

GeoChallenge 2011

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Project Co-Instructors: Prof. Victor Marcus & Prof. Fred Akl

Industrial Advisor: Dr. Craig Calabria, GeoSystems Consultants

15 April 2011

Description

Project Background

- Design and build reinforced retaining structure (Mechanically Stabilized Earth wall)
- Wall supports retained soil, vertical and horizontal loads
- Optimize design by using minimal amount of reinforcement
- Submit final design report to qualify for 2011 GeoChallenge Competition in Dallas, TX

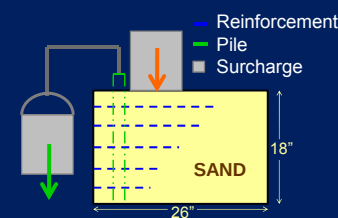
Competition Guidelines

- Soil type, reinforcement, and materials predefined
- Methodology and final to be submitted
- Report score based on design equations, material properties, factors of safety, and assumptions
- Trial and error methods heavily penalized

Design Components

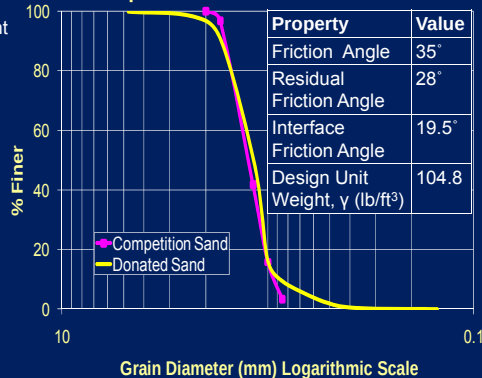
Test Set-Up Components

Box Geometry



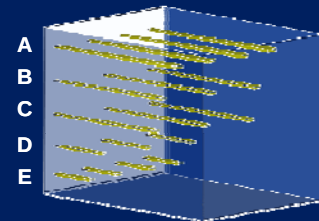
Property	Value
Tensile Strength	29 lb/in
Connection Strength: ¾" Strips	62.00 lb/in
Connection Strength: 1" Strips	58.78 lb/in

Comparison of Grain Size Distribution



Final Design

Row	Strip Depth (in)	Strip Width (in)	# of Strips	Strip Length (in)	FS Breakage	FS Pullout
A	2	1	4	20	2.66	1.10
B	5	0.75	3	16	1.46	1.21
C	8	0.75	3	11	1.33	1.13
D	11	0.75	3	8	1.28	1.16
E	14	0.75	4	6	1.10	1.21



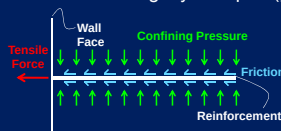
Design Methodology

Design Procedure

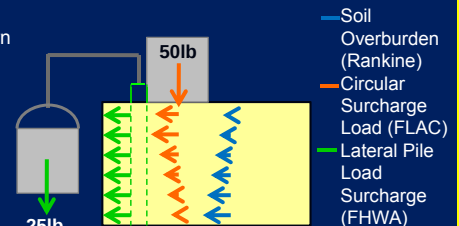
- Balance of capacity and demand
- FHWA design manual (FHWA-NHI-00-43)
- Design procedure implemented in spreadsheet
 - Design based on safety against
 - Pullout of reinforcement
 - (Indicated insufficient length)
 - Breakage of reinforcement
 - (Indicates insufficient cross-sectional area)

Capacity of MSE Wall

- Reinforcement carries tension, soil cannot
- Confining pressure on reinforcement clamps it down
- Wall fails if:
 - Reinforcement is not strong enough (breaks)
 - Reinforcement is not tightly clamped (pulls out)



Demand: Lateral Stresses on Wall



Design Components

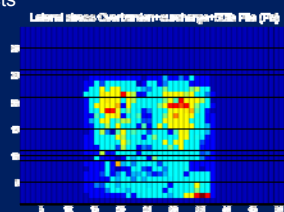
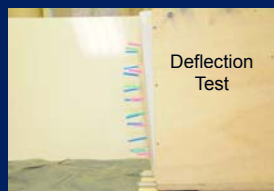
Accomplishments

- Design report qualified on Feb. 4, 2011 for GeoChallenge Competition
 - Team ranked 3rd nationally
 - Team received \$2000 travel grant
- Presentation to Delaware Valley Geotechnical Institute-ASCE dinner meeting on Feb. 22nd 2011
- Project selected for demonstration at Accepted Student Day, March 26, 2011
- Widener Geo Senior Project Team placed 6th nationally at Geochallenge, March 14, 2011



Extension of Current Research

- Identify the sequence that the resistance is mobilized
 - Determine acting lateral stresses on wall facing
 - Stress distribution measured by tactile sensor
 - Measure deflection of facing
 - Determine lateral stresses on facing as wall deflects



- Utilize actual measurements to improve wall design (performance based design)