# CALCULATION SUMMARY SHEET



PROJECT NUMBER: 143418

PROJECT NAME: USEN – Trench 13 Design

DATE: February 2015

CALCULATION NUMBER: C.02 Revision:

**CALCULATION TITLE: Trench 13 Excavation and Final Cover Slope Stability**

**DESCRIPTION OF CALCULATION:**

Calculation to document the stability of the Trench 13 excavation and cover configuration for static and pseudo-static loading conditions, considering soil properties, thickness, and waste properties.

**REFERENCES USED:**

1. Modeling Program WinStabl, Version 3.0
2. Supplement Landfill Report for Trench 12 (for soil properties determined by lab testing and previous trench calculations)
3. Boring records for the vicinity of Trench 13.
4. Design basis and construction specifications for Trench 11 and 12 Final Covers (for cover design calculations)

**REVIEW COMMENTS:**

| | | | |
|---|---|---|---|
| CALCULATION MADE BY: | SLW (SRES) | DATE: | Various Dates |
| CALCULATION CHECKED BY: | CAB | DATE: | Various Dates |
| CALCULATION REVISED BY: | PAZ | DATE: | 04/06/15 |
| CALCULATION REVIEWED BY: | SLW | DATE: | 06/16/15 |

## Trench 13 Slope Stability Calculations

These slope stability calculations are done to confirm the stability of excavation slopes and final cover slopes for the design of Trench 13 at the US Ecology Nevada facility east of Beatty, NV. The design for new Trench 13 utilizes a below-grade excavation and above-grade and final cover configuration that is identical in most respects to that used (and approved by NDEP) for Trench 12. Differences between Trench 12 and Trench 13 slopes primarily are that the Trench 13 maximum excavation depth is slightly less than Trench 12 and the Trench 13 maximum final cover height is slightly more than Trench 12.

Aspects of Trench 13 design (and construction) significant to short-term and long-term slope stability are assumed to be the same as have been considered, and previously approved by the Nevada Division of Environmental Protection (NDEP) for previous US Ecology Nevada disposal trench design, including Trench 12 excavation and Trenches 11 and 12 final covers. Accordingly, the slope stability evaluation method and significant calculation input (e.g., material properties and seismicity) are same for these Trench 13 calculations. As a result of the similarities between new Trench 13 and previous trenches and stability evaluations, a limited number of confirming calculations are made for Trench 13. These include the following:

- Maximum excavation depth with corresponding leveling fill berm thickness, and 'natural surface soil layer' thicknesses of 10, 15, and 20 feet, under static and pseudo-static loading conditions

- Maximum height final cover configuration with 15-feet leveling fill berm thickness, under static and pseudo-static loading conditions.

    - Shallow failure – failure plane primarily within final cover material

    - Deep failure – failure plane primarily within waste, penetrating leveling fill berm

**Calculation Method:** The computer modeling program WinSTABL Version 3.00 (2002) **(Reference 1)** using the Modified Bishop Method of analysis, was used to assess slope stability. This approach is consistent with the approach used, and approved by NDEP, for Trench 12. The model accepts as input the material properties (principally unit weight, cohesive strength, and angle of internal friction) and a set of coordinates defining the position of the materials in typical Trench 13 cross-sections. The model then is asked to find failure surfaces through the various layers. For these analyses, a pseudo-static condition is assumed to represent seismic loading. The output of the model is calculated factors of safety for the identified failure surface and materials.

**Trench 13 Design Aspects**: Significant aspects of the Trench 13 design that are considered in these calculations are as follow.

- Excavation side slopes: 0.5H:1.0V
- Maximum excavation depth (south side) at 70 feet plus five feet deep typical LCRS sump.
- "Cohesionless" surface soil is removed and replaced with compacted native soil
- "Leveling" berm placement along south Trench 13 HCL (horizontal control line) to elevation 2768 feet and along the north Trench 13 HCL to elevation 2772 feet.
- Above-grade and waste slopes: 3.0H:1.0V on steep slopes, 20:1 on top deck slopes
- Final cover thickness: 3 feet
- Final cover maximum elevation: 2860 feet

All of these design aspects are depicted on materials included with this calculation.

**Materials Properties**: The properties of subsurface, waste, and final cover materials considered in these calculations, including layer thicknesses and strength properties, are consistent with site-specific laboratory testing results, technical literature, and assumptions made for previous slope stability calculations for the US Ecology Nevada facility.

1. Final cover soil- the strength properties of the three-feet thick surface soil layer are determined by laboratory testing (loose-placed soil density) and a reasonable assumption (cohesion). Although the final cover soil is intended to be placed without compaction, an 85% modified dry density is used as the as-placed density target during construction (83% was achieved for the Trench 11 placement). As such, a minimal degree of cohesion is assumed to be achieved, represented as C=170 PSF. (Note – C=170 pounds per square foot (PSF) was determined by laboratory testing) **(Reference 2)**

2. Disposed waste: The assumed cohesive strength of waste is 550 PSF. 1996 calculations (as cited in Trench 12 calculations) provide justification (copied and included in this calculation from "Enclosure C to Attachment 1 of the October 1996 Response to NOD") (**Reference 2)** for using hazardous waste cohesion values from 575 to 900 PSF. The unit weight of waste used in the Trench 12 and Trench 13 calculations is 100 PCF. The actual unit weight of waste disposed by US Ecology Nevada has been determined to be 96.3 PCF. Adjusting the waste weight to 100 PCF is justified by actual site waste disposal records. Waste unit weight likely increases with depth in the disposal cell, and might also increase over time as most disposed waste is subject to consolidation, but generally not subject to physical degradation. This consolidation is considered by applying slightly increased unit weight and cohesion values in a 'deeper waste' layer.

3. Recompacted surface soil layer and leveling berm layer: Native materials are used to replace the "cohesionless surface soil layer" surrounding the HCL that marks the horizontal limit of excavation at ground surface. The replacement zone extends approximately 25 feet, horizontally, outside the HCL. To consider

various possible conditions for this layer, varying thicknesses for the natural soil layer (i.e., 10, 15, and 20 feet) are used in stability calculations.

The leveling berm (i.e., compacted soil fill that is placed from the top of the replaced "cohesionless surface soil layer" to elevation 2768 feet along the south Trench 13 boundary) is considered to be 6.0 feet thick in the area of the Phase 13D sump which approximately coincides with the lowest pre-excavation surface topography along the south trench boundary. As such, this represents both the location of thickest leveling fill and deepest Trench 13 excavation slope. The leveling berm fill will be constructed of the same materials and placed with the same compaction specifications as the recompacted surface soil. As such, it is considered the same layer in these calculations.

Laboratory testing for Trench 12 determined the dry density (110 PCF) and cohesion properties (370 PSF) of the recompacted surface soil **(Reference 2)**. These values are used in these calculations.

In the excavation slope stability analyses, a "sensitivity analysis" was done to determine stability for three different thicknesses of the combination of 10, 15 and 20 feet of "recompacted surface soil" and 6.0 feet of "leveling berm" The combinations of "recompacted soil" and "leveling berm" considered in the stability analyses are 16, 21, and 26 feet. These analyses indicated that slope stability is acceptable when the total thickness of recompacted soil and leveling berm is 20 feet or less. Slope stability is unacceptable (SF<1.0) when the combined thickness is more than 20 feet. Varying thickness are considered because, at the time of these calculations, the actual thickness of the cohesionless soil, layer (to be replaced) was not known. If this soil layer is >15 feet thick, additional measures might be required to increase the cohesive strength in the recompacted soil layer. A separate evaluation of a combined thickness of 26 feet thick was considered with increased cohesion, as might be provided by addition of portland cement or other additive.

4. Native surface soil layer. This layer is present outside the limits of the "recompacted surface soil and leveling berm layer". As such, few (if any) failure surfaces pass through this layer. The native soil layer also is considered at thicknesses of 10, 15 and 20 feet for the excavation stability analyses. A mid-range thickness of 14 feet is considered for the final cover stability analyses. Properties of this material are the same as were used for Trench 12 stability calculations.

5. Native subsurface layers. Three layers of native materials are considered in these calculations. The layers are assumed to have the same density with depth, with progressively higher cohesive strength. Soil boring records reviewed for the Trench 13 area **(Reference 3)** do not allow identification of a consistent depth for the transition from one layer to the next. Accordingly, reasonable transition depths are assumed.

    - Native subsurface layer 1

- Native subsurface layer 2
- Native subsurface layer 3

The following table lists the material properties considered.

| Material | Unit Weight (PCF) | Cohesion (PSF) | Basis for Values |
|---|---|---|---|
| Final Cover soil | 110 | 170 | Laboratory testing determined cohesion value for 85% MDD |
| Disposed Waste (shallow) | 100 | 550 | Previous calculation |
| Disposed Waste (deep) | 115 | 750 | Assumption |
| Recompacted surface soil layer and leveling berm layer | 110 | 370 | Laboratory test |
| Native surface soil layer. | 120 | 0 | Previous calculation |
| Native subsurface soil layer 1 | 120 | 1440 | Previous calculation, assumption |
| Native subsurface soil layer 2 | 120 | 2880 | Previous calculation, assumption |
| Native subsurface soil layer 3 | 120 | 4320 | Previous calculation, assumption |

Notes:
Unit weight and cohesion values in Table from **References 2 and 4**
PSF = pounds per square foot
PCF = pounds per cubic foot

**Results**

To be acceptable, the factors of safety against slope failure under static loading and pseudo-static loading conditions should equal or exceed 1.5 and 1.0, respectively. The pseudo-static loading condition is 0.42 g, which simulates the maximum horizontal acceleration value with a 90 percent or greater probability of not being exceeded in 250 years, Nevada Administrative Code (NAC) 444.6793. The source of these criteria are the Trench 11 and Trench 12 slope stability calculations, RCRA regulations/guidance based on Federal and NV requirements for MSW landfills (40CFR 258.14), and NDEP T12 direction (provided on December 17, 1996). SF criteria from USEPA and other guidance (e.g., Ohio EPA).

The slope conditions and configurations considered are as follow.

1. Maximum **EXCAVATION** depth and three corresponding combined recompacted soil and leveling fill berm thicknesses, under static and pseudo-static loading conditions

    a. 16-feet thick recompacted surface soil and leveling berm

    b. 21-feet thick recompacted surface soil and leveling berm

    c. 26-feet thick recompacted surface soil and leveling berm

    d. 26-feet thick recompacted surface soil and leveling berm, with increased cohesion

2. Maximum height **FINAL COVER** configuration with a 14-foot berm used to provide a level starting surface for the final cover contruction, under static and pseudo-static loading conditions.

    a. Shallow failure – failure plane within final cover material

    b. Deep failure – failure plane within waste, penetrating leveling fill berm

The results of the slope stability calculations for the various slope and material configurations are as follow.

| **Slope considered** | **Minimum SF Static** | **Minimum SF 0.42 g** | **Comment** |
|---|---|---|---|
| EXCAVATION | | | |
| 1a – 16-ft combined | 2.01 | 1.18 | |
| 1b – 21-ft combined | 1.90 | 1.01 | |
| 1c – 26-ft combined | 1.68 | 0.90 | SF<1.0, requires increased cohesion or decreased thickness |
| 1d – 26-ft combined, increased cohesion | -- | 1.00 | Cohesion in combined layer increased to 900 PSF |
| FINAL COVER | | | |
| 2a – Shallow failure | 4.74 | 1.93 | |
| 2b – Deep failure | 2.50 | 1.02 | |

OUTPUT

Failure Surfaces and Model Output

| **Slope considered** | **Model Run Static** | **Model Run 0.42 g** |
|---|---|---|
| EXCAVATION | | |
| 1a – 16-ft combined | 10 foot surface soil - 0 | 10 foot surface soil – 0.42 |
| 1b – 21-ft combined | 15 foot surface soil 0 | 15 foot surface soil – 0.42 |
| 1c – 26-ft combined | 20 foot surface soil -0 | 20 foot surface soil – 0.42 |
| 1d – 26-ft combined, increased cohesion | NA | 20 foot surface soil – 0.42 increased C |
| FINAL COVER | | |
| 2a – Shallow failure | Shallow cover failure - 0 | Shallow cover failure – 0.42 |
| 2b – Deep failure | Deep cover failure - 0 | Deep cover failure – 0.42 |

## REFERENCES

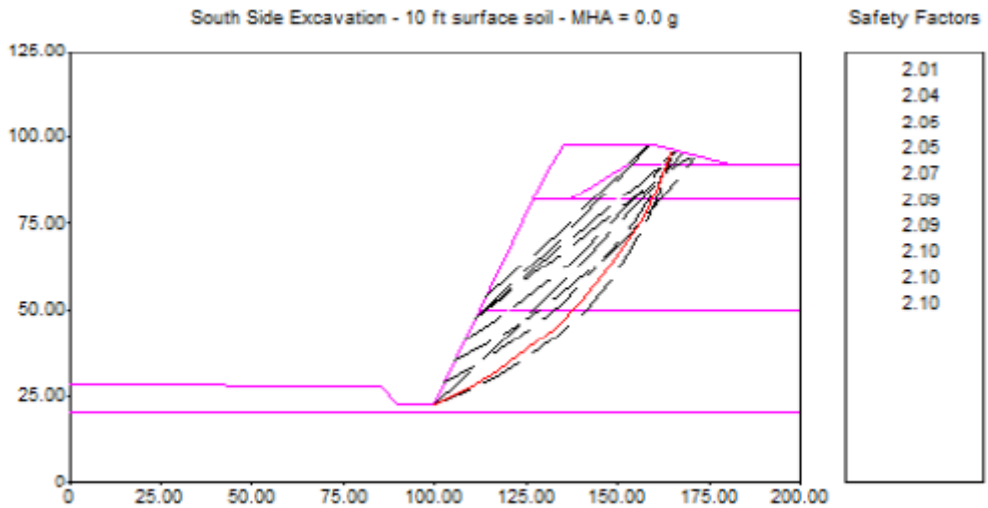
**AquAeTer, 2007, Supplement Landfill Report for Trench 12, US Ecology Nevada. (CD-ROM)**

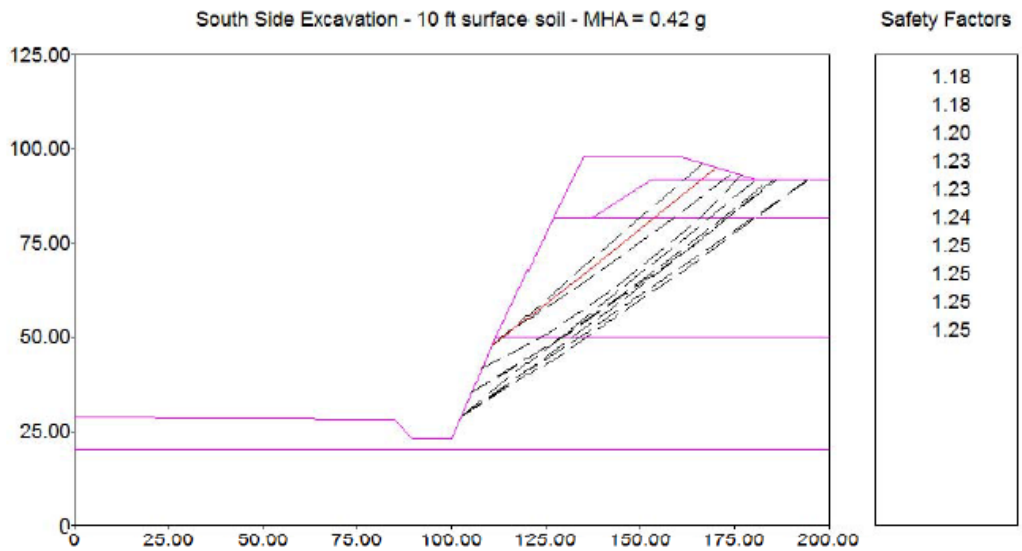
**AquAeTer, 2008, Design Basis and Construction Specifications for Trenches 11 and 12 Final Covers, Beatty, Nevada Facility. Supplement to: Trench 12 Construction Quality Assurance Plan. (CD-ROM)**

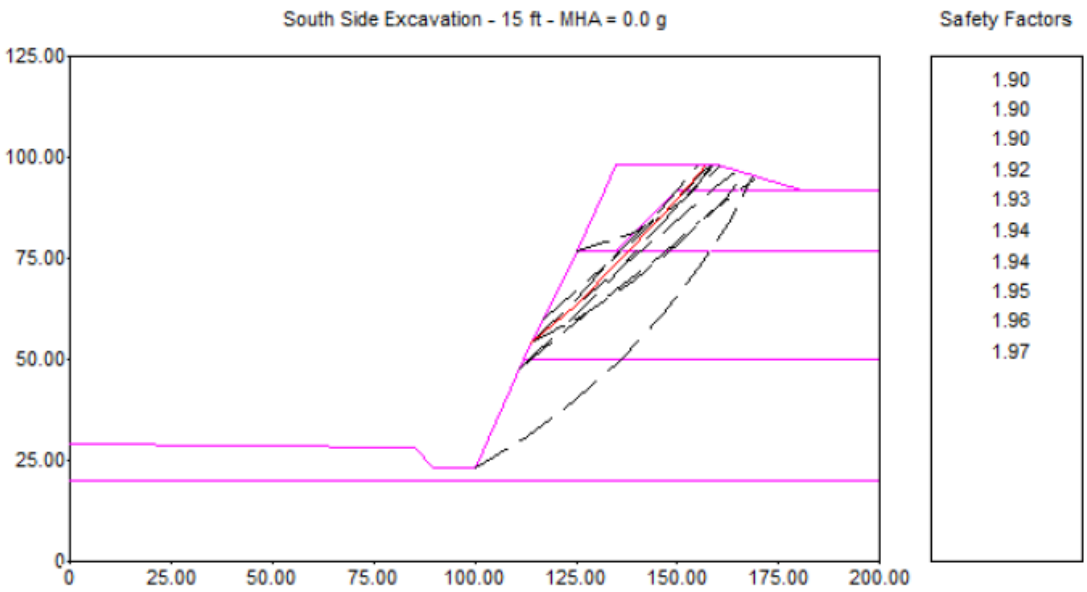
**Bosscher, P.J., and Betkas, H, 2002, WinStabl 3.0, A computer program for the analysis of stability of slopes, The University of Wisconsin-Madison,**

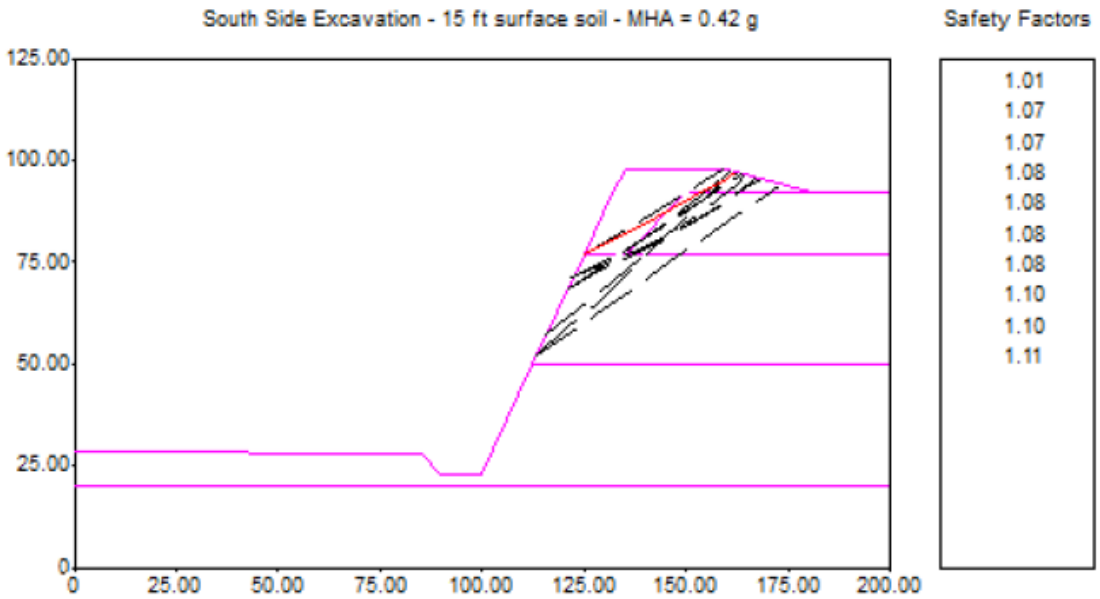
**Boring records for the vicinity of Trench 13: U.S. Department of the Interior, 2010, "*Characterization of Geologic Deposits in the Vicinity of US Ecology, Amargosa Basin, Southern Nevada*", Scientific Investigations Report 2010–5134 (not included)**

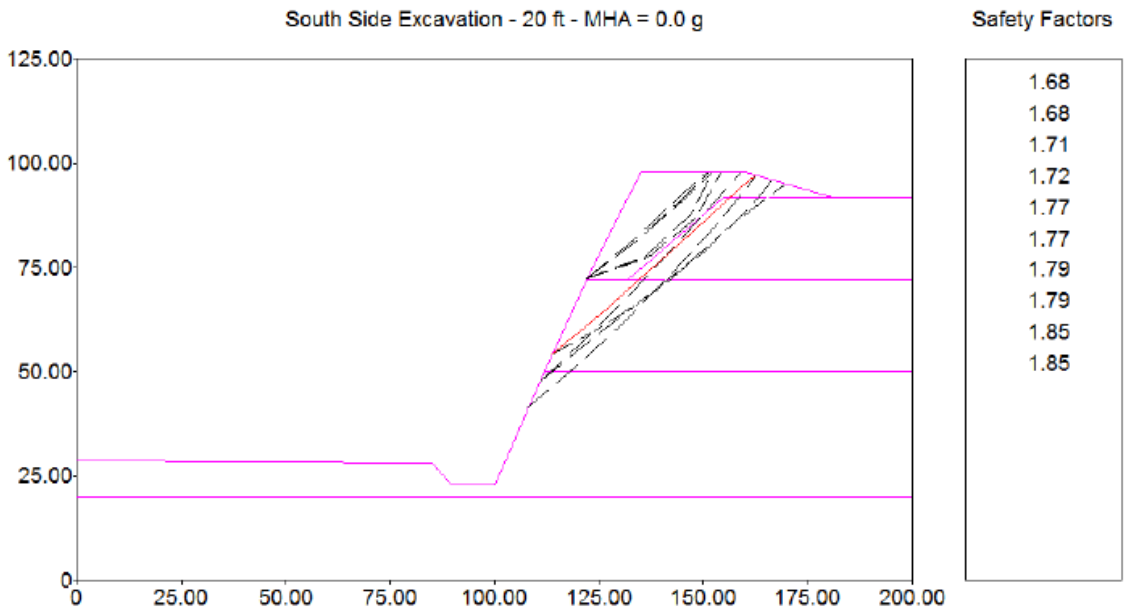
# Excavation **Failure Surfaces**

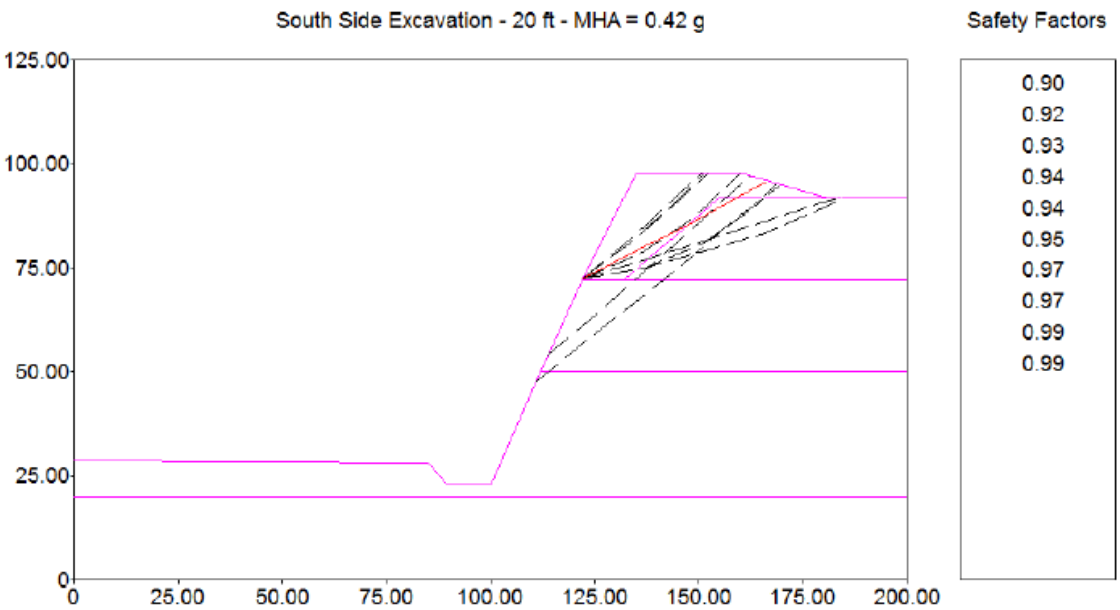


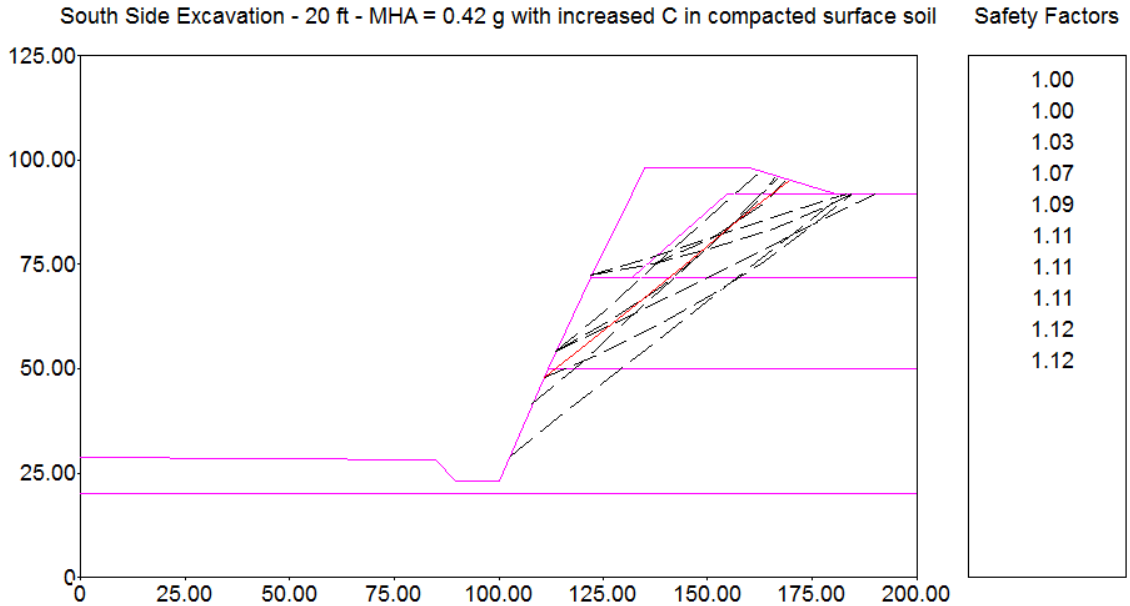




South Side Excavation - 15 ft - MHA = 0.0 g
Safety Factors
1.90
1.90
1.90
1.92
1.93
1.94
1.94
1.95
1.96
1.97
125.00
100.00
75.00
50.00
25.00
0
0
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00


South Side Excavation - 15 ft surface soil - MHA = 0.42 g
Safety Factors
1.01
1.07
1.07
1.08
1.08
1.08
1.08
1.10
1.10
1.11
125.00
100.00
75.00
50.00
25.00
0
0
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00

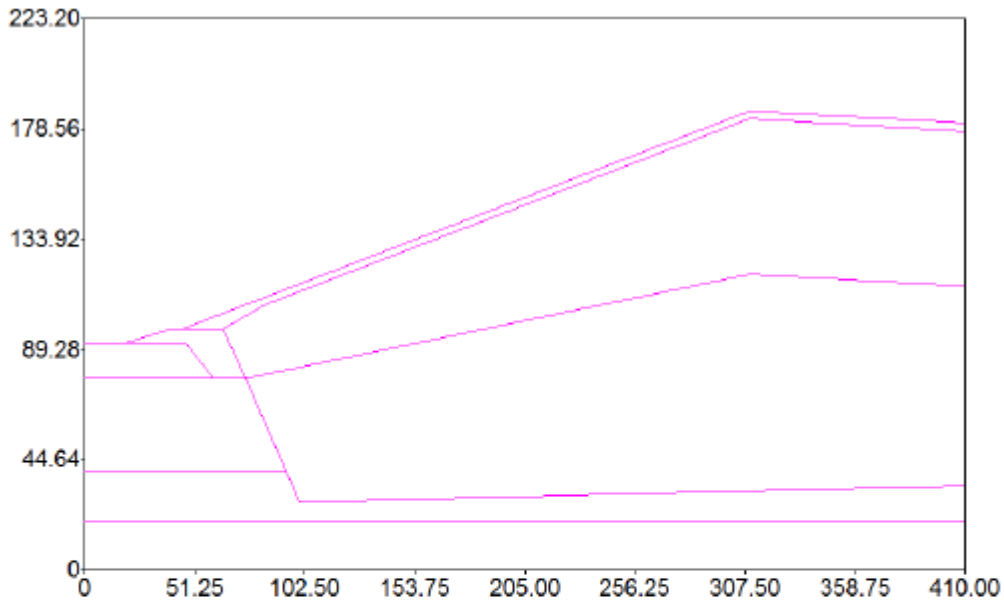

South Side Excavation - 20 ft - MHA = 0.0 g
Safety Factors
1.68
1.68
1.71
1.72
1.77
1.77
1.79
1.79
1.85
1.85
125.00
100.00
75.00
50.00
25.00
0
0
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00


South Side Excavation - 20 ft - MHA = 0.42 g
Safety Factors
0.90
0.92
0.93
0.94
0.94
0.95
0.97
0.97
0.99
0.99
125.00
100.00
75.00
50.00
25.00
0
0
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00



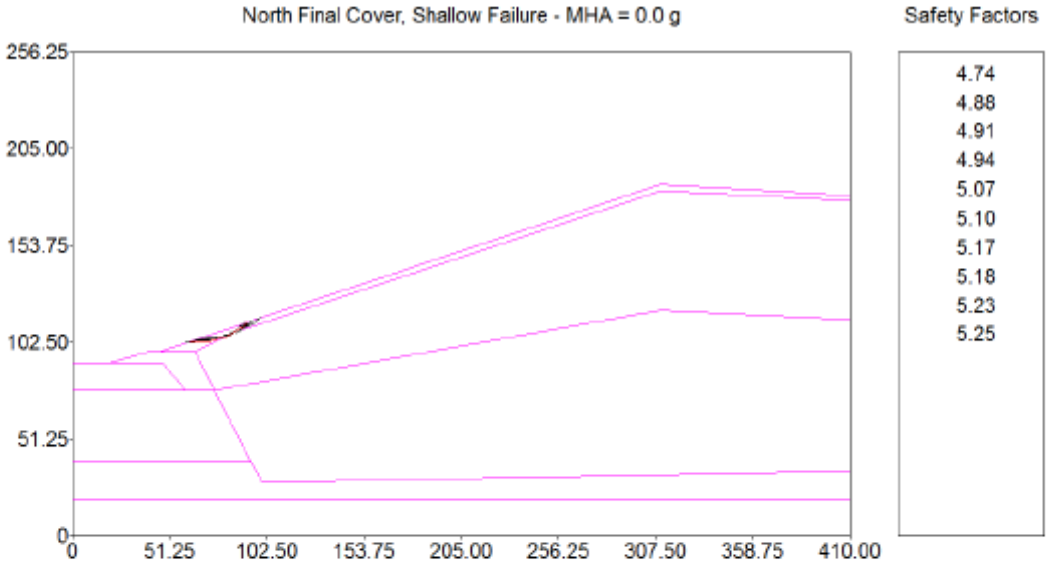

| | Moist Unit Weight | Saturated Unit Weight | Isotropic Strength Intercept | Isotropic Strength Angle | Pore Pressure Parameter | Pore Pressure Constant | Piezometric Surface Number |
|---|---|---|---|---|---|---|---|
| 1 | 110.00 | 110.00 | 900.00 | 35.00 | 0.00 | 0.00 | 0 |
| 2 | 120.00 | 120.00 | 0.00 | 35.00 | 0.00 | 0.00 | 0 |
| 3 | 120.00 | 120.00 | 1440.00 | 35.00 | 0.00 | 0.00 | 0 |
| 4 | 120.00 | 120.00 | 2880.00 | 35.00 | 0.00 | 0.00 | 0 |
| 5 | 120.00 | 120.00 | 4320.00 | 35.00 | 0.00 | 0.00 | 0 |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |

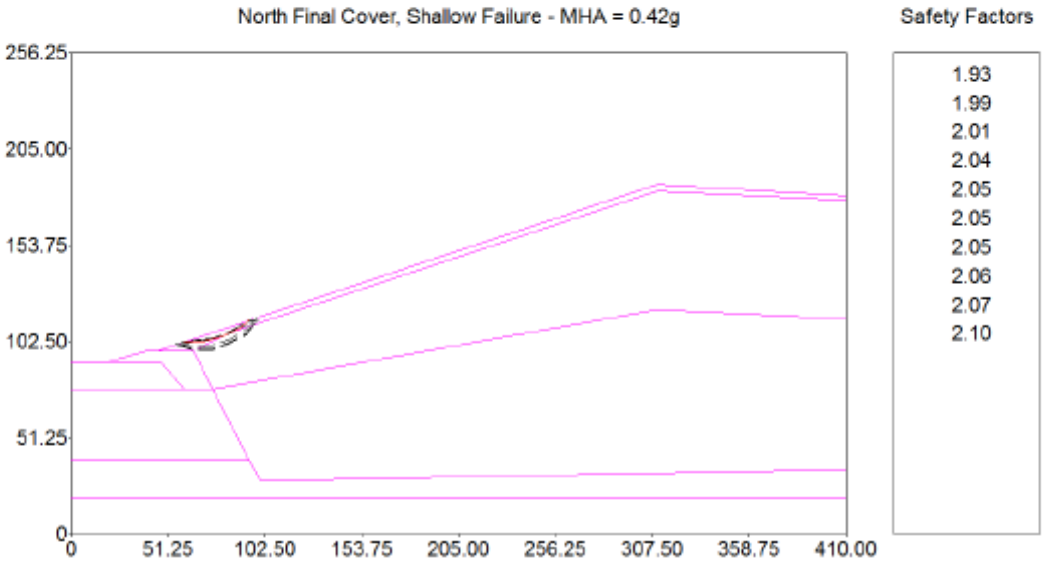
# Cover Failure Surfaces

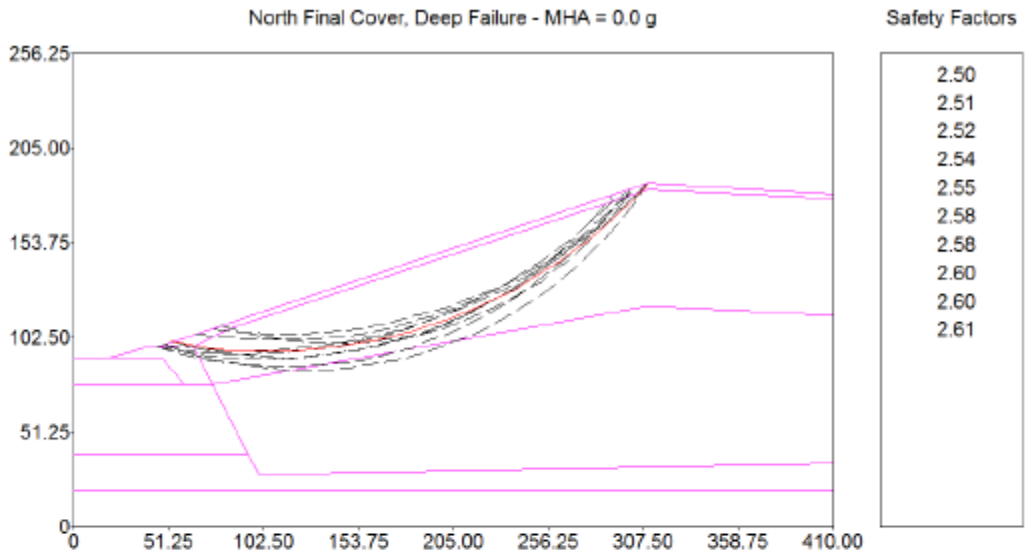


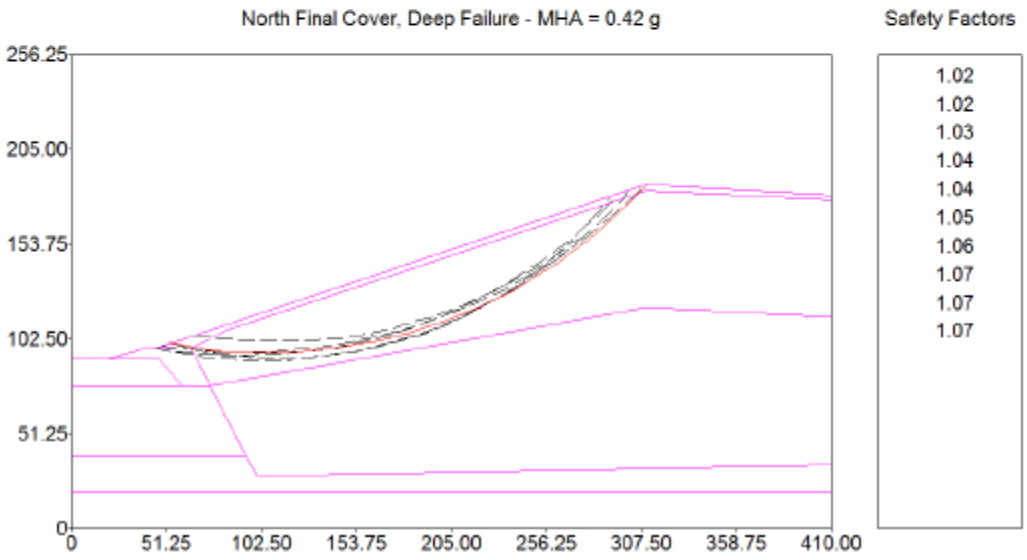

| | Moist Unit Weight | Saturated Unit Weight | Isotropic Strength Intercept | Isotropic Strength Angle | Pore Pressure Parameter | Pore Pressure Constant | Piezometric Surface Number |
|---|---|---|---|---|---|---|---|
| 1 | 110.00 | 110.00 | 170.00 | 35.00 | 0.00 | 0.00 | 0 |
| 2 | 100.00 | 100.00 | 550.00 | 27.00 | 0.00 | 0.00 | 0 |
| 3 | 110.00 | 110.00 | 370.00 | 35.00 | 0.00 | 0.00 | 0 |
| 4 | 120.00 | 120.00 | 0.00 | 35.00 | 0.00 | 0.00 | 0 |
| 5 | 120.00 | 120.00 | 1440.00 | 35.00 | 0.00 | 0.00 | 0 |
| 6 | 120.00 | 120.00 | 2880.00 | 35.00 | 0.00 | 0.00 | 0 |
| 7 | 120.00 | 120.00 | 4320.00 | 35.00 | 0.00 | 0.00 | 0 |
| 8 | 115.00 | 115.00 | 750.00 | 27.00 | 0.00 | 0.00 | 0 |

2019


North Final Cover, Shallow Failure - MHA = 0.0 g
Safety Factors
4.74
4.88
4.91
4.94
5.07
5.10
5.17
5.18
5.23
5.25
256.25
205.00
153.75
102.50
51.25
0
0
51.25
102.50
153.75
205.00
256.25
307.50
358.75
410.00


North Final Cover, Shallow Failure - MHA = 0.42g
Safety Factors
1.93
1.99
2.01
2.04
2.05
2.05
2.05
2.06
2.07
2.10
256.25
205.00
153.75
102.50
51.25
0
0
51.25
102.50
153.75
205.00
256.25
307.50
358.75
410.00


North Final Cover, Deep Failure - MHA = 0.0 g
Safety Factors
2.50
2.51
2.52
2.54
2.55
2.58
2.58
2.60
2.60
2.61
256.25
205.00
153.75
102.50
51.25
0
0
51.25
102.50
153.75
205.00
256.25
307.50
358.75
410.00


North Final Cover, Deep Failure - MHA = 0.42 g
Safety Factors
1.02
1.02
1.03
1.04
1.04
1.05
1.06
1.07
1.07
1.07
256.25
205.00
153.75
102.50
51.25
0
0
51.25
102.50
153.75
205.00
256.25
307.50
358.75
410.00

# MODEL OUTPUT FILES

**EXCAVATION**
**10 foot surface soil**
**MHA=0.0g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 10 ft surface so
il - MHA = 0.0 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 127.00 | 82.00 | 3 |
| 6 | 127.00 | 82.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 127.00 | 82.00 | 137.00 | 82.00 | 3 |
| 12 | 137.00 | 82.00 | 153.00 | 92.00 | 2 |
| 13 | 153.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 137.00 | 82.00 | 200.00 | 82.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

| Soil Type | Total Unit Wt. | Saturated Unit Wt. | Cohesion Intercept | Friction Angle | Pore Pressure | Pressure Constant | Piez. Surface |
|---|---|---|---|---|---|---|---|

| No. | (pcf) | (pcf) | (psf) | (deg) | Param. | (psf) | No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.000 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 125.00 ft.

Each Surface Terminates Between X = 150.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 12 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 100.00 | 23.00 |
| 2 | 108.91 | 27.54 |
| 3 | 117.42 | 32.79 |
| 4 | 125.46 | 38.74 |
| 5 | 132.98 | 45.33 |
| 6 | 139.93 | 52.52 |

| | | |
|---|---|---|
| 7 | 146.25 | 60.27 |
| 8 | 151.92 | 68.51 |
| 9 | 156.88 | 77.19 |
| 10 | 161.10 | 86.26 |
| 11 | 164.55 | 95.64 |
| 12 | 164.82 | 96.62 |

Circle Center At X = 49.9 ; Y = 132.5 and Radius, 120.5

*** 2.014 ***

Failure Surface Specified By 11 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 102.78 | 29.25 |
| 2 | 111.46 | 34.22 |
| 3 | 119.76 | 39.80 |
| 4 | 127.64 | 45.95 |
| 5 | 135.06 | 52.66 |
| 6 | 141.98 | 59.88 |
| 7 | 148.36 | 67.57 |
| 8 | 154.18 | 75.71 |
| 9 | 159.40 | 84.24 |
| 10 | 164.00 | 93.12 |
| 11 | 165.43 | 96.45 |

Circle Center At X = 37.8 ; Y = 152.9 and Radius, 139.7

*** 2.039 ***

Failure Surface Specified By 12 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 100.00 | 23.00 |
| 2 | 109.24 | 26.83 |
| 3 | 118.06 | 31.54 |
| 4 | 126.37 | 37.10 |
| 5 | 134.10 | 43.45 |
| 6 | 141.17 | 50.52 |
| 7 | 147.50 | 58.26 |
| 8 | 153.05 | 66.58 |
| 9 | 157.75 | 75.40 |
| 10 | 161.56 | 84.65 |
| 11 | 164.45 | 94.22 |
| 12 | 164.92 | 96.59 |

Circle Center At X = 65.8 ; Y = 118.8 and Radius, 101.7

*** 2.049 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 108.33 | 41.75 |
| 2 | 116.66 | 47.28 |
| 3 | 124.70 | 53.23 |
| 4 | 132.42 | 59.59 |
| 5 | 139.81 | 66.33 |
| 6 | 146.84 | 73.44 |
| 7 | 153.50 | 80.90 |
| 8 | 159.77 | 88.69 |
| 9 | 165.39 | 96.46 |

Circle Center At X = 4.5 ; Y = 207.2 and Radius, 195.4

*** 2.054 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 118.68 | 54.54 |
| 3 | 126.24 | 61.08 |
| 4 | 133.79 | 67.64 |
| 5 | 141.34 | 74.20 |
| 6 | 148.87 | 80.77 |
| 7 | 156.40 | 87.36 |
| 8 | 163.92 | 93.95 |
| 9 | 166.44 | 96.16 |

Circle Center At X = ****** ; Y = 6105.0 and Radius, 7998.2

*** 2.071 ***

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 118.34 | 54.91 |
| 3 | 125.48 | 61.92 |
| 4 | 132.52 | 69.02 |
| 5 | 139.46 | 76.22 |
| 6 | 146.30 | 83.51 |
| 7 | 153.04 | 90.89 |
| 8 | 159.36 | 98.00 |

Circle Center At X = -392.6 ; Y = 582.4 and Radius, 734.4

*** 2.086 ***

Failure Surface Specified By 10 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 105.56 | 35.50 |
| 2 | 114.26 | 40.42 |
| 3 | 122.68 | 45.83 |
| 4 | 130.78 | 51.69 |
| 5 | 138.54 | 57.99 |
| 6 | 145.94 | 64.72 |
| 7 | 152.95 | 71.85 |
| 8 | 159.55 | 79.37 |
| 9 | 165.72 | 87.23 |
| 10 | 171.04 | 94.85 |

Circle Center At X = 21.7 ; Y = 193.8 and Radius, 179.2

*** 2.088 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 118.96 | 54.20 |
| 3 | 126.80 | 60.40 |
| 4 | 134.64 | 66.62 |
| 5 | 142.46 | 72.85 |
| 6 | 150.27 | 79.09 |
| 7 | 158.07 | 85.35 |
| 8 | 165.87 | 91.61 |
| 9 | 170.18 | 95.09 |

Circle Center At X = ****** ; Y = 5139.6 and Radius, 6481.5

*** 2.096 ***

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 54.03 |
| 2 | 121.34 | 60.71 |
| 3 | 128.64 | 67.53 |
| 4 | 135.81 | 74.51 |
| 5 | 142.83 | 81.63 |
| 6 | 149.70 | 88.90 |
| 7 | 156.41 | 96.30 |
| 8 | 157.89 | 98.00 |

Circle Center At X = -205.5 ; Y = 417.8 and Radius, 484.1

*** 2.101 ***

Failure Surface Specified By 11 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 100.00 | 23.00 |
| 2 | 107.11 | 30.03 |
| 3 | 114.16 | 37.13 |
| 4 | 121.15 | 44.28 |
| 5 | 128.07 | 51.49 |
| 6 | 134.94 | 58.76 |
| 7 | 141.75 | 66.09 |
| 8 | 148.49 | 73.47 |
| 9 | 155.18 | 80.91 |
| 10 | 161.80 | 88.40 |
| 11 | 168.11 | 95.68 |

Circle Center At X = -733.5 ; Y = 872.4 and Radius, 1190.1

*** 2.103 ***

```
           Y            A     X     I     S            F     T

           0.00     25.00     50.00     75.00    100.00    125.00

X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
            -
            -
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -           2 7
```

```
             -       ...10  . 4
             -          ...207..5* 9
             -           .1.....4 .5 .
             -       ........2.7...8 9..  .
S    125.00 +            ..1.....4..56 . . . *
             -        .........2. 7. ...9. ..
             -         .......31..2..4..56....    * *
             -        ..............7......6. *.
             -          .........31..2.04.85..9...
             -             .........31.7..4...6.....
     150.00 +          .... ...........1.0..5...9...
             -             ............3.72.4 ..6*..
             -            ..................317.24...*
             -              . ..................31.21.
             -              ....................7.851
             -                . ................ ..7
F    175.00 +                 .....................
             -                    ................*
             -                      ...............
             -                        .............
             -                             ........
             -                                 ....
T    200.00 +       *           *            *   *
```

**EXCAVATION**
**10 foot surface soil**
**MHA=0.42g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 10 ft surface so
il - MHA = 0.42 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 127.00 | 82.00 | 3 |
| 6 | 127.00 | 82.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 127.00 | 82.00 | 137.00 | 82.00 | 3 |
| 12 | 137.00 | 82.00 | 153.00 | 92.00 | 2 |
| 13 | 153.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 137.00 | 82.00 | 200.00 | 82.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

| Soil Type | Total Unit Wt. | Saturated Unit Wt. | Cohesion Intercept | Friction Angle | Pore Pressure | Pressure Constant | Piez. Surface |
|---|---|---|---|---|---|---|---|

| No. | (pcf) | (pcf) | (psf) | (deg) | Param. | (psf) | No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.420 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 125.00 ft.

Each Surface Terminates Between X = 150.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 118.96 | 54.20 |
| 3 | 126.80 | 60.40 |
| 4 | 134.64 | 66.62 |
| 5 | 142.46 | 72.85 |
| 6 | 150.27 | 79.09 |

| | | |
|---|---|---|
| 7 | 158.07 | 85.35 |
| 8 | 165.87 | 91.61 |
| 9 | 170.18 | 95.09 |

Circle Center At X = ****** ; Y = 5139.6 and Radius, 6481.5

*** 1.182 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 119.35 | 53.67 |
| 3 | 127.55 | 59.39 |
| 4 | 135.71 | 65.17 |
| 5 | 143.84 | 71.00 |
| 6 | 151.92 | 76.89 |
| 7 | 159.96 | 82.83 |
| 8 | 167.96 | 88.83 |
| 9 | 174.56 | 93.84 |

Circle Center At X = -725.7 ; Y = 1273.4 and Radius, 1483.9

*** 1.184 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 118.68 | 54.54 |
| 3 | 126.24 | 61.08 |
| 4 | 133.79 | 67.64 |
| 5 | 141.34 | 74.20 |
| 6 | 148.87 | 80.77 |
| 7 | 156.40 | 87.36 |
| 8 | 163.92 | 93.95 |
| 9 | 166.44 | 96.16 |

Circle Center At X = ****** ; Y = 6105.0 and Radius, 7998.2

*** 1.201 ***

Failure Surface Specified By 12 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 102.78 | 29.25 |
| 2 | 110.61 | 35.47 |

| | | |
|---|---|---|
| 3 | 118.44 | 41.69 |
| 4 | 126.26 | 47.93 |
| 5 | 134.07 | 54.17 |
| 6 | 141.88 | 60.42 |
| 7 | 149.68 | 66.68 |
| 8 | 157.47 | 72.94 |
| 9 | 165.25 | 79.22 |
| 10 | 173.03 | 85.50 |
| 11 | 180.81 | 91.79 |
| 12 | 181.07 | 92.00 |

Circle Center At X = ****** ; Y = 7499.1 and Radius, 9533.0

*** 1.228 ***

Failure Surface Specified By 12 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 102.78 | 29.25 |
| 2 | 110.97 | 34.99 |
| 3 | 119.11 | 40.80 |
| 4 | 127.20 | 46.67 |
| 5 | 135.24 | 52.62 |
| 6 | 143.24 | 58.63 |
| 7 | 151.18 | 64.70 |
| 8 | 159.07 | 70.84 |
| 9 | 166.91 | 77.05 |
| 10 | 174.70 | 83.33 |
| 11 | 182.43 | 89.66 |
| 12 | 185.23 | 92.00 |

Circle Center At X = -579.4 ; Y = 1011.4 and Radius, 1195.9

*** 1.231 ***

Failure Surface Specified By 13 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 102.78 | 29.25 |
| 2 | 111.07 | 34.84 |
| 3 | 119.36 | 40.43 |
| 4 | 127.64 | 46.04 |
| 5 | 135.92 | 51.65 |
| 6 | 144.19 | 57.27 |
| 7 | 152.45 | 62.90 |
| 8 | 160.71 | 68.54 |
| 9 | 168.97 | 74.18 |
| 10 | 177.22 | 79.84 |
| 11 | 185.46 | 85.50 |
| 12 | 193.69 | 91.17 |
| 13 | 194.89 | 92.00 |

Circle Center At X = ****** ; Y = 8084.0 and Radius, 9708.4

*** 1.244 ***

Failure Surface Specified By 13 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 102.78 | 29.25 |
| 2 | 111.30 | 34.49 |
| 3 | 119.76 | 39.81 |
| 4 | 128.18 | 45.21 |
| 5 | 136.54 | 50.70 |
| 6 | 144.85 | 56.26 |
| 7 | 153.11 | 61.89 |
| 8 | 161.32 | 67.61 |
| 9 | 169.47 | 73.41 |
| 10 | 177.56 | 79.28 |
| 11 | 185.60 | 85.23 |
| 12 | 193.58 | 91.26 |
| 13 | 194.54 | 92.00 |

Circle Center At X = -443.9 ; Y = 927.2 and Radius, 1051.3

*** 1.250 ***

Failure Surface Specified By 11 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 105.56 | 35.50 |
| 2 | 114.11 | 40.69 |
| 3 | 122.57 | 46.02 |
| 4 | 130.93 | 51.51 |
| 5 | 139.19 | 57.14 |
| 6 | 147.35 | 62.92 |
| 7 | 155.41 | 68.84 |
| 8 | 163.36 | 74.91 |
| 9 | 171.20 | 81.11 |
| 10 | 178.93 | 87.46 |
| 11 | 184.27 | 92.00 |

Circle Center At X = -181.5 ; Y = 518.6 and Radius, 562.0

*** 1.251 ***

Failure Surface Specified By 10 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 108.33 | 41.75 |

| | | |
|---|---|---|
| 2 | 117.14 | 46.50 |
| 3 | 125.75 | 51.58 |
| 4 | 134.15 | 57.00 |
| 5 | 142.33 | 62.75 |
| 6 | 150.29 | 68.81 |
| 7 | 158.00 | 75.18 |
| 8 | 165.46 | 81.84 |
| 9 | 172.65 | 88.79 |
| 10 | 176.85 | 93.19 |

Circle Center At X = -8.5 ; Y = 269.0 and Radius, 255.6

*** 1.253 ***

Failure Surface Specified By 11 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 105.56 | 35.50 |
| 2 | 114.13 | 40.64 |
| 3 | 122.63 | 45.92 |
| 4 | 131.03 | 51.34 |
| 5 | 139.35 | 56.89 |
| 6 | 147.58 | 62.57 |
| 7 | 155.71 | 68.39 |
| 8 | 163.75 | 74.33 |
| 9 | 171.70 | 80.41 |
| 10 | 179.54 | 86.61 |
| 11 | 186.13 | 92.00 |

Circle Center At X = -208.5 ; Y = 569.2 and Radius, 619.3

*** 1.255 ***

```
           Y            A     X     I     S            F     T

           0.00     25.00     50.00     75.00    100.00    125.00

X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
```

```
            -
            -
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -           4 8
            -       .....  . 9
            -          ...4.8..1* .
            -           .....4.9 .3 .
            -       ........5.8..21 ...  .
S    125.00 +            ......4.9..1. . . . *
            -        .........65 8. 2.... ..
            -         ...........549...1.....    * *
            -        ...........76.8..2..... *.
            -          ............549...13......
            -             .........6.8..2..........
     150.00 +          .... ..........549..21.......
            -              ..........6.08.... ...*..
            -            ...............549..213...*
            -              . ..........6..8.......3.
            -              ................549..213.
            -                . ..........76.8.. 9.1
F    175.00 +                 ................54..92
            -                    ...........6..8.*
            -                      .............55
            -                        .........6..0
            -                             ......67
            -                                 ...6
T    200.00 +       *           *            *   *
```

**EXCAVATION**
**15 foot surface soil**
**MHA=0.0g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 15 ft - MHA = 0.
0 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 125.00 | 77.00 | 3 |
| 6 | 125.00 | 77.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 125.00 | 77.00 | 135.00 | 77.00 | 3 |
| 12 | 135.00 | 77.00 | 150.00 | 92.00 | 2 |
| 13 | 150.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 127.00 | 77.00 | 200.00 | 77.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

| Soil Type | Total Unit Wt. | Saturated Unit Wt. | Cohesion Intercept | Friction Angle | Pore Pressure | Pressure Constant | Piez. Surface |
|---|---|---|---|---|---|---|---|

| No. | (pcf) | (pcf) | (psf) | (deg) | Param. | (psf) | No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 125.00 ft.

Each Surface Terminates Between X = 150.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 15.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 53.92 |
| 2 | 124.93 | 64.07 |
| 3 | 135.65 | 74.57 |
| 4 | 146.03 | 85.40 |
| 5 | 156.06 | 96.55 |
| 6 | 157.29 | 98.00 |

Circle Center At X = -201.2 ; Y = 407.9 and Radius, 473.9

*** 1.898 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 125.00 | 77.00 |
| 2 | 139.34 | 81.40 |
| 3 | 151.77 | 89.80 |
| 4 | 158.39 | 98.00 |

Circle Center At X = 117.4 ; Y = 127.2 and Radius, 50.7

*** 1.903 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 53.92 |
| 2 | 125.32 | 63.64 |
| 3 | 136.74 | 73.36 |
| 4 | 148.16 | 83.09 |
| 5 | 159.56 | 92.84 |
| 6 | 164.19 | 96.80 |

Circle Center At X = ****** ; Y = ****** and Radius, ******

*** 1.904 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 116.67 | 59.69 |
| 2 | 128.11 | 69.40 |
| 3 | 139.26 | 79.43 |
| 4 | 150.11 | 89.79 |
| 5 | 158.22 | 98.00 |

Circle Center At X = -208.2 ; Y = 454.3 and Radius, 511.1

*** 1.917 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 121.89 | 58.43 |
| 3 | 132.45 | 69.09 |
| 4 | 142.78 | 79.96 |

| | | |
|---|---|---|
| 5 | 152.88 | 91.05 |
| 6 | 158.94 | 98.00 |

Circle Center At X = -377.3 ; Y = 563.7 and Radius, 710.3

*** 1.934 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 125.00 | 77.00 |
| 2 | 139.22 | 81.78 |
| 3 | 152.00 | 89.63 |
| 4 | 160.41 | 97.88 |

Circle Center At X = 111.1 ; Y = 142.0 and Radius, 66.5

*** 1.938 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 122.81 | 57.39 |
| 3 | 134.49 | 66.80 |
| 4 | 146.16 | 76.23 |
| 5 | 157.81 | 85.68 |
| 6 | 169.44 | 95.15 |
| 7 | 169.58 | 95.26 |

Circle Center At X = ****** ; Y = 6312.5 and Radius, 8025.1

*** 1.940 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 53.92 |
| 2 | 127.07 | 61.09 |
| 3 | 139.50 | 69.48 |
| 4 | 151.06 | 79.04 |
| 5 | 161.65 | 89.66 |
| 6 | 166.88 | 96.03 |

Circle Center At X = 46.3 ; Y = 194.1 and Radius, 155.6

```
      ***     1.946   ***


Failure Surface Specified By  8 Coordinate Points


  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)

    1        100.00       23.00
    2        112.76       30.89
    3        124.76       39.89
    4        135.92       49.92
    5        146.13       60.90
    6        155.34       72.74
    7        163.45       85.36
    8        168.75       95.50

Circle Center At X =   17.9 ; Y =  170.0  and Radius,  168.4


      ***     1.961   ***


Failure Surface Specified By  6 Coordinate Points


  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)

    1        113.89       53.92
    2        124.39       64.64
    3        134.73       75.50
    4        144.92       86.51
    5        154.94       97.68
    6        155.22       98.00

Circle Center At X = -613.1 ; Y =  777.1  and Radius, 1025.4


      ***     1.973   ***



           Y            A     X     I     S            F     T


           0.00     25.00     50.00     75.00    100.00    125.00

X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
```

```
A     50.00 +
            -
            -
            -
            -
            -
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -           . .
            -             .  .
            -          .9. . . 5* 1
            -       ........  .. .  4
            -            ......... 5. . .
S    125.00 +              .9.......831    *
            -        ...... ........... 4 .
            -         .. ...............75.0*.    * *
            -             ......9.... ..831.42.
            -             .. ........... ...5. .
            -         ....  ... ....9... .7. .10..
     150.00 +             ..................83..2*..
            -              ..............9.. .  5 .1
            -            ....  .............  7 .3 *
            -             .. ..................9.8..3
            -                 ................... .8.
            -                ... ................ 7
F    175.00 +                   ...................
            -                    ................*
            -                     ................
            -                         ............
            -                           . ........
            -                                  ....
T    200.00 +       *           *          *     *
```

**EXCAVATION**
**15 foot surface soil**
**MHA=0.0g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 15 ft surface so
il - MHA = 0.42 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 125.00 | 77.00 | 3 |
| 6 | 125.00 | 77.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 125.00 | 77.00 | 135.00 | 77.00 | 3 |
| 12 | 135.00 | 77.00 | 150.00 | 92.00 | 2 |
| 13 | 150.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 127.00 | 77.00 | 200.00 | 77.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

| Soil Type | Total Unit Wt. | Saturated Unit Wt. | Cohesion Intercept | Friction Angle | Pore Pressure | Pressure Constant | Piez. Surface |
|---|---|---|---|---|---|---|---|

| No. | (pcf) | (pcf) | (psf) | (deg) | Param. | (psf) | No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.420 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 125.00 ft.

Each Surface Terminates Between X = 150.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 125.00 | 77.00 |
| 2 | 133.91 | 81.55 |
| 3 | 142.74 | 86.23 |
| 4 | 151.50 | 91.05 |
| 5 | 160.19 | 96.01 |
| 6 | 162.40 | 97.31 |

Circle Center At X = -164.2 ; Y = 654.4 and Radius, 645.8

*** 1.015 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 121.05 | 68.80 |
| 2 | 129.43 | 74.27 |
| 3 | 137.80 | 79.74 |
| 4 | 146.16 | 85.22 |
| 5 | 154.52 | 90.72 |
| 6 | 162.87 | 96.22 |
| 7 | 163.88 | 96.89 |

Circle Center At X = ****** ; Y = 7156.9 and Radius, 8459.8

*** 1.069 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.16 | 52.41 |
| 2 | 121.40 | 58.07 |
| 3 | 129.63 | 63.75 |
| 4 | 137.86 | 69.44 |
| 5 | 146.07 | 75.14 |
| 6 | 154.27 | 80.86 |
| 7 | 162.46 | 86.59 |
| 8 | 170.65 | 92.34 |
| 9 | 173.29 | 94.20 |

Circle Center At X = ****** ; Y = 4878.3 and Radius, 5851.8

*** 1.070 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.37 | 71.54 |
| 2 | 131.27 | 76.10 |
| 3 | 139.95 | 81.07 |
| 4 | 148.39 | 86.43 |
| 5 | 156.57 | 92.18 |
| 6 | 162.99 | 97.15 |

Circle Center At X = 28.0 ; Y = 266.6 and Radius, 216.7

*** 1.075 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 121.05 | 68.80 |
| 2 | 129.59 | 74.01 |
| 3 | 137.94 | 79.52 |
| 4 | 146.08 | 85.32 |
| 5 | 154.02 | 91.40 |
| 6 | 161.51 | 97.57 |

Circle Center At X = -21.7 ; Y = 312.4 and Radius, 282.3

*** 1.079 ***

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 115.79 | 57.87 |
| 2 | 123.65 | 64.05 |
| 3 | 131.50 | 70.25 |
| 4 | 139.35 | 76.45 |
| 5 | 147.19 | 82.65 |
| 6 | 155.02 | 88.87 |
| 7 | 162.85 | 95.09 |
| 8 | 164.79 | 96.63 |

Circle Center At X = ****** ; Y = 7893.5 and Radius, 9966.1

*** 1.081 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 121.05 | 68.80 |
| 2 | 129.94 | 73.39 |
| 3 | 138.75 | 78.12 |
| 4 | 147.48 | 83.00 |
| 5 | 156.13 | 88.02 |
| 6 | 164.69 | 93.18 |
| 7 | 168.51 | 95.57 |

Circle Center At X = -153.7 ; Y = 611.8 and Radius, 608.6

*** 1.083 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 125.00 | 77.00 |
| 2 | 133.60 | 82.11 |
| 3 | 142.16 | 87.28 |
| 4 | 150.68 | 92.51 |
| 5 | 159.17 | 97.79 |
| 6 | 159.51 | 98.00 |

Circle Center At X = -631.8 ; Y = 1359.5 and Radius, 1489.1

*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.16 | 52.41 |
| 2 | 120.77 | 58.89 |
| 3 | 128.27 | 65.51 |
| 4 | 135.64 | 72.27 |
| 5 | 142.88 | 79.16 |
| 6 | 149.99 | 86.19 |
| 7 | 156.98 | 93.35 |
| 8 | 161.06 | 97.70 |

Circle Center At X = -232.8 ; Y = 466.6 and Radius, 539.7

*** 1.103 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.37 | 71.54 |
| 2 | 131.70 | 75.12 |
| 3 | 140.79 | 79.29 |
| 4 | 149.60 | 84.03 |
| 5 | 158.09 | 89.32 |
| 6 | 166.22 | 95.14 |
| 7 | 167.21 | 95.94 |

Circle Center At X = 70.6 ; Y = 220.3 and Radius, 157.5

*** 1.112 ***

```
            Y            A     X     I     S            F     T

            0.00     25.00     50.00     75.00    100.00    125.00
X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
            -
            -
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *.
            -           ...
            -       ..... ....
            -         ..........*3.
            -             .......  6..
            -       ..... .........39.. 24
S    125.00 +            .............6.. .*
            -        ................39..72
            -          ..... ...........6.4*.1   * *
            -        ... ...............39.62 .
            -          ....................4.18
            -            . ................3..62...
     150.00 +          .... ...................941*..
            -              ........ ........3..725..
            -            ................. .... 041*
            -               . ................3..21
            -              .................   ..776
            -                  ................. 3.
F    175.00 +                 . ..................3
            -                   ................*
            -                     ...............
            -                        ............
            -                           .........
            -                               .....
    T    200.00 +       *           *          *     *
```

**EXCAVATION**
**20 foot surface soil**
**MHA=0.0g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 20 ft - MHA = 0.
0 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 122.00 | 72.00 | 3 |
| 6 | 122.00 | 72.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 122.00 | 72.00 | 132.00 | 72.00 | 3 |
| 12 | 132.00 | 72.00 | 155.00 | 92.00 | 2 |
| 13 | 155.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 127.00 | 72.00 | 200.00 | 72.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

| Soil Type | Total Unit Wt. | Saturated Unit Wt. | Cohesion Intercept | Friction Angle | Pore Pressure | Pressure Constant | Piez. Surface |
|---|---|---|---|---|---|---|---|

| No. | (pcf) | (pcf) | (psf) | (deg) | Param. | (psf) | No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 125.00 ft.

Each Surface Terminates Between X = 150.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 15.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 54.16 |
| 2 | 125.14 | 64.07 |
| 3 | 136.39 | 74.00 |
| 4 | 147.62 | 83.94 |
| 5 | 158.85 | 93.89 |
| 6 | 162.63 | 97.25 |

Circle Center At X = ****** ; Y = ****** and Radius, ******

*** 1.676 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 134.11 | 81.59 |
| 3 | 145.30 | 91.58 |
| 4 | 151.50 | 98.00 |

Circle Center At X = 3.5 ; Y = 239.1 and Radius, 204.6

*** 1.677 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 134.05 | 81.67 |
| 3 | 145.46 | 91.40 |
| 4 | 152.55 | 98.00 |

Circle Center At X = -85.3 ; Y = 350.5 and Radius, 347.0

*** 1.712 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 133.62 | 82.20 |
| 3 | 144.83 | 92.17 |
| 4 | 151.12 | 98.00 |

Circle Center At X = -363.7 ; Y = 652.1 and Radius, 756.3

*** 1.719 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 122.81 | 57.39 |
| 3 | 134.49 | 66.80 |
| 4 | 146.16 | 76.23 |
| 5 | 157.81 | 85.68 |
| 6 | 169.44 | 95.15 |
| 7 | 169.58 | 95.26 |

Circle Center At X = ****** ; Y = 6312.5 and Radius, 8025.1

*** 1.768 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 54.16 |
| 2 | 127.02 | 61.41 |
| 3 | 139.40 | 69.88 |
| 4 | 150.93 | 79.47 |
| 5 | 161.50 | 90.12 |
| 6 | 166.45 | 96.16 |

Circle Center At X = 43.9 ; Y = 196.4 and Radius, 158.5

*** 1.771 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 136.21 | 77.86 |
| 3 | 147.28 | 87.98 |
| 4 | 152.22 | 98.00 |

Circle Center At X = 114.8 ; Y = 112.4 and Radius, 40.6

*** 1.789 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 121.89 | 58.43 |
| 3 | 132.45 | 69.09 |
| 4 | 142.78 | 79.96 |
| 5 | 152.88 | 91.05 |
| 6 | 158.94 | 98.00 |

Circle Center At X = -377.3 ; Y = 563.7 and Radius, 710.3

*** 1.791 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 136.39 | 77.38 |
| 3 | 147.92 | 86.97 |
| 4 | 154.21 | 98.00 |

Circle Center At X = 115.7 ; Y = 113.9 and Radius, 42.0

*** 1.853 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 108.33 | 41.75 |
| 2 | 119.70 | 51.54 |
| 3 | 130.68 | 61.76 |
| 4 | 141.24 | 72.41 |
| 5 | 151.39 | 83.46 |
| 6 | 161.09 | 94.90 |
| 7 | 162.88 | 97.18 |

Circle Center At X = -136.6 ; Y = 337.7 and Radius, 384.2

*** 1.853 ***

```
           Y            A     X     I     S            F     T

           0.00     25.00     50.00     75.00    100.00    125.00

X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
            -
            -
```

```
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -           . .
            -             .  0
            -          ... . . 5* 1
            -       ........  .. .  .
            -           ........0 5.   . *
S    125.00 +              ..........61  * .
            -        ...... .........0. .  .
            -         .. ..............58*.. 2   * *
            -             ........... ..6.17...
            -             .. ........... 0..8. .
            -         ....  ... ........ .5. .17.2
     150.00 +             ...................60.9...2
            -              ..................... .8*.3
            -            ....  .............  5 ..1*
            -             .. ................ ..6.01
            -                 ....................6.
            -                ...  ................5
F    175.00 +                   ...................
            -                    ................*
            -                     ................
            -                         ............
            -                           .  .......
            -                                  ....
    T    200.00 +       *           *        *       *
```

**EXCAVATION**
**20 foot surface soil**
**MHA=0.42g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 20 ft - MHA = 0.
42 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 122.00 | 72.00 | 3 |
| 6 | 122.00 | 72.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 122.00 | 72.00 | 132.00 | 72.00 | 3 |
| 12 | 132.00 | 72.00 | 155.00 | 92.00 | 2 |
| 13 | 155.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 127.00 | 72.00 | 200.00 | 72.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

| Soil Type | Total Unit Wt. | Saturated Unit Wt. | Cohesion Intercept | Friction Angle | Pore Pressure | Pressure Constant | Piez. Surface |
|---|---|---|---|---|---|---|---|

| No. | (pcf) | (pcf) | (psf) | (deg) | Param. | (psf) | No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.420 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 125.00 ft.

Each Surface Terminates Between X = 150.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 135.64 | 79.14 |
| 3 | 148.88 | 86.21 |
| 4 | 161.92 | 93.62 |
| 5 | 166.21 | 96.23 |

Circle Center At X = -117.5 ; Y = 569.6 and Radius, 551.9

*** 0.904 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 136.95 | 75.31 |
| 3 | 150.78 | 81.12 |
| 4 | 163.13 | 89.63 |
| 5 | 168.73 | 95.50 |

Circle Center At X = 115.7 ; Y = 145.2 and Radius, 73.1

*** 0.915 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 136.54 | 76.92 |
| 3 | 150.84 | 81.45 |
| 4 | 165.13 | 86.02 |
| 5 | 179.40 | 90.63 |
| 6 | 183.61 | 92.00 |

Circle Center At X = ****** ; Y = 4722.4 and Radius, 4870.0

*** 0.932 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 54.16 |
| 2 | 125.14 | 64.07 |
| 3 | 136.39 | 74.00 |
| 4 | 147.62 | 83.94 |
| 5 | 158.85 | 93.89 |
| 6 | 162.63 | 97.25 |

Circle Center At X = ****** ; Y = ****** and Radius, ******

*** 0.939 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 134.11 | 81.59 |
| 3 | 145.30 | 91.58 |
| 4 | 151.50 | 98.00 |

Circle Center At X = 3.5 ; Y = 239.1 and Radius, 204.6

*** 0.944 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 134.05 | 81.67 |
| 3 | 145.46 | 91.40 |
| 4 | 152.55 | 98.00 |

Circle Center At X = -85.3 ; Y = 350.5 and Radius, 347.0

*** 0.955 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 133.62 | 82.20 |
| 3 | 144.83 | 92.17 |
| 4 | 151.12 | 98.00 |

Circle Center At X = -363.7 ; Y = 652.1 and Radius, 756.3

*** 0.972 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 122.81 | 57.39 |
| 3 | 134.49 | 66.80 |
| 4 | 146.16 | 76.23 |

| | | |
|---|---|---|
| 5 | 157.81 | 85.68 |
| 6 | 169.44 | 95.15 |
| 7 | 169.58 | 95.26 |

Circle Center At X = ****** ; Y = 6312.5 and Radius, 8025.1

*** 0.974 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 136.97 | 75.19 |
| 3 | 151.49 | 78.95 |
| 4 | 165.71 | 83.73 |
| 5 | 179.56 | 89.48 |
| 6 | 184.61 | 92.00 |

Circle Center At X = 90.4 ; Y = 284.7 and Radius, 214.6

*** 0.988 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 135.98 | 78.41 |
| 3 | 148.49 | 86.69 |
| 4 | 159.36 | 97.04 |
| 5 | 160.05 | 97.98 |

Circle Center At X = 95.2 ; Y = 153.5 and Radius, 85.4

*** 0.993 ***

```
           Y            A     X     I     S            F     T

           0.00     25.00     50.00     75.00    100.00    125.00

X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
```

```
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
            -
            -
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -           . .
            -             .  .
            -          ... . . 8* 4
            -       ........  .. .  .
            -            ......... 8.   . *
S    125.00 +              ...........4  * .
            -        ......  ........... .  .
            -         .. ..............8.*.. 5   * *
            -             ........... ....231..
            -             .. ........... ..... .
            -         ....  ... ......... .8. .4..5
     150.00 +             ...................2310...5
            -              ..................... ..*.6
            -            ....  .............  8 ..4*
            -             .. ................ ..21.4
            -                 ...............93...1.
            -                ...  ................8
F    175.00 +                   ..................
            -                    ...............3*
            -                     ...............3
            -                         ............
            -                           .  .......
            -                                 ....
T    200.00 +       *           *        *       *
```

**EXCAVATION**
**20 foot surface soil – increased cohesion (850 psf)**
**MHA=0.42g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 20 ft - MHA = 0.
42 g with increased C in compacted surfa

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 122.00 | 72.00 | 3 |
| 6 | 122.00 | 72.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 122.00 | 72.00 | 132.00 | 72.00 | 3 |
| 12 | 132.00 | 72.00 | 155.00 | 92.00 | 2 |
| 13 | 155.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 127.00 | 72.00 | 200.00 | 72.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

| Soil Type | Total Unit Wt. | Saturated Unit Wt. | Cohesion Intercept | Friction Angle | Pore Pressure | Pressure Constant | Piez. Surface |
|---|---|---|---|---|---|---|---|

| No. | (pcf) | (pcf) | (psf) | (deg) | Param. | (psf) | No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 900.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.420 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 125.00 ft.

Each Surface Terminates Between X = 150.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 122.81 | 57.39 |
| 3 | 134.49 | 66.80 |
| 4 | 146.16 | 76.23 |
| 5 | 157.81 | 85.68 |
| 6 | 169.44 | 95.15 |

| | | |
|---|---|---|
| 7 | 169.58 | 95.26 |

Circle Center At X = ****** ; Y = 6312.5 and Radius, 8025.1

*** 1.000 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 54.16 |
| 2 | 125.14 | 64.07 |
| 3 | 136.39 | 74.00 |
| 4 | 147.62 | 83.94 |
| 5 | 158.85 | 93.89 |
| 6 | 162.63 | 97.25 |

Circle Center At X = ****** ; Y = ****** and Radius, ******

*** 1.001 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 54.16 |
| 2 | 127.02 | 61.41 |
| 3 | 139.40 | 69.88 |
| 4 | 150.93 | 79.47 |
| 5 | 161.50 | 90.12 |
| 6 | 166.45 | 96.16 |

Circle Center At X = 43.9 ; Y = 196.4 and Radius, 158.5

*** 1.030 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.89 | 54.16 |
| 2 | 127.34 | 60.79 |
| 3 | 140.79 | 67.44 |
| 4 | 154.22 | 74.11 |
| 5 | 167.66 | 80.79 |
| 6 | 181.08 | 87.48 |
| 7 | 190.13 | 92.00 |

Circle Center At X = ****** ; Y = ****** and Radius, ******

*** 1.065 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 136.54 | 76.92 |
| 3 | 150.84 | 81.45 |
| 4 | 165.13 | 86.02 |
| 5 | 179.40 | 90.63 |
| 6 | 183.61 | 92.00 |

Circle Center At X = ****** ; Y = 4722.4 and Radius, 4870.0

*** 1.087 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 136.97 | 75.19 |
| 3 | 151.49 | 78.95 |
| 4 | 165.71 | 83.73 |
| 5 | 179.56 | 89.48 |
| 6 | 184.61 | 92.00 |

Circle Center At X = 90.4 ; Y = 284.7 and Radius, 214.6

*** 1.105 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 122.22 | 72.45 |
| 2 | 136.95 | 75.31 |
| 3 | 150.78 | 81.12 |
| 4 | 163.13 | 89.63 |
| 5 | 168.73 | 95.50 |

Circle Center At X = 115.7 ; Y = 145.2 and Radius, 73.1

*** 1.106 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 108.33 | 41.75 |
| 2 | 119.63 | 51.61 |
| 3 | 130.80 | 61.63 |
| 4 | 141.84 | 71.79 |
| 5 | 152.74 | 82.09 |
| 6 | 163.50 | 92.54 |
| 7 | 166.97 | 96.01 |

Circle Center At X = -628.6 ; Y = 897.5 and Radius, 1129.4

*** 1.111 ***

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 102.78 | 29.25 |
| 2 | 114.60 | 38.48 |
| 3 | 126.41 | 47.73 |
| 4 | 138.21 | 56.99 |
| 5 | 150.01 | 66.26 |
| 6 | 161.79 | 75.54 |
| 7 | 173.56 | 84.84 |
| 8 | 182.61 | 92.00 |

Circle Center At X = ****** ; Y = ****** and Radius, ******

*** 1.118 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 124.89 | 53.92 |
| 3 | 138.33 | 60.59 |
| 4 | 151.37 | 68.00 |
| 5 | 163.98 | 76.12 |
| 6 | 176.12 | 84.93 |
| 7 | 184.81 | 92.00 |

Circle Center At X = 11.4 ; Y = 299.2 and Radius, 270.2

*** 1.118 ***

```
            Y            A     X     I     S            F     T

            0.00     25.00     50.00     75.00    100.00    125.00
X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
            -
            -
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -           9 .
            -             .  8
            -          ... . . 1* 2
            -       .......9  .. .  .
            -            ........8 1.   . *
S    125.00 +              ....9..0..32  * .
            -        ...... ........48. .  .
            -         .. ..............1.*.. .   * *
            -             .........90 ..3.25...
            -             .. ..........4 8.... .
            -         ....  ... ........ .1. .2...
     150.00 +             .............9....35......
            -              ...............4..8 ..*..
            -            ....  .............  1 ..2*
            -             .. .............9.. ..38.2
            -                 ...............465...3.
            -                ...  ................1
F    175.00 +                   ..............9....
            -                    ...............45*
            -                     ...............5
            -                         ............
            -                           .  ......4
            -                                  ....
T    200.00 +       *           *        *       *
```

**FINAL COVER**

**Shallow Failure**
**MHA = 0.0 g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION North Final Cover, Shallow Failure - MHA = 0.0 g

BOUNDARY COORDINATES

5 Top Boundaries
21 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 92.00 | 19.00 | 92.00 | 4 |
| 2 | 19.00 | 92.00 | 40.00 | 98.00 | 3 |
| 3 | 40.00 | 98.00 | 46.00 | 98.00 | 3 |
| 4 | 46.00 | 98.00 | 310.00 | 186.00 | 1 |
| 5 | 310.00 | 186.00 | 410.00 | 181.00 | 1 |
| 6 | 46.00 | 98.00 | 65.00 | 98.00 | 3 |
| 7 | 65.00 | 98.00 | 85.00 | 108.00 | 2 |
| 8 | 85.00 | 108.00 | 310.00 | 183.00 | 2 |
| 9 | 310.00 | 183.00 | 410.00 | 178.00 | 2 |
| 10 | 65.00 | 98.00 | 75.00 | 78.00 | 3 |
| 11 | 75.00 | 78.00 | 310.00 | 120.00 | 8 |
| 12 | 310.00 | 120.00 | 410.00 | 115.00 | 8 |
| 13 | 75.00 | 78.00 | 94.00 | 40.00 | 5 |
| 14 | 94.00 | 40.00 | 100.00 | 28.00 | 6 |
| 15 | 100.00 | 28.00 | 410.00 | 34.20 | 6 |
| 16 | 19.00 | 92.00 | 47.00 | 92.00 | 4 |
| 17 | 47.00 | 92.00 | 60.00 | 78.00 | 4 |
| 18 | 60.00 | 78.00 | 75.00 | 78.00 | 5 |
| 19 | 0.00 | 78.00 | 60.00 | 78.00 | 5 |
| 20 | 0.00 | 40.00 | 94.00 | 40.00 | 6 |
| 21 | 0.00 | 20.00 | 410.00 | 20.00 | 7 |

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 170.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 100.0 | 100.0 | 550.0 | 27.0 | 0.00 | 0.0 | 0 |
| 3 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 6 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 7 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |
| 8 | 115.0 | 115.0 | 750.0 | 27.0 | 0.00 | 0.0 | 0 |

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

500 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 60.00 ft.
and X = 70.00 ft.

Each Surface Terminates Between X = 90.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 62.22 | 103.41 |
| 2 | 72.22 | 103.71 |
| 3 | 81.84 | 106.44 |
| 4 | 90.49 | 111.45 |
| 5 | 92.66 | 113.55 |

Circle Center At X = 66.0 ; Y = 143.8 and Radius, 40.6

*** 4.743 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 61.11 | 103.04 |
| 2 | 71.06 | 104.06 |
| 3 | 80.77 | 106.46 |
| 4 | 90.05 | 110.19 |
| 5 | 98.72 | 115.17 |
| 6 | 99.63 | 115.88 |

Circle Center At X = 58.7 ; Y = 174.8 and Radius, 71.8

*** 4.880 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 63.33 | 103.78 |
| 2 | 73.33 | 103.83 |
| 3 | 82.84 | 106.95 |
| 4 | 90.92 | 112.83 |
| 5 | 91.06 | 113.02 |

Circle Center At X = 68.2 ; Y = 135.6 and Radius, 32.2

*** 4.911 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 63.33 | 103.78 |
| 2 | 73.31 | 104.49 |
| 3 | 82.94 | 107.18 |
| 4 | 91.84 | 111.73 |
| 5 | 95.19 | 114.40 |

Circle Center At X = 64.8 ; Y = 153.7 and Radius, 49.9

*** 4.942 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 65.56 | 104.52 |
| 2 | 75.54 | 105.05 |
| 3 | 85.09 | 108.04 |
| 4 | 93.60 | 113.29 |
| 5 | 94.42 | 114.14 |

Circle Center At X = 68.4 ; Y = 144.5 and Radius, 40.1

*** 5.069 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 65.56 | 104.52 |
| 2 | 75.55 | 104.75 |
| 3 | 85.01 | 108.00 |
| 4 | 92.38 | 113.46 |

Circle Center At X = 69.8 ; Y = 136.9 and Radius, 32.7

*** 5.098 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 60.00 | 102.67 |
| 2 | 69.94 | 103.77 |
| 3 | 79.60 | 106.36 |
| 4 | 88.76 | 110.37 |
| 5 | 95.03 | 114.34 |

Circle Center At X = 57.7 ; Y = 168.9 and Radius, 66.3

*** 5.173 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 67.78 | 105.26 |
| 2 | 77.75 | 106.00 |
| 3 | 87.36 | 108.75 |
| 4 | 96.22 | 113.41 |

| | | |
|---|---|---|
| 5 | 98.94 | 115.65 |

Circle Center At X = 69.2 ; Y = 154.1 and Radius, 48.9

*** 5.178 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 63.33 | 103.78 |
| 2 | 73.32 | 104.27 |
| 3 | 82.80 | 107.47 |
| 4 | 90.73 | 112.91 |

Circle Center At X = 66.5 ; Y = 140.0 and Radius, 36.4

*** 5.231 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 64.44 | 104.15 |
| 2 | 74.44 | 104.51 |
| 3 | 84.05 | 107.27 |
| 4 | 92.71 | 112.27 |
| 5 | 94.77 | 114.26 |

Circle Center At X = 68.0 ; Y = 145.1 and Radius, 41.1

*** 5.253 ***

```
           Y            A     X     I     S            F     T

           0.00     51.25    102.50    153.75    205.00    256.25

X      0.00 +---*---*-+----*--*-+---------+---------+---------+
            -
            -                 *
            -
            -
            -                  *
      51.25 +                 *
            -              *    1
            -                  *18
            -              *   .32
            -                  ..*7
            -       *          ...1.
```

```
A    102.50 +    *                .22
            -
            -
            -
            -
            -
X    153.75 +
            -
            -
            -
            -
            -
I    205.00 +
            -
            -
            -
            -
            -
S    256.25 +
            -
            -
            -
            -
            -
     307.50 +                       *             *
            -
            -
            -
            -
            -
F    358.75 +
            -
            -
            -
            -
            -
T    410.00 +   *  *               *             *
```

**FINAL COVER**
**Shallow Failure**
**MHA = 0.42 g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION North Final Cover, Shallow Failure - MHA = 0.42g

BOUNDARY COORDINATES

5 Top Boundaries
21 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 92.00 | 19.00 | 92.00 | 4 |
| 2 | 19.00 | 92.00 | 40.00 | 98.00 | 3 |
| 3 | 40.00 | 98.00 | 46.00 | 98.00 | 3 |
| 4 | 46.00 | 98.00 | 310.00 | 186.00 | 1 |
| 5 | 310.00 | 186.00 | 410.00 | 181.00 | 1 |
| 6 | 46.00 | 98.00 | 65.00 | 98.00 | 3 |
| 7 | 65.00 | 98.00 | 85.00 | 108.00 | 2 |
| 8 | 85.00 | 108.00 | 310.00 | 183.00 | 2 |
| 9 | 310.00 | 183.00 | 410.00 | 178.00 | 2 |
| 10 | 65.00 | 98.00 | 75.00 | 78.00 | 3 |
| 11 | 75.00 | 78.00 | 310.00 | 120.00 | 8 |
| 12 | 310.00 | 120.00 | 410.00 | 115.00 | 8 |
| 13 | 75.00 | 78.00 | 94.00 | 40.00 | 5 |
| 14 | 94.00 | 40.00 | 100.00 | 28.00 | 6 |
| 15 | 100.00 | 28.00 | 410.00 | 34.20 | 6 |
| 16 | 19.00 | 92.00 | 47.00 | 92.00 | 4 |
| 17 | 47.00 | 92.00 | 60.00 | 78.00 | 4 |
| 18 | 60.00 | 78.00 | 75.00 | 78.00 | 5 |
| 19 | 0.00 | 78.00 | 60.00 | 78.00 | 5 |
| 20 | 0.00 | 40.00 | 94.00 | 40.00 | 6 |
| 21 | 0.00 | 20.00 | 410.00 | 20.00 | 7 |

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 170.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 100.0 | 100.0 | 550.0 | 27.0 | 0.00 | 0.0 | 0 |
| 3 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 6 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 7 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |
| 8 | 115.0 | 115.0 | 750.0 | 27.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.420 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

500 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 55.00 ft.
and X = 70.00 ft.

Each Surface Terminates Between X = 90.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 60.00 | 102.67 |
| 2 | 69.99 | 103.20 |
| 3 | 79.68 | 105.65 |
| 4 | 88.72 | 109.92 |
| 5 | 94.47 | 114.16 |

Circle Center At X = 62.3 ; Y = 154.2 and Radius, 51.6

*** 1.928 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 55.00 | 101.00 |
| 2 | 64.94 | 102.07 |
| 3 | 74.67 | 104.40 |
| 4 | 84.01 | 107.96 |
| 5 | 92.82 | 112.69 |
| 6 | 95.22 | 114.41 |

Circle Center At X = 51.7 ; Y = 178.8 and Radius, 77.8

*** 1.994 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 58.33 | 102.11 |
| 2 | 68.31 | 102.86 |
| 3 | 77.98 | 105.41 |
| 4 | 87.03 | 109.66 |
| 5 | 92.28 | 113.43 |

Circle Center At X = 59.2 ; Y = 157.0 and Radius, 54.9

*** 2.014 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 55.00 | 101.00 |
| 2 | 64.62 | 98.28 |
| 3 | 74.62 | 98.39 |
| 4 | 84.19 | 101.30 |

| | | |
|---|---|---|
| 5 | 92.55 | 106.80 |
| 6 | 99.02 | 114.42 |
| 7 | 99.67 | 115.89 |

Circle Center At X = 69.3 ; Y = 133.1 and Radius, 35.1

*** 2.044 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 55.00 | 101.00 |
| 2 | 64.74 | 98.71 |
| 3 | 74.73 | 99.10 |
| 4 | 84.26 | 102.14 |
| 5 | 92.63 | 107.60 |
| 6 | 99.25 | 115.10 |
| 7 | 99.62 | 115.87 |

Circle Center At X = 68.3 ; Y = 135.7 and Radius, 37.2

*** 2.047 ***

Failure Surface Specified By 7 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 55.00 | 101.00 |
| 2 | 64.63 | 98.31 |
| 3 | 74.63 | 98.46 |
| 4 | 84.18 | 101.42 |
| 5 | 92.51 | 106.96 |
| 6 | 98.93 | 114.63 |
| 7 | 99.45 | 115.82 |

Circle Center At X = 69.1 ; Y = 133.1 and Radius, 35.0

*** 2.049 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 63.33 | 103.78 |
| 2 | 73.29 | 104.67 |
| 3 | 82.97 | 107.20 |
| 4 | 92.09 | 111.31 |
| 5 | 98.21 | 115.40 |

Circle Center At X = 63.0 ; Y = 163.8 and Radius, 60.1

*** 2.054 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 60.00 | 102.67 |
| 2 | 69.94 | 103.78 |
| 3 | 79.64 | 106.20 |
| 4 | 88.94 | 109.88 |
| 5 | 97.66 | 114.77 |
| 6 | 98.74 | 115.58 |

Circle Center At X = 56.6 ; Y = 177.8 and Radius, 75.2

*** 2.063 ***

Failure Surface Specified By 5 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 58.33 | 102.11 |
| 2 | 68.29 | 103.08 |
| 3 | 77.97 | 105.58 |
| 4 | 87.15 | 109.54 |
| 5 | 94.48 | 114.16 |

Circle Center At X = 57.0 ; Y = 166.7 and Radius, 64.6

*** 2.067 ***

Failure Surface Specified By 6 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 55.00 | 101.00 |
| 2 | 64.91 | 99.66 |
| 3 | 74.86 | 100.66 |
| 4 | 84.30 | 103.95 |
| 5 | 92.72 | 109.36 |
| 6 | 98.66 | 115.55 |

Circle Center At X = 65.6 ; Y = 142.3 and Radius, 42.6

*** 2.096 ***

```
            Y            A     X     I     S            F     T

            0.00     51.25    102.50    153.75    205.00    256.25

X      0.00 +---*---*-+----*--*-+---------+---------+---------+
            -
            -                 *
            -
            -
            -                  *
      51.25 +                 * 2
            -             *  ..1
            -                 *1.
            -             *  .421
            -                ..4*.
            -       *         ..417
A    102.50 +    *              .44
            -
            -
            -
            -
            -
X    153.75 +
            -
            -
            -
            -
            -
I    205.00 +
            -
            -
            -
            -
            -
S    256.25 +
            -
            -
            -
            -
            -
     307.50 +                      *            *
            -
            -
            -
            -
            -
F    358.75 +
            -
            -
            -
            -
            -
T    410.00 +   *  *              *            *
```

**FINAL COVER**
**Deep Failure**
**MHA = 0.0 g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION North Final Cover, Deep Failure - MHA = 0.0 g

BOUNDARY COORDINATES

5 Top Boundaries
21 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 92.00 | 19.00 | 92.00 | 4 |
| 2 | 19.00 | 92.00 | 40.00 | 98.00 | 3 |
| 3 | 40.00 | 98.00 | 46.00 | 98.00 | 3 |
| 4 | 46.00 | 98.00 | 310.00 | 186.00 | 1 |
| 5 | 310.00 | 186.00 | 410.00 | 181.00 | 1 |
| 6 | 46.00 | 98.00 | 65.00 | 98.00 | 3 |
| 7 | 65.00 | 98.00 | 85.00 | 108.00 | 2 |
| 8 | 85.00 | 108.00 | 310.00 | 183.00 | 2 |
| 9 | 310.00 | 183.00 | 410.00 | 178.00 | 2 |
| 10 | 65.00 | 98.00 | 75.00 | 78.00 | 3 |
| 11 | 75.00 | 78.00 | 310.00 | 120.00 | 8 |
| 12 | 310.00 | 120.00 | 410.00 | 115.00 | 8 |
| 13 | 75.00 | 78.00 | 94.00 | 40.00 | 5 |
| 14 | 94.00 | 40.00 | 100.00 | 28.00 | 6 |
| 15 | 100.00 | 28.00 | 410.00 | 34.20 | 6 |
| 16 | 19.00 | 92.00 | 47.00 | 92.00 | 4 |
| 17 | 47.00 | 92.00 | 60.00 | 78.00 | 4 |
| 18 | 60.00 | 78.00 | 75.00 | 78.00 | 5 |
| 19 | 0.00 | 78.00 | 60.00 | 78.00 | 5 |
| 20 | 0.00 | 40.00 | 94.00 | 40.00 | 6 |
| 21 | 0.00 | 20.00 | 410.00 | 20.00 | 7 |

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 170.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 100.0 | 100.0 | 550.0 | 27.0 | 0.00 | 0.0 | 0 |
| 3 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 6 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 7 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |
| 8 | 115.0 | 115.0 | 750.0 | 27.0 | 0.00 | 0.0 | 0 |

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

500 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 40.00 ft.
and X = 80.00 ft.

Each Surface Terminates Between X = 100.00 ft.
and X = 310.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 30 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 53.33 | 100.44 |
| 2 | 63.18 | 98.70 |
| 3 | 73.08 | 97.31 |
| 4 | 83.03 | 96.28 |
| 5 | 93.01 | 95.62 |
| 6 | 103.00 | 95.33 |
| 7 | 113.00 | 95.39 |
| 8 | 122.99 | 95.82 |

| | | |
|---|---|---|
| 9 | 132.96 | 96.62 |
| 10 | 142.90 | 97.78 |
| 11 | 152.78 | 99.30 |
| 12 | 162.60 | 101.18 |
| 13 | 172.35 | 103.41 |
| 14 | 182.01 | 106.00 |
| 15 | 191.57 | 108.94 |
| 16 | 201.01 | 112.23 |
| 17 | 210.33 | 115.85 |
| 18 | 219.51 | 119.82 |
| 19 | 228.54 | 124.12 |
| 20 | 237.40 | 128.74 |
| 21 | 246.10 | 133.69 |
| 22 | 254.60 | 138.94 |
| 23 | 262.91 | 144.51 |
| 24 | 271.01 | 150.37 |
| 25 | 278.89 | 156.53 |
| 26 | 286.55 | 162.97 |
| 27 | 293.96 | 169.68 |
| 28 | 301.12 | 176.66 |
| 29 | 308.02 | 183.89 |
| 30 | 309.85 | 185.95 |

Circle Center At X = 106.2 ; Y = 369.6 and Radius, 274.3

*** 2.498 ***

Failure Surface Specified By 30 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 44.44 | 98.00 |
| 2 | 54.23 | 95.96 |
| 3 | 64.10 | 94.30 |
| 4 | 74.01 | 93.02 |
| 5 | 83.97 | 92.11 |
| 6 | 93.96 | 91.59 |
| 7 | 103.96 | 91.46 |
| 8 | 113.95 | 91.71 |
| 9 | 123.93 | 92.34 |
| 10 | 133.88 | 93.35 |
| 11 | 143.79 | 94.74 |
| 12 | 153.63 | 96.52 |
| 13 | 163.39 | 98.67 |
| 14 | 173.07 | 101.19 |
| 15 | 182.64 | 104.08 |
| 16 | 192.10 | 107.33 |
| 17 | 201.42 | 110.95 |
| 18 | 210.60 | 114.92 |
| 19 | 219.62 | 119.24 |
| 20 | 228.47 | 123.90 |
| 21 | 237.13 | 128.90 |
| 22 | 245.59 | 134.22 |
| 23 | 253.84 | 139.87 |
| 24 | 261.87 | 145.83 |
| 25 | 269.67 | 152.09 |
| 26 | 277.22 | 158.65 |
| 27 | 284.51 | 165.49 |
| 28 | 291.54 | 172.61 |
| 29 | 298.29 | 179.99 |

| | | |
|---|---|---|
| 30 | 300.77 | 182.92 |

Circle Center At X = 102.5 ; Y = 352.2 and Radius, 260.8

*** 2.512 ***

Failure Surface Specified By 30 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 48.89 | 98.96 |
| 2 | 58.80 | 97.65 |
| 3 | 68.75 | 96.67 |
| 4 | 78.73 | 96.01 |
| 5 | 88.73 | 95.69 |
| 6 | 98.73 | 95.69 |
| 7 | 108.72 | 96.02 |
| 8 | 118.70 | 96.69 |
| 9 | 128.65 | 97.68 |
| 10 | 138.56 | 98.99 |
| 11 | 148.43 | 100.64 |
| 12 | 158.23 | 102.60 |
| 13 | 167.97 | 104.89 |
| 14 | 177.62 | 107.50 |
| 15 | 187.18 | 110.42 |
| 16 | 196.65 | 113.66 |
| 17 | 206.00 | 117.21 |
| 18 | 215.22 | 121.06 |
| 19 | 224.32 | 125.21 |
| 20 | 233.27 | 129.67 |
| 21 | 242.08 | 134.41 |
| 22 | 250.72 | 139.44 |
| 23 | 259.19 | 144.76 |
| 24 | 267.48 | 150.35 |
| 25 | 275.59 | 156.21 |
| 26 | 283.49 | 162.33 |
| 27 | 291.19 | 168.71 |
| 28 | 298.68 | 175.34 |
| 29 | 305.94 | 182.21 |
| 30 | 309.53 | 185.84 |

Circle Center At X = 93.6 ; Y = 399.3 and Radius, 303.6

*** 2.518 ***

Failure Surface Specified By 28 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 53.33 | 100.44 |
| 2 | 63.03 | 97.98 |
| 3 | 72.82 | 95.95 |
| 4 | 82.69 | 94.36 |
| 5 | 92.62 | 93.22 |
| 6 | 102.60 | 92.51 |

| | | |
|---|---|---|
| 7 | 112.60 | 92.26 |
| 8 | 122.60 | 92.44 |
| 9 | 132.57 | 93.08 |
| 10 | 142.52 | 94.16 |
| 11 | 152.40 | 95.68 |
| 12 | 162.21 | 97.64 |
| 13 | 171.92 | 100.03 |
| 14 | 181.51 | 102.86 |
| 15 | 190.96 | 106.11 |
| 16 | 200.27 | 109.78 |
| 17 | 209.40 | 113.86 |
| 18 | 218.33 | 118.35 |
| 19 | 227.06 | 123.22 |
| 20 | 235.57 | 128.49 |
| 21 | 243.83 | 134.12 |
| 22 | 251.83 | 140.12 |
| 23 | 259.55 | 146.47 |
| 24 | 266.99 | 153.16 |
| 25 | 274.12 | 160.17 |
| 26 | 280.92 | 167.50 |
| 27 | 287.40 | 175.12 |
| 28 | 290.90 | 179.63 |

Circle Center At X = 113.4 ; Y = 316.4 and Radius, 224.2

*** 2.543 ***

Failure Surface Specified By 29 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 44.44 | 98.00 |
| 2 | 54.32 | 96.45 |
| 3 | 64.25 | 95.25 |
| 4 | 74.22 | 94.41 |
| 5 | 84.21 | 93.93 |
| 6 | 94.20 | 93.81 |
| 7 | 104.20 | 94.04 |
| 8 | 114.18 | 94.64 |
| 9 | 124.14 | 95.59 |
| 10 | 134.05 | 96.89 |
| 11 | 143.91 | 98.56 |
| 12 | 153.71 | 100.57 |
| 13 | 163.43 | 102.93 |
| 14 | 173.05 | 105.64 |
| 15 | 182.58 | 108.69 |
| 16 | 191.98 | 112.08 |
| 17 | 201.26 | 115.81 |
| 18 | 210.40 | 119.87 |
| 19 | 219.39 | 124.25 |
| 20 | 228.22 | 128.95 |
| 21 | 236.87 | 133.96 |
| 22 | 245.34 | 139.28 |
| 23 | 253.61 | 144.90 |
| 24 | 261.67 | 150.82 |
| 25 | 269.52 | 157.02 |
| 26 | 277.14 | 163.49 |
| 27 | 284.52 | 170.24 |
| 28 | 291.66 | 177.24 |
| 29 | 295.33 | 181.11 |

Circle Center At X = 92.6 ; Y = 372.9 and Radius, 279.1

*** 2.550 ***

Failure Surface Specified By 30 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 44.44 | 98.00 |
| 2 | 54.02 | 95.12 |
| 3 | 63.72 | 92.66 |
| 4 | 73.51 | 90.64 |
| 5 | 83.38 | 89.06 |
| 6 | 93.32 | 87.91 |
| 7 | 103.29 | 87.21 |
| 8 | 113.29 | 86.95 |
| 9 | 123.29 | 87.14 |
| 10 | 133.27 | 87.76 |
| 11 | 143.21 | 88.83 |
| 12 | 153.09 | 90.34 |
| 13 | 162.90 | 92.29 |
| 14 | 172.62 | 94.67 |
| 15 | 182.21 | 97.48 |
| 16 | 191.68 | 100.71 |
| 17 | 200.99 | 104.36 |
| 18 | 210.13 | 108.42 |
| 19 | 219.08 | 112.88 |
| 20 | 227.82 | 117.73 |
| 21 | 236.34 | 122.97 |
| 22 | 244.62 | 128.58 |
| 23 | 252.64 | 134.55 |
| 24 | 260.39 | 140.87 |
| 25 | 267.85 | 147.53 |
| 26 | 275.01 | 154.51 |
| 27 | 281.85 | 161.81 |
| 28 | 288.36 | 169.40 |
| 29 | 294.53 | 177.27 |
| 30 | 297.87 | 181.96 |

Circle Center At X = 114.1 ; Y = 312.2 and Radius, 225.3

*** 2.575 ***

Failure Surface Specified By 27 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 66.67 | 104.89 |
| 2 | 76.56 | 103.41 |
| 3 | 86.50 | 102.31 |
| 4 | 96.47 | 101.59 |
| 5 | 106.46 | 101.24 |
| 6 | 116.46 | 101.27 |
| 7 | 126.46 | 101.68 |

| | | |
|---|---|---|
| 8 | 136.43 | 102.47 |
| 9 | 146.36 | 103.63 |
| 10 | 156.24 | 105.16 |
| 11 | 166.05 | 107.07 |
| 12 | 175.79 | 109.35 |
| 13 | 185.44 | 112.00 |
| 14 | 194.97 | 115.01 |
| 15 | 204.39 | 118.37 |
| 16 | 213.67 | 122.09 |
| 17 | 222.81 | 126.16 |
| 18 | 231.78 | 130.57 |
| 19 | 240.58 | 135.32 |
| 20 | 249.20 | 140.39 |
| 21 | 257.62 | 145.79 |
| 22 | 265.83 | 151.50 |
| 23 | 273.81 | 157.52 |
| 24 | 281.57 | 163.83 |
| 25 | 289.08 | 170.44 |
| 26 | 296.33 | 177.32 |
| 27 | 302.31 | 183.44 |

Circle Center At X = 110.7 ; Y = 365.7 and Radius, 264.5

*** 2.584 ***

Failure Surface Specified By 31 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 48.89 | 98.96 |
| 2 | 58.33 | 95.68 |
| 3 | 67.92 | 92.83 |
| 4 | 77.63 | 90.42 |
| 5 | 87.43 | 88.46 |
| 6 | 97.32 | 86.94 |
| 7 | 107.26 | 85.89 |
| 8 | 117.24 | 85.28 |
| 9 | 127.24 | 85.14 |
| 10 | 137.24 | 85.45 |
| 11 | 147.21 | 86.22 |
| 12 | 157.13 | 87.44 |
| 13 | 166.99 | 89.12 |
| 14 | 176.76 | 91.25 |
| 15 | 186.42 | 93.82 |
| 16 | 195.96 | 96.83 |
| 17 | 205.35 | 100.27 |
| 18 | 214.57 | 104.14 |
| 19 | 223.61 | 108.42 |
| 20 | 232.44 | 113.12 |
| 21 | 241.04 | 118.21 |
| 22 | 249.40 | 123.69 |
| 23 | 257.51 | 129.55 |
| 24 | 265.34 | 135.77 |
| 25 | 272.87 | 142.35 |
| 26 | 280.10 | 149.26 |
| 27 | 287.00 | 156.50 |
| 28 | 293.57 | 164.04 |
| 29 | 299.78 | 171.88 |
| 30 | 305.63 | 179.99 |
| 31 | 309.43 | 185.81 |

Circle Center At X = 125.4 ; Y = 303.7 and Radius, 218.6

*** 2.596 ***

Failure Surface Specified By 27 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 80.00 | 109.33 |
| 2 | 89.57 | 106.43 |
| 3 | 99.28 | 104.02 |
| 4 | 109.09 | 102.11 |
| 5 | 118.99 | 100.70 |
| 6 | 128.95 | 99.80 |
| 7 | 138.94 | 99.41 |
| 8 | 148.94 | 99.52 |
| 9 | 158.92 | 100.15 |
| 10 | 168.86 | 101.29 |
| 11 | 178.72 | 102.93 |
| 12 | 188.49 | 105.07 |
| 13 | 198.14 | 107.71 |
| 14 | 207.63 | 110.83 |
| 15 | 216.96 | 114.44 |
| 16 | 226.09 | 118.52 |
| 17 | 235.00 | 123.05 |
| 18 | 243.67 | 128.04 |
| 19 | 252.07 | 133.46 |
| 20 | 260.19 | 139.31 |
| 21 | 268.00 | 145.56 |
| 22 | 275.47 | 152.20 |
| 23 | 282.60 | 159.21 |
| 24 | 289.36 | 166.58 |
| 25 | 295.74 | 174.28 |
| 26 | 301.72 | 182.30 |
| 27 | 302.53 | 183.51 |

Circle Center At X = 141.6 ; Y = 295.4 and Radius, 196.0

*** 2.603 ***

Failure Surface Specified By 27 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 75.56 | 107.85 |
| 2 | 85.48 | 106.62 |
| 3 | 95.44 | 105.74 |
| 4 | 105.43 | 105.23 |
| 5 | 115.43 | 105.07 |
| 6 | 125.42 | 105.28 |
| 7 | 135.41 | 105.85 |
| 8 | 145.36 | 106.79 |
| 9 | 155.28 | 108.08 |
| 10 | 165.14 | 109.73 |

| | | |
|---|---|---|
| 11 | 174.94 | 111.73 |
| 12 | 184.66 | 114.09 |
| 13 | 194.28 | 116.80 |
| 14 | 203.81 | 119.86 |
| 15 | 213.21 | 123.26 |
| 16 | 222.49 | 126.99 |
| 17 | 231.62 | 131.06 |
| 18 | 240.60 | 135.46 |
| 19 | 249.42 | 140.18 |
| 20 | 258.06 | 145.22 |
| 21 | 266.51 | 150.56 |
| 22 | 274.76 | 156.21 |
| 23 | 282.80 | 162.16 |
| 24 | 290.62 | 168.39 |
| 25 | 298.21 | 174.90 |
| 26 | 305.57 | 181.68 |
| 27 | 309.89 | 185.96 |

Circle Center At X = 114.6 ; Y = 381.3 and Radius, 276.2

*** 2.613 ***

```
            Y            A     X     I     S            F     T

            0.00     51.25    102.50    153.75    205.00    256.25

X      0.00 +---*---*-+----*--*-+---------+---------+---------+
            -
            -                 *
            -
            -
            -                  *
      51.25 +               ..*21
            -              *..61.
            -             ....2*7.
            -            ..*..2179
            -        .....6217*
            -       *    .....62170.
A    102.50 +    *       .....62170..
            -          ......6219....
            -         .......64170...
            -         .......82370....
            -         .......62170....
            -         .......62130.....
X    153.75 +         .......86157.....
            -         ........6217......
            -         .......86.150......
            -         ........8621.......
            -         ........8.613......
            -          ........8.430......
I    205.00 +          .........6.13.......
            -           ........86213......
            -           .........86137......
            -            .........86130.....
            -             .........8613......
            -              .........8613.....
S    256.25 +               .........86134....
            -                 ........8.134....
            -                   ........81225..
```

```
             -                       .......8.124..
             -                        ........81124
             -                            .......122
      307.50 +                         *       ....8*
             -
             -
             -
             -
             -
F     358.75 +
             -
             -
             -
             -
             -
T     410.00 +   *  *                *            *
```

**FINAL COVER**
**Deep Failure**
**MHA = 0.42 g**

** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION North Final Cover, Deep Failure - MHA = 0.0 g

BOUNDARY COORDINATES

5 Top Boundaries
21 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 92.00 | 19.00 | 92.00 | 4 |
| 2 | 19.00 | 92.00 | 40.00 | 98.00 | 3 |
| 3 | 40.00 | 98.00 | 46.00 | 98.00 | 3 |
| 4 | 46.00 | 98.00 | 310.00 | 186.00 | 1 |
| 5 | 310.00 | 186.00 | 410.00 | 181.00 | 1 |
| 6 | 46.00 | 98.00 | 65.00 | 98.00 | 3 |
| 7 | 65.00 | 98.00 | 85.00 | 108.00 | 2 |
| 8 | 85.00 | 108.00 | 310.00 | 183.00 | 2 |
| 9 | 310.00 | 183.00 | 410.00 | 178.00 | 2 |
| 10 | 65.00 | 98.00 | 75.00 | 78.00 | 3 |
| 11 | 75.00 | 78.00 | 310.00 | 120.00 | 8 |
| 12 | 310.00 | 120.00 | 410.00 | 115.00 | 8 |
| 13 | 75.00 | 78.00 | 94.00 | 40.00 | 5 |
| 14 | 94.00 | 40.00 | 100.00 | 28.00 | 6 |
| 15 | 100.00 | 28.00 | 410.00 | 34.20 | 6 |
| 16 | 19.00 | 92.00 | 47.00 | 92.00 | 4 |
| 17 | 47.00 | 92.00 | 60.00 | 78.00 | 4 |
| 18 | 60.00 | 78.00 | 75.00 | 78.00 | 5 |
| 19 | 0.00 | 78.00 | 60.00 | 78.00 | 5 |
| 20 | 0.00 | 40.00 | 94.00 | 40.00 | 6 |
| 21 | 0.00 | 20.00 | 410.00 | 20.00 | 7 |

ISOTROPIC SOIL PARAMETERS

8 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 110.0 | 110.0 | 170.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 100.0 | 100.0 | 550.0 | 27.0 | 0.00 | 0.0 | 0 |
| 3 | 110.0 | 110.0 | 370.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 6 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 7 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |
| 8 | 115.0 | 115.0 | 750.0 | 27.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.420 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

500 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 40.00 ft.
and X = 80.00 ft.

Each Surface Terminates Between X = 100.00 ft.
and X = 310.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 30 Coordinate Points

| Point | X-Surf | Y-Surf |
|---|---|---|

| No. | (ft) | (ft) |
|---|---|---|
| 1 | 53.33 | 100.44 |
| 2 | 63.18 | 98.70 |
| 3 | 73.08 | 97.31 |
| 4 | 83.03 | 96.28 |
| 5 | 93.01 | 95.62 |
| 6 | 103.00 | 95.33 |
| 7 | 113.00 | 95.39 |
| 8 | 122.99 | 95.82 |
| 9 | 132.96 | 96.62 |
| 10 | 142.90 | 97.78 |
| 11 | 152.78 | 99.30 |
| 12 | 162.60 | 101.18 |
| 13 | 172.35 | 103.41 |
| 14 | 182.01 | 106.00 |
| 15 | 191.57 | 108.94 |
| 16 | 201.01 | 112.23 |
| 17 | 210.33 | 115.85 |
| 18 | 219.51 | 119.82 |
| 19 | 228.54 | 124.12 |
| 20 | 237.40 | 128.74 |
| 21 | 246.10 | 133.69 |
| 22 | 254.60 | 138.94 |
| 23 | 262.91 | 144.51 |
| 24 | 271.01 | 150.37 |
| 25 | 278.89 | 156.53 |
| 26 | 286.55 | 162.97 |
| 27 | 293.96 | 169.68 |
| 28 | 301.12 | 176.66 |
| 29 | 308.02 | 183.89 |
| 30 | 309.85 | 185.95 |

Circle Center At X = 106.2 ; Y = 369.6 and Radius, 274.3

*** 1.018 ***

Failure Surface Specified By 30 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 48.89 | 98.96 |
| 2 | 58.80 | 97.65 |
| 3 | 68.75 | 96.67 |
| 4 | 78.73 | 96.01 |
| 5 | 88.73 | 95.69 |
| 6 | 98.73 | 95.69 |
| 7 | 108.72 | 96.02 |
| 8 | 118.70 | 96.69 |
| 9 | 128.65 | 97.68 |
| 10 | 138.56 | 98.99 |
| 11 | 148.43 | 100.64 |
| 12 | 158.23 | 102.60 |
| 13 | 167.97 | 104.89 |
| 14 | 177.62 | 107.50 |
| 15 | 187.18 | 110.42 |
| 16 | 196.65 | 113.66 |
| 17 | 206.00 | 117.21 |
| 18 | 215.22 | 121.06 |
| 19 | 224.32 | 125.21 |

| | | |
|---|---|---|
| 20 | 233.27 | 129.67 |
| 21 | 242.08 | 134.41 |
| 22 | 250.72 | 139.44 |
| 23 | 259.19 | 144.76 |
| 24 | 267.48 | 150.35 |
| 25 | 275.59 | 156.21 |
| 26 | 283.49 | 162.33 |
| 27 | 291.19 | 168.71 |
| 28 | 298.68 | 175.34 |
| 29 | 305.94 | 182.21 |
| 30 | 309.53 | 185.84 |

Circle Center At X = 93.6 ; Y = 399.3 and Radius, 303.6

*** 1.025 ***

Failure Surface Specified By 30 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 44.44 | 98.00 |
| 2 | 54.23 | 95.96 |
| 3 | 64.10 | 94.30 |
| 4 | 74.01 | 93.02 |
| 5 | 83.97 | 92.11 |
| 6 | 93.96 | 91.59 |
| 7 | 103.96 | 91.46 |
| 8 | 113.95 | 91.71 |
| 9 | 123.93 | 92.34 |
| 10 | 133.88 | 93.35 |
| 11 | 143.79 | 94.74 |
| 12 | 153.63 | 96.52 |
| 13 | 163.39 | 98.67 |
| 14 | 173.07 | 101.19 |
| 15 | 182.64 | 104.08 |
| 16 | 192.10 | 107.33 |
| 17 | 201.42 | 110.95 |
| 18 | 210.60 | 114.92 |
| 19 | 219.62 | 119.24 |
| 20 | 228.47 | 123.90 |
| 21 | 237.13 | 128.90 |
| 22 | 245.59 | 134.22 |
| 23 | 253.84 | 139.87 |
| 24 | 261.87 | 145.83 |
| 25 | 269.67 | 152.09 |
| 26 | 277.22 | 158.65 |
| 27 | 284.51 | 165.49 |
| 28 | 291.54 | 172.61 |
| 29 | 298.29 | 179.99 |
| 30 | 300.77 | 182.92 |

Circle Center At X = 102.5 ; Y = 352.2 and Radius, 260.8

*** 1.026 ***

Failure Surface Specified By 28 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 53.33 | 100.44 |
| 2 | 63.03 | 97.98 |
| 3 | 72.82 | 95.95 |
| 4 | 82.69 | 94.36 |
| 5 | 92.62 | 93.22 |
| 6 | 102.60 | 92.51 |
| 7 | 112.60 | 92.26 |
| 8 | 122.60 | 92.44 |
| 9 | 132.57 | 93.08 |
| 10 | 142.52 | 94.16 |
| 11 | 152.40 | 95.68 |
| 12 | 162.21 | 97.64 |
| 13 | 171.92 | 100.03 |
| 14 | 181.51 | 102.86 |
| 15 | 190.96 | 106.11 |
| 16 | 200.27 | 109.78 |
| 17 | 209.40 | 113.86 |
| 18 | 218.33 | 118.35 |
| 19 | 227.06 | 123.22 |
| 20 | 235.57 | 128.49 |
| 21 | 243.83 | 134.12 |
| 22 | 251.83 | 140.12 |
| 23 | 259.55 | 146.47 |
| 24 | 266.99 | 153.16 |
| 25 | 274.12 | 160.17 |
| 26 | 280.92 | 167.50 |
| 27 | 287.40 | 175.12 |
| 28 | 290.90 | 179.63 |

Circle Center At X = 113.4 ; Y = 316.4 and Radius, 224.2

*** 1.040 ***

Failure Surface Specified By 29 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 44.44 | 98.00 |
| 2 | 54.32 | 96.45 |
| 3 | 64.25 | 95.25 |
| 4 | 74.22 | 94.41 |
| 5 | 84.21 | 93.93 |
| 6 | 94.20 | 93.81 |
| 7 | 104.20 | 94.04 |
| 8 | 114.18 | 94.64 |
| 9 | 124.14 | 95.59 |
| 10 | 134.05 | 96.89 |
| 11 | 143.91 | 98.56 |
| 12 | 153.71 | 100.57 |
| 13 | 163.43 | 102.93 |
| 14 | 173.05 | 105.64 |
| 15 | 182.58 | 108.69 |
| 16 | 191.98 | 112.08 |
| 17 | 201.26 | 115.81 |
| 18 | 210.40 | 119.87 |
| 19 | 219.39 | 124.25 |

| | | |
|---|---|---|
| 20 | 228.22 | 128.95 |
| 21 | 236.87 | 133.96 |
| 22 | 245.34 | 139.28 |
| 23 | 253.61 | 144.90 |
| 24 | 261.67 | 150.82 |
| 25 | 269.52 | 157.02 |
| 26 | 277.14 | 163.49 |
| 27 | 284.52 | 170.24 |
| 28 | 291.66 | 177.24 |
| 29 | 295.33 | 181.11 |

Circle Center At X = 92.6 ; Y = 372.9 and Radius, 279.1

*** 1.041 ***

Failure Surface Specified By 27 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 66.67 | 104.89 |
| 2 | 76.56 | 103.41 |
| 3 | 86.50 | 102.31 |
| 4 | 96.47 | 101.59 |
| 5 | 106.46 | 101.24 |
| 6 | 116.46 | 101.27 |
| 7 | 126.46 | 101.68 |
| 8 | 136.43 | 102.47 |
| 9 | 146.36 | 103.63 |
| 10 | 156.24 | 105.16 |
| 11 | 166.05 | 107.07 |
| 12 | 175.79 | 109.35 |
| 13 | 185.44 | 112.00 |
| 14 | 194.97 | 115.01 |
| 15 | 204.39 | 118.37 |
| 16 | 213.67 | 122.09 |
| 17 | 222.81 | 126.16 |
| 18 | 231.78 | 130.57 |
| 19 | 240.58 | 135.32 |
| 20 | 249.20 | 140.39 |
| 21 | 257.62 | 145.79 |
| 22 | 265.83 | 151.50 |
| 23 | 273.81 | 157.52 |
| 24 | 281.57 | 163.83 |
| 25 | 289.08 | 170.44 |
| 26 | 296.33 | 177.32 |
| 27 | 302.31 | 183.44 |

Circle Center At X = 110.7 ; Y = 365.7 and Radius, 264.5

*** 1.055 ***

Failure Surface Specified By 30 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|

| | | |
|---|---|---|
| 1 | 44.44 | 98.00 |
| 2 | 54.02 | 95.12 |
| 3 | 63.72 | 92.66 |
| 4 | 73.51 | 90.64 |
| 5 | 83.38 | 89.06 |
| 6 | 93.32 | 87.91 |
| 7 | 103.29 | 87.21 |
| 8 | 113.29 | 86.95 |
| 9 | 123.29 | 87.14 |
| 10 | 133.27 | 87.76 |
| 11 | 143.21 | 88.83 |
| 12 | 153.09 | 90.34 |
| 13 | 162.90 | 92.29 |
| 14 | 172.62 | 94.67 |
| 15 | 182.21 | 97.48 |
| 16 | 191.68 | 100.71 |
| 17 | 200.99 | 104.36 |
| 18 | 210.13 | 108.42 |
| 19 | 219.08 | 112.88 |
| 20 | 227.82 | 117.73 |
| 21 | 236.34 | 122.97 |
| 22 | 244.62 | 128.58 |
| 23 | 252.64 | 134.55 |
| 24 | 260.39 | 140.87 |
| 25 | 267.85 | 147.53 |
| 26 | 275.01 | 154.51 |
| 27 | 281.85 | 161.81 |
| 28 | 288.36 | 169.40 |
| 29 | 294.53 | 177.27 |
| 30 | 297.87 | 181.96 |

Circle Center At X = 114.1 ; Y = 312.2 and Radius, 225.3

*** 1.057 ***

Failure Surface Specified By 31 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 48.89 | 98.96 |
| 2 | 58.33 | 95.68 |
| 3 | 67.92 | 92.83 |
| 4 | 77.63 | 90.42 |
| 5 | 87.43 | 88.46 |
| 6 | 97.32 | 86.94 |
| 7 | 107.26 | 85.89 |
| 8 | 117.24 | 85.28 |
| 9 | 127.24 | 85.14 |
| 10 | 137.24 | 85.45 |
| 11 | 147.21 | 86.22 |
| 12 | 157.13 | 87.44 |
| 13 | 166.99 | 89.12 |
| 14 | 176.76 | 91.25 |
| 15 | 186.42 | 93.82 |
| 16 | 195.96 | 96.83 |
| 17 | 205.35 | 100.27 |
| 18 | 214.57 | 104.14 |
| 19 | 223.61 | 108.42 |
| 20 | 232.44 | 113.12 |
| 21 | 241.04 | 118.21 |

| | | |
|---|---|---|
| 22 | 249.40 | 123.69 |
| 23 | 257.51 | 129.55 |
| 24 | 265.34 | 135.77 |
| 25 | 272.87 | 142.35 |
| 26 | 280.10 | 149.26 |
| 27 | 287.00 | 156.50 |
| 28 | 293.57 | 164.04 |
| 29 | 299.78 | 171.88 |
| 30 | 305.63 | 179.99 |
| 31 | 309.43 | 185.81 |

Circle Center At X = 125.4 ; Y = 303.7 and Radius, 218.6

*** 1.067 ***

Failure Surface Specified By 27 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 75.56 | 107.85 |
| 2 | 85.48 | 106.62 |
| 3 | 95.44 | 105.74 |
| 4 | 105.43 | 105.23 |
| 5 | 115.43 | 105.07 |
| 6 | 125.42 | 105.28 |
| 7 | 135.41 | 105.85 |
| 8 | 145.36 | 106.79 |
| 9 | 155.28 | 108.08 |
| 10 | 165.14 | 109.73 |
| 11 | 174.94 | 111.73 |
| 12 | 184.66 | 114.09 |
| 13 | 194.28 | 116.80 |
| 14 | 203.81 | 119.86 |
| 15 | 213.21 | 123.26 |
| 16 | 222.49 | 126.99 |
| 17 | 231.62 | 131.06 |
| 18 | 240.60 | 135.46 |
| 19 | 249.42 | 140.18 |
| 20 | 258.06 | 145.22 |
| 21 | 266.51 | 150.56 |
| 22 | 274.76 | 156.21 |
| 23 | 282.80 | 162.16 |
| 24 | 290.62 | 168.39 |
| 25 | 298.21 | 174.90 |
| 26 | 305.57 | 181.68 |
| 27 | 309.89 | 185.96 |

Circle Center At X = 114.6 ; Y = 381.3 and Radius, 276.2

*** 1.068 ***

Failure Surface Specified By 27 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|

| | | |
|---|---|---|
| 1 | 80.00 | 109.33 |
| 2 | 89.57 | 106.43 |
| 3 | 99.28 | 104.02 |
| 4 | 109.09 | 102.11 |
| 5 | 118.99 | 100.70 |
| 6 | 128.95 | 99.80 |
| 7 | 138.94 | 99.41 |
| 8 | 148.94 | 99.52 |
| 9 | 158.92 | 100.15 |
| 10 | 168.86 | 101.29 |
| 11 | 178.72 | 102.93 |
| 12 | 188.49 | 105.07 |
| 13 | 198.14 | 107.71 |
| 14 | 207.63 | 110.83 |
| 15 | 216.96 | 114.44 |
| 16 | 226.09 | 118.52 |
| 17 | 235.00 | 123.05 |
| 18 | 243.67 | 128.04 |
| 19 | 252.07 | 133.46 |
| 20 | 260.19 | 139.31 |
| 21 | 268.00 | 145.56 |
| 22 | 275.47 | 152.20 |
| 23 | 282.60 | 159.21 |
| 24 | 289.36 | 166.58 |
| 25 | 295.74 | 174.28 |
| 26 | 301.72 | 182.30 |
| 27 | 302.53 | 183.51 |

Circle Center At X = 141.6 ; Y = 295.4 and Radius, 196.0

*** 1.069 ***

```
           Y            A     X     I     S            F     T

           0.00     51.25    102.50    153.75    205.00    256.25

X      0.00 +---*---*-+----*--*-+---------+---------+---------+
            -
            -                 *
            -
            -
            -                  *
      51.25 +               ..*21
            -              *..71.
            -             ....3*6.
            -            ..*..3169
            -          .....7316*
            -       *   .....73169.
A    102.50 +    *      .....73169..
            -          ......7310....
            -         .......74169...
            -         .......83269....
            -         .......73169....
            -         .......73129.....
X    153.75 +         .......87156.....
            -         ........7316......
            -         .......87.159......
            -         ........8731.......
            -         ........8.712......
```

```
            -          ........8.429......
I    205.00 +          .........7.12.......
            -           ........87312......
            -           .........87126......
            -            .........87129.....
            -             .........8712......
            -              .........8712.....
S    256.25 +               .........87124....
            -                 ........8.124....
            -                   ........81235..
            -                     .......8.124..
            -                      ........81134
            -                          .......133
     307.50 +                      *       ....8*
            -
            -
            -
            -
            -
F    358.75 +
            -
            -
            -
            -
            -
T    410.00 +   *  *               *            *
```