Case Studies in Shallow Landslide Repair and Severe Erosion Mitigation along Roadway Networks in Appalachia

August 5, 2010
Colby Barrett
Keith Bender
Outline

• Technology Overview
  – GCS®
  – Launched Soil Nails/Micropiles
  – Structural Wire Mesh
  – Shotcrete

• Case Studies

• Questions
Technology Overview
Geosynthetically Confined Soil

Photo courtesy of M. Adams
Definitions

Wall Type

External

- Tieback
- Soil Nails

Internal

- MSE
- GCS

Increased Reinforcement Frequency

- metallic
- geosynthetic

- Strips
- Wire Grids
- 0.8m
- 0.6m
- 0.4m
- 0.2m

Increased Reinforcement Frequency
GCS®
1. *Unique* Composite Structure
2. Internally stable
3. Friction Connections
4. Lightweight Inclusions
5. Close spacing
6. High Factor of Safety

MSE
1. Reinforced Soil Structure
2. Quasi-tieback
3. Pin Connections
4. Strong reinforcement
5. Wide Spacing
6. Failure Rate

No Required Embedment; Truncated Base

Required Embedment
Weak Reinforcement?

$T_{ult} = 20 \text{ lbs/in}$

3372 lbs/ft$^2$

Photo courtesy of M. Adams
Negative Batter?
(22.5 tsf) Load?
Million foot/pound impact
"The result suggests....with a the strongest earthquake that has ever happened on earth, a GRS abutment will likely feel "nothing.""

Dr. J. T. H. Wu (Reporting on the NCHRP GCS/GRS shake table testing, April, 2010)
Project Report for
Launched Soil Nails—
1992 Demonstration
Project

Volume 2
Launched Nails
Densification *Without* Soil Matrix Disruption
1. Average bond = 3.1 psi (ungrounded); 11.5 psi (grouted)
Landslide in dry conditions, FOS>1.0

Perched Water Table Due to Meteoric Infiltration, FOS<1.0

Hollow, Perforated Launched Soil Nails act as drains during high Moisture events, allowing drainage and acting as tensile Inclusions, FOS>>1.0
Temporary Shoring for Ohio DOT

3 DAYS AND $45,000
NO PROJECT DELAY

COMPARED TO
$200,000 AND 6 WEEKS
FOR A
PILE WALL
Mesh Installation

South Lake Tahoe Residence (Final)
Method: Morgenstern-Price
FOS: 1.057

Name: Lower Sandy Silt
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 33°

Name: Upper Sandy Silt
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 28°
Mesh Installation

South Lake Tahoe Residence (Final)
Method: Morgenstern-Price
FOS: 1.272

Name: Upper Sandy Silt
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 28°

Name: Lower Sandy Silt
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 33°
Almost anything can be planted in this system; including live stakes, sprigs, bare root, plugs and seed.
During Construction
Henry County, Road “Z”