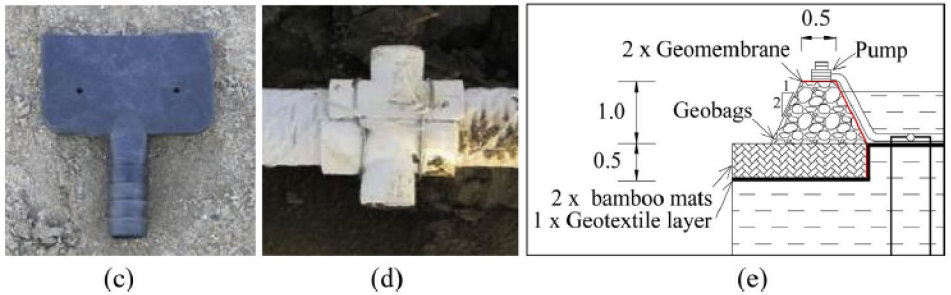
Connecting PVD to fitting cap

Flexible pipe system connecting to vacuum pump



Case history examples (cont'd)





Major updates on the GeoTechTools Templates

Major updates

- ❑ Design
- ❑ Case histories
- ❑ Bibliography (references)
- ❑ Photos

Simple combination

- ❑ Fact sheet
- ❑ Cost
- ❑ QA/QC
- ❑ Specs

Acknowledgement

- G-I and TCC for approving this project and providing funding
- SIC chair, José Clemente and SIC past chair, Jie Han
- GSC chair Mark H. Wayne

THANK YOU VERY MUCH FOR YOUR ATTENTION!