

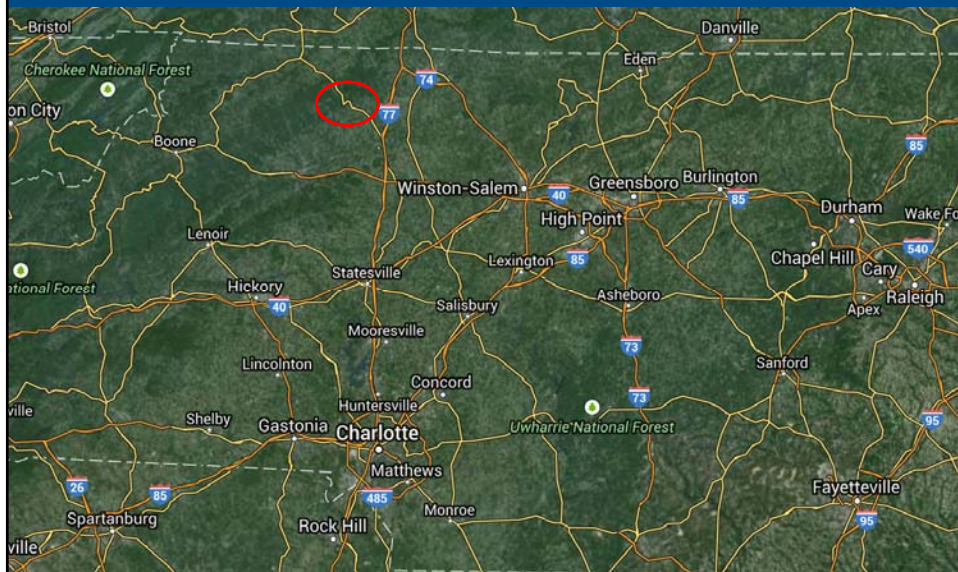


Soldier Pile Wall Failure on US 21 in Blue Ridge Mountains

Nate Beard, P.E.
Matt Birchmier, P.E.

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US 21, Wilkes County, NC



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NCDOT Div. 11 Maintenance



May 31, 2013



May 31, 2013



May 31, 2013



July 8, 2013 (+5 weeks)

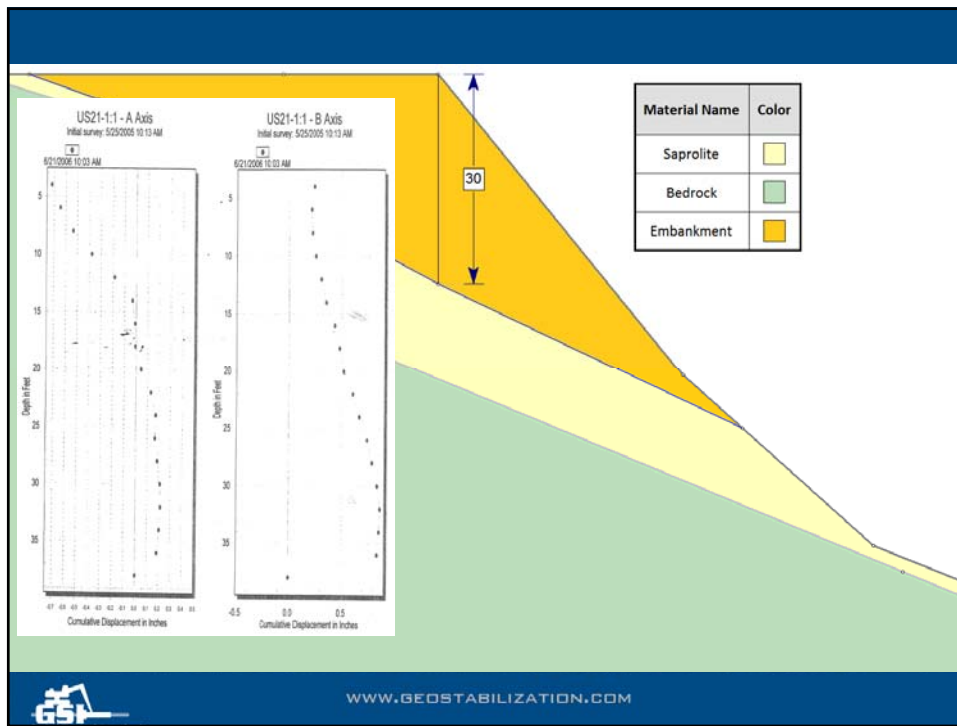


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July 8, 2013



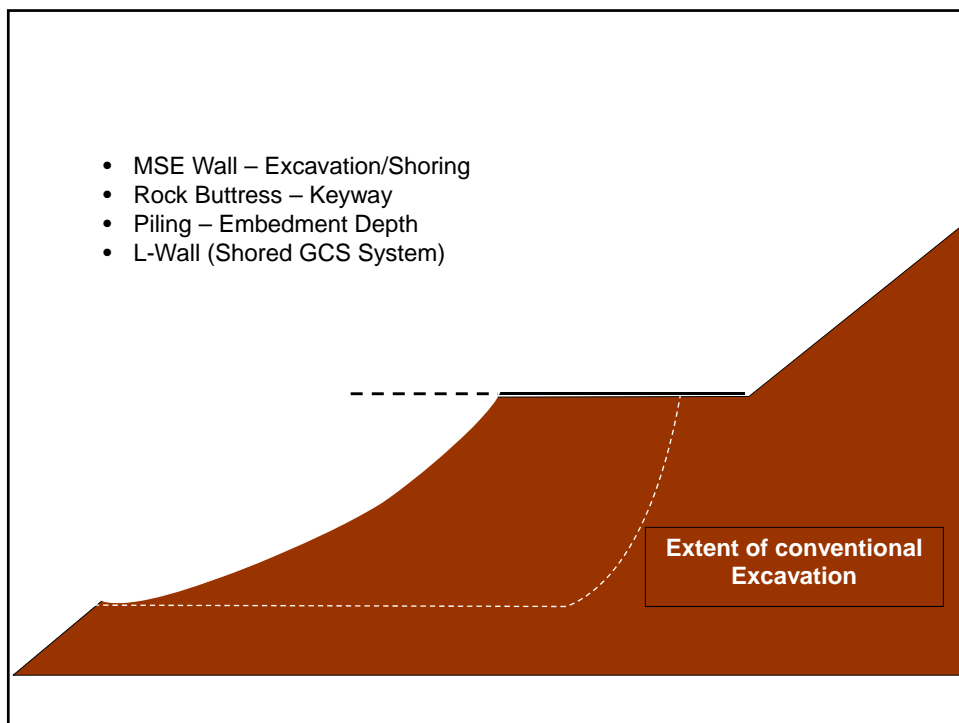
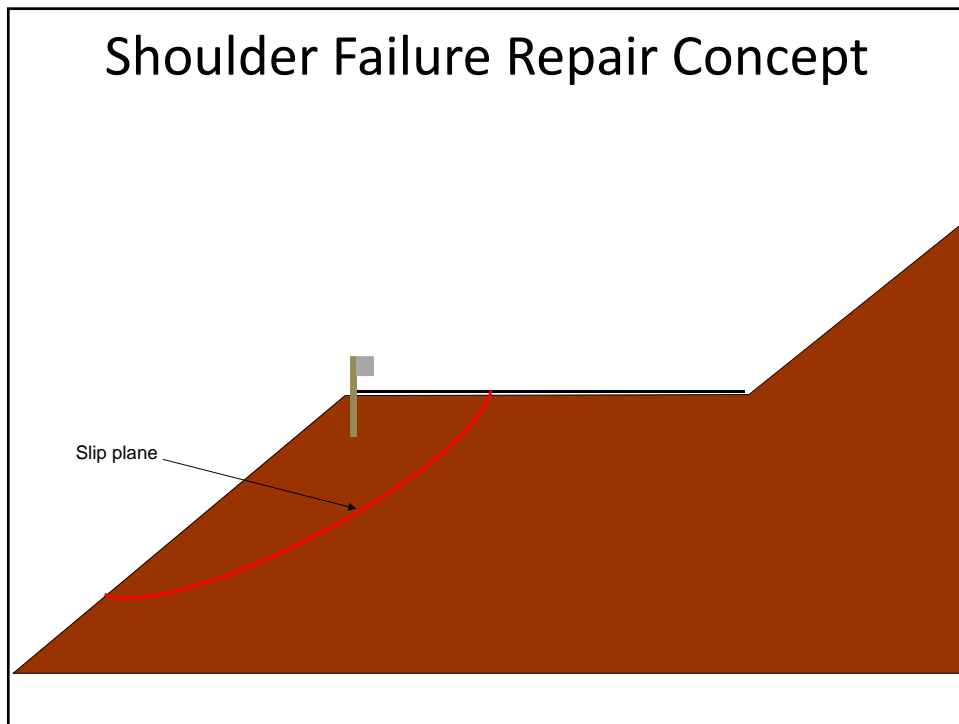
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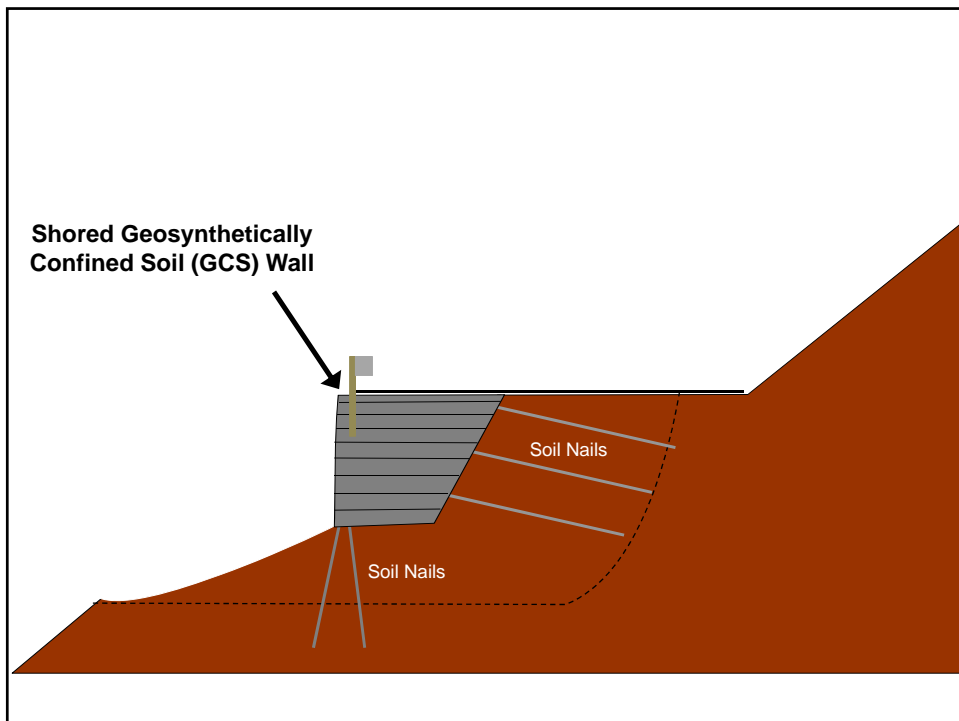
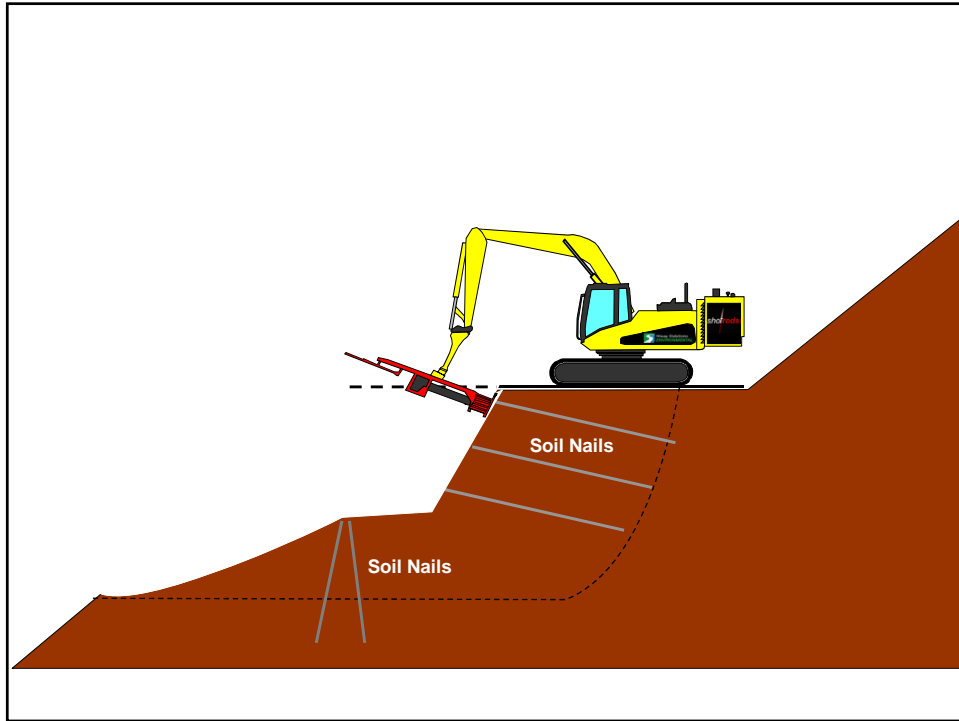


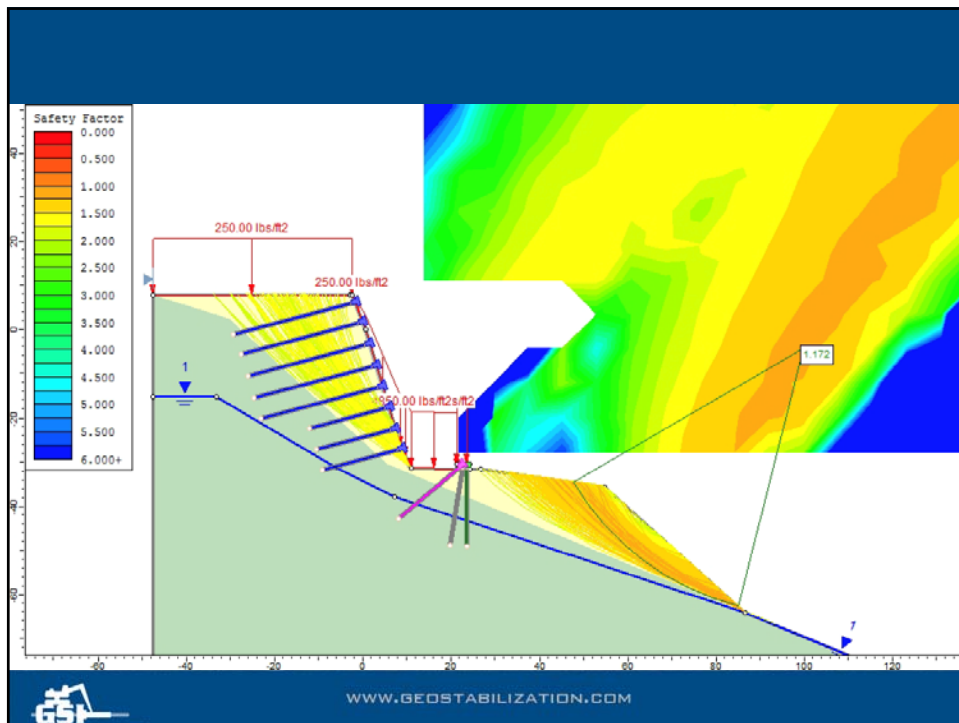
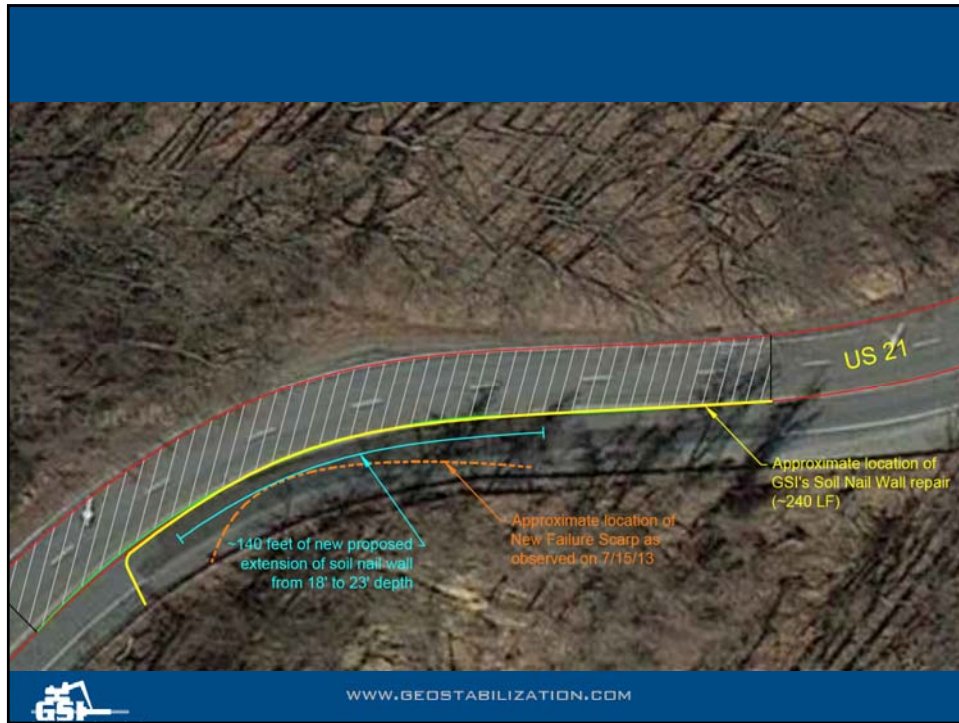
July 8, 2013

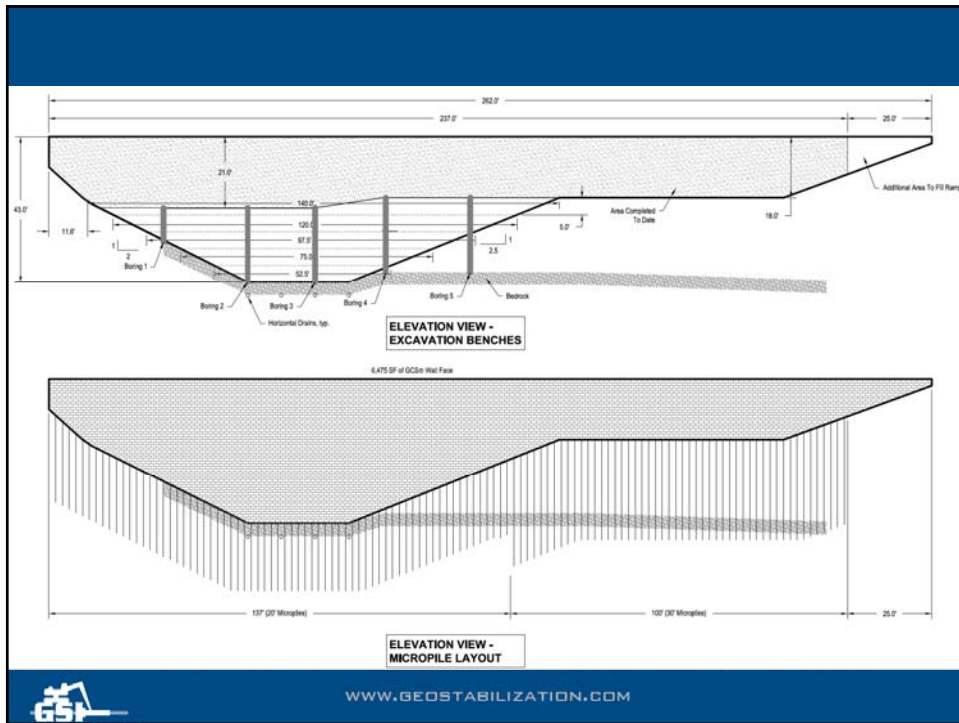
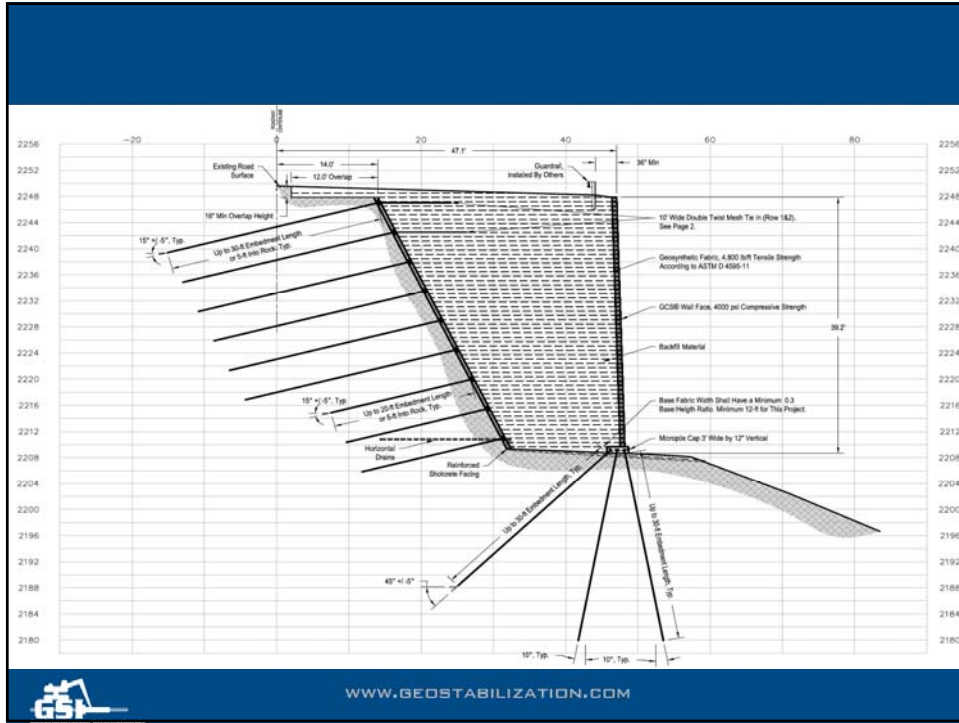


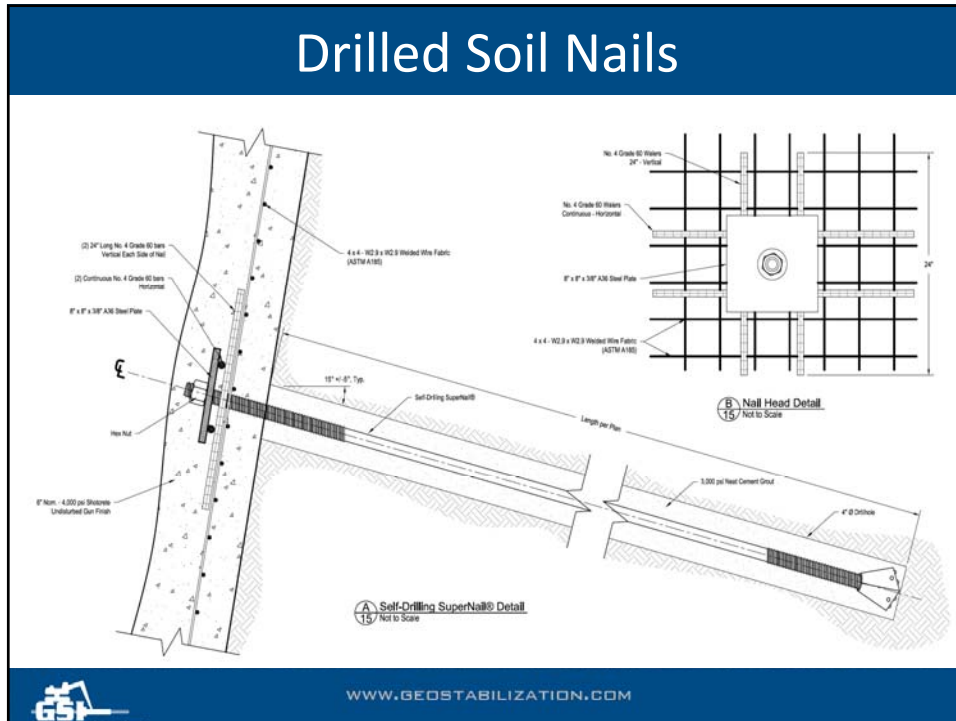
Shoulder Failure Repair Concept





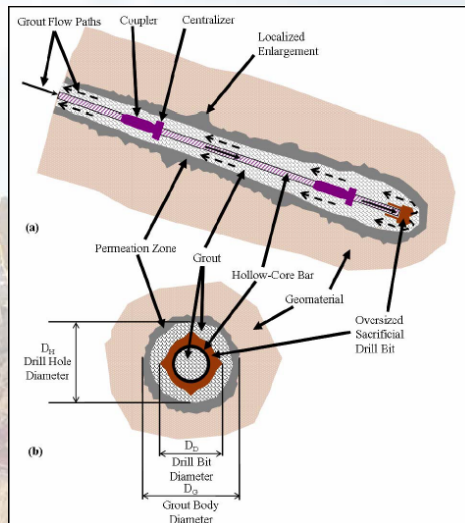






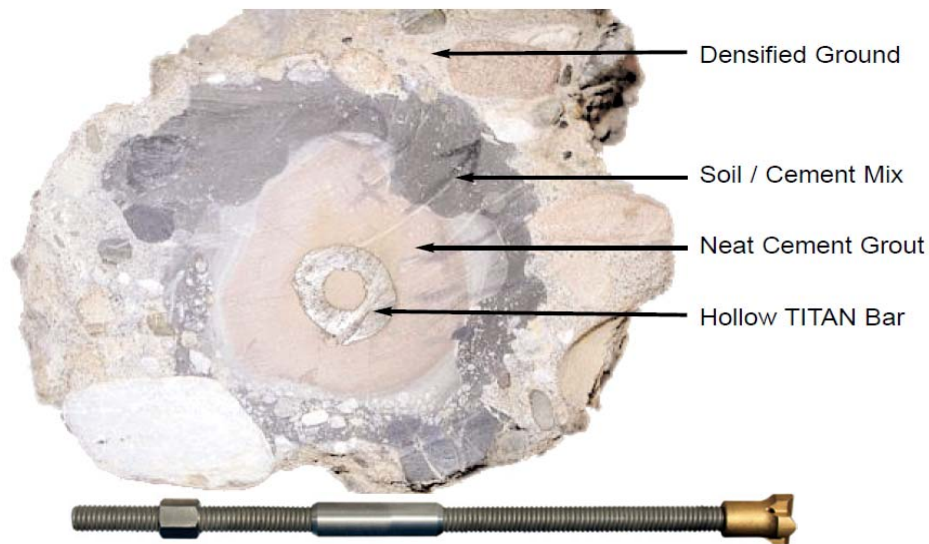
Drilled Soil Nails

- Suitable for collapsing soil
- Suitable for actively moving landslides
- High installation rates
- High pullout capacity
- High bending/shear capacity
- Suitable for rock and soil
- FHWA design guidance



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Drilled Soil Nails



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Drilled Soil Nails

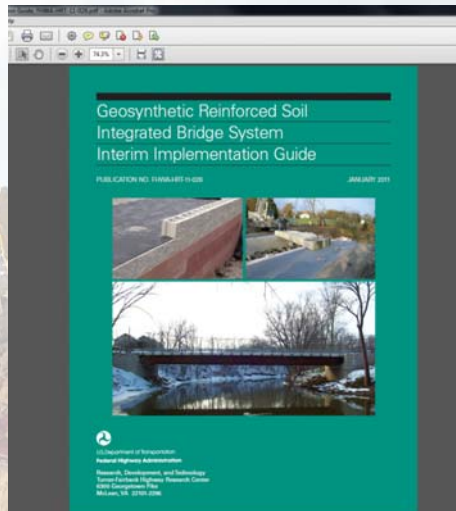
- 3-inch drill bit generated a 6-inch diameter grout body
- Soil nail bar ~1-inch dia.



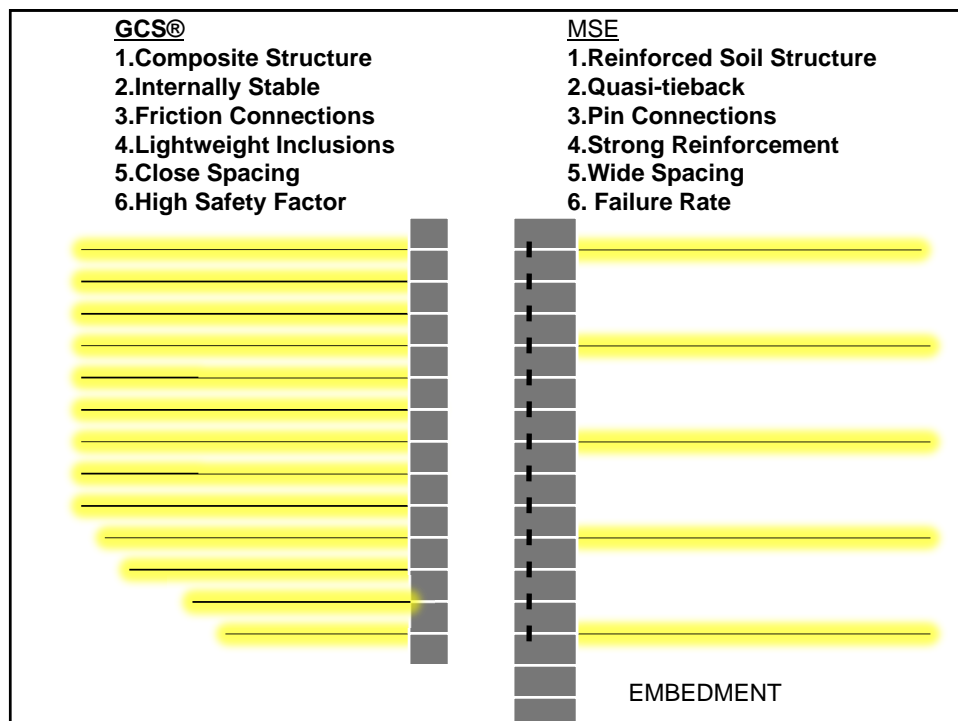
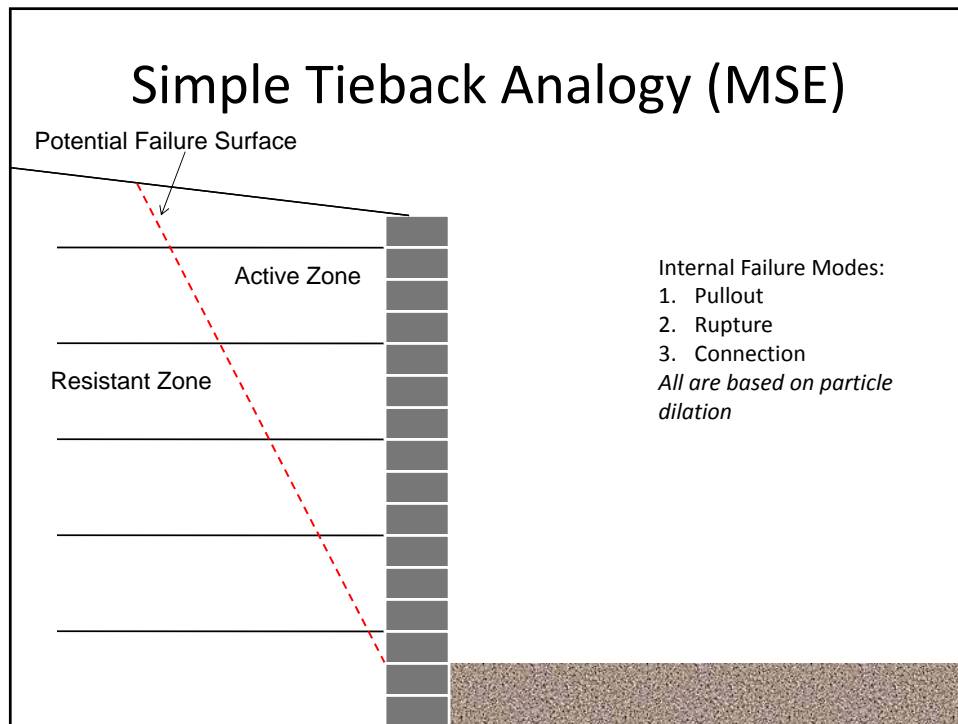
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GCS/GRS

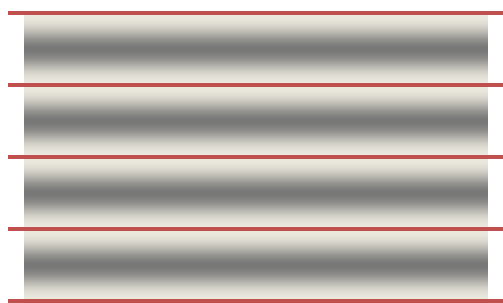
- GRS - Geosynthetic Reinforced Soil
 - An engineered fill of closely spaced (< 12") alternating layers of compacted granular fill material and geosynthetic reinforcement



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Spacing Controls PerformanceNot Strength of the Inclusion



BASED ON
NCHRP REPORT 556

Composite Failure

FHWA Mini-Pier Experiment



$T_{ult} = 100 \text{ lbs/in}$ (silt fence material)
Failure @ 400kPa



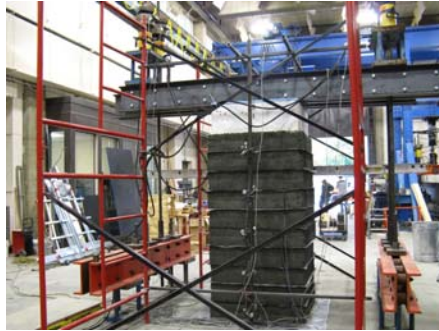
Concrete

Photo courtesy of M. Adams

Performance Test

2,400 lb/ft @ 8" Spacing, No CMU Facing, <0.5% strain
18,000 lb/ft shown in Post-Picture

Pre-



Post-



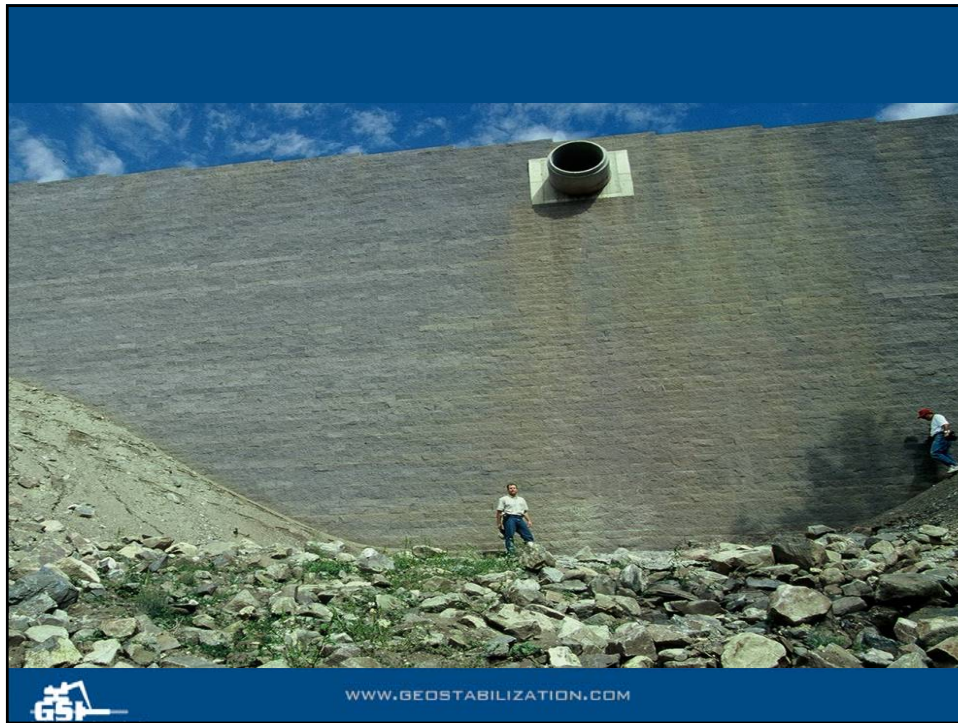
Weak Reinforcement?



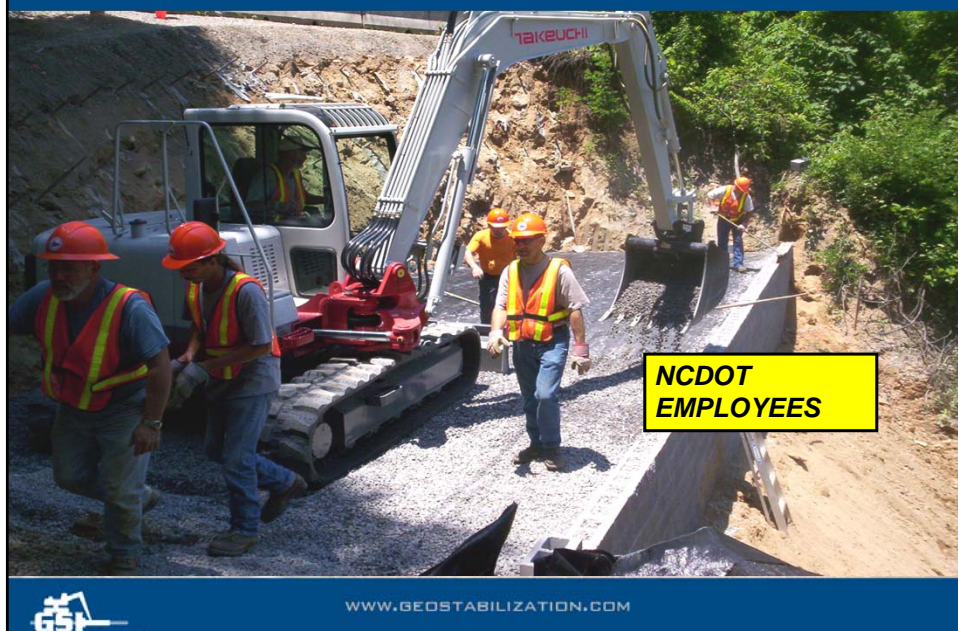


GCS Walls





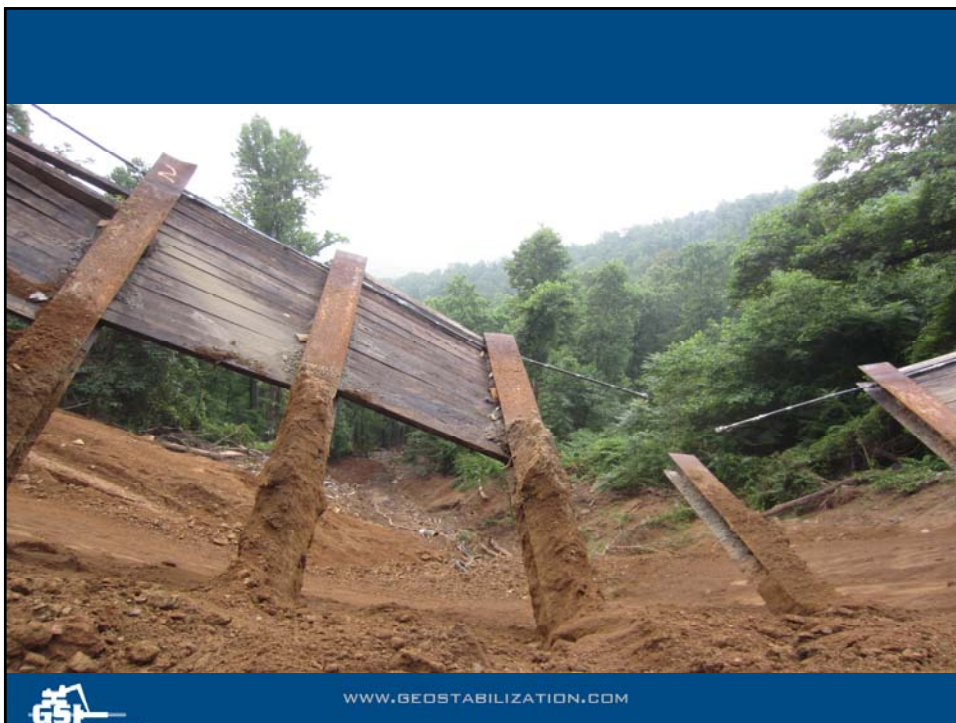
GRS Walls – Maggie Valley 2004



July 13, 2013 (Construction Began)



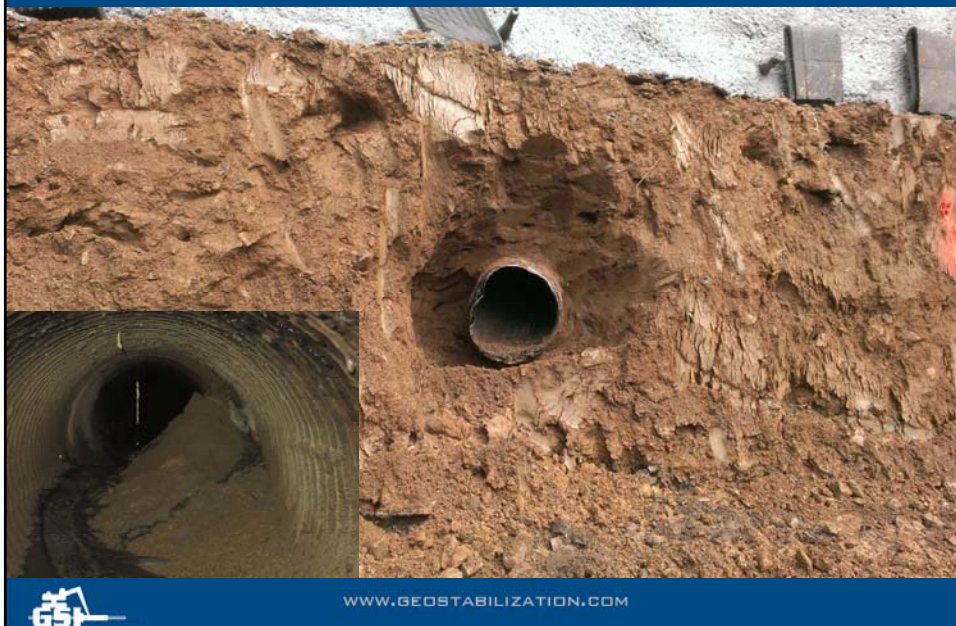
Access Complications



8,710 LF of Soil Nailing



18" Cross Culvert



30 Horizontal Drains



6,800 LF Micropiles



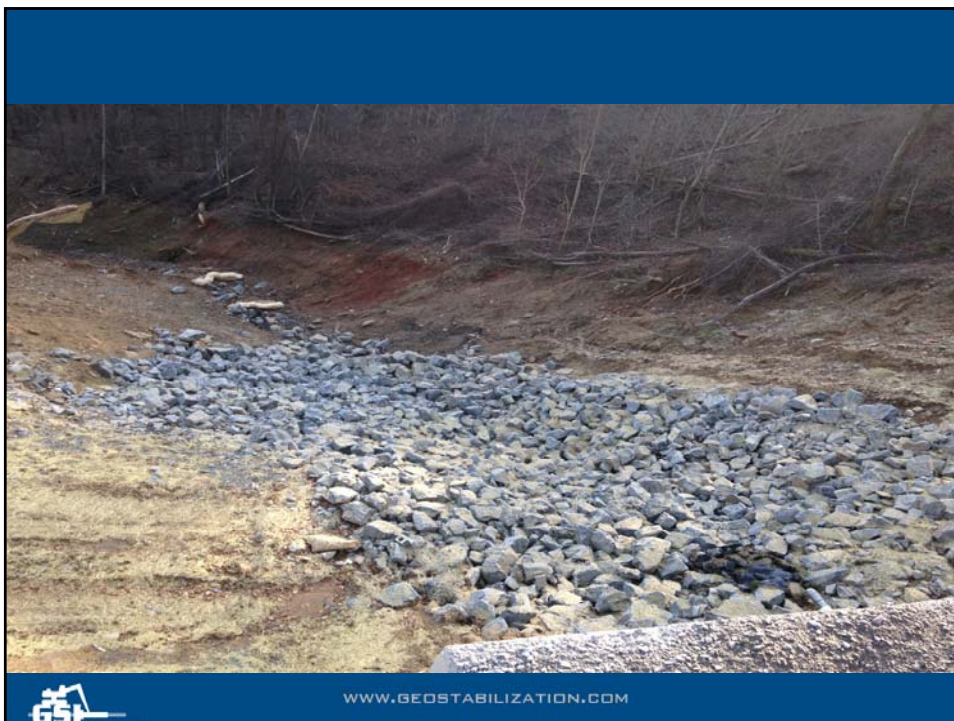
NCDOT Maintenance Personnel



September 2013



NCDOT Built 8,000 SF Shored GRS Wall







Geocell



