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**CENTER FOR  
GEOTECHNICAL PRACTICE AND RESEARCH**

**COMPARISON OF COMPUTER PROGRAMS  
FOR ANALYSIS OF REINFORCED SLOPES**

by

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**Report of a study performed by the Virginia Tech Center for  
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# COMPARISON OF COMPUTER PROGRAMS FOR ANALYSIS OF REINFORCED SLOPES

## - Program Review -

### 1 Objective & Method

#### 1 Program Highlights

- Comments on important program features.

- 2 - UTEXAS4
- 3 - SLOPE/W
- 4 - SLIDE
- 6 - XSTABL
- 7 - WINSTABL
- 8 - RSS
- 9 - SNAIL
- 10 - GoldNail
- 11 - Summary

#### 13 Summary Table of Program Features

- Compare the programs side by side!

#### 15 Table of Analysis Methods

- Conditions of equilibrium, assumptions, and comments.

#### 16 Program Ratings

- Discussion of program performance in key areas.

- 16 - Accuracy
- 16 - Computation Time
- 17 - Learning Curve
- 17 - Data Entry/Analysis Time
- 18 - Reinforced Slope Design
- 18 - Unreinforced Slope Data Entry
- 18 - Soil Nail Data Entry
- 19 - Tiedback Wall Data Entry
- 19 - MSE Wall Data Entry
- 19 - Output Time/Quality

#### 20 Summary Table of Program Ratings

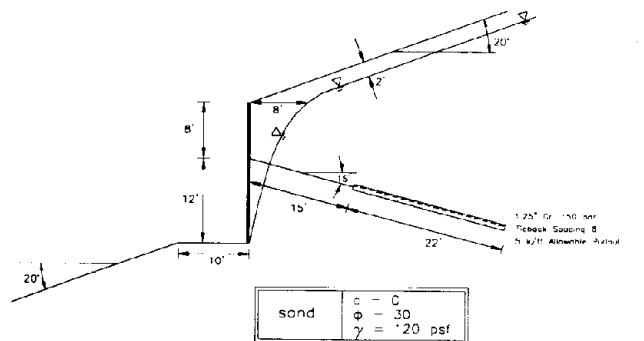
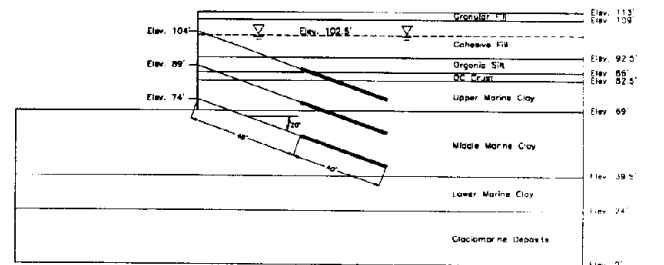
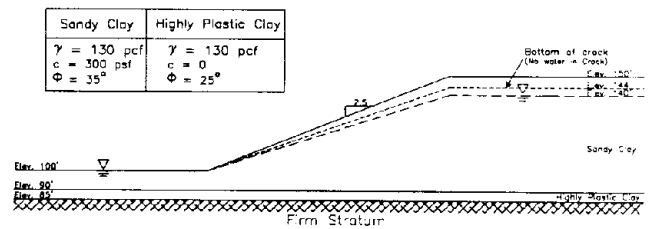
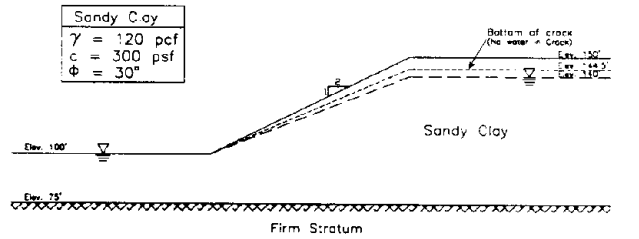
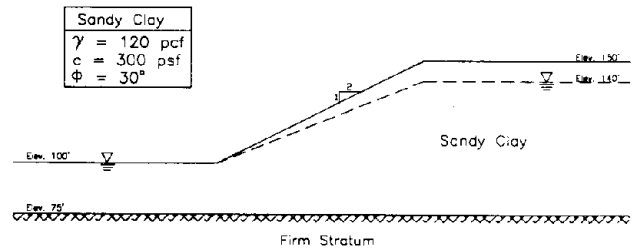
- Which program will suit your needs?

## - Lessons Learned -

#### 21 Analysis Difficulties

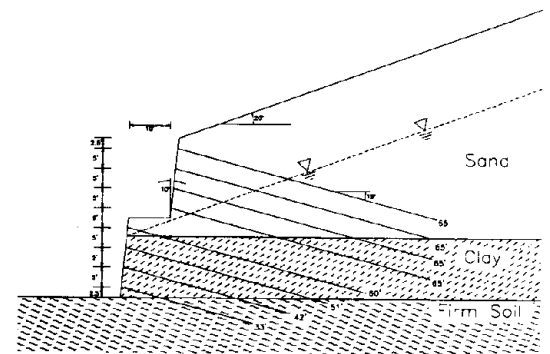
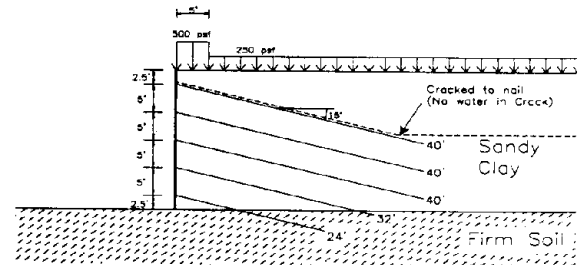
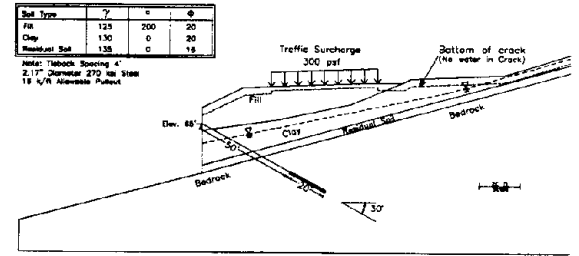
- The calculated solution may be incorrect!

- 21 - Causes of Difficulties
- 22 - Tips for Coping with Difficulties



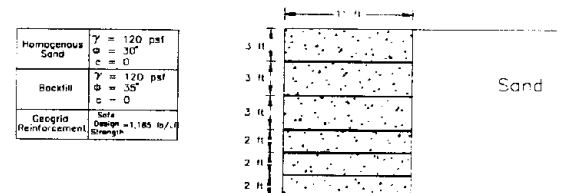
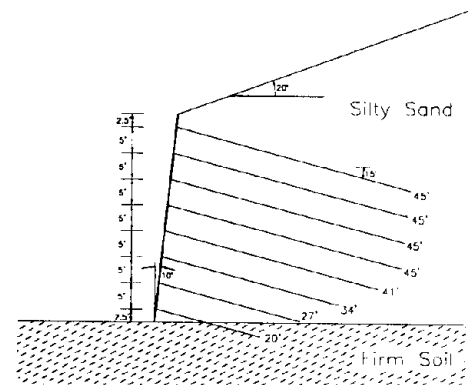
- Sidebars -

- 2 **UTEXAS4 Update**  
- Reinforced slopes require a larger range of acceptable side force inclination.
- 4 **SLOPE/W Search Tip**  
- Toe circles made easy.
- 6 **Slide Update**  
- Speed increases, new soil models, and more!
- 7 **Minimum Required Force for Stability**  
- A useful tool for preliminary design.
- 9 **RSS Reinforcement Limitations**  
- Horizontal reinforcement limits applicability, but makes the program ideal for MSE reinforcement.
- 10 **MSE Walls – Include the bottom layer?**  
- Important analysis tips.
- 11 **MSE Reinforcement in GoldNail**  
- Development length definition problems.
- 12 **Equivalent Tension Crack**  
- What to do if there is no program option.
- 12 **Definition of Factor of Safety**  
- Fundamental program differences that can change F.
- 16 **Piezometric or Phreatic Surface?**  
- An important difference affecting the factor of safety.
- 17 **Language Barrier**  
- Problems encountered with different types of reinforcement in specialty programs.
- 23 **Program Comments**  
- Search methods and contours increase confidence in analysis.



- Appendices -

- 24 **Appendix A**  
- Results for example problems.
  - 25 - Factor of Safety Summary Table
  - 26 - Spencer's Method
  - 27 - Bishop's Modified Method
  - 28 - Janbu's Simplified Method
  - 29 - Difficulty Index
- 30 **Appendix B**  
- Example slopes and critical slip surfaces.
- 124 **Appendix C**  
- Detailed notes for each program, with comments on analysis methods and search routines, capabilities, and limitations.
  - 125 - UTEXAS4
  - 128 - SLOPE/W
  - 130 - SLIDE
  - 132 - XSTABL
  - 135 - WINSTABL
  - 137 - RSS



144 **Appendix D**

- Calculations

139 - SNAIL

142 - GoldNail

145 - Soil Nail Capacity

147 - Equivalent Bond Stress for SNAIL

148 - Crack Depth

149 **Appendix E**

- References

