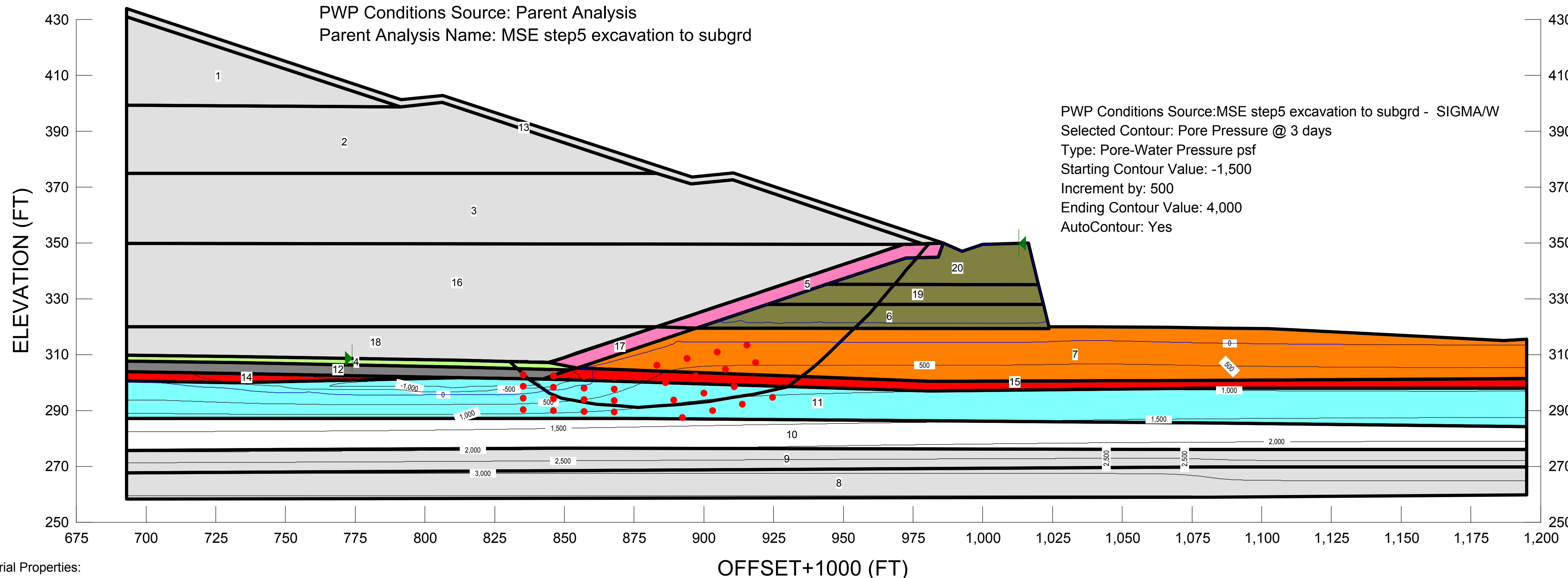
Title: Model City - RMU-2 XS 1350 MSE
Name: Inward Failure - Drained
File Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
File Name: RMU2X1350mse21.gsz
Date: 2/21/2013Time: 4:58:25 PM
Analysis Kind: SLOPE/W
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Slip Surface Option: Block
Optimization: Yes
Slip Surface Factor of Safety: 1.69

Slip Surface Option: Block
Surface Limits
Left Coordinate: (773.93733, 308.59677) ft
Right Coordinate: (1,012.8109, 349.89418) ft

PURPOSE:
To determine the critical failure surface and factor of safety for the excavation to the subgrade after berm placement at cross-section 13+50. This analysis assumes drained conditions and uses the effective stresses/pore water pressure for the excavation after 90 days.

1.69

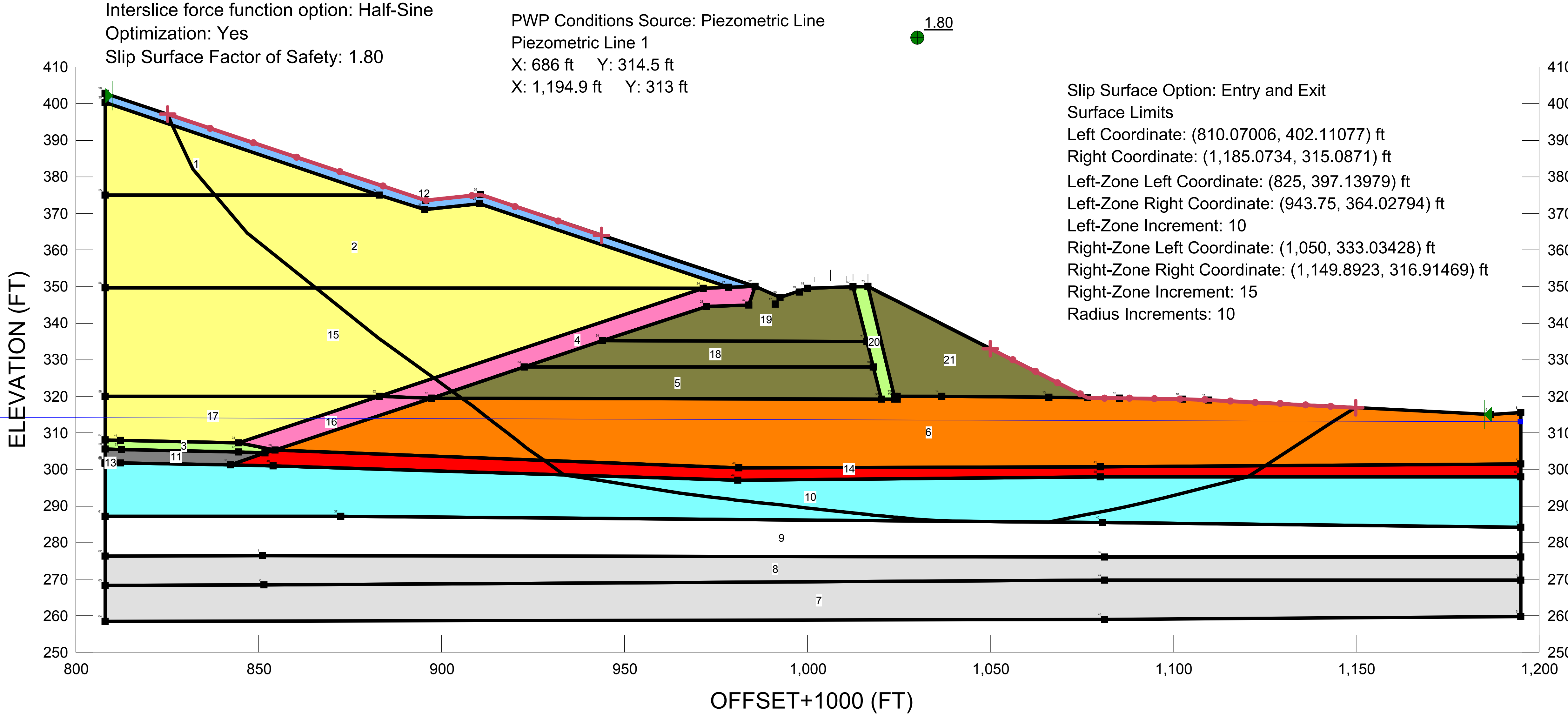


Region No. - Material
1 NOT ACTIVE
2 NOT ACTIVE
3 NOT ACTIVE
4 Bottom Liner
5 side slope liner
6 STRUCTURAL FILL
7 Upper Till
8 NOT ACTIVE
9 NOT ACTIVE
10 Deflection surface
11 GC-Drained
12 CCL
13 NOT ACTIVE
14 GC OverConsolidated
15 GC OverConsolidated
16 NOT ACTIVE
17 side slope liner
18 NOT ACTIVE
19 STRUCTURAL FILL
20 STRUCTURAL FILL

Material Properties:
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: GC-Drained Model: Shear/Normal Fn. Unit Weight: 118 pcf Strength Function: normalized N^m Anisotropic Strength Fn: clay ellipse staticshear
Name: GC OverConsolidated Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 100 psf Phi': 30 °
Name: side slope liner Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 100 psf Phi': 13 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: STRUCTURAL FILL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 195 psf Phi': 28.7 °
Name: NOT ACTIVE Model: (None)

Title: Model City - RMU-2 XS 1350 MSE
Name: FINAL WALL DRAINED -GLOBAL Post Grid
File Name: RMU2X1350msepostgrid.gsz
Date: 2/16/2013Time: 2:15:56 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.80

PURPOSE:
To determine the critical global failure surface for long-term (fully consolidated, drained analysis) for a 2:1 (H:V) berm without reinforcing for the final configuration of RMU-2 located at cross-section 13+50.

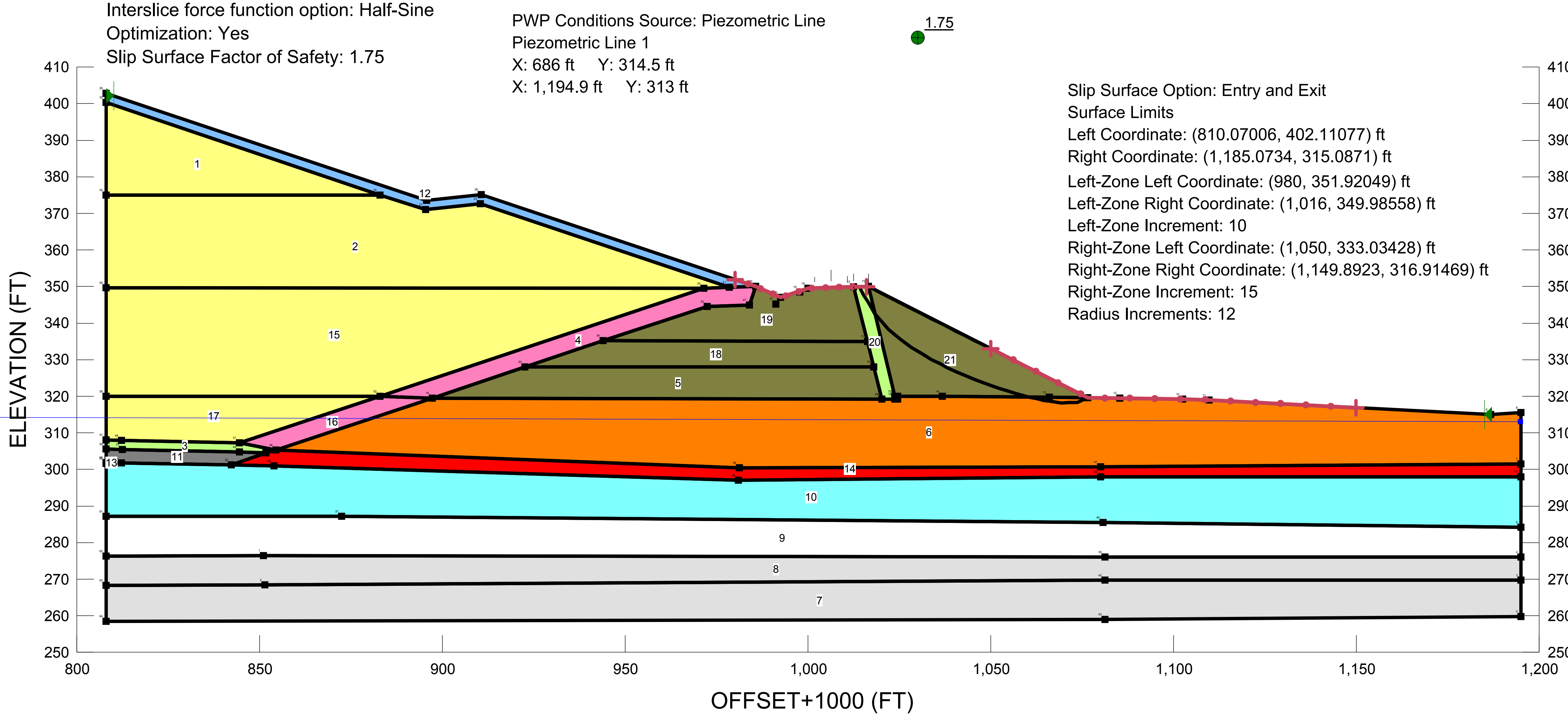


Region No. - Material
1 Waste Material
2 Waste Material
3 Bottom Liner
4 side slope liner
5 STRUCTURAL FILL
6 Upper Till
7 NOT ACTIVE
8 NOT ACTIVE
9 Deflection surface
10 GC-Drained
11 CCL
12 final cover
13 GC OverConsolidated
14 GC OverConsolidated
15 Waste Material
16 side slope liner
17 Waste Material
18 STRUCTURAL FILL
19 STRUCTURAL FILL
20 AGGRAGATE
21 STRUCTURAL FILL

Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 ° Piezometric Line: 1
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 ° Piezometric Line: 1
Name: GC-Drained Model: Shear/Normal Fn. Unit Weight: 118 pcf Strength Function: normalized N^m Anisotropic Strength Fn: clay ellipse staticshear Piezometric Line: 1
Name: GC OverConsolidated Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 100 psf Phi': 30 ° Piezometric Line: 1
Name: side slope liner Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 100 psf Phi': 13 ° Piezometric Line: 1
Name: Deflection surface Model: Bedrock (Impenetrable) Piezometric Line: 1
Name: STRUCTURAL FILL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 195 psf Phi': 28.7 °
Name: final cover Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 °
Name: NOT ACTIVE Model: (None) Piezometric Line: 1

Title: Model City - RMU-2 XS 1350 MSE
Name: FINAL WALL DRAINED - Berm Post Grid
File Name: RMU2X1350msepostgrid.gsz
Date: 2/16/2013Time: 2:15:56 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.75

PURPOSE:
To determine the critical failure surface within the berm for long-term (fully consolidated, drained analysis) for a 2:1 (H:V) berm without reinforcing for the final configuration of RMU-2 located at cross-section 13+50.



Region No. - Material
1 Waste Material
2 Waste Material
3 Bottom Liner
4 side slope liner
5 STRUCTURAL FILL
6 Upper Till
7 NOT ACTIVE
8 NOT ACTIVE
9 Deflection surface
10 GC-Drained
11 CCL
12 final cover
13 GC OverConsolidated
14 GC OverConsolidated
15 Waste Material
16 side slope liner
17 Waste Material
18 STRUCTURAL FILL
19 STRUCTURAL FILL
20 AGGRAGATE
21 STRUCTURAL FILL

Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 ° Piezometric Line: 1
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 ° Piezometric Line: 1
Name: GC-Drained Model: Shear/Normal Fn. Unit Weight: 118 pcf Strength Function: normalized N^m Anisotropic Strength Fn: clay ellipse staticshear Piezometric Line: 1
Name: GC OverConsolidated Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 100 psf Phi': 30 ° Piezometric Line: 1
Name: side slope liner Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 100 psf Phi': 13 ° Piezometric Line: 1
Name: Deflection surface Model: Bedrock (Impenetrable) Piezometric Line: 1
Name: STRUCTURAL FILL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 195 psf Phi': 28.7 °
Name: final cover Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 °
Name: NOT ACTIVE Model: (None) Piezometric Line: 1

Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, ASCE, V. 133(4), pp. 381-392, April 2007

SEE NOTES BELOW FOR GUIDANCE IN THE USE OF SPREADSHEET

Input Parameters			
Yield Coefficient (ky)	0.2	Based on pseudostatic analysis	
Initial Fundamental Period (Ts)	0.24	seconds	1D: Ts=4H/Vs 2D: Ts=2.6H/Vs
Degraded Period (1.5Ts)	0.36	seconds	
Moment Magnitude (Mw)	5.6		
Spectral Acceleration (Sa(1.5Ts))	0.16	g	

Additional Input Parameters			
Probability of Exceedance #1 (P1)	15	%	
Probability of Exceedance #2 (P2)	5	%	
Probability of Exceedance #3 (P3)	1	%	
Displacement Threshold (d_threshold)	15.24	cm	6 in

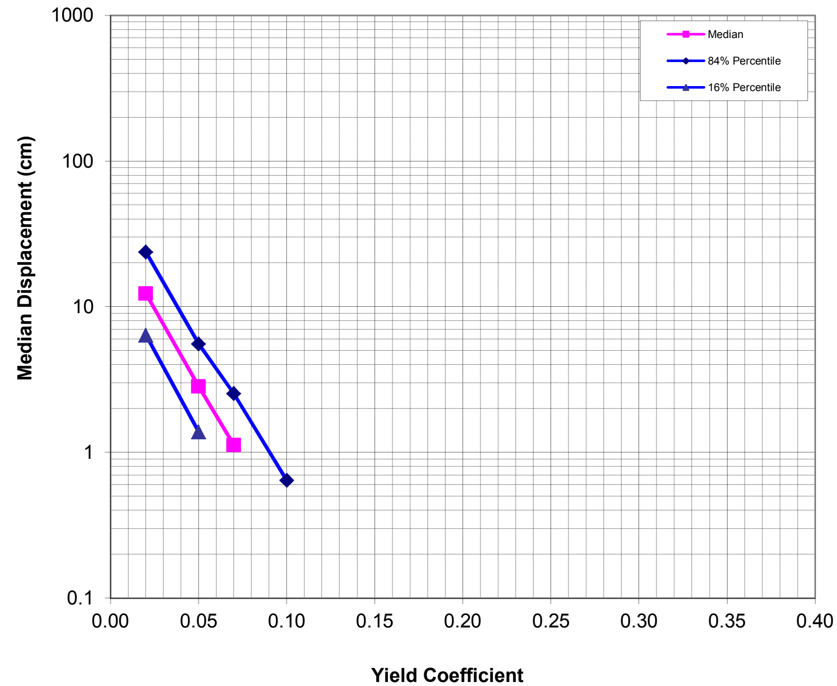
Intermediate Calculated Parameters			
Non-Zero Seismic Displacement Est (D)	0.12	cm	eq. (5) or (6)
Standard Deviation of Non-Zero Seismic D	0.66		

Results			
Probability of Negligible Displ. (P(D=0))	0.998		eq. (3)
D1	<1	cm	calc. using eq. (7)
D2	<1	cm	calc. using eq. (7)
D3	<1	cm	calc. using eq. (7)
P(D>d_threshold)	0.000		eq. (7)

Notes
1. Values highlighted in blue are input parameters
2. Probability of Exceedance is the desired probability of exceeding a particular displacement value.
3. Displacements D1, D2, and D3 correspond to P1, P2, and P3, respectively.
(e.g., the probability of exceeding displacement D1 is P1)
4. Calculated seismic displacements are due to deviatoric deformation only (add in volumetrically induced movement).
5. ky may range between 0.01 and 0.5, Ts between 0 and 2 s, Sa between 0.002 and 2.7 g, M between 4.5 and 9
6. Rigid slope is assumed for Ts < 0.05 s
7. When a value for D is not calculated, D is < 1cm
8. ky may be estimated using the simplified equations shown below.
9. Examples of how Ts is estimated are shown below.
10. Vs = weighted avg. shear wave velocity for the sliding mass, e.g., for 2 layers, Vs = [(h1)(Vs1) + (h2)(Vs2)]/(h1 + h2)

Dependence on ky

ky	P(D="0")	D (cm)	Dmedian (cm)	D1 (cm)	D3 (cm)
0.020	0.00	12.3	12.3	23.8	6.4
0.05	0.04	2.9	2.8	5.6	1.4
0.07	0.25	1.5	1.1	2.5	<1
0.1	0.70	0.7	<1	0.6	<1
0.15	0.97	0.3	<1	<1	<1
0.2	1.00	0.1	<1	<1	<1
0.3	1.00	0.0	<1	<1	<1
0.4	1.00	0.0	<1	<1	<1



Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, Vol 133, No. 4, pp. 381-392, April 2007

ATTACHEMENT 1

Table of Contents

FINAL WALL DRAINED -GLOBAL

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 641
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/19/2013
Time: 11:34:07 PM
File Name: RMU2X1350msesslopewonly.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/19/2013
Last Solved Time: 11:39:10 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

FINAL WALL DRAINED -GLOBAL

Description: block search with grids
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
Lambda
Lambda 1: -1
Lambda 2: -0.8
Lambda 3: -0.6
Lambda 4: -0.4
Lambda 5: -0.2
Lambda 6: 0
Lambda 7: 0.2
Lambda 8: 0.4
Lambda 9: 0.6

Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.01
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC-Drained

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: normalized N^m
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

STRUCTURAL FILL

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 195 psf
Phi': 28.7 °
Phi-B: 0 °

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf

Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

AGGRAGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (870.475, 381.99875) ft
Left-Zone Right Coordinate: (943.75, 364.02794) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,030, 320) ft
Right-Zone Right Coordinate: (1,110, 318.98701) ft
Right-Zone Increment: 10
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	800	314.5
Coordinate 2	1,194.9	313

Reinforcements

Reinforcement 1

Type: Geosynthetic

Outside Point: (1,024.5, 319.5) ft
Inside Point: (993, 319.3918) ft
Slip Surface Intersection: () ft
Total Length: 31.500186 ft
Reinforcement Direction: 0.19681 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft
Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes

Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (991, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs

Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft

Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (985.9975, 331.5) ft
Slip Surface Intersection: () ft
Total Length: 34.8775 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft

Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: () ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: () ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1

Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: () ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft

Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: () ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: () ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft

Slip Surface Intersection: () ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: () ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor

Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

normalized N^m

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: Mesri1
Field
tan_Phi_100kPa: .548982
power: .147
pa: 2089
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5

Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25
Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75

Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft^2)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61

Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	STRUCTURAL FILL	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-Drained	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	STRUCTURAL FILL	53,54,71,70	595.93
Region 19	STRUCTURAL FILL	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 1,332
F of S: 1.71
Volume: 7,784.4723 ft³
Weight: 952,213.09 lbs
Resisting Moment: 51,621,975 lbs-ft
Activating Moment: 30,121,688 lbs-ft
Resisting Force: 345,856.8 lbs
Activating Force: 202,269.58 lbs
F of S Rank: 1
Exit: (1,108.1718, 319.05442) ft
Entry: (872.04648, 381.47552) ft
Radius: 122.51089 ft
Center: (1,023.8265, 419.03797) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	874.79179	379.15917	0	135.39264	78.168975	0
Slice 2	878.62914	375.92141	0	316.86471	182.94193	0
Slice 3	881.36059	373.61676	0	433.66269	250.37527	0
Slice 4	886.0545	369.65629	0	630.85174	364.22242	0
Slice 5	892.4045	364.11792	0	891.59634	514.76339	0

Slice 6	898.89855	358.28274	0	1,289.879	744.71201	0
Slice 7	905.14196	352.48582	0	1,757.4718	1,014.6768	0
Slice 8	909.29341	348.50068	0	2,089.2836	1,206.2484	0
Slice 9	910.5	347.34243	0	2,185.3165	1,261.6931	0
Slice 10	916.30025	341.77454	0	2,445.7681	1,412.0649	0
Slice 11	923.44749	335.13373	0	2,895.4124	1,671.6671	0
Slice 12	927.16355	332.13183	-1,130.3665	3,326.2887	767.93426	100
Slice 13	930.85548	329.14941	0	3,158.8972	1,729.4457	195
Slice 14	937.59527	323.70488	0	3,507.5798	1,920.3438	195
Slice 15	943.2004	319.17694	-325.78301	3,755.812	2,256.7195	150
Slice 16	943.7443	318.72804	-297.90055	3,725.3327	2,238.4057	150
Slice 17	946.70954	316.2222	-142.23872	3,876.472	2,329.2193	150
Slice 18	950.35789	313.13908	49.283522	4,070.8971	2,416.4292	150
Slice 19	954.85332	309.53162	273.32298	4,416.7297	2,489.6099	150
Slice 20	961.96655	303.90345	622.83484	4,812.4257	2,517.3602	150
Slice 21	967.89369	299.21375	914.06738	5,181.6069	2,463.8651	100
Slice 22	970.67715	297.0114	1,050.8342	5,450.5774	1,850.7976	318.95308
Slice 23	971.29505	296.64353	1,073.6431	6,911.655	1,874.9571	323.11773
Slice 24	971.95	296.51206	1,081.6917	6,910.1588	1,872.3422	322.66685
Slice 25	975.45	295.80948	1,124.7027	6,887.9641	1,854.46	319.58501
Slice 26	979.4314	295.01027	1,173.6296	6,856.1523	1,832.2764	315.76212
Slice 27	980.6814	294.76433	1,188.6801	6,883.4653	1,801.4315	310.44659
Slice 28	981.125	294.68222	1,193.699	6,877.4257	1,798.4479	309.93156
Slice 29	982.625	294.40455	1,210.6699	6,856.7214	1,788.273	308.17937
Slice 30	984.875	293.98805	1,236.1262	6,862.2946	1,782.8995	307.25368
Slice 31	989.125	293.20133	1,284.2104	6,787.8119	1,749.7155	301.53427
Slice 32	996.25	291.88241	1,364.8221	6,945.5284	1,770.6051	305.13278
Slice 33	1,006.25	290.0313	1,477.9614	7,392.5884	1,860.5856	320.64055
Slice 34	1,014.3787	288.52659	1,569.9284	7,531.049	1,873.0558	322.78766
Slice 35	1,016.3787	288.16649	1,591.9244	7,708.726	1,759.1906	303.16617
Slice 36	1,017.25	288.07789	1,597.2463	7,315.0088	1,660.8153	286.2135
Slice 37	1,019.125	287.88725	1,608.6982	6,344.6946	1,414.2731	243.7264
Slice 38	1,020.8762	287.70919	1,619.394	5,475.7743	1,186.9133	204.54408
Slice 39	1,022.6262	287.8533	1,609.9865	5,189.3729	1,155.2117	199.08092
Slice 40	1,024.125	288.13043	1,592.3389	4,548.6141	981.31447	169.11278
Slice 41	1,030.625	289.33224	1,515.8048	4,402.9916	961.71842	165.73567
Slice 42	1,040.4678	291.15213	1,399.9111	4,153.1557	923.52877	159.15446
Slice 43	1,049.6068	293.05077	1,279.2696	3,934.3215	921.64378	158.82941
Slice 44	1,060.514	295.44667	1,127.1802	3,548.1382	846.90783	145.95021

Slice 45	1,068.9588	297.27025	1,011.3872	3,256.6256	794.18551	136.8643
Slice 46	1,074.5835	299.1849	890.5799	3,426.9814	1,464.3921	100
Slice 47	1,077.5224	300.60252	801.42358	3,221.6031	1,397.2913	100
Slice 48	1,081.5226	302.68282	670.66489	2,876.4209	1,325.3519	150
Slice 49	1,086.0587	305.04178	522.39058	2,435.3869	1,149.4441	150
Slice 50	1,093.0594	309.41283	247.97805	1,787.8744	925.26303	150
Slice 51	1,100.8757	314.39959	-65.04875	906.15427	544.47241	150
Slice 52	1,105.3359	317.24515	-243.66848	391.18285	235.04637	150

Figure 5 **Long Term Drained Conditions with Final Waste Grades – Cohesionless Fill**

FINAL WALL DRAINED -GLOBAL Cohesionless

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 640
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/19/2013
Time: 7:54:52 PM
File Name: RMU2X1350msesslopewonly.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/19/2013
Last Solved Time: 8:04:24 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

FINAL WALL DRAINED -GLOBAL Cohesionless

Description: E&E with Drained GC
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6

Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.01
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC-Drained

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: normalized N^m
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

AGGREGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

cohesionless Structural Fill

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (870.475, 381.99875) ft
Left-Zone Right Coordinate: (943.75, 364.02794) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,030, 320) ft
Right-Zone Right Coordinate: (1,110, 318.98701) ft
Right-Zone Increment: 10
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	805	314.5
Coordinate 2	1,194.9	313

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 319.5) ft
Inside Point: (993, 319.3918) ft
Slip Surface Intersection: () ft
Total Length: 31.500186 ft
Reinforcement Direction: 0.19681 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft

Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (991, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1

Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (985.9975, 331.5) ft
Slip Surface Intersection: () ft
Total Length: 34.8775 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft

Governing Component: (none)

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: () ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft

Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: () ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °

Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: () ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0

Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: () ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: () ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft
Slip Surface Intersection: () ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: () ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function

Function: Modifier Factor vs. Inclination
  Curve Fit to Data: 100 %
  Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
  Data Point: (-60, 1)
  Data Point: (-30, 1)
  Data Point: (-17.838428, 0.90468204)
  Data Point: (-3, 0.706)
  Data Point: (3, 0.706)
  Data Point: (23.685228, 0.90009497)
  Data Point: (39.261389, 1)
  Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
  Curve Fit to Data: 100 %
  Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
  Data Point: (0, 0)
  Data Point: (500, 235)
  Data Point: (1,000, 463)
  Data Point: (2,000, 899)
  Data Point: (5,000, 2,057)
  Data Point: (10,000, 3,515)
  Data Point: (15,000, 4,430)
Estimation Properties
  Intact Rock Param.: 10
  Geological Strength: 100
  Disturbance Factor: 0
  SigmaC: 600,000 psf
  SigmaC: 300,000 psf
  Num. Points: 20

normalized N^m

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
  Assembly: GeoStudio AddIns1
  Function: Mesri1
  Field
    tan_Phi_100kPa: .548982
    power: .147
    pa: 2089
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25

Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft²)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	cohesionless Structural Fill	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-Drained	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	cohesionless Structural Fill	53,54,71,70	595.93
Region 19	cohesionless Structural Fill	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 1,332
F of S: 1.73
Volume: 9,135.3121 ft³
Weight: 1,090,189.6 lbs
Resisting Moment: 62,678,156 lbs-ft
Activating Moment: 36,194,174 lbs-ft
Resisting Force: 377,103.88 lbs
Activating Force: 226,489.89 lbs
F of S Rank: 1
Exit: (1,102.0944, 319.25588) ft
Entry: (870.475, 381.99875) ft
Radius: 122.05208 ft
Center: (1,008.2285, 431.77222) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

Slice 1	871.06483	380.41295	0	91.371342	52.753269	0
Slice 2	872.36641	376.91358	0	280.19034	161.76797	0
Slice 3	873.91513	372.74975	0	491.82483	283.9552	0
Slice 4	878.87605	365.18329	0	1,096.789	633.23142	0
Slice 5	883.72215	358.93616	0	1,437.7541	830.08773	0
Slice 6	888.49473	353.79186	0	1,796.6941	1,037.3218	0
Slice 7	893.97258	348.09365	0	2,084.8036	1,203.6619	0
Slice 8	895.55	346.45278	0	2,166.2318	1,250.6745	0
Slice 9	898.8891	342.97936	0	2,448.4481	1,413.6121	0
Slice 10	906.3391	335.50721	0	3,115.7167	1,798.8599	0
Slice 11	911.42254	330.5504	0	3,497.3112	2,019.1736	0
Slice 12	914.23525	327.80776	-856.62743	4,148.0411	957.65074	100
Slice 13	919.40356	322.76819	-543.39905	3,759.8103	2,536.0241	0
Slice 14	925.10615	317.20765	-197.79054	4,123.0841	2,477.3989	150
Slice 15	928.04296	314.38557	-22.397454	4,427.4835	2,660.3005	150
Slice 16	931.33881	311.50404	156.61881	4,616.0046	2,679.4693	150
Slice 17	938.64711	305.45688	532.20695	5,136.3704	2,766.4605	150
Slice 18	943.53596	301.56094	774.13995	5,430.4571	2,688.3259	100
Slice 19	945.97659	299.616	894.91868	5,555.2821	2,690.662	100
Slice 20	948.12209	297.90624	1,001.0924	5,817.0487	1,999.189	344.52609
Slice 21	952.15917	297.065	1,052.6169	7,255.1341	1,931.9455	332.93771
Slice 22	959.8955	295.65171	1,138.9486	7,197.024	1,893.5028	326.31229
Slice 23	967.63183	294.23843	1,225.2804	7,139.7009	1,855.135	319.70059
Slice 24	971.74635	293.48678	1,271.1953	7,109.1742	1,834.6632	316.17259
Slice 25	972.19635	293.4114	1,275.7911	7,197.9716	1,787.1779	307.99006
Slice 26	975.45	292.92606	1,305.2955	7,153.4189	1,768.0969	304.70168
Slice 27	979.75	292.28463	1,344.2882	7,087.5447	1,741.0171	300.03443
Slice 28	981.125	292.07953	1,356.7568	7,061.4016	1,731.0269	298.31404
Slice 29	982.625	291.85577	1,370.3589	7,032.4377	1,720.0038	296.4137
Slice 30	984.875	291.52014	1,390.762	7,001.3132	1,706.6434	294.11076
Slice 31	986.39085	291.29402	1,404.5079	6,977.159	1,696.8046	292.41515
Slice 32	989.76585	290.82535	1,432.9429	6,903.2831	1,648.1491	284.03037
Slice 33	996.25	289.94058	1,486.5961	7,038.412	1,669.0655	287.63491
Slice 34	1,001.8061	289.18245	1,532.5697	7,304.2096	1,725.2757	297.32193
Slice 35	1,008.0561	288.3161	1,585.1292	7,443.6104	1,752.8026	302.06643
Slice 36	1,014.375	287.43464	1,638.6154	7,554.9234	1,767.5507	304.60701
Slice 37	1,016.375	287.15565	1,655.5442	7,561.7706	1,764.9803	304.16502
Slice 38	1,017.25	287.0336	1,662.9505	7,210.47	1,673.1278	288.33382
Slice 39	1,019.0787	286.7785	1,678.4294	6,353.4132	1,445.8889	249.17447

Slice 40	1,021.9537	286.79901	1,676.4597	5,407.4225	1,140.6249	196.56745
Slice 41	1,023.7889	286.97368	1,665.1194	4,462.9237	892.30808	153.77416
Slice 42	1,024.1638	287.0602	1,659.6305	4,701.8606	1,054.2461	181.68156
Slice 43	1,030.625	288.65216	1,558.7414	4,490.4026	1,021.4739	176.03374
Slice 44	1,041.9331	291.43833	1,382.1694	4,086.6895	953.56907	164.33149
Slice 45	1,052.2992	293.99242	1,220.3057	3,697.9945	884.91432	152.49971
Slice 46	1,061.7411	296.46351	1,063.843	3,356.396	851.36945	146.71908
Slice 47	1,066.3313	297.75043	982.43763	3,156.6332	813.73177	140.23304
Slice 48	1,069.3664	299.28661	885.85117	3,295.0653	1,390.9604	100
Slice 49	1,078.6602	304.24748	574.0617	2,488.7233	1,150.4448	150
Slice 50	1,085.3345	307.81012	350.15088	1,892.2779	926.60341	150
Slice 51	1,089.4667	310.62262	173.65886	1,554.9935	829.98956	150
Slice 52	1,097.8045	316.32296	-184.04388	591.52578	355.42454	150

Figure 6 Long Term Drained Conditions Berm only or Near Berm Failures – Cohesive Fill

FINAL WALL DRAINED

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 641
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/19/2013
Time: 11:34:07 PM
File Name: RMU2X1350msesslopewonly.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/19/2013
Last Solved Time: 11:34:14 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

FINAL WALL DRAINED

Description: with grids
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
Lambda
Lambda 1: -1
Lambda 2: -0.8
Lambda 3: -0.6
Lambda 4: -0.4
Lambda 5: -0.2
Lambda 6: 0
Lambda 7: 0.2
Lambda 8: 0.4
Lambda 9: 0.6

Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.01
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC-Drained

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: normalized N^m
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

STRUCTURAL FILL

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 195 psf
Phi': 28.7 °
Phi-B: 0 °

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf

Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

AGGRAGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (1,000, 349.5) ft
Left-Zone Right Coordinate: (1,012.5232, 349.88529) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,017.7053, 345.01264) ft
Right-Zone Right Coordinate: (1,030, 320) ft
Right-Zone Increment: 10
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	805	314.5
Coordinate 2	1,200	313

Reinforcements

Reinforcement 1

Type: Geosynthetic

Outside Point: (1,024.5, 319.5) ft
Inside Point: (993.0002, 319.37606) ft
Slip Surface Intersection: () ft
Total Length: 31.500044 ft
Reinforcement Direction: 0.22544 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 0.75
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft
Inside Point: (993, 322.5) ft
Slip Surface Intersection: (1,017.3921, 322.5) ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes

Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 2,769.1878 lbs
Pullout Force per Length: 749.75683 lbs/ft
Available Length: 24.392054 ft
Required Length: 3.693448 ft
Governing Component: Tensile Capacity

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: (1,016.0627, 324) ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 2,769.1878 lbs
Pullout Force per Length: 851.21922 lbs/ft
Available Length: 25.062723 ft
Required Length: 3.2532017 ft
Governing Component: Tensile Capacity

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (990.9978, 325.5) ft
Slip Surface Intersection: (1,014.6582, 325.5) ft
Total Length: 31.3772 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs

Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 2,769.1878 lbs
Pullout Force per Length: 830.04686 lbs/ft
Available Length: 23.660408 ft
Required Length: 3.3361825 ft
Governing Component: Tensile Capacity

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: (1,013.279, 327) ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 2,299.834 lbs
Pullout Force per Length: 786.99936 lbs/ft
Available Length: 23.278953 ft
Required Length: 2.9222819 ft
Governing Component: Tensile Capacity

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: (1,011.9065, 328.5) ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 2,299.834 lbs
Pullout Force per Length: 761.26346 lbs/ft
Available Length: 21.906529 ft

Required Length: 3.0210749 ft
Governing Component: Tensile Capacity

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (987.9975, 331.5) ft
Slip Surface Intersection: (1,009.3314, 331.5) ft
Total Length: 32.8775 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 2,299.834 lbs
Pullout Force per Length: 665.40517 lbs/ft
Available Length: 21.333918 ft
Required Length: 3.4562911 ft
Governing Component: Tensile Capacity

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft

Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: (1,006.7221, 334.5) ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 2,299.834 lbs
Pullout Force per Length: 536.35169 lbs/ft
Available Length: 22.722114 ft
Required Length: 4.2879215 ft
Governing Component: Tensile Capacity

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: (1,004.721, 337.5) ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 2,299.834 lbs
Pullout Force per Length: 453.34699 lbs/ft
Available Length: 22.721008 ft
Required Length: 5.0730103 ft
Governing Component: Tensile Capacity

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1

Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: (1,003.0935, 340.5) ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 1,408.0616 lbs
Pullout Force per Length: 312.81979 lbs/ft
Available Length: 21.093474 ft
Required Length: 4.5011909 ft
Governing Component: Tensile Capacity

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft

Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: (1,001.7266, 343.5) ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 1,079.5139 lbs
Pullout Force per Length: 243.43708 lbs/ft
Available Length: 20.226614 ft
Required Length: 4.4344679 ft
Governing Component: Tensile Capacity

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: (1,001.106, 345) ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 610.20944 lbs
Pullout Force per Length: 80.226964 lbs/ft
Available Length: 7.6060393 ft
Required Length: 7.6060393 ft
Governing Component: Pullout Resistance

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft

Slip Surface Intersection: (1,000.7374, 346.5) ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 339.95049 lbs
Pullout Force per Length: 80.226964 lbs/ft
Available Length: 4.2373595 ft
Required Length: 4.2373595 ft
Governing Component: Pullout Resistance

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: (1,000.3687, 348) ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 149.9185 lbs
Pullout Force per Length: 80.226964 lbs/ft
Available Length: 1.8686798 ft
Required Length: 1.8686798 ft
Governing Component: Pullout Resistance

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor

Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

normalized N^m

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: Mesri1
Field
tan_Phi_100kPa: .548982
power: .147
pa: 2089
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5

Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25
Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75

Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft^2)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61

Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	STRUCTURAL FILL	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-Drained	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	STRUCTURAL FILL	53,54,71,70	595.93
Region 19	STRUCTURAL FILL	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 1,332
F of S: 2.13
Volume: 363.71486 ft³
Weight: 45,609.382 lbs
Resisting Moment: 2,513,469.4 lbs-ft
Activating Moment: 1,179,703.1 lbs-ft
Resisting Force: 74,040.624 lbs
Activating Force: 34,751.686 lbs
F of S Rank: 1
Exit: (1,023.4625, 321.18985) ft
Entry: (1,000, 349.5) ft
Radius: 37.962751 ft
Center: (1,035.992, 355.27479) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	1,000.5556	347.23971	0	-77.38252	-42.365692	195
Slice 2	1,001.3904	344.30216	0	259.01954	141.80906	195
Slice 3	1,002.112	342.65419	0	349.51496	191.35385	195
Slice 4	1,002.9965	340.71274	0	462.17029	253.03084	195
Slice 5	1,004.0019	338.75739	0	1,009.3185	552.58576	195

Slice 6	1,005.1282	336.78814	0	854.10445	467.60853	195
Slice 7	1,005.8334	335.58589	0	1,553.8732	850.72072	195
Slice 8	1,006.1193	335.20102	0	1,654.6284	905.88259	195
Slice 9	1,006.7383	334.48112	0	1,013.2163	554.71973	195
Slice 10	1,007.6888	333.37579	0	1,969.0642	1,078.0312	195
Slice 11	1,008.7254	332.18685	0	2,223.7648	1,217.4757	195
Slice 12	1,009.8482	330.91428	0	1,612.4118	882.76968	195
Slice 13	1,010.7777	329.84017	0	2,634.0812	1,442.1173	195
Slice 14	1,011.514	328.96452	0	2,762.5595	1,512.4572	195
Slice 15	1,012.1231	328.26335	0	795.05052	435.27745	195
Slice 16	1,012.432	327.92568	0	2,859.9058	1,565.7527	195
Slice 17	1,012.9649	327.3433	0	1,867.0248	1,022.1662	195
Slice 18	1,013.8946	326.32718	0	2,929.7598	1,603.9966	195
Slice 19	1,014.8321	325.31434	0	1,838.7868	1,006.7064	195
Slice 20	1,015.7774	324.30477	0	1,974.6971	1,081.1151	195
Slice 21	1,016.2904	323.75685	0	3,008.0305	1,646.8486	195
Slice 22	1,016.4154	323.61695	0	3,007.8258	1,646.7365	195
Slice 23	1,016.875	323.09133	0	2,793.8532	1,529.59	195
Slice 24	1,017.625	322.23359	0	1,445.3129	791.28569	195
Slice 25	1,018.2367	321.53407	0	2,190.6371	1,199.3388	195
Slice 26	1,019.1112	321.23342	0	1,885.3488	1,032.1983	195
Slice 27	1,019.892	321.19668	-468.79386	1,465.6188	1,627.7346	0
Slice 28	1,020.4634	321.18994	-468.50876	1,271.3413	1,411.9676	0
Slice 29	1,021.3203	321.18991	-468.71026	935.34257	1,038.8032	0
Slice 30	1,022.1772	321.18989	-468.91176	579.30509	643.38348	0
Slice 31	1,023.034	321.18986	-469.11326	199.09581	221.1183	0

FINAL WALL -GLOBAL Cohesionless Undrained GC (2)

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 640
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/19/2013
Time: 7:54:52 PM
File Name: RMU2X1350msesslopewonly.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/19/2013
Last Solved Time: 7:56:38 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

FINAL WALL -GLOBAL Cohesionless Undrained GC (2)

Description: to determine critical FS near face
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0

Lambda 7: 0.2
Lambda 8: 0.4
Lambda 9: 0.6
Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.01
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

GC-UNDRAINED

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: SHANSEP CONSOLIDATED UNDRAINED-STATIC
Phi-B: 0 °

Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

AGGREGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

cohesionless Structural Fill

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (954.9937, 360.27256) ft
Left-Zone Right Coordinate: (995.8, 348.1) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,030, 320) ft
Right-Zone Right Coordinate: (1,110, 318.98701) ft
Right-Zone Increment: 10
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	805	314.5
Coordinate 2	1,194.9	313

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 319.5) ft
Inside Point: (993, 319.3918) ft
Slip Surface Intersection: (993.01662, 319.39186) ft
Total Length: 31.500186 ft
Reinforcement Direction: 0.19681 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 21.408356 lbs
Pullout Force per Length: 1,287.8385 lbs/ft
Available Length: 0.016623478 ft
Required Length: 0.016623478 ft
Governing Component: Pullout Resistance

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft

Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (991, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1

Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (985.9975, 331.5) ft
Slip Surface Intersection: () ft
Total Length: 34.8775 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft

Governing Component: (none)

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: () ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft

Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: () ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °

Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: () ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0

Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: () ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: () ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft
Slip Surface Intersection: () ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: () ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function

Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

SHANSEP CONSOLIDATED UNDRAINED-STATIC

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: SHANSEPP
Field
MPP: 5000
m: 0.7
S: .34
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25

Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft²)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	cohesionless Structural Fill	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-UNDRAINED	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	cohesionless Structural Fill	53,54,71,70	595.93
Region 19	cohesionless Structural Fill	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 1,332
F of S: 1.74
Volume: 1,867.8425 ft³
Weight: 224,049.34 lbs
Resisting Moment: 10,155,909 lbs-ft
Activating Moment: 5,842,968.2 lbs-ft
Resisting Force: 126,073.57 lbs
Activating Force: 72,626.404 lbs
F of S Rank: 1
Exit: (1,045.9181, 319.92164) ft
Entry: (955.00579, 360.26852) ft
Radius: 58.312178 ft
Center: (1,026.8171, 382.1321) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

Slice 1	955.16723	358.89667	0	42.444949	24.505603	0
Slice 2	955.47248	356.30262	0	116.84749	67.461928	0
Slice 3	957.31104	352.29643	0	507.74691	293.14781	0
Slice 4	960.01939	347.84733	0	707.57629	408.51936	0
Slice 5	963.08476	344.16878	-1,889.282	1,115.7508	257.59137	100
Slice 6	967.11167	340.21708	-1,643.6626	1,145.433	772.60429	0
Slice 7	970.2934	337.23208	-1,458.1622	1,336.2386	901.30429	0
Slice 8	971.95	335.79494	-1,368.8826	1,398.6167	943.37885	0
Slice 9	972.56617	335.2604	-1,335.675	1,421.3118	958.6869	0
Slice 10	974.86827	333.26328	-1,211.6072	1,505.0185	1,015.1478	0
Slice 11	977.7521	330.79063	-1,058.0066	1,640.05	1,106.2277	0
Slice 12	979.0735	329.69578	-990.00486	1,685.4624	1,136.8587	0
Slice 13	980.43322	328.6103	-922.59749	1,774.6336	1,197.0054	0
Slice 14	982.60972	326.92079	-817.69481	1,843.4299	1,243.4092	0
Slice 15	984.875	325.16237	-708.51297	1,926.3865	1,299.3641	0
Slice 16	985.90405	324.36357	-658.91495	1,968.6065	1,327.8419	0
Slice 17	987.59085	323.10875	-581.01889	2,051.3704	1,383.6668	0
Slice 18	990.65635	320.83826	-440.07653	2,134.7352	1,439.8971	0
Slice 19	992.34455	319.64457	-365.99528	2,773.1946	1,870.5434	0
Slice 20	992.86674	319.44821	-353.86813	2,818.4945	1,901.0986	0
Slice 21	994.80047	318.7211	-308.96051	2,975.9253	1,788.1163	150
Slice 22	997.93442	317.54268	-236.1794	3,256.0825	1,956.4517	150
Slice 23	999.7507	316.85033	-193.41266	3,325.8627	1,998.3799	150
Slice 24	1,001.8282	315.99081	-140.27736	3,459.3738	2,078.6015	150
Slice 25	1,005.4847	314.47805	-46.759121	3,682.8008	2,212.8499	150
Slice 26	1,009.2436	312.92287	49.381743	3,914.7064	2,322.5214	150
Slice 27	1,011.8372	311.83749	116.4868	4,026.4488	2,349.3422	150
Slice 28	1,014.375	310.74021	184.34776	4,161.102	2,389.475	150
Slice 29	1,016.375	309.87547	237.8279	4,259.9852	2,416.756	150
Slice 30	1,017.2769	309.48553	261.94344	3,991.55	2,240.9738	150
Slice 31	1,019.1519	308.95096	294.85063	3,890.3827	2,160.4136	150
Slice 32	1,020.8821	308.63791	313.96927	3,087.5654	1,666.5447	150
Slice 33	1,022.6321	308.71456	308.76638	2,942.4912	1,582.5015	150
Slice 34	1,023.9331	308.93685	294.58285	2,179.5938	1,132.6288	150
Slice 35	1,024.3081	309.03572	288.32342	2,540.9517	1,353.5156	150
Slice 36	1,026.4697	309.797	240.30112	2,324.1091	1,252.0781	150
Slice 37	1,030.4091	311.18437	152.78304	1,913.5549	1,057.9785	150
Slice 38	1,034.3485	312.57175	65.264973	1,523.1772	876.00201	150
Slice 39	1,036.5341	313.39475	13.385362	1,587.642	945.90879	150

Slice 40	1,036.82	313.56597	2.6323935	1,538.394	922.77866	150
Slice 41	1,039.6087	315.23618	-102.25806	1,067.3206	641.31091	150
Slice 42	1,044.1228	318.39306	-300.33081	432.09865	259.63106	150

Figure 8 **Global Consolidated Undrained Critical Surface Location – Cohesionless Fill**

FINAL WALL -GLOBAL Cohesionless Undrained GC

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 640
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/19/2013
Time: 7:54:52 PM
File Name: RMU2X1350msesslopewonly.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/19/2013
Last Solved Time: 8:05:30 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

FINAL WALL -GLOBAL Cohesionless Undrained GC

Description: to determine critical FS
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0

Lambda 7: 0.2
Lambda 8: 0.4
Lambda 9: 0.6
Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.01
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Line: 1

Upper Till
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface
Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

final cover
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

NOT ACTIVE
Model: (None)
Pore Water Pressure
Piezometric Line: 1

GC-UNDRAINED
Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: SHANSEP CONSOLIDATED UNDRAINED-STATIC
Phi-B: 0 °

Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

AGGRAGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

cohesionless Structural Fill

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (870.475, 381.99875) ft
Left-Zone Right Coordinate: (943.75, 364.02794) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,030, 320) ft
Right-Zone Right Coordinate: (1,110, 318.98701) ft
Right-Zone Increment: 10
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	805	314.5
Coordinate 2	1,194.9	313

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 319.5) ft
Inside Point: (993, 319.3918) ft
Slip Surface Intersection: () ft
Total Length: 31.500186 ft
Reinforcement Direction: 0.19681 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft

Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (991, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1

Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (985.9975, 331.5) ft
Slip Surface Intersection: () ft
Total Length: 34.8775 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 340 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft

Governing Component: (none)

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: () ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft

Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: () ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °

Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: () ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0

Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: () ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: () ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft
Slip Surface Intersection: () ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: () ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function

Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

SHANSEP CONSOLIDATED UNDRAINED-STATIC

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: SHANSEPP
Field
MPP: 5000
m: 0.7
S: .34
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25

Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft²)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	cohesionless Structural Fill	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-UNDRAINED	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	cohesionless Structural Fill	53,54,71,70	595.93
Region 19	cohesionless Structural Fill	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 1,332
F of S: 1.54
Volume: 9,219.4228 ft³
Weight: 1,098,764.2 lbs
Resisting Moment: 47,721,542 lbs-ft
Activating Moment: 31,114,064 lbs-ft
Resisting Force: 320,892.14 lbs
Activating Force: 204,630.52 lbs
F of S Rank: 1
Exit: (1,090.1187, 319.42944) ft
Entry: (870.475, 381.99875) ft
Radius: 118.70309 ft
Center: (996.21824, 412.73389) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	871.03367	380.42347	0	83.671281	48.307637	0

Slice 2	872.27471	376.92409	0	256.06564	147.83957	0
Slice 3	873.78374	372.66908	0	450.51536	260.10517	0
Slice 4	877.8478	365.46084	0	984.78027	568.56316	0
Slice 5	882.0426	359.49028	0	1,410.385	814.28617	0
Slice 6	886.86056	353.98866	0	1,673.6226	966.26648	0
Slice 7	893.06056	346.9089	0	2,004.0426	1,157.0346	0
Slice 8	895.55	344.06621	0	2,133.5449	1,231.8027	0
Slice 9	900.2821	338.66264	0	2,520.6213	1,455.2814	0
Slice 10	907.00821	331.07388	0	3,106.7996	1,793.7116	0
Slice 11	909.77611	328.0317	-869.53069	3,831.525	884.57724	100
Slice 12	910.5	327.23608	-820.05781	3,896.9706	899.68656	100
Slice 13	911.69665	325.92085	-738.27459	3,964.0304	915.16853	100
Slice 14	915.18422	322.08768	-499.9221	3,491.9758	2,355.3674	0
Slice 15	919.72507	317.09686	-189.58521	3,791.9499	2,278.4334	150
Slice 16	922.20546	314.39086	-21.325965	4,030.061	2,421.505	150
Slice 17	924.68956	311.81223	138.9839	4,198.1678	2,439.0037	150
Slice 18	930.63862	305.91554	505.50917	4,714.4242	2,528.9713	150
Slice 19	936.4637	300.29662	854.73165	5,133.3845	2,470.2814	100
Slice 20	938.66918	298.16919	986.95365	5,632.8934	500.1253	1,166.9632
Slice 21	941.4225	297.46081	1,030.4956	7,339	1,728.1585	0.00023876991
Slice 22	949.99435	295.66902	1,140.2456	7,309.2588	1,689.9465	-0.00012389282
Slice 23	959.86653	293.82674	1,252.834	7,417.349	1,579.0618	0.00021817005
Slice 24	967.62217	292.6482	1,324.5132	7,355.6629	1,544.9	-4.356124e-006
Slice 25	971.95	291.99054	1,364.5118	7,321.6652	1,525.9454	0.00015704778
Slice 26	975.45	291.45869	1,396.8594	7,286.6343	1,508.6861	0.00026162182
Slice 27	979.75	290.80526	1,436.6008	7,236.8415	1,485.7519	-5.6556162e-005
Slice 28	981.125	290.59632	1,449.3089	7,216.0431	1,477.1688	0.00020409208
Slice 29	982.1596	290.4391	1,458.8708	7,200.1621	1,470.6516	0.00015135703
Slice 30	983.5346	290.2482	1,470.4533	7,282.8933	1,433.8671	0.00024864744
Slice 31	984.875	290.09646	1,479.5999	7,268.3528	1,428.0241	-5.4358713e-005
Slice 32	989.125	289.61535	1,508.6008	7,156.5187	1,393.2817	-0.00020035904
Slice 33	995.937	288.84422	1,555.0843	7,259.0555	1,407.1091	0.00014481734
Slice 34	999.687	288.41454	1,580.9957	7,442.3902	1,467.3491	0.00030617178
Slice 35	1,006.25	287.5633	1,632.5379	7,627.4111	1,500.7646	4.8664282e-005
Slice 36	1,014.375	286.50945	1,696.3472	7,803.4487	1,528.8601	-4.3108964e-006
Slice 37	1,016.375	286.25005	1,712.0541	7,815.6116	1,527.9725	0.00031882123
Slice 38	1,017.25	286.13656	1,718.9258	7,466.3221	1,438.8114	-0.0004097557
Slice 39	1,019.1771	286.0234	1,725.524	6,817.096	1,222.0029	8.2695787e-005
Slice 40	1,021.0099	286.00202	1,726.4184	5,936.3833	341.90155	797.7705

Slice 41	1,022.7078	286.20519	1,713.3329	5,531.1552	354.80805	827.88563
Slice 42	1,024.125	286.48896	1,695.2854	4,959.8726	338.53017	789.90353
Slice 43	1,024.6391	286.59189	1,688.7393	4,954.3515	338.56201	789.97797
Slice 44	1,030.7641	288.63644	1,559.6887	4,974.8442	382.48176	892.45731
Slice 45	1,039.9798	291.74128	1,363.7344	4,485.3928	372.30893	868.71998
Slice 46	1,048.9686	295.09363	1,152.39	4,045.2552	378.86921	884.02851
Slice 47	1,055.0814	297.55486	997.3418	3,930.0718	413.57424	965.00578
Slice 48	1,058.0828	299.22654	892.30825	3,837.4783	1,700.3947	100
Slice 49	1,063.3652	302.16869	707.44991	3,275.9981	1,543.3395	150
Slice 50	1,067.7365	304.60332	554.47984	2,768.123	1,330.091	150
Slice 51	1,075.3326	309.50396	246.85645	1,974.8667	1,038.2933	150
Slice 52	1,083.2212	314.79933	-85.468603	955.43837	574.08529	150
Slice 53	1,087.6843	317.79533	-273.49013	385.51534	231.64099	150

Figure 9 **Proximate. to Berm Failure -Consolidated Undrained –Critical Surface Location-Cohesive Fill**

Undrained - static

File Information

- Title: Model City - RMU-2 XS 1350 MSE
- Created By: Peter J. Carey
- Last Edited By: Peter J. Carey
- Revision Number: 641
- File Version: 8.0
- Tool Version: 8.0.10.6504
- Date: 2/19/2013
- Time: 11:34:07 PM
- File Name: RMU2X1350msesslopewonly.gsz
- Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
- Last Solved Date: 2/19/2013
- Last Solved Time: 11:34:54 PM

Project Settings

- Length(L) Units: feet
- Time(t) Units: Days
- Force(F) Units: lbf
- Pressure(p) Units: psf
- Strength Units: psf
- Unit Weight of Water: 62.4 pcf
- View: 2D

Analysis Settings

Undrained - static

- Description: determination of critical surface
- Kind: SLOPE/W
- Method: Morgenstern-Price
- Settings
  - Side Function
    - Interslice force function option: Half-Sine
  - Lambda
    - Lambda 1: -0.2
    - Lambda 2: 0
    - Lambda 3: 0.2
    - Lambda 4: 0.4
    - Lambda 5: 0.5
    - Lambda 6: 0.7
    - Lambda 7: 0.9
    - Lambda 8: 1.1
    - Lambda 9: 1.2

Lambda 10: 1.3
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Block
Critical slip surfaces saved: 4
Restrict Block Crossing: No
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

STRUCTURAL FILL UNDRAINED-R based

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion': 363 psf
Phi': 26.3 °
Phi-B: 0 °

GC-UNDRAINED

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: SHANSEP CONSOLIDATED UNDRAINED-STATIC
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Slip Surface Block

Left Grid
Upper Left: (984, 318) ft
Lower Left: (979.5, 303) ft
Lower Right: (1,003.5, 298.5) ft
X Increments: 5
Y Increments: 3
Starting Angle: 115 °
Ending Angle: 135 °
Angle Increments: 2
Right Grid
Upper Left: (1,012, 315.5) ft
Lower Left: (1,014.5, 300) ft
Lower Right: (1,031.5, 301.5) ft
X Increments: 3
Y Increments: 3
Starting Angle: 5 °
Ending Angle: 45 °
Angle Increments: 2

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	805	314.5
Coordinate 2	1,200	313

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 319.5) ft
Inside Point: (993, 319.3918) ft
Slip Surface Intersection: (993.01892, 319.39186) ft
Total Length: 31.500186 ft
Reinforcement Direction: 0.19681 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 8,000 lbs
Pullout Force: 22.717158 lbs
Pullout Force per Length: 1,200.8852 lbs/ft
Available Length: 0.018917011 ft
Required Length: 0.018917011 ft
Governing Component: Pullout Resistance

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 8,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft

Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (990.9978, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.3772 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85

Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (986, 331.5) ft
Slip Surface Intersection: () ft
Total Length: 34.875 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft

Governing Component: (none)

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: () ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft

Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: () ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °

Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: () ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0

Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: () ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 2,705.8824 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: () ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 2,705.8824 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft
Slip Surface Intersection: () ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: () ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function

Function: Modifier Factor vs. Inclination
  Curve Fit to Data: 100 %
  Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
  Data Point: (-60, 1)
  Data Point: (-30, 1)
  Data Point: (-17.838428, 0.90468204)
  Data Point: (-3, 0.706)
  Data Point: (3, 0.706)
  Data Point: (23.685228, 0.90009497)
  Data Point: (39.261389, 1)
  Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
  Curve Fit to Data: 100 %
  Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
  Data Point: (0, 0)
  Data Point: (500, 235)
  Data Point: (1,000, 463)
  Data Point: (2,000, 899)
  Data Point: (5,000, 2,057)
  Data Point: (10,000, 3,515)
  Data Point: (15,000, 4,430)
Estimation Properties
  Intact Rock Param.: 10
  Geological Strength: 100
  Disturbance Factor: 0
  SigmaC: 600,000 psf
  SigmaC: 300,000 psf
  Num. Points: 20

SHANSEP CONSOLIDATED UNDRAINED-STATIC

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
  Assembly: GeoStudio AddIns1
  Function: SHANSEPP
  Field
    MPP: 5000
    m: 0.7
    S: .34
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25

Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft²)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	STRUCTURAL FILL UNDRAINED-R based	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-UNDRAINED	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	STRUCTURAL FILL UNDRAINED-R based	53,54,71,70	595.93
Region 19	STRUCTURAL FILL UNDRAINED-R based	22,20,18,67,71,54,23,47	667.86
Region 20	Waste Material	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 3,457
F of S: 1.71
Volume: 1,864.8265 ft³
Weight: 232,278.24 lbs
Resisting Moment: 10,653,945 lbs-ft
Activating Moment: 6,230,946 lbs-ft
Resisting Force: 130,535.49 lbs
Activating Force: 76,355.173 lbs
F of S Rank: 1
Exit: (1,045.3054, 319.92688) ft
Entry: (945.83381, 363.33195) ft
Radius: 62.458742 ft
Center: (1,043.5, 376.5) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	948.07824	361.26823	0	121.66338	70.242385	0

Slice 2	951.85709	357.79363	0	307.6401	177.61609	0
Slice 3	955.2354	354.57297	0	450.26145	259.95857	0
Slice 4	958.6287	351.13722	0	591.12438	341.28582	0
Slice 5	961.54683	348.07489	0	721.94275	416.81384	0
Slice 6	964.39448	345.08652	-1,946.3693	912.256	210.61089	100
Slice 7	966.26765	343.09637	-1,822.628	982.61268	226.85401	100
Slice 8	969.08095	339.96985	0	995.3279	491.92169	363
Slice 9	971.95	336.78137	0	1,174.0989	580.2758	363
Slice 10	972.92495	335.69787	0	1,231.8972	608.84151	363
Slice 11	973.83805	334.68311	0	1,284.7796	634.97763	363
Slice 12	976.3631	332.35498	0	1,570.812	776.34364	363
Slice 13	978.94895	330.05973	0	1,691.2952	835.89015	363
Slice 14	980.42736	328.83062	0	1,831.9115	905.38705	363
Slice 15	982.72841	326.97402	0	1,926.0244	951.90055	363
Slice 16	984.875	325.24204	0	2,038.5008	1,007.4898	363
Slice 17	986.0591	324.28665	0	2,108.4046	1,042.0384	363
Slice 18	987.90115	322.95563	0	2,291.3588	1,132.4601	363
Slice 19	990.96705	320.79239	0	2,379.9963	1,176.2674	363
Slice 20	992.67365	319.58824	0	2,444.4477	1,208.1213	363
Slice 21	993.0278	319.38804	0	2,990.2013	1,477.8495	363
Slice 22	994.431	318.78418	-312.22083	3,096.3156	1,860.4541	150
Slice 23	997.82685	317.36367	-224.38548	3,452.2358	2,074.3125	150
Slice 24	1,001.6615	315.78556	-126.82055	3,750.1056	2,253.2908	150
Slice 25	1,004.9845	314.41803	-42.273517	3,947.5732	2,371.9413	150
Slice 26	1,006.8006	313.67065	3.9321952	4,055.9101	2,434.6739	150
Slice 27	1,009.7276	312.44371	79.799551	4,211.1798	2,482.3836	150
Slice 28	1,014.387	310.4886	200.69431	4,390.8299	2,517.6875	150
Slice 29	1,016.387	309.6565	252.14378	4,578.1873	2,599.3492	150
Slice 30	1,017.25	309.3486	271.15193	4,264.2499	2,399.2953	150
Slice 31	1,018.9252	308.75099	308.04611	3,566.367	1,957.7967	150
Slice 32	1,020.0502	308.4251	328.11497	4,013.0409	2,214.1268	150
Slice 33	1,021.6291	308.45798	325.68943	3,126.5118	1,682.9039	150
Slice 34	1,023.3791	308.62196	315.04233	2,886.1089	1,544.8527	150
Slice 35	1,024.125	308.89397	297.89207	2,537.793	1,345.8682	150
Slice 36	1,026.582	309.7899	241.40394	2,276.353	1,222.7208	150
Slice 37	1,030.7459	311.30827	145.67103	1,828.4932	1,011.1416	150
Slice 38	1,034.3138	312.8455	48.902292	1,618.6921	943.22489	150
Slice 39	1,036.2749	313.87231	-15.635697	1,336.6821	803.15961	150
Slice 40	1,038.3239	314.94514	-83.065342	1,054.339	633.51081	150

Slice 41	1,042.6016	317.84803	-265.21983	528.68078	317.66346	150

Figure 10 Proximate to Berm Failure – Consolidated Undrained Yield Acc.-Cohesive Fill

Undrained - Yield Acc.

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 640
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/19/2013
Time: 7:54:52 PM
File Name: RMU2X1350msesslopewonly.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/19/2013
Last Solved Time: 7:55:00 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Undrained - Yield Acc.

Description: determination of yield acceleration
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
Lambda
Lambda 1: 0.6
Lambda 2: 1.1
Lambda 3: 1.2
Lambda 4: 1.3
Lambda 5: 1.4
Lambda 6: 1.5
Lambda 7: 1.6
Lambda 8: 1.7
Lambda 9: 1.8

Lambda 10: 1.9
Lambda 11: 2
Lambda 12: 2.1
Lambda 13: 2.2
Lambda 14: 2.3
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Fully-Specified
Critical slip surfaces saved: 1
Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Sensitivity
Modifiers

	Property	Offset
	Analyses[4].Applied.SeismicX	Range(Mean=0,Delta=0.01)

Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb

Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

STRUCTURAL FILL UNDRAINED-R based

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion': 363 psf
Phi': 26.3 °
Phi-B: 0 °

GC-UNDRAINED

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: SHANSEP CONSOLIDATED UNDRAINED-STATIC
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

AGGREGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X (ft)	Y (ft)
	939.8	367.3
	943.6574	362.74815
	947.6865	359.07808
	951.2006	355.87705
	954.0869	353.19193
	956.4755	350.8105
	959.4231	347.77539
	962.8733	344.2228
	964.802	342.25424
	967.2599	339.97938
	970.5255	337.03138
	971.95	335.82189

	972.5906	335.27796
	973.9917	334.0883
	976.8511	331.72841
	979.9832	329.19817
	982.5368	327.1352
	983.8036	326.12711
	984.875	325.34527
	987.8048	323.20723
	991.1798	320.80171
	992.894	319.62535
	996.644	317.90396
	1,002.99	315.16026
	1,006.3	313.71596
	1,009.46	312.23423
	1,012.4	310.85909
	1,014.38	309.98565
	1,016.38	309.10203
	1,017.25	308.71545
	1,018.72	308.06793
	1,019.84	307.75419
	1,021.4	307.76343
	1,023.15	307.96834
	1,024.13	308.29108
	1,026.54	309.09441
	1,030.63	310.45177
	1,034.71	311.80913
	1,036.84	312.51608
	1,038.16	313.00651
	1,042.79	314.73075
	1,048.54	316.95427
	1,053.27	318.87715
	1,059.7	321.9

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)

Coordinate 1	805	314.5
Coordinate 2	1,200	313

Seismic Coefficients

Horz Seismic Coef.: 0.2
Ignore seismic load in strength: Yes

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 319.5) ft
Inside Point: (993, 319.3918) ft
Slip Surface Intersection: (993.39978, 319.39317) ft
Total Length: 31.500186 ft
Reinforcement Direction: 0.19681 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 8,000 lbs
Pullout Force: 527.52825 lbs
Pullout Force per Length: 1,319.5254 lbs/ft
Available Length: 0.39978637 ft
Required Length: 0.39978637 ft
Governing Component: Pullout Resistance

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 0.85
Force Orientation: 0

Max. Pullout Force: 8,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft
Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (990.9978, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.3772 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft

Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (986, 331.5) ft
Slip Surface Intersection: () ft
Total Length: 34.875 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1

Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: () ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs

Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: () ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: () ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft

Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: () ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 2,705.8824 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: () ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1

Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 2,705.8824 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft
Slip Surface Intersection: () ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: () ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 0 lbs

Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

SHANSEP CONSOLIDATED UNDRAINED-STATIC

Model: Add-In Function

Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: SHANSEPP
Field
MPP: 5000
m: 0.7
S: .34
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8

Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25
Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320

Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft²)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	STRUCTURAL FILL UNDRAINED-R based	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-UNDRAINED	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	STRUCTURAL FILL UNDRAINED-R based	53,54,71,70	595.93
Region 19	STRUCTURAL FILL UNDRAINED-R based	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 1
F of S: 1.56
Volume: 1,996.7716 ft³
Weight: 248,693.99 lbs
Resisting Moment: 12,509,881 lbs-ft
Activating Moment: 8,041,884.6 lbs-ft
Resisting Force: 154,370.24 lbs
Activating Force: 99,247.464 lbs
F of S Rank: 1
Exit: (1,055.3208, 319.84128) ft

Entry: (942.10814, 364.57632) ft
Radius: 67.245068 ft
Center: (1,028.5, 384) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	942.88277	363.66224	0	59.674811	34.453268	0
Slice 2	944.7934	361.71338	0	177.14945	102.27728	0
Slice 3	946.80795	359.87834	0	256.1067	147.86327	0
Slice 4	949.44355	357.47757	0	331.35162	191.30594	0
Slice 5	952.64375	354.53449	0	399.67575	230.7529	0
Slice 6	955.2812	352.00122	0	431.52752	249.14253	0
Slice 7	957.10521	350.16209	0	450.45221	260.06871	0
Slice 8	958.57901	348.64454	0	468.84173	270.6859	0
Slice 9	960.2672	346.90624	0	485.76065	280.45404	0
Slice 10	961.9923	345.12995	-1,948.51	465.95832	107.57495	100
Slice 11	963.83765	343.23852	-1,830.9221	469.32978	108.35332	100
Slice 12	964.88533	342.17711	-1,764.9387	507.95572	117.27082	100
Slice 13	966.11428	341.03968	0	612.14212	302.53948	363
Slice 14	968.8927	338.50538	0	671.75094	331.99999	363
Slice 15	971.01275	336.61767	0	743.49917	367.46018	363
Slice 16	971.725	336.01293	0	752.23654	371.77845	363
Slice 17	972.175	335.63084	0	757.50559	374.38258	363
Slice 18	972.4953	335.35888	0	761.10554	376.16179	363
Slice 19	972.6859	335.19704	0	763.03702	377.11638	363
Slice 20	973.38645	334.60221	0	770.13441	380.62413	363
Slice 21	975.4214	332.90835	0	813.22253	401.91961	363
Slice 22	977.67555	331.06239	0	856.06863	423.09547	363
Slice 23	979.2416	329.79727	0	873.58085	431.75055	363
Slice 24	980.72476	328.59909	0	890.83334	440.27726	363
Slice 25	982.00156	327.5676	0	907.69065	448.60866	363
Slice 26	983.1702	326.63115	0	939.94367	464.5491	363
Slice 27	983.9018	326.05545	0	1,042.0077	514.99226	363
Slice 28	984.4375	325.66453	0	1,057.1472	522.4747	363
Slice 29	985.3125	325.026	0	1,084.8247	536.15377	363
Slice 30	986.7774	323.95698	0	1,113.8498	550.49887	363
Slice 31	989.4923	322.00447	0	1,191.0395	588.64839	363
Slice 32	991.8399	320.34872	0	1,293.2207	639.14948	363

Slice 33	992.697	319.76054	0	1,323.7222	654.22428	363
Slice 34	993.2379	319.46749	0	2,846.4044	1,406.7807	363
Slice 35	995.1129	318.60679	-301.31334	2,107.2287	1,266.1507	150
Slice 36	998.322	317.17847	-212.9468	2,502.1339	1,503.4337	150
Slice 37	1,001.495	315.80662	-128.09525	2,784.2145	1,672.9249	150
Slice 38	1,004.6223	314.448	-44.058168	3,031.8399	1,821.7132	150
Slice 39	1,006.2773	313.72585	0.61182015	3,182.0884	1,911.624	150
Slice 40	1,007.88	312.9751	47.079216	3,166.7312	1,874.476	150
Slice 41	1,010.93	311.54666	135.49083	3,460.9592	1,998.143	150
Slice 42	1,012.45	310.83703	179.41134	3,755.4628	2,148.7085	150
Slice 43	1,013.44	310.40031	206.42808	3,832.0724	2,178.5069	150
Slice 44	1,015.315	309.57256	257.63573	3,978.1196	2,235.4923	150
Slice 45	1,016.315	309.13075	284.96772	4,062.0576	2,269.5046	150
Slice 46	1,016.44	309.07537	288.3937	4,058.9961	2,265.6065	150
Slice 47	1,016.875	308.88208	300.35192	3,985.0187	2,213.9712	150
Slice 48	1,017.625	308.55027	320.87933	3,844.6819	2,117.3142	150
Slice 49	1,018.36	308.22651	340.90779	3,685.5711	2,009.6764	150
Slice 50	1,019.28	307.91106	360.37363	4,304.2485	2,369.7191	150
Slice 51	1,020.045	307.7554	369.90528	6,562.365	3,720.8052	150
Slice 52	1,020.825	307.76002	369.43216	6,026.9335	3,399.3697	150
Slice 53	1,022.275	307.86588	362.48285	6,355.78	3,601.1362	150
Slice 54	1,023.45	308.06714	349.64624	9,585.7144	5,549.5896	150
Slice 55	1,023.94	308.22851	339.46064	8,761.3214	5,060.3645	150
Slice 56	1,024.315	308.35275	331.6193	8,631.2492	4,986.9208	150
Slice 57	1,025.52	308.75441	306.26986	7,852.9282	4,534.4898	150
Slice 58	1,028.585	309.77309	241.97803	6,062.3012	3,497.203	150
Slice 59	1,032.67	311.13045	156.31078	4,248.3119	2,458.7223	150
Slice 60	1,035.73	312.14767	92.111179	3,197.9802	1,866.1944	150
Slice 61	1,036.795	312.50114	69.801974	2,892.3238	1,695.9422	150
Slice 62	1,037.5	312.7613	53.401521	2,882.7677	1,700.0547	150
Slice 63	1,038.9682	313.30748	18.971855	2,459.5965	1,466.4752	150
Slice 64	1,041.2832	314.1696	-35.373	1,883.3399	1,131.6248	150
Slice 65	1,044.2275	315.28663	-105.77354	1,311.4832	788.01859	150
Slice 66	1,047.1025	316.39839	-175.82863	859.82788	516.63671	150
Slice 67	1,050.905	317.91571	-271.41045	426.50463	256.26984	150
Slice 68	1,054.2954	319.35921	-362.28841	122.02734	73.321426	150

Figure 11 Stability with Articulating Dump Strip Load – Cohesive Fill

Undrained w Articulating Dump 1

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 640
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/19/2013
Time: 7:54:52 PM
File Name: RMU2X1350msesslopewonly.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/19/2013
Last Solved Time: 7:55:46 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Undrained w Articulating Dump 1

Description: Strip Load - cat 740 with Cohesionless Fill
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: 0
  - Lambda 2: 0.2
  - Lambda 3: 0.4
  - Lambda 4: 0.6
  - Lambda 5: 0.8
  - Lambda 6: 1
  - Lambda 7: 1.1
  - Lambda 8: 1.2
  - Lambda 9: 1.3

Lambda 10: 1.4
Lambda 11: 1.5
Lambda 12: 1.6
Lambda 13: 1.7
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.002
Minimum Slip Surface Depth: 4 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure

Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

STRUCTURAL FILL UNDRAINED-R based

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion': 363 psf
Phi': 26.3 °
Phi-B: 0 °

GC-UNDRAINED

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: SHANSEP CONSOLIDATED UNDRAINED-STATIC
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

AGGRAGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (1,000, 349.5) ft
Left-Zone Right Coordinate: (1,012.5232, 349.88529) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,017.7053, 345.01262) ft
Right-Zone Right Coordinate: (1,030, 320) ft
Right-Zone Increment: 10
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	805	314.5
Coordinate 2	1,200	313

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 2,700 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	999.65	350.6
	1,005.1	350.72

Surcharge Load 2

Surcharge (Unit Weight): 2,700 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	1,007.45	350.85
	1,012.95	350.94

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 319.5) ft
Inside Point: (993, 319.3918) ft
Slip Surface Intersection: () ft
Total Length: 31.500186 ft
Reinforcement Direction: 0.19681 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 8,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 2

Type: Geosynthetic

Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 8,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft
Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes

Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (990.9978, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.3772 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs

Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: (1,016.6694, 330) ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 779.81223 lbs
Pullout Force per Length: 780.94185 lbs/ft
Available Length: 5.4193885 ft

Required Length: 0.99855352 ft
Governing Component: Tensile Capacity

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (986, 331.5) ft
Slip Surface Intersection: (1,013.9691, 331.5) ft
Total Length: 34.875 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 3,821.0799 lbs
Pullout Force per Length: 860.88644 lbs/ft
Available Length: 27.969111 ft
Required Length: 4.4385412 ft
Governing Component: Tensile Capacity

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: (1,012.4193, 333) ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 779.81223 lbs
Pullout Force per Length: 826.32765 lbs/ft
Available Length: 1.9193271 ft
Required Length: 0.94370826 ft
Governing Component: Tensile Capacity

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft

Inside Point: (984, 334.5) ft
Slip Surface Intersection: (1,010.8214, 334.5) ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 3,821.0799 lbs
Pullout Force per Length: 758.48706 lbs/ft
Available Length: 26.821427 ft
Required Length: 5.0377655 ft
Governing Component: Tensile Capacity

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: (1,007.5188, 337.5) ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 3,821.0799 lbs
Pullout Force per Length: 617.48388 lbs/ft
Available Length: 25.518764 ft
Required Length: 6.1881453 ft
Governing Component: Tensile Capacity

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: (1,004.4839, 340.5) ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85

Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 2,339.4367 lbs
Pullout Force per Length: 407.70358 lbs/ft
Available Length: 22.483948 ft
Required Length: 5.7380823 ft
Governing Component: Tensile Capacity

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: (1,002.902, 343.5) ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 2,705.8824 lbs
Pullout Force: 1,793.5681 lbs
Pullout Force per Length: 384.12152 lbs/ft
Available Length: 21.401977 ft
Required Length: 4.6692727 ft

Governing Component: Tensile Capacity

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: (1,002.0823, 345) ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 2,705.8824 lbs
Pullout Force: 1,793.5681 lbs
Pullout Force per Length: 301.2076 lbs/ft
Available Length: 8.5823297 ft
Required Length: 5.9545912 ft
Governing Component: Tensile Capacity

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.475, 346.5) ft
Slip Surface Intersection: (1,001.2456, 346.5) ft
Total Length: 20.65 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 596.6358 lbs
Pullout Force per Length: 125.0663 lbs/ft
Available Length: 4.7705561 ft
Required Length: 4.7705561 ft
Governing Component: Pullout Resistance

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft

Slip Surface Intersection: (1,000.6356, 348) ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 267.08781 lbs
Pullout Force per Length: 125.0663 lbs/ft
Available Length: 2.1355698 ft
Required Length: 2.1355698 ft
Governing Component: Pullout Resistance

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
  Curve Fit to Data: 100 %
  Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
  Data Point: (-60, 1)
  Data Point: (-30, 1)
  Data Point: (-17.838428, 0.90468204)
  Data Point: (-3, 0.706)
  Data Point: (3, 0.706)
  Data Point: (23.685228, 0.90009497)
  Data Point: (39.261389, 1)
  Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
  Curve Fit to Data: 100 %
  Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
  Data Point: (0, 0)
  Data Point: (500, 235)
  Data Point: (1,000, 463)

Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

SHANSEP CONSOLIDATED UNDRAINED-STATIC

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: SHANSEPP
Field
MPP: 5000
m: 0.7
S: .34
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5

Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25
Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320

Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft²)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	STRUCTURAL FILL UNDRAINED-R based	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-UNDRAINED	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	STRUCTURAL FILL UNDRAINED-R based	53,54,71,70	595.93
Region 19	STRUCTURAL FILL UNDRAINED-R based	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 1,332
F of S: 1.51
Volume: 254.53356 ft³
Weight: 31,501.426 lbs
Resisting Moment: 2,049,925 lbs-ft
Activating Moment: 1,358,840.8 lbs-ft
Resisting Force: 65,648.684 lbs
Activating Force: 43,520.98 lbs
F of S Rank: 1
Exit: (1,021.6963, 328.49818) ft
Entry: (1,000, 349.5) ft
Radius: 26.201773 ft
Center: (1,028.9795, 359.03616) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	1,000.2771	348.85017	0	1,297.193	641.11271	363
Slice 2	1,000.903	347.34237	0	1,717.4952	848.83898	363
Slice 3	1,001.6604	345.75458	0	1,570.7742	776.32497	363
Slice 4	1,002.4581	344.31232	0	1,850.7477	914.69651	363
Slice 5	1,003.2367	342.88743	0	1,903.3453	940.69186	363
Slice 6	1,004.0731	341.30221	0	1,927.4576	952.60888	363
Slice 7	1,004.8101	340.14782	0	2,158.0689	1,066.5841	363
Slice 8	1,005.6215	339.35977	0	573.17908	283.28274	363
Slice 9	1,006.6644	338.34689	0	646.34038	319.44131	363
Slice 10	1,007.3179	337.70538	0	661.64059	327.00315	363
Slice 11	1,007.8742	337.13658	0	4,420.351	2,184.6735	363
Slice 12	1,008.7824	336.29386	0	2,560.9343	1,265.6926	363
Slice 13	1,009.7554	335.45443	0	2,510.0887	1,240.5631	363
Slice 14	1,010.3892	334.89659	0	2,545.5003	1,258.0646	363
Slice 15	1,010.9787	334.3527	0	4,878.5984	2,411.1535	363
Slice 16	1,011.868	333.5197	0	2,564.9554	1,267.6799	363
Slice 17	1,012.4064	333.01256	0	4,798.8857	2,371.757	363
Slice 18	1,012.725	332.70414	0	2,604.0494	1,287.0014	363
Slice 19	1,013.5357	331.91954	0	2,932.0678	1,449.1182	363
Slice 20	1,014.6535	331.07046	0	1,875.6034	926.98093	363
Slice 21	1,015.7178	330.50599	0	1,940.6826	959.14509	363
Slice 22	1,016.375	330.15747	0	1,983.827	980.46838	363
Slice 23	1,016.5676	330.05532	0	1,972.4675	974.85416	363
Slice 24	1,017.16	329.72063	0	2,079.1572	1,027.5835	363

Slice 25	1,018.216	329.19658	-967.59037	1,545.9073	1,716.904	0
Slice 26	1,019.2785	328.74615	-939.73532	1,060.3062	1,177.5894	0
Slice 27	1,020.2814	328.51524	-925.56465	882.27476	979.86539	0
Slice 28	1,021.2247	328.50387	-925.07836	248.69984	276.20916	0

Figure 12 **Stability with Articulating Dump Strip Load – Cohesionless Fill**

Drained w Articulating Dump (3)

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 643
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/20/2013
Time: 2:56:22 PM
File Name: RMU2X1350msesslopewonly.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/20/2013
Last Solved Time: 2:56:28 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Drained w Articulating Dump (3)

Description: Strip Load - cat 740 with Cohesionless Fill
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: 0
  - Lambda 2: 0.2
  - Lambda 3: 0.4
  - Lambda 4: 0.6
  - Lambda 5: 0.8
  - Lambda 6: 1
  - Lambda 7: 1.1
  - Lambda 8: 1.2
  - Lambda 9: 1.3

Lambda 10: 1.4
Lambda 11: 1.5
Lambda 12: 1.6
Lambda 13: 1.7
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.002
Minimum Slip Surface Depth: 4 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure

Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC-Drained

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: normalized N^m
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)

Pore Water Pressure
Piezometric Line: 1

AGGRAGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

cohesionless Structural Fill

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (996.7, 348.4) ft
Left-Zone Right Coordinate: (1,012.5232, 349.88529) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,017.7053, 345.01262) ft
Right-Zone Right Coordinate: (1,030, 320) ft
Right-Zone Increment: 10
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (862.97153, 384.49705) ft
Right Coordinate: (1,141.6477, 317.34298) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	805	314.5
Coordinate 2	1,200	313

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 2,700 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	999.65	350.6
	1,005.1	350.72

Surcharge Load 2

Surcharge (Unit Weight): 2,700 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	1,007.45	350.85
	1,012.95	350.94

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 319.5) ft
Inside Point: (993, 319.3918) ft
Slip Surface Intersection: () ft
Total Length: 31.500186 ft
Reinforcement Direction: 0.19681 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 8,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 2

Type: Geosynthetic

Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 8,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft
Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes

Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (990.9978, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.3772 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 6,941.1765 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs

Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: (1,016.9577, 330) ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 772.33395 lbs
Pullout Force per Length: 778.36674 lbs/ft
Available Length: 5.7076934 ft

Required Length: 0.99224942 ft
Governing Component: Tensile Capacity

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (986, 331.5) ft
Slip Surface Intersection: (1,014.7315, 331.5) ft
Total Length: 34.875 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 3,784.4364 lbs
Pullout Force per Length: 816.18548 lbs/ft
Available Length: 28.73154 ft
Required Length: 4.6367357 ft
Governing Component: Tensile Capacity

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: (1,013.0191, 333) ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 772.33395 lbs
Pullout Force per Length: 780.3191 lbs/ft
Available Length: 2.5190809 ft
Required Length: 0.98976682 ft
Governing Component: Tensile Capacity

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft

Inside Point: (984, 334.5) ft
Slip Surface Intersection: (1,011.2175, 334.5) ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 3,784.4364 lbs
Pullout Force per Length: 722.0195 lbs/ft
Available Length: 27.217494 ft
Required Length: 5.2414601 ft
Governing Component: Tensile Capacity

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (982, 337.5) ft
Slip Surface Intersection: (1,007.4823, 337.5) ft
Total Length: 37.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 5,764.7059 lbs
Pullout Force: 3,784.4364 lbs
Pullout Force per Length: 584.0185 lbs/ft
Available Length: 25.482274 ft
Required Length: 6.479994 ft
Governing Component: Tensile Capacity

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: (1,004.2712, 340.5) ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85

Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 2,317.0019 lbs
Pullout Force per Length: 434.04023 lbs/ft
Available Length: 22.271229 ft
Required Length: 5.3382191 ft
Governing Component: Tensile Capacity

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 1,176.4706 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.5, 343.5) ft
Slip Surface Intersection: (1,001.7979, 343.5) ft
Total Length: 36.375 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 2,705.8824 lbs
Pullout Force: 1,776.3681 lbs
Pullout Force per Length: 287.7896 lbs/ft
Available Length: 20.297937 ft
Required Length: 6.172454 ft

Governing Component: Tensile Capacity

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (993.5, 345) ft
Slip Surface Intersection: (1,000.7518, 345) ft
Total Length: 24 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 2,705.8824 lbs
Pullout Force: 1,776.3681 lbs
Pullout Force per Length: 287.7896 lbs/ft
Available Length: 7.2517823 ft
Required Length: 6.172454 ft
Governing Component: Tensile Capacity

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft
Slip Surface Intersection: (999.63849, 346.5) ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 337.77008 lbs
Pullout Force per Length: 107.62191 lbs/ft
Available Length: 3.1384879 ft
Required Length: 3.1384879 ft
Governing Component: Pullout Resistance

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft

Slip Surface Intersection: (998.51265, 348) ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 34 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 0.85
Force Orientation: 0
Max. Pullout Force: 3,529.4118 lbs
Pullout Force: 0.38718693 lbs
Pullout Force per Length: 30.60723 lbs/ft
Available Length: 0.012650179 ft
Required Length: 0.012650179 ft
Governing Component: Pullout Resistance

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)

Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

normalized N^m

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: Mesri1
Field
tan_Phi_100kPa: .548982
power: .147
pa: 2089
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5

Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25
Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320

Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350

Regions

	Material	Points	Area (ft^2)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	cohesionless Structural Fill	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-Drained	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	cohesionless Structural Fill	53,54,71,70	595.93
Region 19	cohesionless Structural Fill	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22

Current Slip Surface

Slip Surface: 1,332
F of S: 1.52
Volume: 263.54026 ft³
Weight: 31,209.806 lbs
Resisting Moment: 2,676,881.2 lbs-ft
Activating Moment: 1,757,424.5 lbs-ft
Resisting Force: 61,155.553 lbs
Activating Force: 40,147.767 lbs
F of S Rank: 1
Exit: (1,021.688, 328.53224) ft
Entry: (997.87975, 348.79325) ft
Radius: 24.357223 ft
Center: (1,034.2709, 368.4015) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	998.24277	348.33825	-2,157.298	42.459523	28.63931	0
Slice 2	999.1279	347.18391	-2,085.4771	173.93008	117.31732	0
Slice 3	999.825	346.25017	-2,027.3767	1,933.5323	1,304.184	0
Slice 4	1,000.3294	345.57454	-1,985.337	1,787.6481	1,205.7839	0
Slice 5	1,001.3615	344.12585	-1,895.1829	2,206.431	1,488.2565	0
Slice 6	1,002.3056	342.84422	-1,815.4336	1,924.9362	1,298.3858	0
Slice 7	1,002.9573	342.07928	-1,767.8553	1,816.001	1,224.9081	0
Slice 8	1,003.7776	341.09767	-1,706.7975	1,772.4788	1,195.552	0
Slice 9	1,004.585	340.09807	-1,644.6136	2,704.0834	1,823.9273	0
Slice 10	1,005.0411	339.5407	-1,609.9418	2,305.622	1,555.1617	0
Slice 11	1,005.5609	339.1121	-1,583.3205	613.06332	413.51643	0
Slice 12	1,006.4825	338.35205	-1,536.1115	683.06886	460.73576	0
Slice 13	1,007.1967	337.75015	-1,498.7221	712.97931	480.91062	0
Slice 14	1,008.1554	336.91044	-1,446.5514	3,881.5469	2,618.1364	0
Slice 15	1,009.217	336.02464	-1,391.5292	2,814.0402	1,898.0941	0
Slice 16	1,010.0538	335.38998	-1,352.1246	2,842.8758	1,917.544	0
Slice 17	1,010.8582	334.77616	-1,314.0131	2,912.928	1,964.7947	0
Slice 18	1,011.841	333.98969	-1,265.1701	4,411.3614	2,975.5008	0
Slice 19	1,012.5379	333.41931	-1,229.7435	2,911.827	1,964.0521	0
Slice 20	1,012.7629	333.2244	-1,217.6346	2,812.4451	1,897.0182	0
Slice 21	1,013.4841	332.59272	-1,178.3886	1,645.4598	1,109.8766	0
Slice 22	1,014.5522	331.65713	-1,120.261	2,945.8419	1,986.9955	0
Slice 23	1,015.6681	330.81954	-1,068.2595	1,675.4715	1,130.1198	0
Slice 24	1,016.375	330.3703	-1,040.3944	1,744.8611	1,176.9237	0

Slice 25	1,017.0515	329.94036	-1,013.7264	1,874.5073	1,264.3711	0
Slice 26	1,017.9706	329.35629	-977.49858	1,284.4484	1,426.5245	0
Slice 27	1,018.7032	328.97641	-953.96783	1,285.1586	1,427.3133	0
Slice 28	1,019.4333	328.68379	-935.88072	969.06313	1,076.2536	0
Slice 29	1,020.2707	328.53616	-926.86748	841.15034	934.19209	0
Slice 30	1,021.2156	328.53355	-926.92809	245.69759	272.87482	0

Figure 14 In-situ Stress Determination

Insitu

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 594
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/16/2013
Time: 3:55:07 PM
File Name: RMU2X1350mse21.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE_C8\
Last Solved Date: 2/16/2013
Last Solved Time: 3:55:42 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Stiffness Units: psf
Unit Weight of Water: 62.4 pcf
Air Pressure: 101.33 psf
View: 2D

Analysis Settings

Insitu

Description: Initial Conditions -SEC-A2
Kind: SIGMA/W
Method: Insitu
Settings
  Initial PWP: Water Table
Control
  Apply Body Force in All Steps: No
Convergence
  Equation Solver: Parallel Direct
Time
  Starting Time: 0 days
  Duration: 0 days
  Ending Time: 0 days

Materials

Upper Till

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 300,000 psf
Unit Weight: 125 pcf
Poisson's Ratio: 0.334
Insitu Ko: 0.5015015
Hydraulic
Vol. WC. Function: Till
K-Function: Upper Glacial Till
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

GC OverConsolidated

Model: Soft Clay (MCC w/ PWP Change)
Stress Strain
O.C. Ratio: 6
Poisson's Ratio: 0.334
Insitu Ko: 0.5015015
Lambda: 0.06
Kappa: 0.01
Initial Void Ratio: 0.5
Unit Weight: 125 pcf
Phi': 30 °
Hydraulic
Vol. WC. Function: Clay soils OC
K-Function: GC 5.7 E-4 ft/day
Ky'/Kx' Ratio: 1
Rotation: 0 °
K-Modifier Function: 1D consol derived k function rmu2 clay
Load Response Ratio: 1

Lower Till

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 600,000 psf
Unit Weight: 145 pcf
Poisson's Ratio: 0.334
Insitu Ko: 0.5015015
Hydraulic
Vol. WC. Function: Till
K-Function: Till
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

UPPER SHALE

Model: Linear Elastic (w/ PWP Change)

Stress Strain
- Effective Young's Modulus (E'): 1,000,000 psf
- Unit Weight: 145 pcf
- Poisson's Ratio: 0.334
- Insitu Ko: 0.5015015

Hydraulic
- Vol. WC. Function: Till
- K-Function: Upper Rock
- Ky'/Kx' Ratio: 1
- Rotation: 0 °
- Load Response Ratio: 1

infinite clay

Model: Linear Elastic (w/ PWP Change)

Stress Strain
- Effective Young's Modulus (E'): 400,000 psf
- Unit Weight: 120 pcf
- Poisson's Ratio: 0.334
- Insitu Ko: 0.5015015

Hydraulic
- Vol. WC. Function: Clay soils
- K-Function: GC 5.7 E-4 ft/day
- Ky'/Kx' Ratio: 1
- Rotation: 0 °
- Load Response Ratio: 1

infinitesand

Model: Linear Elastic (w/ PWP Change)

Stress Strain
- Effective Young's Modulus (E'): 400,000 psf
- Unit Weight: 120 pcf
- Poisson's Ratio: 0.334
- Insitu Ko: 0.5015015

Hydraulic
- Vol. WC. Function: silty sand
- K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec
- Ky'/Kx' Ratio: 0.1
- Rotation: 0 °
- Load Response Ratio: 1

Boundary Conditions

Fixed X

X: X-Displacement 0

Fixed X/Y

X: X-Displacement 0

Y: Y-Displacement 0

Initial Water Tables

Initial Water Table 1

Max. negative head: 5
Coordinates
Coordinate 1: (686, 315) ft
Coordinate 2: (1,200, 313) ft

K Functions

Silty Sand, k = 0.567 ft/day 2 E-4cm/sec

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.567)
Data Point: (0.01, 0.567)
Data Point: (0.035938, 0.567)
Data Point: (0.12915, 0.567)
Data Point: (0.46416, 0.567)
Data Point: (1.1111, 0.567)
Data Point: (1.6681, 0.567)
Data Point: (5.9948, 0.567)
Data Point: (21.544, 0.567)
Data Point: (77.426, 0.567)
Data Point: (105.93, 0.5402376)
Data Point: (210.74, 0.3387258)
Data Point: (278.26, 0.2567376)
Data Point: (315.56, 0.2232846)
Data Point: (420.37, 0.1406916)
Data Point: (525.19, 0.0779121)
Data Point: (630, 0.03843882)
Data Point: (734.81, 0.01673406)
Data Point: (839.63, 0.005422788)
Data Point: (944.44, 0.000745983)
Data Point: (1,000, 7.14735e-005)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Upper Glacial Till

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %

Segment Curvature: 36 %
K-Saturation: 0.0057
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.0057)
Data Point: (0.01, 0.0057)
Data Point: (0.046416, 0.0057)
Data Point: (0.21544, 0.0057)
Data Point: (1, 0.0057)
Data Point: (4.6416, 0.0057)
Data Point: (11.111, 0.0057)
Data Point: (21.544, 0.0057)
Data Point: (100, 0.0057)
Data Point: (464.16, 0.0016245)
Data Point: (1,059.3, 0.0002427972)
Data Point: (2,107.4, 1.492716e-005)
Data Point: (2,154.4, 1.369596e-005)
Data Point: (3,155.6, 4.086672e-006)
Data Point: (4,203.7, 1.82115e-006)
Data Point: (5,251.9, 9.03222e-007)
Data Point: (6,300, 4.30521e-007)
Data Point: (7,348.1, 2.028516e-007)
Data Point: (8,396.3, 7.73661e-008)
Data Point: (9,444.4, 2.691312e-008)
Data Point: (10,000, 2.691312e-008)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Upper Rock

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.567)
Data Point: (0.01, 0.567)
Data Point: (10,000, 0.567)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Till

Model: Hyd K Data Point Function

Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.000567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.000567)
Data Point: (0.01, 0.000567)
Data Point: (10,000, 0.000567)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

GC 5.7 E-4 ft/day
Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.00057
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (10, 0.00057)
Data Point: (1,000, 9e-006)
Data Point: (5,000, 5e-006)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Hydraulic K Modifier Functions

1D consol derived k function rmu2 clay
Model: Spline Data Point Function (Y Log)
Function: K-Modifier vs. Y-Effective Stress
Curve Fit to Data: 100 %
Segment Curvature: 75 %
Y-Intercept: 1.2
Data Points: Y-Effective Stress (psf), K-Modifier
Data Point: (1,000, 1.2)
Data Point: (2,000, 1)
Data Point: (4,000, 0.839)
Data Point: (8,000, 0.70417211)
Data Point: (12,000, 0.63551782)
Data Point: (16,000, 0.59090577)

Vol. Water Content Functions

Clay soils OC

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 7e-005 /psf
Saturated Water Content: 0.31427274 ft^3/ft^3
Residual Water Content: 0.031427274 ft^3/ft^3
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.31427274
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.29999999)
Data Point: (0.018329807, 0.29999998)
Data Point: (0.033598183, 0.29999996)
Data Point: (0.061584821, 0.29999991)
Data Point: (0.11288379, 0.29999982)
Data Point: (0.20691381, 0.29999962)
Data Point: (0.37926902, 0.29999917)
Data Point: (0.6951928, 0.29999814)
Data Point: (1.274275, 0.29999578)
Data Point: (2.3357215, 0.29999026)
Data Point: (4.2813324, 0.2999772)
Data Point: (7.8475997, 0.29994599)
Data Point: (14.384499, 0.29987093)
Data Point: (26.366509, 0.29968944)
Data Point: (48.329302, 0.29924951)
Data Point: (88.586679, 0.29818464)
Data Point: (162.37767, 0.29563126)
Data Point: (297.63514, 0.28967022)
Data Point: (545.55948, 0.27661743)
Data Point: (1,000, 0.25163343)
Estimation Properties
Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.3 ft^3/ft^3
Sample Material: Clay
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Clay soils

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 0.0004 /psf
Saturated Water Content: 0.60995302 ft^3/ft^3
Residual Water Content: 0.060995302 ft^3/ft^3
Curve Fit to Data: 100 %
Segment Curvature: 100 %

Porosity: 0.60995302
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.43999998)
Data Point: (0.018329807, 0.43999997)
Data Point: (0.033598183, 0.43999994)
Data Point: (0.061584821, 0.43999987)
Data Point: (0.11288379, 0.43999974)
Data Point: (0.20691381, 0.43999944)
Data Point: (0.37926902, 0.43999878)
Data Point: (0.6951928, 0.43999728)
Data Point: (1.274275, 0.43999381)
Data Point: (2.3357215, 0.43998571)
Data Point: (4.2813324, 0.43996655)
Data Point: (7.8475997, 0.43992079)
Data Point: (14.384499, 0.4398107)
Data Point: (26.366509, 0.43954452)
Data Point: (48.329302, 0.43889927)
Data Point: (88.586679, 0.43733747)
Data Point: (162.37767, 0.43359251)
Data Point: (297.63514, 0.42484965)
Data Point: (545.55948, 0.40570556)
Data Point: (1,000, 0.36906236)
Estimation Properties
Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.44 ft^3/ft^3
Sample Material: Clay
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Till

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 5e-006 /psf
Saturated Water Content: 0.20000173 ft^3/ft^3
Residual Water Content: 0.020000173 ft^3/ft^3
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.20000173
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.19999999)
Data Point: (0.018329807, 0.19999999)
Data Point: (0.033598183, 0.19999997)
Data Point: (0.061584821, 0.19999993)
Data Point: (0.11288379, 0.19999985)
Data Point: (0.20691381, 0.19999967)
Data Point: (0.37926902, 0.19999922)
Data Point: (0.6951928, 0.19999811)
Data Point: (1.274275, 0.19999535)

Data Point: (2.3357215, 0.19998838)
Data Point: (4.2813324, 0.19997056)
Data Point: (7.8475997, 0.19992471)
Data Point: (14.384499, 0.19980625)
Data Point: (26.366509, 0.19949952)
Data Point: (48.329302, 0.19870702)
Data Point: (88.586679, 0.19668084)
Data Point: (162.37767, 0.19165467)
Data Point: (297.63514, 0.18009116)
Data Point: (545.55948, 0.15752337)
Data Point: (1,000, 0.12453739)
Estimation Properties
Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.2 ft³/ft³
Sample Material: Silty Clay
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

silty sand
Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 1e-005 /psf
Saturated Water Content: 0.30000011 ft³/ft³
Residual Water Content: 0.030000011 ft³/ft³
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.30000011
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
Data Point: (0.01, 0.29999996)
Data Point: (0.018329807, 0.29999991)
Data Point: (0.033598183, 0.29999977)
Data Point: (0.061584821, 0.29999942)
Data Point: (0.11288379, 0.29999854)
Data Point: (0.20691381, 0.29999626)
Data Point: (0.37926902, 0.29999039)
Data Point: (0.6951928, 0.29997521)
Data Point: (1.274275, 0.29993588)
Data Point: (2.3357215, 0.29983385)
Data Point: (4.2813324, 0.29956912)
Data Point: (7.8475997, 0.29888334)
Data Point: (14.384499, 0.29711648)
Data Point: (26.366509, 0.29263189)
Data Point: (48.329302, 0.28167657)
Data Point: (88.586679, 0.25725429)
Data Point: (162.37767, 0.21239326)
Data Point: (297.63514, 0.15298031)
Data Point: (545.55948, 0.099847233)
Data Point: (1,000, 0.064649441)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0.3 ft^3/ft^3

Sample Material: Silty Sand

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	320
Point 16	1,023.75	319.25
Point 17	897.25	319.5
Point 18	991.25	345.25
Point 19	1,000	349.5
Point 20	1,016.25	350
Point 21	997.75	348.5
Point 22	992.5	347
Point 23	978.5	349.75
Point 24	985.75	350
Point 25	972.4	344.55
Point 26	971.5	349.5
Point 27	910.4	372.6
Point 28	910.6	375.1

Point 29	895.4	371.1
Point 30	895.7	373.6
Point 31	806.4	402.8
Point 32	806.2	400.3
Point 33	791.2	398.8
Point 34	791.4	401.3
Point 35	693	431
Point 36	693	434
Point 37	844.5	307.25
Point 38	842.25	301.25
Point 39	812.5	305.5
Point 40	812.25	301.75
Point 41	732	309.25
Point 42	732	307.25
Point 43	732	303.25
Point 44	883	375
Point 45	751	276
Point 46	751	268
Point 47	854.5	305.25
Point 48	872.5	287.25
Point 49	981.25	300.5
Point 50	1,081.25	276
Point 51	1,080.75	285.5
Point 52	1,080	300.75
Point 53	1,081.25	269.75
Point 54	1,081.25	259
Point 55	812.25	308
Point 56	844.5	304.75
Point 57	851.75	304.5
Point 58	984	344.9
Point 59	732	300
Point 60	854	301
Point 61	981	297
Point 62	1,080	298
Point 63	1,195	298
Point 64	693	399.3332
Point 65	693	375
Point 66	693	349.776
Point 67	693	320

Point 68	693	309.8841
Point 69	693	307.7256
Point 70	693	303.8841
Point 71	693	300.629
Point 72	693	287.25
Point 73	693	275.7081
Point 74	693	267.6094
Point 75	693	258.2508
Point 76	883	320
Point 77	922.5817	328
Point 78	1,021.75	328
Point 79	944	335.1869
Point 80	1,020	335

Lines

	Start Point	End Point	Stress/Strain Boundary
Line 1	35	33	
Line 2	33	32	
Line 3	32	44	
Line 4	44	29	
Line 5	29	27	
Line 6	27	23	
Line 7	23	26	
Line 8	37	55	
Line 9	55	41	
Line 10	42	39	
Line 11	39	56	
Line 12	56	57	
Line 13	57	47	
Line 14	47	37	
Line 15	47	17	
Line 16	25	58	
Line 17	24	23	
Line 18	15	16	
Line 19	16	17	
Line 20	15	14	
Line 21	14	13	
Line 22	13	12	

Line 23	12	10	
Line 24	10	11	
Line 25	11	9	
Line 26	9	8	
Line 27	8	7	Fixed X
Line 28	7	52	
Line 29	52	49	
Line 30	49	47	
Line 31	4	6	Fixed X
Line 32	4	3	Fixed X
Line 33	3	5	Fixed X
Line 34	46	2	
Line 35	2	53	
Line 36	53	3	
Line 37	5	54	Fixed X/Y
Line 38	45	1	
Line 39	1	50	
Line 40	50	4	
Line 41	48	51	
Line 42	51	6	
Line 43	43	40	
Line 44	40	38	
Line 45	38	57	
Line 46	36	35	Fixed X
Line 47	24	28	
Line 48	28	30	
Line 49	30	31	
Line 50	31	34	
Line 51	34	36	
Line 52	7	63	Fixed X
Line 53	63	6	Fixed X
Line 54	62	63	
Line 55	60	61	
Line 56	61	62	
Line 57	38	60	
Line 58	59	40	
Line 59	33	64	
Line 60	44	65	
Line 61	26	66	

Line 62	41	68	
Line 63	69	42	
Line 64	70	43	
Line 65	71	59	
Line 66	72	48	
Line 67	73	45	
Line 68	74	46	
Line 69	54	75	Fixed X/Y
Line 70	64	35	Fixed X
Line 71	65	64	Fixed X
Line 72	66	65	Fixed X
Line 73	26	76	
Line 74	67	66	Fixed X
Line 75	76	67	
Line 76	76	17	
Line 77	76	37	
Line 78	68	69	Fixed X
Line 79	70	69	Fixed X
Line 80	71	70	Fixed X
Line 81	72	71	Fixed X
Line 82	73	72	Fixed X
Line 83	74	73	Fixed X
Line 84	75	74	Fixed X
Line 85	17	77	
Line 86	78	15	
Line 87	77	79	
Line 88	79	25	
Line 89	77	78	
Line 90	79	80	
Line 91	80	78	
Line 92	24	22	
Line 93	22	19	
Line 94	19	20	
Line 95	20	80	
Line 96	58	24	
Line 97	68	67	Fixed X

Regions

	Points	Area (ft^2)	Material
Region 1	35,33,64	1,554.8	
Region 2	64,33,32,44,65	3,703.1	
Region 3	44,29,27,23,26,66,65	6,228	
Region 4	69,42,39,56,57,47,37,55,41,68	357.53	Upper Till
Region 5	17,77,79,25,58,24,23,26,76	490.49	
Region 6	17,77,78,15,16	975.4	
Region 7	47,17,16,15,14,13,12,10,11,9,8,7,52,49	5,551.3	Upper Till
Region 8	74,46,2,53,3,5,54,75	5,092.1	UPPER SHALE
Region 9	73,45,1,50,4,3,53,2,46,74	3,618.8	Lower Till
Region 10	72,48,51,6,4,50,1,45,73	5,119.8	infinitesand
Region 11	71,59,40,38,60,61,62,63,6,51,48,72	6,390.3	infinite clay
Region 12	69,42,39,56,57,38,40,43,70	590.69	GC OverConsolidated
Region 13	35,33,32,44,29,27,23,24,28,30,31,34,36	773.09	
Region 14	70,43,40,59,71	257.26	GC OverConsolidated
Region 15	38,57,47,49,52,7,63,62,61,60	1,187.5	GC OverConsolidated
Region 16	67,66,26,76	6,948.8	
Region 17	37,47,17,76	214.47	Upper Till
Region 18	68,41,55,37,76,67	1,964.3	Upper Till
Region 19	77,79,80,78	622.19	
Region 20	24,22,19,20,80,79,25,58	724.07	

Figure 15 Coupled Consolidation – Pore pressures 3 day Elapsed Time – Cohesive Fill

MSE step 1 (4)

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Revision Number: 636
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/25/2013
Time: 9:51:45 PM
File Name: RMU2X1350mse21.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE_C8\
Last Solved Date: 2/25/2013
Last Solved Time: 9:52:22 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Stiffness Units: psf
Unit Weight of Water: 62.4 pcf
Air Pressure: 101.33 psf
View: 2D

Analysis Settings

MSE step 1 (4)

Description: Fill at once
Kind: SIGMA/W
Parent: Insitu
Method: Coupled Stress/PWP
Settings
- Initial Stress: Parent Analysis
- Initial PWP: Parent Analysis
- Exclude cumulative values: Yes

Control
- Apply Body Force in All Steps: No
- Saturated Zone Only: No

Convergence
- Maximum Number of Iterations: 50
- Minimum Pressure Head Difference: 0.001
- Minimum Displacement Difference: 0.001

Significant Digits: 3
Hydraulic Under-Relaxation Criteria
Under-Relaxation Initial Rate: 1
Under-Relaxation Min. Rate: 0.1
Under-Relaxation Reduction Rate: 0.65
Under-Relaxation Iterations: 10
Equation Solver: Parallel Direct
Time
Starting Time: 0 days
Duration: 30 days
# of Steps: 10
Step Generation Method: Linear
Save Steps Every: 1

Materials

Upper Till

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 300,000 psf
Unit Weight: 125 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Upper Glacial Till
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

GC-Drained

Model: Soft Clay (MCC w/ PWP Change)
Stress Strain
O.C. Ratio: 4
Poisson's Ratio: 0.334
Lambda: 0.14
Kappa: 0.013
Initial Void Ratio: 1
Unit Weight: 118 pcf
Phi': 27 °
Hydraulic
Vol. WC. Function: Clay soils
K-Function: GC 5.7 E-4 ft/day
Ky'/Kx' Ratio: 1
Rotation: 0 °
K-Modifier Function: 1D consol derived k function rmu2 clay
Load Response Ratio: 1

GC OverConsolidated

Model: Soft Clay (MCC w/ PWP Change)
Stress Strain
O.C. Ratio: 6

Poisson's Ratio: 0.334
Lambda: 0.06
Kappa: 0.01
Initial Void Ratio: 0.5
Unit Weight: 125 pcf
Phi': 30 °
Hydraulic
Vol. WC. Function: Clay soils OC
K-Function: GC 5.7 E-4 ft/day
Ky'/Kx' Ratio: 1
Rotation: 0 °
K-Modifier Function: 1D consol derived k function rmu2 clay
Load Response Ratio: 1

Sand/Silt

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 300,000 psf
Unit Weight: 135 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: silty sand
K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec
Ky'/Kx' Ratio: 0.1
Rotation: 0 °
Load Response Ratio: 1

Lower Till

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 600,000 psf
Unit Weight: 145 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Till
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

STRUCTURAL FILL

Model: Linear Elastic (Effective)
Stress Strain
Effective Young's Modulus (E'): 100,000 psf
Unit Weight: 130 pcf
Poisson's Ratio: 0.334

UPPER SHALE

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 1,000,000 psf
Unit Weight: 145 pcf

Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Upper Rock
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

NOT ACTIVE

Model: (none)

Boundary Conditions

Fixed X

X: X-Displacement 0

Fixed X/Y

X: X-Displacement 0
Y: Y-Displacement 0

Drainage

Type: Head (H) 315.5
Review: No

drainage 313

Type: Head (H) 313
Review: No

Initial Water Tables

Initial Water Table 1

Max. negative head: 5
Coordinates
Coordinate 1: (200, 315.5) ft
Coordinate 2: (1,200, 315.5) ft

K Functions

Silty Sand, k = 0.567 ft/day 2 E-4cm/sec

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.567)
Data Point: (0.01, 0.567)
Data Point: (0.035938, 0.567)

Data Point: (0.12915, 0.567)
Data Point: (0.46416, 0.567)
Data Point: (1.1111, 0.567)
Data Point: (1.6681, 0.567)
Data Point: (5.9948, 0.567)
Data Point: (21.544, 0.567)
Data Point: (77.426, 0.567)
Data Point: (105.93, 0.5402376)
Data Point: (210.74, 0.3387258)
Data Point: (278.26, 0.2567376)
Data Point: (315.56, 0.2232846)
Data Point: (420.37, 0.1406916)
Data Point: (525.19, 0.0779121)
Data Point: (630, 0.03843882)
Data Point: (734.81, 0.01673406)
Data Point: (839.63, 0.005422788)
Data Point: (944.44, 0.000745983)
Data Point: (1,000, 7.14735e-005)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Upper Glacial Till

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.0057
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.0057)
Data Point: (0.01, 0.0057)
Data Point: (0.046416, 0.0057)
Data Point: (0.21544, 0.0057)
Data Point: (1, 0.0057)
Data Point: (4.6416, 0.0057)
Data Point: (11.111, 0.0057)
Data Point: (21.544, 0.0057)
Data Point: (100, 0.0057)
Data Point: (464.16, 0.0016245)
Data Point: (1,059.3, 0.0002427972)
Data Point: (2,107.4, 1.492716e-005)
Data Point: (2,154.4, 1.369596e-005)
Data Point: (3,155.6, 4.086672e-006)
Data Point: (4,203.7, 1.82115e-006)
Data Point: (5,251.9, 9.03222e-007)
Data Point: (6,300, 4.30521e-007)
Data Point: (7,348.1, 2.028516e-007)
Data Point: (8,396.3, 7.73661e-008)

Data Point: (9,444.4, 2.691312e-008)
Data Point: (10,000, 2.691312e-008)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Upper Rock

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.567)
Data Point: (0.01, 0.567)
Data Point: (10,000, 0.567)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Till

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.000567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.000567)
Data Point: (0.01, 0.000567)
Data Point: (10,000, 0.000567)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

GC 5.7 E-4 ft/day

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.00057

Data Points: Matric Suction (psf), X-Conductivity (ft/days)

Data Point: (10, 0.00057)

Data Point: (1,000, 9e-006)

Data Point: (5,000, 5e-006)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Hydraulic K Sat: 0 ft/days

Residual Water Content: 0 ft^3/ft^3

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

Hydraulic K Modifier Functions

1D consol derived k function rmu2 clay

Model: Spline Data Point Function (Y Log)

Function: K-Modifier vs. Y-Effective Stress

Curve Fit to Data: 100 %

Segment Curvature: 75 %

Y-Intercept: 1.2

Data Points: Y-Effective Stress (psf), K-Modifier

Data Point: (1,000, 1.2)

Data Point: (2,000, 1)

Data Point: (4,000, 0.839)

Data Point: (8,000, 0.70417211)

Data Point: (12,000, 0.63551782)

Data Point: (16,000, 0.59090577)

Vol. Water Content Functions

Clay soils OC

Model: Vol WC Data Point Function

Function: Vol. Water Content vs. Pore-Water Pressure

Mv: 7e-005 /psf

Saturated Water Content: 0.31427274 ft^3/ft^3

Residual Water Content: 0.031427274 ft^3/ft^3

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0.31427274

Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.29999999)

Data Point: (0.018329807, 0.29999998)

Data Point: (0.033598183, 0.29999996)

Data Point: (0.061584821, 0.29999991)

Data Point: (0.11288379, 0.29999982)

Data Point: (0.20691381, 0.29999962)

Data Point: (0.37926902, 0.29999917)

Data Point: (0.6951928, 0.29999814)

Data Point: (1.274275, 0.29999578)

Data Point: (2.3357215, 0.29999026)
Data Point: (4.2813324, 0.2999772)
Data Point: (7.8475997, 0.29994599)
Data Point: (14.384499, 0.29987093)
Data Point: (26.366509, 0.29968944)
Data Point: (48.329302, 0.29924951)
Data Point: (88.586679, 0.29818464)
Data Point: (162.37767, 0.29563126)
Data Point: (297.63514, 0.28967022)
Data Point: (545.55948, 0.27661743)
Data Point: (1,000, 0.25163343)

Estimation Properties

Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.3 ft³/ft³
Sample Material: Clay
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Clay soils

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Mv: 0.0004 /psf
Saturated Water Content: 0.60995302 ft³/ft³
Residual Water Content: 0.060995302 ft³/ft³
Curve Fit to Data: 100 %
Segment Curvature: 100 %

Porosity: 0.60995302
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)

Data Point: (0.01, 0.43999998)
Data Point: (0.018329807, 0.43999997)
Data Point: (0.033598183, 0.43999994)
Data Point: (0.061584821, 0.43999987)
Data Point: (0.11288379, 0.43999974)
Data Point: (0.20691381, 0.43999944)
Data Point: (0.37926902, 0.43999878)
Data Point: (0.6951928, 0.43999728)
Data Point: (1.274275, 0.43999381)
Data Point: (2.3357215, 0.43998571)
Data Point: (4.2813324, 0.43996655)
Data Point: (7.8475997, 0.43992079)
Data Point: (14.384499, 0.4398107)
Data Point: (26.366509, 0.43954452)
Data Point: (48.329302, 0.43889927)
Data Point: (88.586679, 0.43733747)
Data Point: (162.37767, 0.43359251)
Data Point: (297.63514, 0.42484965)
Data Point: (545.55948, 0.40570556)
Data Point: (1,000, 0.36906236)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0.44 ft^3/ft^3

Sample Material: Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

Till

Model: Vol WC Data Point Function

Function: Vol. Water Content vs. Pore-Water Pressure

Mv: 5e-006 /psf

Saturated Water Content: 0.20000173 ft^3/ft^3

Residual Water Content: 0.020000173 ft^3/ft^3

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0.20000173

Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.19999999)

Data Point: (0.018329807, 0.19999999)

Data Point: (0.033598183, 0.19999997)

Data Point: (0.061584821, 0.19999993)

Data Point: (0.11288379, 0.19999985)

Data Point: (0.20691381, 0.19999967)

Data Point: (0.37926902, 0.19999922)

Data Point: (0.6951928, 0.19999811)

Data Point: (1.274275, 0.19999535)

Data Point: (2.3357215, 0.19998838)

Data Point: (4.2813324, 0.19997056)

Data Point: (7.8475997, 0.19992471)

Data Point: (14.384499, 0.19980625)

Data Point: (26.366509, 0.19949952)

Data Point: (48.329302, 0.19870702)

Data Point: (88.586679, 0.19668084)

Data Point: (162.37767, 0.19165467)

Data Point: (297.63514, 0.18009116)

Data Point: (545.55948, 0.15752337)

Data Point: (1,000, 0.12453739)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0.2 ft^3/ft^3

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

silty sand

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 1e-005 /psf
Saturated Water Content: 0.30000011 ft^3/ft^3
Residual Water Content: 0.030000011 ft^3/ft^3
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.30000011
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.29999996)
Data Point: (0.018329807, 0.29999991)
Data Point: (0.033598183, 0.29999977)
Data Point: (0.061584821, 0.29999942)
Data Point: (0.11288379, 0.29999854)
Data Point: (0.20691381, 0.29999626)
Data Point: (0.37926902, 0.29999039)
Data Point: (0.6951928, 0.29997521)
Data Point: (1.274275, 0.29993588)
Data Point: (2.3357215, 0.29983385)
Data Point: (4.2813324, 0.29956912)
Data Point: (7.8475997, 0.29888334)
Data Point: (14.384499, 0.29711648)
Data Point: (26.366509, 0.29263189)
Data Point: (48.329302, 0.28167657)
Data Point: (88.586679, 0.25725429)
Data Point: (162.37767, 0.21239326)
Data Point: (297.63514, 0.15298031)
Data Point: (545.55948, 0.099847233)
Data Point: (1,000, 0.064649441)
Estimation Properties
Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.3 ft^3/ft^3
Sample Material: Silty Sand
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75

Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	320
Point 16	1,023.75	319.25
Point 17	897.25	319.5
Point 18	991.25	345.25
Point 19	1,000	349.5
Point 20	1,016.25	350
Point 21	997.75	348.5
Point 22	992.5	347
Point 23	978.5	349.75
Point 24	985.75	350
Point 25	972.4	344.55
Point 26	971.5	349.5
Point 27	910.4	372.6
Point 28	910.6	375.1
Point 29	895.4	371.1
Point 30	895.7	373.6
Point 31	806.4	402.8
Point 32	806.2	400.3
Point 33	791.2	398.8
Point 34	791.4	401.3
Point 35	693	431
Point 36	693	434
Point 37	844.5	307.25
Point 38	842.25	301.25
Point 39	812.5	305.5
Point 40	812.25	301.75
Point 41	732	309.25
Point 42	732	307.25
Point 43	732	303.25
Point 44	883	375

Point 45	751	276
Point 46	751	268
Point 47	854.5	305.25
Point 48	872.5	287.25
Point 49	981.25	300.5
Point 50	1,081.25	276
Point 51	1,080.75	285.5
Point 52	1,080	300.75
Point 53	1,081.25	269.75
Point 54	1,081.25	259
Point 55	812.25	308
Point 56	844.5	304.75
Point 57	851.75	304.5
Point 58	984	344.9
Point 59	732	300
Point 60	854	301
Point 61	981	297
Point 62	1,080	298
Point 63	1,195	298
Point 64	693	399.3332
Point 65	693	375
Point 66	693	349.776
Point 67	693	320
Point 68	693	309.8841
Point 69	693	307.7256
Point 70	693	303.8841
Point 71	693	300.629
Point 72	693	287.25
Point 73	693	275.7081
Point 74	693	267.6094
Point 75	693	258.2508
Point 76	883	320
Point 77	922.5817	328
Point 78	1,021.75	328
Point 79	944	335.1869
Point 80	1,020	335

Lines

	Start Point	End Point	Stress/Strain Boundary	Hydraulic Boundary
Line 1	35	33		
Line 2	33	32		
Line 3	32	44		
Line 4	44	29		
Line 5	29	27		
Line 6	27	23		
Line 7	23	26		
Line 8	37	55		
Line 9	55	41		
Line 10	42	39		
Line 11	39	56		
Line 12	56	57		
Line 13	57	47		
Line 14	47	37		
Line 15	47	17		
Line 16	25	58		
Line 17	24	23		
Line 18	15	16		
Line 19	16	17		
Line 20	15	14		
Line 21	14	13		
Line 22	13	12		
Line 23	12	10		
Line 24	10	11		
Line 25	11	9		
Line 26	9	8		
Line 27	8	7	Fixed X	
Line 28	7	52		
Line 29	52	49		
Line 30	49	47		
Line 31	4	6	Fixed X	drainage 313
Line 32	4	3	Fixed X	drainage 313
Line 33	3	5	Fixed X	drainage 313
Line 34	46	2		
Line 35	2	53		
Line 36	53	3		
Line 37	5	54	Fixed X/Y	drainage 313

Line 38	45	1		
Line 39	1	50		
Line 40	50	4		
Line 41	48	51		
Line 42	51	6		
Line 43	43	40		
Line 44	40	38		
Line 45	38	57		
Line 46	36	35	Fixed X	
Line 47	24	28		
Line 48	28	30		
Line 49	30	31		
Line 50	31	34		
Line 51	34	36		
Line 52	7	63	Fixed X	
Line 53	63	6	Fixed X	
Line 54	62	63		
Line 55	60	61		
Line 56	61	62		
Line 57	38	60		
Line 58	59	40		
Line 59	33	64		
Line 60	44	65		
Line 61	26	66		
Line 62	41	68		
Line 63	69	42		
Line 64	70	43		
Line 65	71	59		
Line 66	72	48		
Line 67	73	45		
Line 68	74	46		
Line 69	54	75	Fixed X/Y	Drainage
Line 70	64	35	Fixed X	
Line 71	65	64	Fixed X	
Line 72	66	65	Fixed X	
Line 73	26	76		
Line 74	67	66	Fixed X	
Line 75	76	67		
Line 76	76	17		

Line 77	76	37		
Line 78	68	69	Fixed X	
Line 79	70	69	Fixed X	
Line 80	71	70	Fixed X	
Line 81	72	71	Fixed X	
Line 82	73	72	Fixed X	Drainage
Line 83	74	73	Fixed X	Drainage
Line 84	75	74	Fixed X	Drainage
Line 85	17	77		
Line 86	78	15		
Line 87	77	79		
Line 88	79	25		
Line 89	77	78		
Line 90	79	80		
Line 91	80	78		
Line 92	24	22		
Line 93	22	19		
Line 94	19	20		
Line 95	20	80		
Line 96	58	24		
Line 97	68	67	Fixed X	

Regions

	Material	Points	Area (ft^2)
Region 1	NOT ACTIVE	35,33,64	1,554.8
Region 2	NOT ACTIVE	64,33,32,44,65	3,703.1
Region 3	NOT ACTIVE	44,29,27,23,26,66,65	6,228
Region 4	Upper Till	69,42,39,56,57,47,37,55,41,68	357.53
Region 5	NOT ACTIVE	17,77,79,25,58,24,23,26,76	490.49
Region 6	STRUCTURAL FILL	17,77,78,15,16	975.4
Region 7	Upper Till	47,17,16,15,14,13,12,10,11,9,8,7,52,49	5,551.3
Region 8	UPPER SHALE	74,46,2,53,3,5,54,75	5,092.1
Region 9	Lower Till	73,45,1,50,4,3,53,2,46,74	3,618.8
Region 10	Sand/Silt	72,48,51,6,4,50,1,45,73	5,119.8
Region 11	GC-Drained	71,59,40,38,60,61,62,63,6,51,48,72	6,390.3
Region 12	GC OverConsolidated	69,42,39,56,57,38,40,43,70	590.69
Region 13	NOT ACTIVE	35,33,32,44,29,27,23,24,28,30,31,34,36	773.09
Region 14	GC OverConsolidated	70,43,40,59,71	257.26

Region 15	GC OverConsolidated	38,57,47,49,52,7,63,62,61,60	1,187.5
Region 16	NOT ACTIVE	67,66,26,76	6,948.8
Region 17	Upper Till	37,47,17,76	214.47
Region 18	Upper Till	68,41,55,37,76,67	1,964.3
Region 19	STRUCTURAL FILL	77,79,80,78	622.19
Region 20	STRUCTURAL FILL	24,22,19,20,80,79,25,58	724.07

Figure 16 Coupled Consolidation – Pore pressures 3 day Elapsed Time – Cohesionless Fill

MSE step 1 cohesionless

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 595
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/16/2013
Time: 4:07:23 PM
File Name: RMU2X1350mse21.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE_C8\
Last Solved Date: 2/16/2013
Last Solved Time: 4:07:48 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Stiffness Units: psf
Unit Weight of Water: 62.4 pcf
Air Pressure: 101.33 psf
View: 2D

Analysis Settings

MSE step 1 cohesionless

Description: Fill at once
Kind: SIGMA/W
Parent: Insitu
Method: Coupled Stress/PWP
Settings
 Initial Stress: Parent Analysis
 Initial PWP: Parent Analysis
 Exclude cumulative values: Yes
Control
 Apply Body Force in All Steps: No
 Saturated Zone Only: No
Convergence
 Maximum Number of Iterations: 50
 Minimum Pressure Head Difference: 0.001

Minimum Displacement Difference: 0.001
Significant Digits: 3
Hydraulic Under-Relaxation Criteria
Under-Relaxation Initial Rate: 1
Under-Relaxation Min. Rate: 0.1
Under-Relaxation Reduction Rate: 0.65
Under-Relaxation Iterations: 10
Equation Solver: Parallel Direct
Time
Starting Time: 0 days
Duration: 30 days
# of Steps: 10
Step Generation Method: Linear
Save Steps Every: 1

Materials

Upper Till
Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 300,000 psf
Unit Weight: 125 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Upper Glacial Till
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

GC-Drained
Model: Soft Clay (MCC w/ PWP Change)
Stress Strain
O.C. Ratio: 4
Poisson's Ratio: 0.334
Lambda: 0.14
Kappa: 0.013
Initial Void Ratio: 1
Unit Weight: 118 pcf
Phi': 27 °
Hydraulic
Vol. WC. Function: Clay soils
K-Function: GC 5.7 E-4 ft/day
Ky'/Kx' Ratio: 1
Rotation: 0 °
K-Modifier Function: 1D consol derived k function rmu2 clay
Load Response Ratio: 1

GC OverConsolidated
Model: Soft Clay (MCC w/ PWP Change)
Stress Strain

O.C. Ratio: 6
Poisson's Ratio: 0.334
Lambda: 0.06
Kappa: 0.01
Initial Void Ratio: 0.5
Unit Weight: 125 pcf
Phi': 30 °
Hydraulic
Vol. WC. Function: Clay soils OC
K-Function: GC 5.7 E-4 ft/day
Ky'/Kx' Ratio: 1
Rotation: 0 °
K-Modifier Function: 1D consol derived k function rmu2 clay
Load Response Ratio: 1

Sand/Silt

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 300,000 psf
Unit Weight: 135 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: silty sand
K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec
Ky'/Kx' Ratio: 0.1
Rotation: 0 °
Load Response Ratio: 1

Lower Till

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 600,000 psf
Unit Weight: 145 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Till
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

UPPER SHALE

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 1,000,000 psf
Unit Weight: 145 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Upper Rock
Ky'/Kx' Ratio: 1
Rotation: 0 °

Load Response Ratio: 1

NOT ACTIVE

Model: (none)

Structural Fill Cohesionless

Model: Linear Elastic (Effective)

Stress Strain

Effective Young's Modulus (E'): 100,000 psf

Unit Weight: 120 pcf

Poisson's Ratio: 0.334

Boundary Conditions

Fixed X

X: X-Displacement 0

Fixed X/Y

X: X-Displacement 0

Y: Y-Displacement 0

Drainage

Type: Head (H) 315.5

Review: No

drainage 313

Type: Head (H) 313

Review: No

Initial Water Tables

Initial Water Table 1

Max. negative head: 5

Coordinates

Coordinate 1: (200, 315.5) ft

Coordinate 2: (1,200, 315.5) ft

K Functions

Silty Sand, k = 0.567 ft/day 2 E-4cm/sec

Model: Hyd K Data Point Function

Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 36 %

K-Saturation: 0.567

Data Points: Matric Suction (psf), X-Conductivity (ft/days)

Data Point: (0.005, 0.567)

Data Point: (0.01, 0.567)

Data Point: (0.035938, 0.567)
Data Point: (0.12915, 0.567)
Data Point: (0.46416, 0.567)
Data Point: (1.1111, 0.567)
Data Point: (1.6681, 0.567)
Data Point: (5.9948, 0.567)
Data Point: (21.544, 0.567)
Data Point: (77.426, 0.567)
Data Point: (105.93, 0.5402376)
Data Point: (210.74, 0.3387258)
Data Point: (278.26, 0.2567376)
Data Point: (315.56, 0.2232846)
Data Point: (420.37, 0.1406916)
Data Point: (525.19, 0.0779121)
Data Point: (630, 0.03843882)
Data Point: (734.81, 0.01673406)
Data Point: (839.63, 0.005422788)
Data Point: (944.44, 0.000745983)
Data Point: (1,000, 7.14735e-005)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Upper Glacial Till

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.0057
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.0057)
Data Point: (0.01, 0.0057)
Data Point: (0.046416, 0.0057)
Data Point: (0.21544, 0.0057)
Data Point: (1, 0.0057)
Data Point: (4.6416, 0.0057)
Data Point: (11.111, 0.0057)
Data Point: (21.544, 0.0057)
Data Point: (100, 0.0057)
Data Point: (464.16, 0.0016245)
Data Point: (1,059.3, 0.0002427972)
Data Point: (2,107.4, 1.492716e-005)
Data Point: (2,154.4, 1.369596e-005)
Data Point: (3,155.6, 4.086672e-006)
Data Point: (4,203.7, 1.82115e-006)
Data Point: (5,251.9, 9.03222e-007)
Data Point: (6,300, 4.30521e-007)
Data Point: (7,348.1, 2.028516e-007)

Data Point: (8,396.3, 7.73661e-008)
Data Point: (9,444.4, 2.691312e-008)
Data Point: (10,000, 2.691312e-008)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Upper Rock

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.567)
Data Point: (0.01, 0.567)
Data Point: (10,000, 0.567)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Till

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.000567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.000567)
Data Point: (0.01, 0.000567)
Data Point: (10,000, 0.000567)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

GC 5.7 E-4 ft/day

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %

K-Saturation: 0.00057
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (10, 0.00057)
Data Point: (1,000, 9e-006)
Data Point: (5,000, 5e-006)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Hydraulic K Modifier Functions

1D consol derived k function rmu2 clay

Model: Spline Data Point Function (Y Log)
Function: K-Modifier vs. Y-Effective Stress
Curve Fit to Data: 100 %
Segment Curvature: 75 %
Y-Intercept: 1.2
Data Points: Y-Effective Stress (psf), K-Modifier
Data Point: (1,000, 1.2)
Data Point: (2,000, 1)
Data Point: (4,000, 0.839)
Data Point: (8,000, 0.70417211)
Data Point: (12,000, 0.63551782)
Data Point: (16,000, 0.59090577)

Vol. Water Content Functions

Clay soils OC

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 7e-005 /psf
Saturated Water Content: 0.31427274 ft^3/ft^3
Residual Water Content: 0.031427274 ft^3/ft^3
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.31427274
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.29999999)
Data Point: (0.018329807, 0.29999998)
Data Point: (0.033598183, 0.29999996)
Data Point: (0.061584821, 0.29999991)
Data Point: (0.11288379, 0.29999982)
Data Point: (0.20691381, 0.29999962)
Data Point: (0.37926902, 0.29999917)
Data Point: (0.6951928, 0.29999814)

Data Point: (1.274275, 0.29999578)
Data Point: (2.3357215, 0.29999026)
Data Point: (4.2813324, 0.2999772)
Data Point: (7.8475997, 0.29994599)
Data Point: (14.384499, 0.29987093)
Data Point: (26.366509, 0.29968944)
Data Point: (48.329302, 0.29924951)
Data Point: (88.586679, 0.29818464)
Data Point: (162.37767, 0.29563126)
Data Point: (297.63514, 0.28967022)
Data Point: (545.55948, 0.27661743)
Data Point: (1,000, 0.25163343)

Estimation Properties

Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.3 ft³/ft³
Sample Material: Clay
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Clay soils

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Mv: 0.0004 /psf
Saturated Water Content: 0.60995302 ft³/ft³
Residual Water Content: 0.060995302 ft³/ft³
Curve Fit to Data: 100 %
Segment Curvature: 100 %

Porosity: 0.60995302
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)

Data Point: (0.01, 0.43999998)
Data Point: (0.018329807, 0.43999997)
Data Point: (0.033598183, 0.43999994)
Data Point: (0.061584821, 0.43999987)
Data Point: (0.11288379, 0.43999974)
Data Point: (0.20691381, 0.43999944)
Data Point: (0.37926902, 0.43999878)
Data Point: (0.6951928, 0.43999728)
Data Point: (1.274275, 0.43999381)
Data Point: (2.3357215, 0.43998571)
Data Point: (4.2813324, 0.43996655)
Data Point: (7.8475997, 0.43992079)
Data Point: (14.384499, 0.4398107)
Data Point: (26.366509, 0.43954452)
Data Point: (48.329302, 0.43889927)
Data Point: (88.586679, 0.43733747)
Data Point: (162.37767, 0.43359251)
Data Point: (297.63514, 0.42484965)
Data Point: (545.55948, 0.40570556)

Data Point: (1,000, 0.36906236)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0.44 ft^3/ft^3

Sample Material: Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

Till

Model: Vol WC Data Point Function

Function: Vol. Water Content vs. Pore-Water Pressure

Mv: 5e-006 /psf

Saturated Water Content: 0.20000173 ft^3/ft^3

Residual Water Content: 0.020000173 ft^3/ft^3

Curve Fit to Data: 100 %

Segment Curvature: 100 %

Porosity: 0.20000173

Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.19999999)

Data Point: (0.018329807, 0.19999999)

Data Point: (0.033598183, 0.19999997)

Data Point: (0.061584821, 0.19999993)

Data Point: (0.11288379, 0.19999985)

Data Point: (0.20691381, 0.19999967)

Data Point: (0.37926902, 0.19999922)

Data Point: (0.6951928, 0.19999811)

Data Point: (1.274275, 0.19999535)

Data Point: (2.3357215, 0.19998838)

Data Point: (4.2813324, 0.19997056)

Data Point: (7.8475997, 0.19992471)

Data Point: (14.384499, 0.19980625)

Data Point: (26.366509, 0.19949952)

Data Point: (48.329302, 0.19870702)

Data Point: (88.586679, 0.19668084)

Data Point: (162.37767, 0.19165467)

Data Point: (297.63514, 0.18009116)

Data Point: (545.55948, 0.15752337)

Data Point: (1,000, 0.12453739)

Estimation Properties

Vol. WC Estimation Method: Sample functions

Saturated Water Content: 0.2 ft^3/ft^3

Sample Material: Silty Clay

Liquid Limit: 0 %

Diameter at 10% passing: 0

Diameter at 60% passing: 0

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

silty sand

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 1e-005 /psf
Saturated Water Content: 0.30000011 ft³/ft³
Residual Water Content: 0.030000011 ft³/ft³
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.30000011
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
Data Point: (0.01, 0.29999996)
Data Point: (0.018329807, 0.29999991)
Data Point: (0.033598183, 0.29999977)
Data Point: (0.061584821, 0.29999942)
Data Point: (0.11288379, 0.29999854)
Data Point: (0.20691381, 0.29999626)
Data Point: (0.37926902, 0.29999039)
Data Point: (0.6951928, 0.29997521)
Data Point: (1.274275, 0.29993588)
Data Point: (2.3357215, 0.29983385)
Data Point: (4.2813324, 0.29956912)
Data Point: (7.8475997, 0.29888334)
Data Point: (14.384499, 0.29711648)
Data Point: (26.366509, 0.29263189)
Data Point: (48.329302, 0.28167657)
Data Point: (88.586679, 0.25725429)
Data Point: (162.37767, 0.21239326)
Data Point: (297.63514, 0.15298031)
Data Point: (545.55948, 0.099847233)
Data Point: (1,000, 0.064649441)
Estimation Properties
Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.3 ft³/ft³
Sample Material: Silty Sand
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75

Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	320
Point 16	1,023.75	319.25
Point 17	897.25	319.5
Point 18	991.25	345.25
Point 19	1,000	349.5
Point 20	1,016.25	350
Point 21	997.75	348.5
Point 22	992.5	347
Point 23	978.5	349.75
Point 24	985.75	350
Point 25	972.4	344.55
Point 26	971.5	349.5
Point 27	910.4	372.6
Point 28	910.6	375.1
Point 29	895.4	371.1
Point 30	895.7	373.6
Point 31	806.4	402.8
Point 32	806.2	400.3
Point 33	791.2	398.8
Point 34	791.4	401.3
Point 35	693	431
Point 36	693	434
Point 37	844.5	307.25
Point 38	842.25	301.25
Point 39	812.5	305.5
Point 40	812.25	301.75
Point 41	732	309.25
Point 42	732	307.25
Point 43	732	303.25
Point 44	883	375

Point 45	751	276
Point 46	751	268
Point 47	854.5	305.25
Point 48	872.5	287.25
Point 49	981.25	300.5
Point 50	1,081.25	276
Point 51	1,080.75	285.5
Point 52	1,080	300.75
Point 53	1,081.25	269.75
Point 54	1,081.25	259
Point 55	812.25	308
Point 56	844.5	304.75
Point 57	851.75	304.5
Point 58	984	344.9
Point 59	732	300
Point 60	854	301
Point 61	981	297
Point 62	1,080	298
Point 63	1,195	298
Point 64	693	399.3332
Point 65	693	375
Point 66	693	349.776
Point 67	693	320
Point 68	693	309.8841
Point 69	693	307.7256
Point 70	693	303.8841
Point 71	693	300.629
Point 72	693	287.25
Point 73	693	275.7081
Point 74	693	267.6094
Point 75	693	258.2508
Point 76	883	320
Point 77	922.5817	328
Point 78	1,021.75	328
Point 79	944	335.1869
Point 80	1,020	335

Lines

	Start Point	End Point	Stress/Strain Boundary	Hydraulic Boundary
Line 1	35	33		
Line 2	33	32		
Line 3	32	44		
Line 4	44	29		
Line 5	29	27		
Line 6	27	23		
Line 7	23	26		
Line 8	37	55		
Line 9	55	41		
Line 10	42	39		
Line 11	39	56		
Line 12	56	57		
Line 13	57	47		
Line 14	47	37		
Line 15	47	17		
Line 16	25	58		
Line 17	24	23		
Line 18	15	16		
Line 19	16	17		
Line 20	15	14		
Line 21	14	13		
Line 22	13	12		
Line 23	12	10		
Line 24	10	11		
Line 25	11	9		
Line 26	9	8		
Line 27	8	7	Fixed X	
Line 28	7	52		
Line 29	52	49		
Line 30	49	47		
Line 31	4	6	Fixed X	drainage 313
Line 32	4	3	Fixed X	drainage 313
Line 33	3	5	Fixed X	drainage 313
Line 34	46	2		
Line 35	2	53		
Line 36	53	3		
Line 37	5	54	Fixed X/Y	drainage 313

Line 38	45	1		
Line 39	1	50		
Line 40	50	4		
Line 41	48	51		
Line 42	51	6		
Line 43	43	40		
Line 44	40	38		
Line 45	38	57		
Line 46	36	35	Fixed X	
Line 47	24	28		
Line 48	28	30		
Line 49	30	31		
Line 50	31	34		
Line 51	34	36		
Line 52	7	63	Fixed X	
Line 53	63	6	Fixed X	
Line 54	62	63		
Line 55	60	61		
Line 56	61	62		
Line 57	38	60		
Line 58	59	40		
Line 59	33	64		
Line 60	44	65		
Line 61	26	66		
Line 62	41	68		
Line 63	69	42		
Line 64	70	43		
Line 65	71	59		
Line 66	72	48		
Line 67	73	45		
Line 68	74	46		
Line 69	54	75	Fixed X/Y	Drainage
Line 70	64	35	Fixed X	
Line 71	65	64	Fixed X	
Line 72	66	65	Fixed X	
Line 73	26	76		
Line 74	67	66	Fixed X	
Line 75	76	67		
Line 76	76	17		

Line 77	76	37		
Line 78	68	69	Fixed X	
Line 79	70	69	Fixed X	
Line 80	71	70	Fixed X	
Line 81	72	71	Fixed X	
Line 82	73	72	Fixed X	Drainage
Line 83	74	73	Fixed X	Drainage
Line 84	75	74	Fixed X	Drainage
Line 85	17	77		
Line 86	78	15		
Line 87	77	79		
Line 88	79	25		
Line 89	77	78		
Line 90	79	80		
Line 91	80	78		
Line 92	24	22		
Line 93	22	19		
Line 94	19	20		
Line 95	20	80		
Line 96	58	24		
Line 97	68	67	Fixed X	

Regions

	Material	Points	Area (ft^2)
Region 1	NOT ACTIVE	35,33,64	1,554.8
Region 2	NOT ACTIVE	64,33,32,44,65	3,703.1
Region 3	NOT ACTIVE	44,29,27,23,26,66,65	6,228
Region 4	Upper Till	69,42,39,56,57,47,37,55,41,68	357.53
Region 5	NOT ACTIVE	17,77,79,25,58,24,23,26,76	490.49
Region 6	Structural Fill Cohesionless	17,77,78,15,16	975.4
Region 7	Upper Till	47,17,16,15,14,13,12,10,11,9,8,7,52,49	5,551.3
Region 8	UPPER SHALE	74,46,2,53,3,5,54,75	5,092.1
Region 9	Lower Till	73,45,1,50,4,3,53,2,46,74	3,618.8
Region 10	Sand/Silt	72,48,51,6,4,50,1,45,73	5,119.8
Region 11	GC-Drained	71,59,40,38,60,61,62,63,6,51,48,72	6,390.3
Region 12	GC OverConsolidated	69,42,39,56,57,38,40,43,70	590.69
Region 13	NOT ACTIVE	35,33,32,44,29,27,23,24,28,30,31,34,36	773.09
Region 14	GC OverConsolidated	70,43,40,59,71	257.26

Region 15	GC OverConsolidated	38,57,47,49,52,7,63,62,61,60	1,187.5
Region 16	NOT ACTIVE	67,66,26,76	6,948.8
Region 17	Upper Till	37,47,17,76	214.47
Region 18	Upper Till	68,41,55,37,76,67	1,964.3
Region 19	Structural Fill Cohesionless	77,79,80,78	622.19
Region 20	Structural Fill Cohesionless	24,22,19,20,80,79,25,58	724.07

Figure 17 **Berm Stability @ 3 day Elapsed Time – Cohesive Fill**

Slope Stability MSE - 3 DAYS of Filling (2)

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 594
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/16/2013
Time: 3:55:07 PM
File Name: RMU2X1350mse21.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/16/2013
Last Solved Time: 4:03:56 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Slope Stability MSE - 3 DAYS of Filling (2)

Description: STABILITY ANALYSIS AT END OF CONSTRUCTION. ANALYSIS USES PORE PRESSURES FROM COUPLED CONSOLIDATION ANALYSIS ASSUMING 60.3 DAY TIME OF STEP LOADING AND SHANSEP MODEL FOR REDICTION OF UNDRAINED STRENGTH OF GC
Kind: SLOPE/W
Parent: MSE step 1 (4)
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.5
  - Lambda 5: -0.4
  - Lambda 6: -0.2

Lambda 7: 0
Lambda 8: 0.2
Lambda 9: 0.4
Lambda 10: 0.6
Lambda 11: 0.8
Lambda 12: 1
PWP Conditions Source: Parent Analysis
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 1
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.002
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °

Deflection surface

Model: Bedrock (Impenetrable)

NOT ACTIVE

Model: (None)

STRUCTURAL FILL UNDRAINED

Model: Undrained (Phi=0)
Unit Weight: 128 pcf
Cohesion': 2,000 psf

GC-UNDRAINED

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: SHANSEP CONSOLIDATED UNDRAINED-STATIC
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (920, 327.13372) ft
Left-Zone Right Coordinate: (1,000, 349.5) ft
Left-Zone Increment: 20
Right Projection: Range
Right-Zone Left Coordinate: (1,030, 320) ft
Right-Zone Right Coordinate: (1,080, 319.56818) ft
Right-Zone Increment: 20
Radius Increments: 15

Slip Surface Limits

Left Coordinate: (900, 320.42276) ft
Right Coordinate: (1,131.413, 317.87465) ft

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 318.5) ft
Inside Point: (993, 318.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 0.75
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft

Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 0.75
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft
Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic

Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (991.003, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.372 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft
Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes

Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs

Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (985.9995, 331.5) ft
Slip Surface Intersection: () ft
Total Length: 34.8755 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft

Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: () ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 100,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 100,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft

Inside Point: (981.625, 337.5) ft
Slip Surface Intersection: () ft
Total Length: 37.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft
Slip Surface Intersection: () ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.2, 343.5) ft
Slip Surface Intersection: () ft
Total Length: 36.675 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1

Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (1,007.5, 345) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft
Slip Surface Intersection: () ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft

Governing Component: (none)

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: () ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Anisotropic Strength Functions

clay ellipse

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.62986487
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.63)
Data Point: (3, 0.63)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

SHANSEP CONSOLIDATED UNDRAINED-STATIC

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1

Function: SHANSEPP
Field
MPP: 5000
m: 0.7
S: .34
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	320
Point 16	1,023.75	319.25
Point 17	897.25	319.5
Point 18	991.25	345.25
Point 19	1,000	349.5
Point 20	1,016.25	350
Point 21	997.75	348.5
Point 22	992.5	347
Point 23	978.5	349.75
Point 24	985.75	350
Point 25	972.4	344.55
Point 26	971.5	349.5
Point 27	910.4	372.6
Point 28	910.6	375.1
Point 29	895.4	371.1
Point 30	895.7	373.6
Point 31	806.4	402.8

Point 32	806.2	400.3
Point 33	791.2	398.8
Point 34	791.4	401.3
Point 35	693	431
Point 36	693	434
Point 37	844.5	307.25
Point 38	842.25	301.25
Point 39	812.5	305.5
Point 40	812.25	301.75
Point 41	732	309.25
Point 42	732	307.25
Point 43	732	303.25
Point 44	883	375
Point 45	751	276
Point 46	751	268
Point 47	854.5	305.25
Point 48	872.5	287.25
Point 49	981.25	300.5
Point 50	1,081.25	276
Point 51	1,080.75	285.5
Point 52	1,080	300.75
Point 53	1,081.25	269.75
Point 54	1,081.25	259
Point 55	812.25	308
Point 56	844.5	304.75
Point 57	851.75	304.5
Point 58	984	344.9
Point 59	732	300
Point 60	854	301
Point 61	981	297
Point 62	1,080	298
Point 63	1,195	298
Point 64	693	399.3332
Point 65	693	375
Point 66	693	349.776
Point 67	693	320
Point 68	693	309.8841
Point 69	693	307.7256
Point 70	693	303.8841

Point 71	693	300.629
Point 72	693	287.25
Point 73	693	275.7081
Point 74	693	267.6094
Point 75	693	258.2508
Point 76	883	320
Point 77	922.5817	328
Point 78	1,021.75	328
Point 79	944	335.1869
Point 80	1,020	335

Regions

	Material	Points	Area (ft²)
Region 1	NOT ACTIVE	35,33,64	1,554.8
Region 2	NOT ACTIVE	64,33,32,44,65	3,703.1
Region 3	NOT ACTIVE	44,29,27,23,26,66,65	6,228
Region 4	Upper Till	69,42,39,56,57,47,37,55,41,68	357.53
Region 5	NOT ACTIVE	17,77,79,25,58,24,23,26,76	490.49
Region 6	STRUCTURAL FILL UNDRAINED	17,77,78,15,16	975.4
Region 7	Upper Till	47,17,16,15,14,13,12,10,11,9,8,7,52,49	5,551.3
Region 8	NOT ACTIVE	74,46,2,53,3,5,54,75	5,092.1
Region 9	NOT ACTIVE	73,45,1,50,4,3,53,2,46,74	3,618.8
Region 10	Deflection surface	72,48,51,6,4,50,1,45,73	5,119.8
Region 11	GC-UNDRAINED	71,59,40,38,60,61,62,63,6,51,48,72	6,390.3
Region 12	GC OverConsolidated	69,42,39,56,57,38,40,43,70	590.69
Region 13	NOT ACTIVE	35,33,32,44,29,27,23,24,28,30,31,34,36	773.09
Region 14	GC OverConsolidated	70,43,40,59,71	257.26
Region 15	GC OverConsolidated	38,57,47,49,52,7,63,62,61,60	1,187.5
Region 16	NOT ACTIVE	67,66,26,76	6,948.8
Region 17	Upper Till	37,47,17,76	214.47
Region 18	Upper Till	68,41,55,37,76,67	1,964.3
Region 19	STRUCTURAL FILL UNDRAINED	77,79,80,78	622.19
Region 20	STRUCTURAL FILL UNDRAINED	24,22,19,20,80,79,25,58	724.07

Current Slip Surface

Slip Surface: 7,057
F of S: 1.38
Volume: 3,364.7905 ft³
Weight: 423,313.82 lbs

Resisting Moment: 12,836,198 lbs-ft
Activating Moment: 9,272,261.7 lbs-ft
Resisting Force: 153,980.34 lbs
Activating Force: 111,142.15 lbs
F of S Rank: 1
Exit: (1,077.4004, 319.60194) ft
Entry: (958.81473, 340.07112) ft
Radius: 60.318302 ft
Center: (1,023.9518, 361.88188) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	960.91975	337.60562	0	-1,424.51	0	2,000
Slice 2	964.10384	333.87626	0	-984.217	0	2,000
Slice 3	967.1519	330.3062	0	-497.63261	0	2,000
Slice 4	970.33595	326.57686	0	77.550979	0	2,000
Slice 5	971.9755	324.7579	0	772.3626	0	2,000
Slice 6	974.75355	322.16763	0	1,169.6133	0	2,000
Slice 7	977.5159	319.65686	-262.97824	1,777.6564	0	2,000
Slice 8	978.21235	319.118	-286.0163	2,267.3442	1,362.3578	150
Slice 9	981.25	316.76769	6.8686698	2,553.1676	1,529.9707	150
Slice 10	984.875	313.96293	509.94059	3,335.9439	1,698.0341	150
Slice 11	986.9774	312.33624	843.06379	3,869.9796	1,818.7545	150
Slice 12	989.27745	310.41165	1,200.5095	4,126.097	1,757.8703	150
Slice 13	991.42505	308.48588	1,514.9432	4,417.518	1,744.0429	150
Slice 14	994.375	305.87651	1,871.499	4,932.7879	1,839.4079	150
Slice 15	998.125	302.55945	2,242.9825	5,666.7892	2,057.2306	150
Slice 16	1,000.1992	300.7247	2,413.0069	6,050.0479	2,185.3547	150
Slice 17	1,000.5626	300.4033	2,473.8975	6,221.0411	2,163.4144	100
Slice 18	1,002.5734	298.74734	2,954.9777	6,612.5424	2,111.696	100
Slice 19	1,006.1553	295.81706	3,286.8697	7,940.801	501.23591	1,169.5523
Slice 20	1,009.6256	292.97805	3,354.7823	8,449.7257	1,739.5457	-0.00025015307
Slice 21	1,013.5586	289.97981	3,239.987	8,586.8665	1,823.8103	-0.00032655264
Slice 22	1,016.0033	288.42226	3,069.759	7,300.3274	308.00042	718.66707
Slice 23	1,018.125	288.60452	3,025.2321	6,317.4269	285.67829	666.58238
Slice 24	1,020.875	288.84074	2,957.6116	4,898.4695	243.79782	568.86112
Slice 25	1,022.75	289.00181	2,905.3708	3,943.7559	202.08732	471.53695
Slice 26	1,024.2325	289.12916	2,860.7374	3,427.1166	168.48598	393.1338
Slice 27	1,026.9547	289.363	2,772.4113	3,351.122	169.57821	395.68256
Slice 28	1,031.434	289.74777	2,613.5365	3,234.8246	173.22865	404.19995
Slice 29	1,035.2118	290.79499	2,427.665	2,833.3923	228.27584	532.64382

Slice 30	1,038.234	292.47449	2,209.3698	2,681.4971	238.89536	557.42219
Slice 31	1,041.2018	294.12385	1,979.0811	2,542.95	251.96666	587.92252
Slice 32	1,045.1177	296.31037	1,671.7621	2,375.4134	269.70952	629.32228
Slice 33	1,050.2364	299.17683	1,294.5804	2,085.4195	456.59117	100
Slice 34	1,054.5174	301.57416	1,035.8196	1,914.7077	528.08923	150
Slice 35	1,058.6537	303.95015	830.16419	1,736.7277	544.71831	150
Slice 36	1,063.5979	307.34783	550.7321	1,542.0246	595.6286	150
Slice 37	1,068.036	310.88482	267.26063	1,262.5962	598.05794	150
Slice 38	1,071.904	314.28104	-3.7491652	1,076.2856	646.69764	150
Slice 39	1,075.5683	317.82831	-245.99341	513.57374	308.58623	150

Figure 18 Berm Stability @ 3 day Elapsed Time – Cohesionless Fill

Slope Stability MSE Cohesionless - 3 DAYS of Filling (3)

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 596
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/16/2013
Time: 4:15:03 PM
File Name: RMU2X1350mse21.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/16/2013
Last Solved Time: 4:18:08 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Slope Stability MSE Cohesionless - 3 DAYS of Filling (3)

Description: STABILITY ANALYSIS AT END OF CONSTRUCTION. ANALYSIS USES PORE PRESSURES FROM COUPLED CONSOLIDATION ANALYSIS ASSUMING 60.3 DAY TIME OF STEP LOADING AND SHANSEP MODEL FOR REDICTION OF UNDRAINED STRENGTH OF GC
Kind: SLOPE/W
Parent: MSE step 1 cohesionless
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
Lambda
Lambda 1: -1
Lambda 2: -0.8
Lambda 3: -0.6

Lambda 4: -0.5
Lambda 5: -0.4
Lambda 6: -0.2
Lambda 7: 0
Lambda 8: 0.2
Lambda 9: 0.4
Lambda 10: 0.6
Lambda 11: 0.8
Lambda 12: 1
PWP Conditions Source: Parent Analysis
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 1
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.002
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °

Deflection surface

Model: Bedrock (Impenetrable)

NOT ACTIVE

Model: (None)

GC-UNDRAINED

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: SHANSEP CONSOLIDATED UNDRAINED-STATIC
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse

Structural Fill Cohesionless

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (920, 327.13372) ft
Left-Zone Right Coordinate: (1,000, 349.5) ft
Left-Zone Increment: 20
Right Projection: Range
Right-Zone Left Coordinate: (1,030, 320) ft
Right-Zone Right Coordinate: (1,080, 319.56818) ft
Right-Zone Increment: 20
Radius Increments: 15

Slip Surface Limits

Left Coordinate: (900, 320.42276) ft
Right Coordinate: (1,131.413, 317.87465) ft

Reinforcements

Reinforcement 1

Type: Geosynthetic
Outside Point: (1,024.5, 318.5) ft
Inside Point: (993, 318.5) ft
Slip Surface Intersection: (994.58381, 318.5) ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 0.75
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs

Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 1,438.5423 lbs
Pullout Force per Length: 908.28059 lbs/ft
Available Length: 1.5838083 ft
Required Length: 1.5838083 ft
Governing Component: Pullout Resistance

Reinforcement 2

Type: Geosynthetic
Outside Point: (1,023.5, 321) ft
Inside Point: (993, 321) ft
Slip Surface Intersection: () ft
Total Length: 30.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 0.75
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 6,800 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 6,800 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 3

Type: Geosynthetic
Outside Point: (1,023.125, 322.5) ft
Inside Point: (993, 322.5) ft
Slip Surface Intersection: () ft
Total Length: 30.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft

Required Length: 0 ft
Governing Component: (none)

Reinforcement 4

Type: Geosynthetic
Outside Point: (1,022.75, 324) ft
Inside Point: (991, 324) ft
Slip Surface Intersection: () ft
Total Length: 31.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 5

Type: Geosynthetic
Outside Point: (1,022.375, 325.5) ft
Inside Point: (991.003, 325.5) ft
Slip Surface Intersection: () ft
Total Length: 31.372 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 5,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 5,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 6

Type: Geosynthetic
Outside Point: (1,022, 327) ft

Inside Point: (990, 327) ft
Slip Surface Intersection: () ft
Total Length: 32 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 7

Type: Geosynthetic
Outside Point: (1,021.5, 328.5) ft
Inside Point: (990, 328.5) ft
Slip Surface Intersection: () ft
Total Length: 31.5 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 8

Type: Geosynthetic
Outside Point: (1,021.25, 330) ft
Inside Point: (1,011.25, 330) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf

Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 9

Type: Geosynthetic
Outside Point: (1,020.875, 331.5) ft
Inside Point: (985.9995, 331.5) ft
Slip Surface Intersection: () ft
Total Length: 34.8755 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 10

Type: Geosynthetic
Outside Point: (1,020.5, 333) ft
Inside Point: (1,010.5, 333) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1

Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 11

Type: Geosynthetic
Outside Point: (1,020.125, 334.5) ft
Inside Point: (984, 334.5) ft
Slip Surface Intersection: () ft
Total Length: 36.125 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 12

Type: Geosynthetic
Outside Point: (1,019.75, 336) ft
Inside Point: (1,009.75, 336) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 100,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 100,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft

Governing Component: (none)

Reinforcement 13

Type: Geosynthetic
Outside Point: (1,019.375, 337.5) ft
Inside Point: (981.625, 337.5) ft
Slip Surface Intersection: () ft
Total Length: 37.75 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 4,900 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 4,900 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 14

Type: Geosynthetic
Outside Point: (1,019, 339) ft
Inside Point: (1,009, 339) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 15

Type: Geosynthetic
Outside Point: (1,018.625, 340.5) ft
Inside Point: (982, 340.5) ft

Slip Surface Intersection: () ft
Total Length: 36.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 16

Type: Geosynthetic
Outside Point: (1,018.25, 342) ft
Inside Point: (1,008.25, 342) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 17

Type: Geosynthetic
Outside Point: (1,017.875, 343.5) ft
Inside Point: (981.2, 343.5) ft
Slip Surface Intersection: () ft
Total Length: 36.675 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °

Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 2,300 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 2,300 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 18

Type: Geosynthetic
Outside Point: (1,017.5, 345) ft
Inside Point: (1,007.5, 345) ft
Slip Surface Intersection: () ft
Total Length: 10 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 1,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 1,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 19

Type: Geosynthetic
Outside Point: (1,017.125, 346.5) ft
Inside Point: (996.5, 346.5) ft
Slip Surface Intersection: () ft
Total Length: 20.625 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0

Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Reinforcement 20

Type: Geosynthetic
Outside Point: (1,016.75, 348) ft
Inside Point: (998.5, 348) ft
Slip Surface Intersection: () ft
Total Length: 18.25 ft
Reinforcement Direction: 0 °
F of S Dependent: Yes
Interface Adhesion: 0 psf
Interface Shear Angle: 30 °
Surface Area Factor: 1
Resistance Reduction Factor: 1
Force Distribution: Concentrated
Tensile Capacity: 3,000 lbs
Reduction Factor: 1
Force Orientation: 0
Max. Pullout Force: 3,000 lbs
Pullout Force: 0 lbs
Pullout Force per Length: 0 lbs/ft
Available Length: 0 ft
Required Length: 0 ft
Governing Component: (none)

Anisotropic Strength Functions

clay ellipse

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.62986487
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.63)
Data Point: (3, 0.63)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

SHANSEP CONSOLIDATED UNDRAINED-STATIC

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: SHANSEPP
Field
MPP: 5000
m: 0.7
S: .34
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	320
Point 16	1,023.75	319.25
Point 17	897.25	319.5
Point 18	991.25	345.25
Point 19	1,000	349.5
Point 20	1,016.25	350
Point 21	997.75	348.5
Point 22	992.5	347
Point 23	978.5	349.75
Point 24	985.75	350
Point 25	972.4	344.55
Point 26	971.5	349.5

Point 27	910.4	372.6
Point 28	910.6	375.1
Point 29	895.4	371.1
Point 30	895.7	373.6
Point 31	806.4	402.8
Point 32	806.2	400.3
Point 33	791.2	398.8
Point 34	791.4	401.3
Point 35	693	431
Point 36	693	434
Point 37	844.5	307.25
Point 38	842.25	301.25
Point 39	812.5	305.5
Point 40	812.25	301.75
Point 41	732	309.25
Point 42	732	307.25
Point 43	732	303.25
Point 44	883	375
Point 45	751	276
Point 46	751	268
Point 47	854.5	305.25
Point 48	872.5	287.25
Point 49	981.25	300.5
Point 50	1,081.25	276
Point 51	1,080.75	285.5
Point 52	1,080	300.75
Point 53	1,081.25	269.75
Point 54	1,081.25	259
Point 55	812.25	308
Point 56	844.5	304.75
Point 57	851.75	304.5
Point 58	984	344.9
Point 59	732	300
Point 60	854	301
Point 61	981	297
Point 62	1,080	298
Point 63	1,195	298
Point 64	693	399.3332
Point 65	693	375

Point 66	693	349.776
Point 67	693	320
Point 68	693	309.8841
Point 69	693	307.7256
Point 70	693	303.8841
Point 71	693	300.629
Point 72	693	287.25
Point 73	693	275.7081
Point 74	693	267.6094
Point 75	693	258.2508
Point 76	883	320
Point 77	922.5817	328
Point 78	1,021.75	328
Point 79	944	335.1869
Point 80	1,020	335

Regions

	Material	Points	Area (ft²)
Region 1	NOT ACTIVE	35,33,64	1,554.8
Region 2	NOT ACTIVE	64,33,32,44,65	3,703.1
Region 3	NOT ACTIVE	44,29,27,23,26,66,65	6,228
Region 4	Upper Till	69,42,39,56,57,47,37,55,41,68	357.53
Region 5	NOT ACTIVE	17,77,79,25,58,24,23,26,76	490.49
Region 6	Structural Fill Cohesionless	17,77,78,15,16	975.4
Region 7	Upper Till	47,17,16,15,14,13,12,10,11,9,8,7,52,49	5,551.3
Region 8	NOT ACTIVE	74,46,2,53,3,5,54,75	5,092.1
Region 9	NOT ACTIVE	73,45,1,50,4,3,53,2,46,74	3,618.8
Region 10	Deflection surface	72,48,51,6,4,50,1,45,73	5,119.8
Region 11	GC-UNDRAINED	71,59,40,38,60,61,62,63,6,51,48,72	6,390.3
Region 12	GC OverConsolidated	69,42,39,56,57,38,40,43,70	590.69
Region 13	NOT ACTIVE	35,33,32,44,29,27,23,24,28,30,31,34,36	773.09
Region 14	GC OverConsolidated	70,43,40,59,71	257.26
Region 15	GC OverConsolidated	38,57,47,49,52,7,63,62,61,60	1,187.5
Region 16	NOT ACTIVE	67,66,26,76	6,948.8
Region 17	Upper Till	37,47,17,76	214.47
Region 18	Upper Till	68,41,55,37,76,67	1,964.3
Region 19	Structural Fill Cohesionless	77,79,80,78	622.19
Region 20	Structural Fill Cohesionless	24,22,19,20,80,79,25,58	724.07

Current Slip Surface

Slip Surface: 7,057
F of S: 1.65
Volume: 1,706.7106 ft^3
Weight: 208,031.2 lbs
Resisting Moment: 4,738,165.8 lbs-ft
Activating Moment: 2,871,008 lbs-ft
Resisting Force: 96,217.242 lbs
Activating Force: 58,540.605 lbs
F of S Rank: 1
Exit: (1,063.4193, 319.77206) ft
Entry: (974.61619, 344.61687) ft
Radius: 49.344043 ft
Center: (1,025.0349, 346.9018) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	976.55809	342.40406	0	183.02711	123.45335	0
Slice 2	979.6215	338.9133	0	464.74973	313.47765	0
Slice 3	981.72063	336.36354	0	632.34005	426.51875	0
Slice 4	983.34913	334.24501	0	785.97469	530.14663	0
Slice 5	984.27295	333.0432	0	930.72108	627.7793	0
Slice 6	985.14795	331.75537	0	1,123.313	757.68416	0
Slice 7	986.66093	329.41131	0	1,360.0439	917.3612	0
Slice 8	988.58098	326.43658	0	1,480.1628	998.3824	0
Slice 9	991.04505	323.0163	0	1,751.6499	1,181.5028	0
Slice 10	993.225	320.23416	-168.45156	1,900.7875	1,282.0974	0
Slice 11	994.3641	318.7804	-252.3523	2,189.9093	1,315.8302	150
Slice 12	996.08365	317.40423	-97.632527	2,763.7954	1,660.6558	150
Slice 13	998.69455	315.70886	136.98771	3,019.8801	1,732.2165	150
Slice 14	1,000.6007	314.47111	352.04306	3,204.4742	1,713.9135	150
Slice 15	1,002.7338	313.07911	612.64256	3,366.2045	1,654.5069	150
Slice 16	1,005.7985	311.07522	948.29287	3,603.38	1,595.3372	150
Slice 17	1,008.8633	309.07133	1,218.3671	3,835.9575	1,572.807	150
Slice 18	1,011.928	307.06743	1,434.3223	4,068.2713	1,582.6362	150
Slice 19	1,014.8552	305.27587	1,582.9804	4,424.5978	1,707.416	150
Slice 20	1,017.4546	303.80434	1,675.4851	4,144.6979	1,483.6527	150
Slice 21	1,019.3296	303.05014	1,700.5108	4,264.4087	1,540.5453	150
Slice 22	1,020.875	302.88352	1,673.8447	3,550.086	1,127.3595	150
Slice 23	1,022.0158	302.76052	1,653.12	3,022.5434	822.83259	150
Slice 24	1,023.0158	302.97974	1,603.2754	3,148.1409	928.24882	150

Slice 25	1,025.2364	303.72938	1,468.0037	2,592.2144	675.49397	150
Slice 26	1,028.394	304.8596	1,271.1512	2,531.073	757.03741	150
Slice 27	1,031.7364	306.11648	1,057.8479	2,372.6551	790.01589	150
Slice 28	1,035.0788	307.37336	855.12687	2,193.0923	803.93071	150
Slice 29	1,037.1933	308.16848	733.95578	2,069.5886	802.52914	150
Slice 30	1,038.8145	308.79089	645.40383	1,979.398	801.54459	150
Slice 31	1,041.1719	309.72346	518.97203	1,838.5573	792.88686	150
Slice 32	1,043.531	310.67717	399.99237	1,666.2293	760.83191	150
Slice 33	1,046.8657	312.12918	234.9431	1,447.9239	728.8324	150
Slice 34	1,050.4101	313.76439	67.20814	1,162.2289	657.95489	150
Slice 35	1,053.1885	315.08448	-48.302603	905.35855	543.9943	150
Slice 36	1,056.0513	316.41578	-150.27088	633.00743	380.34924	150
Slice 37	1,058.9985	317.75829	-238.90795	387.42047	232.78571	150
Slice 38	1,061.9457	319.1008	-309.91653	158.62696	95.312696	150

MSE step5 excavation to subgrd

File Information

- Title: Model City - RMU-2 XS 1350 MSE
- Created By: Peter J. Carey
- Last Edited By: Peter J. Carey
- Revision Number: 624
- File Version: 8.0
- Tool Version: 8.0.10.6504
- Date: 2/21/2013
- Time: 2:34:16 PM
- File Name: RMU2X1350mse21.gsz
- Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE_C8\
- Last Solved Date: 2/21/2013
- Last Solved Time: 2:41:24 PM

Project Settings

- Length(L) Units: feet
- Time(t) Units: Days
- Force(F) Units: lbf
- Pressure(p) Units: psf
- Strength Units: psf
- Stiffness Units: psf
- Unit Weight of Water: 62.4 pcf
- Air Pressure: 101.33 psf
- View: 2D

Analysis Settings

MSE step5 excavation to subgrd

- Description: Excavation to subgrade
- Kind: SIGMA/W
- Parent: MSE step 2 consol
- Method: Coupled Stress/PWP
- Settings
  - Initial Stress: Parent Analysis
  - Initial PWP: Parent Analysis
  - Exclude cumulative values: Yes
- Control
  - Apply Body Force in All Steps: No
  - Saturated Zone Only: Yes
- Convergence
  - Maximum Number of Iterations: 50
  - Minimum Pressure Head Difference: 0.001

Minimum Displacement Difference: 0.001
Significant Digits: 3
Hydraulic Under-Relaxation Criteria
Under-Relaxation Initial Rate: 1
Under-Relaxation Min. Rate: 0.1
Under-Relaxation Reduction Rate: 0.65
Under-Relaxation Iterations: 10
Equation Solver: Parallel Direct
Time
Starting Time: 60 days
Duration: 30 days
# of Steps: 10
Step Generation Method: Linear
Save Steps Every: 5

Materials

Upper Till

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 300,000 psf
Unit Weight: 125 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Upper Glacial Till
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

GC-Drained

Model: Soft Clay (MCC w/ PWP Change)
Stress Strain
O.C. Ratio: 4
Poisson's Ratio: 0.334
Lambda: 0.14
Kappa: 0.013
Initial Void Ratio: 1
Unit Weight: 118 pcf
Phi': 27 °
Hydraulic
Vol. WC. Function: Clay soils
K-Function: GC 5.7 E-4 ft/day
Ky'/Kx' Ratio: 1
Rotation: 0 °
K-Modifier Function: 1D consol derived k function rmu2 clay
Load Response Ratio: 1

GC OverConsolidated

Model: Soft Clay (MCC w/ PWP Change)
Stress Strain

O.C. Ratio: 6
Poisson's Ratio: 0.334
Lambda: 0.06
Kappa: 0.01
Initial Void Ratio: 0.5
Unit Weight: 125 pcf
Phi': 30 °
Hydraulic
Vol. WC. Function: Clay soils OC
K-Function: GC 5.7 E-4 ft/day
Ky'/Kx' Ratio: 1
Rotation: 0 °
K-Modifier Function: 1D consol derived k function rmu2 clay
Load Response Ratio: 1

Sand/Silt

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 300,000 psf
Unit Weight: 135 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: silty sand
K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec
Ky'/Kx' Ratio: 0.1
Rotation: 0 °
Load Response Ratio: 1

Lower Till

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 600,000 psf
Unit Weight: 145 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Till
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

STRUCTURAL FILL

Model: Linear Elastic (Effective)
Stress Strain
Effective Young's Modulus (E'): 100,000 psf
Unit Weight: 130 pcf
Poisson's Ratio: 0.334

UPPER SHALE

Model: Linear Elastic (w/ PWP Change)
Stress Strain
Effective Young's Modulus (E'): 1,000,000 psf

Unit Weight: 145 pcf
Poisson's Ratio: 0.334
Hydraulic
Vol. WC. Function: Till
K-Function: Upper Rock
Ky'/Kx' Ratio: 1
Rotation: 0 °
Load Response Ratio: 1

Boundary Conditions

Fixed X/Y

X: X-Displacement 0
Y: Y-Displacement 0

Drainage

Type: Head (H) 315.5
Review: No

drainage 313

Type: Head (H) 313
Review: No

noflowzeropress

Type: Total Flux (Q) 0
Review: Yes

Initial Water Tables

Initial Water Table 1

Max. negative head: 5
Coordinates
Coordinate 1: (200, 315.5) ft
Coordinate 2: (1,200, 315.5) ft

K Functions

Silty Sand, k = 0.567 ft/day 2 E-4cm/sec

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.567
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.567)
Data Point: (0.01, 0.567)
Data Point: (0.035938, 0.567)
Data Point: (0.12915, 0.567)

Data Point: (0.46416, 0.567)
Data Point: (1.1111, 0.567)
Data Point: (1.6681, 0.567)
Data Point: (5.9948, 0.567)
Data Point: (21.544, 0.567)
Data Point: (77.426, 0.567)
Data Point: (105.93, 0.5402376)
Data Point: (210.74, 0.3387258)
Data Point: (278.26, 0.2567376)
Data Point: (315.56, 0.2232846)
Data Point: (420.37, 0.1406916)
Data Point: (525.19, 0.0779121)
Data Point: (630, 0.03843882)
Data Point: (734.81, 0.01673406)
Data Point: (839.63, 0.005422788)
Data Point: (944.44, 0.000745983)
Data Point: (1,000, 7.14735e-005)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Upper Glacial Till

Model: Hyd K Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 36 %
K-Saturation: 0.0057
Data Points: Matric Suction (psf), X-Conductivity (ft/days)
Data Point: (0.005, 0.0057)
Data Point: (0.01, 0.0057)
Data Point: (0.046416, 0.0057)
Data Point: (0.21544, 0.0057)
Data Point: (1, 0.0057)
Data Point: (4.6416, 0.0057)
Data Point: (11.111, 0.0057)
Data Point: (21.544, 0.0057)
Data Point: (100, 0.0057)
Data Point: (464.16, 0.0016245)
Data Point: (1,059.3, 0.0002427972)
Data Point: (2,107.4, 1.492716e-005)
Data Point: (2,154.4, 1.369596e-005)
Data Point: (3,155.6, 4.086672e-006)
Data Point: (4,203.7, 1.82115e-006)
Data Point: (5,251.9, 9.03222e-007)
Data Point: (6,300, 4.30521e-007)
Data Point: (7,348.1, 2.028516e-007)
Data Point: (8,396.3, 7.73661e-008)
Data Point: (9,444.4, 2.691312e-008)

Data Point: (10,000, 2.691312e-008)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Hydraulic K Sat: 0 ft/days

Residual Water Content: 0 ft^3/ft^3

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

Upper Rock

Model: Hyd K Data Point Function

Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 36 %

K-Saturation: 0.567

Data Points: Matric Suction (psf), X-Conductivity (ft/days)

Data Point: (0.005, 0.567)

Data Point: (0.01, 0.567)

Data Point: (10,000, 0.567)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Hydraulic K Sat: 0 ft/days

Residual Water Content: 0 ft^3/ft^3

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

Till

Model: Hyd K Data Point Function

Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 36 %

K-Saturation: 0.000567

Data Points: Matric Suction (psf), X-Conductivity (ft/days)

Data Point: (0.005, 0.000567)

Data Point: (0.01, 0.000567)

Data Point: (10,000, 0.000567)

Estimation Properties

Hyd. K-Function Estimation Method: Van Genuchten Function

Hydraulic K Sat: 0 ft/days

Residual Water Content: 0 ft^3/ft^3

Maximum: 1,000

Minimum: 0.01

Num. Points: 20

GC 5.7 E-4 ft/day

Model: Hyd K Data Point Function

Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

K-Saturation: 0.00057

Data Points: Matric Suction (psf), X-Conductivity (ft/days)

Data Point: (10, 0.00057)
Data Point: (1,000, 9e-006)
Data Point: (5,000, 5e-006)
Estimation Properties
Hyd. K-Function Estimation Method: Van Genuchten Function
Hydraulic K Sat: 0 ft/days
Residual Water Content: 0 ft^3/ft^3
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Hydraulic K Modifier Functions

1D consol derived k function rmu2 clay

Model: Spline Data Point Function (Y Log)
Function: K-Modifier vs. Y-Effective Stress
Curve Fit to Data: 100 %
Segment Curvature: 75 %
Y-Intercept: 1.2
Data Points: Y-Effective Stress (psf), K-Modifier
Data Point: (1,000, 1.2)
Data Point: (2,000, 1)
Data Point: (4,000, 0.839)
Data Point: (8,000, 0.70417211)
Data Point: (12,000, 0.63551782)
Data Point: (16,000, 0.59090577)

Vol. Water Content Functions

Clay soils OC

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 7e-005 /psf
Saturated Water Content: 0.31427274 ft^3/ft^3
Residual Water Content: 0.031427274 ft^3/ft^3
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.31427274
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.29999999)
Data Point: (0.018329807, 0.29999998)
Data Point: (0.033598183, 0.29999996)
Data Point: (0.061584821, 0.29999991)
Data Point: (0.11288379, 0.29999982)
Data Point: (0.20691381, 0.29999962)
Data Point: (0.37926902, 0.29999917)
Data Point: (0.6951928, 0.29999814)
Data Point: (1.274275, 0.29999578)
Data Point: (2.3357215, 0.29999026)

Data Point: (4.2813324, 0.2999772)
Data Point: (7.8475997, 0.29994599)
Data Point: (14.384499, 0.29987093)
Data Point: (26.366509, 0.29968944)
Data Point: (48.329302, 0.29924951)
Data Point: (88.586679, 0.29818464)
Data Point: (162.37767, 0.29563126)
Data Point: (297.63514, 0.28967022)
Data Point: (545.55948, 0.27661743)
Data Point: (1,000, 0.25163343)

Estimation Properties

Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.3 ft^3/ft^3
Sample Material: Clay
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Clay soils

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Mv: 0.0004 /psf
Saturated Water Content: 0.60995302 ft^3/ft^3
Residual Water Content: 0.060995302 ft^3/ft^3
Curve Fit to Data: 100 %
Segment Curvature: 100 %

Porosity: 0.60995302
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.43999998)
Data Point: (0.018329807, 0.43999997)
Data Point: (0.033598183, 0.43999994)
Data Point: (0.061584821, 0.43999987)
Data Point: (0.11288379, 0.43999974)
Data Point: (0.20691381, 0.43999944)
Data Point: (0.37926902, 0.43999878)
Data Point: (0.6951928, 0.43999728)
Data Point: (1.274275, 0.43999381)
Data Point: (2.3357215, 0.43998571)
Data Point: (4.2813324, 0.43996655)
Data Point: (7.8475997, 0.43992079)
Data Point: (14.384499, 0.4398107)
Data Point: (26.366509, 0.43954452)
Data Point: (48.329302, 0.43889927)
Data Point: (88.586679, 0.43733747)
Data Point: (162.37767, 0.43359251)
Data Point: (297.63514, 0.42484965)
Data Point: (545.55948, 0.40570556)
Data Point: (1,000, 0.36906236)

Estimation Properties

Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.44 ft³/ft³
Sample Material: Clay
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Till

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 5e-006 /psf
Saturated Water Content: 0.20000173 ft³/ft³
Residual Water Content: 0.020000173 ft³/ft³
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.20000173
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
Data Point: (0.01, 0.19999999)
Data Point: (0.018329807, 0.19999999)
Data Point: (0.033598183, 0.19999997)
Data Point: (0.061584821, 0.19999993)
Data Point: (0.11288379, 0.19999985)
Data Point: (0.20691381, 0.19999967)
Data Point: (0.37926902, 0.19999922)
Data Point: (0.6951928, 0.19999811)
Data Point: (1.274275, 0.19999535)
Data Point: (2.3357215, 0.19998838)
Data Point: (4.2813324, 0.19997056)
Data Point: (7.8475997, 0.19992471)
Data Point: (14.384499, 0.19980625)
Data Point: (26.366509, 0.19949952)
Data Point: (48.329302, 0.19870702)
Data Point: (88.586679, 0.19668084)
Data Point: (162.37767, 0.19165467)
Data Point: (297.63514, 0.18009116)
Data Point: (545.55948, 0.15752337)
Data Point: (1,000, 0.12453739)
Estimation Properties
Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.2 ft³/ft³
Sample Material: Silty Clay
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

silty sand

Model: Vol WC Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Mv: 1e-005 /psf
Saturated Water Content: 0.30000011 ft^3/ft^3
Residual Water Content: 0.030000011 ft^3/ft^3
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Porosity: 0.30000011
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.29999996)
Data Point: (0.018329807, 0.29999991)
Data Point: (0.033598183, 0.29999977)
Data Point: (0.061584821, 0.29999942)
Data Point: (0.11288379, 0.29999854)
Data Point: (0.20691381, 0.29999626)
Data Point: (0.37926902, 0.29999039)
Data Point: (0.6951928, 0.29997521)
Data Point: (1.274275, 0.29993588)
Data Point: (2.3357215, 0.29983385)
Data Point: (4.2813324, 0.29956912)
Data Point: (7.8475997, 0.29888334)
Data Point: (14.384499, 0.29711648)
Data Point: (26.366509, 0.29263189)
Data Point: (48.329302, 0.28167657)
Data Point: (88.586679, 0.25725429)
Data Point: (162.37767, 0.21239326)
Data Point: (297.63514, 0.15298031)
Data Point: (545.55948, 0.099847233)
Data Point: (1,000, 0.064649441)
Estimation Properties
Vol. WC Estimation Method: Sample functions
Saturated Water Content: 0.3 ft^3/ft^3
Sample Material: Silty Sand
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1,000
Minimum: 0.01
Num. Points: 20

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75

Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	320
Point 16	1,023.75	319.25
Point 17	897.25	319.5
Point 18	991.25	345.25
Point 19	1,000	349.5
Point 20	1,016.25	350
Point 21	997.75	348.5
Point 22	992.5	347
Point 23	978.5	349.75
Point 24	985.75	350
Point 25	972.4	344.55
Point 26	971.5	349.5
Point 27	910.4	372.6
Point 28	910.6	375.1
Point 29	895.4	371.1
Point 30	895.7	373.6
Point 31	806.4	402.8
Point 32	806.2	400.3
Point 33	791.2	398.8
Point 34	791.4	401.3
Point 35	693	431
Point 36	693	434
Point 37	844.5	307.25
Point 38	842.25	301.25
Point 39	812.5	305.5
Point 40	812.25	301.75
Point 41	732	309.25
Point 42	732	307.25
Point 43	732	303.25
Point 44	883	375

Point 45	751	276
Point 46	751	268
Point 47	854.5	305.25
Point 48	872.5	287.25
Point 49	981.25	300.5
Point 50	1,081.25	276
Point 51	1,080.75	285.5
Point 52	1,080	300.75
Point 53	1,081.25	269.75
Point 54	1,081.25	259
Point 55	812.25	308
Point 56	844.5	304.75
Point 57	851.75	304.5
Point 58	984	344.9
Point 59	732	300
Point 60	854	301
Point 61	981	297
Point 62	1,080	298
Point 63	1,195	298
Point 64	693	399.3332
Point 65	693	375
Point 66	693	349.776
Point 67	693	320
Point 68	693	309.8841
Point 69	693	307.7256
Point 70	693	303.8841
Point 71	693	300.629
Point 72	693	287.25
Point 73	693	275.7081
Point 74	693	267.6094
Point 75	693	258.2508
Point 76	883	320
Point 77	922.5817	328
Point 78	1,021.75	328
Point 79	944	335.1869
Point 80	1,020	335

Lines

	Start Point	End Point	Hydraulic Boundary	Stress/Strain Boundary
Line 1	35	33		
Line 2	33	32		
Line 3	32	44		
Line 4	44	29		
Line 5	29	27		
Line 6	27	23		
Line 7	23	26		
Line 8	37	55		
Line 9	55	41		
Line 10	42	39		
Line 11	39	56		
Line 12	56	57		
Line 13	57	47		
Line 14	47	37		
Line 15	47	17	noflowzeropress	
Line 16	25	58		
Line 17	24	23		
Line 18	15	16		
Line 19	16	17		
Line 20	15	14	noflowzeropress	
Line 21	14	13	noflowzeropress	
Line 22	13	12	noflowzeropress	
Line 23	12	10	noflowzeropress	
Line 24	10	11	noflowzeropress	
Line 25	11	9	noflowzeropress	
Line 26	9	8	noflowzeropress	
Line 27	8	7		
Line 28	7	52		
Line 29	52	49		
Line 30	49	47		
Line 31	4	6		
Line 32	4	3		
Line 33	3	5		
Line 34	46	2		
Line 35	2	53		
Line 36	53	3		
Line 37	5	54	drainage 313	Fixed X/Y

Line 38	45	1		
Line 39	1	50		
Line 40	50	4		
Line 41	48	51		
Line 42	51	6		
Line 43	43	40	noflowzeropress	
Line 44	40	38	noflowzeropress	
Line 45	38	57	noflowzeropress	
Line 46	36	35		
Line 47	24	28		
Line 48	28	30		
Line 49	30	31		
Line 50	31	34		
Line 51	34	36		
Line 52	7	63		
Line 53	63	6		
Line 54	62	63		
Line 55	60	61		
Line 56	61	62		
Line 57	38	60		
Line 58	59	40		
Line 59	33	64		
Line 60	44	65		
Line 61	26	66		
Line 62	41	68		
Line 63	69	42		
Line 64	70	43	noflowzeropress	
Line 65	71	59		
Line 66	72	48		
Line 67	73	45		
Line 68	74	46		
Line 69	54	75	Drainage	Fixed X/Y
Line 70	64	35		
Line 71	65	64		
Line 72	66	65		
Line 73	26	76		
Line 74	67	66		
Line 75	76	67		
Line 76	76	17		

Line 77	76	37		
Line 78	68	69		
Line 79	70	69		
Line 80	71	70		
Line 81	72	71		
Line 82	73	72		
Line 83	74	73		
Line 84	75	74		
Line 85	17	77		
Line 86	78	15		
Line 87	77	79		
Line 88	79	25		
Line 89	77	78		
Line 90	79	80		
Line 91	80	78		
Line 92	24	22		
Line 93	22	19		
Line 94	19	20		
Line 95	20	80		
Line 96	58	24		
Line 97	68	67		

Regions

	Points	Area (ft²)	Material
Region 1	35,33,64	1,554.8	
Region 2	64,33,32,44,65	3,703.1	
Region 3	44,29,27,23,26,66,65	6,228	
Region 4	69,42,39,56,57,47,37,55,41,68	357.53	
Region 5	17,77,79,25,58,24,23,26,76	490.49	
Region 6	17,77,78,15,16	975.4	STRUCTURAL FILL
Region 7	47,17,16,15,14,13,12,10,11,9,8,7,52,49	5,551.3	Upper Till
Region 8	74,46,2,53,3,5,54,75	5,092.1	UPPER SHALE
Region 9	73,45,1,50,4,3,53,2,46,74	3,618.8	Lower Till
Region 10	72,48,51,6,4,50,1,45,73	5,119.8	Sand/Silt
Region 11	71,59,40,38,60,61,62,63,6,51,48,72	6,390.3	GC-Drained
Region 12	69,42,39,56,57,38,40,43,70	590.69	
Region 13	35,33,32,44,29,27,23,24,28,30,31,34,36	773.09	
Region 14	70,43,40,59,71	257.26	GC OverConsolidated

Region 15	38,57,47,49,52,7,63,62,61,60	1,187.5	GC OverConsolidated
Region 16	67,66,26,76	6,948.8	
Region 17	37,47,17,76	214.47	
Region 18	68,41,55,37,76,67	1,964.3	
Region 19	77,79,80,78	622.19	STRUCTURAL FILL
Region 20	24,22,19,20,80,79,25,58	724.07	STRUCTURAL FILL

Figure 20 **Stability of Excavation @75 Days Following Berm Filling – Consolidated Undrained**

Inward Failure - Undrained

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Revision Number: 627
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/21/2013
Time: 4:58:25 PM
File Name: RMU2X1350mse21.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/21/2013
Last Solved Time: 5:17:56 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Inward Failure - Undrained

Description: Undrained with liner placed - no waste
Kind: SLOPE/W
Parent: MSE step5 excavation to subgrd
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6

Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Parent Analysis
Slip Surface
Direction of movement: Right to Left
Use Passive Mode: No
Slip Surface Option: Block
Critical slip surfaces saved: 1
Restrict Block Crossing: No
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.01
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf

Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °

Deflection surface

Model: Bedrock (Impenetrable)

STRUCTURAL FILL

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 195 psf
Phi': 28.7 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)

GC-UNDRAINED

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: SHANSEP CONSOLIDATED UNDRAINED-STATIC
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse

Slip Surface Limits

Left Coordinate: (773.93733, 308.59677) ft
Right Coordinate: (1,012.8109, 349.89418) ft

Slip Surface Block

Left Grid
- Upper Left: (835.2, 302.8) ft
- Lower Left: (835.2, 290.3) ft
- Lower Right: (867.9, 289.4) ft
- X Increments: 3
- Y Increments: 3
- Starting Angle: 135 °
- Ending Angle: 180 °
- Angle Increments: 2

Right Grid
- Upper Left: (883.2, 306.2) ft
- Lower Left: (892.3, 287.5) ft
- Lower Right: (924.6, 294.7) ft

X Increments: 3
Y Increments: 3
Starting Angle: 45 °
Ending Angle: 65 °
Angle Increments: 2

Anisotropic Strength Functions

clay ellipse

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.62986487
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.63)
Data Point: (3, 0.63)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

SHANSEP CONSOLIDATED UNDRAINED-STATIC

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: SHANSEPP
Field
MPP: 5000
m: 0.7
S: .34
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	320
Point 16	1,023.75	319.25
Point 17	897.25	319.5
Point 18	991.25	345.25
Point 19	1,000	349.5
Point 20	1,016.25	350
Point 21	997.75	348.5
Point 22	992.5	347
Point 23	978.5	349.75
Point 24	985.75	350
Point 25	972.4	344.55
Point 26	971.5	349.5
Point 27	910.4	372.6
Point 28	910.6	375.1

Point 29	895.4	371.1
Point 30	895.7	373.6
Point 31	806.4	402.8
Point 32	806.2	400.3
Point 33	791.2	398.8
Point 34	791.4	401.3
Point 35	693	431
Point 36	693	434
Point 37	844.5	307.25
Point 38	842.25	301.25
Point 39	812.5	305.5
Point 40	812.25	301.75
Point 41	732	309.25
Point 42	732	307.25
Point 43	732	303.25
Point 44	883	375
Point 45	751	276
Point 46	751	268
Point 47	854.5	305.25
Point 48	872.5	287.25
Point 49	981.25	300.5
Point 50	1,081.25	276
Point 51	1,080.75	285.5
Point 52	1,080	300.75
Point 53	1,081.25	269.75
Point 54	1,081.25	259
Point 55	812.25	308
Point 56	844.5	304.75
Point 57	851.75	304.5
Point 58	984	344.9
Point 59	732	300
Point 60	854	301
Point 61	981	297
Point 62	1,080	298
Point 63	1,195	298
Point 64	693	399.3332
Point 65	693	375
Point 66	693	349.776
Point 67	693	320

Point 68	693	309.8841
Point 69	693	307.7256
Point 70	693	303.8841
Point 71	693	300.629
Point 72	693	287.25
Point 73	693	275.7081
Point 74	693	267.6094
Point 75	693	258.2508
Point 76	883	320
Point 77	922.5817	328
Point 78	1,021.75	328
Point 79	944	335.1869
Point 80	1,020	335

Regions

	Material	Points	Area (ft²)
Region 1	NOT ACTIVE	35,33,64	1,554.8
Region 2	NOT ACTIVE	64,33,32,44,65	3,703.1
Region 3	NOT ACTIVE	44,29,27,23,26,66,65	6,228
Region 4	Bottom Liner	69,42,39,56,57,47,37,55,41,68	357.53
Region 5	side slope liner	17,77,79,25,58,24,23,26,76	490.49
Region 6	STRUCTURAL FILL	17,77,78,15,16	975.4
Region 7	Upper Till	47,17,16,15,14,13,12,10,11,9,8,7,52,49	5,551.3
Region 8	NOT ACTIVE	74,46,2,53,3,5,54,75	5,092.1
Region 9	NOT ACTIVE	73,45,1,50,4,3,53,2,46,74	3,618.8
Region 10	Deflection surface	72,48,51,6,4,50,1,45,73	5,119.8
Region 11	GC-UNDRAINED	71,59,40,38,60,61,62,63,6,51,48,72	6,390.3
Region 12	CCL	69,42,39,56,57,38,40,43,70	590.69
Region 13	NOT ACTIVE	35,33,32,44,29,27,23,24,28,30,31,34,36	773.09
Region 14	GC OverConsolidated	70,43,40,59,71	257.26
Region 15	GC OverConsolidated	38,57,47,49,52,7,63,62,61,60	1,187.5
Region 16	NOT ACTIVE	67,66,26,76	6,948.8
Region 17	side slope liner	37,47,17,76	214.47
Region 18	NOT ACTIVE	68,41,55,37,76,67	1,964.3
Region 19	STRUCTURAL FILL	77,79,80,78	622.19
Region 20	STRUCTURAL FILL	24,22,19,20,80,79,25,58	724.07

Current Slip Surface

Slip Surface: 2,305
F of S: 1.65
Volume: 3,205.5598 ft³
Weight: 395,535.53 lbs
Resisting Moment: 28,018,641 lbs-ft
Activating Moment: 16,958,368 lbs-ft
Resisting Force: 138,951.16 lbs
Activating Force: 84,231.415 lbs
F of S Rank: 1
Exit: (842.41695, 307.29844) ft
Entry: (980.85921, 349.83135) ft
Radius: 74.883112 ft
Center: (828.9, 459) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	843.45847	306.46377	0	128.68412	60.787928	0.050654675
Slice 2	845.07314	305.16979	0	364.08864	170.48255	1.1473272
Slice 3	846.65135	303.90502	0	1,121.3888	197.73111	1,000
Slice 4	848.45311	302.4611	-818.0923	1,194.5211	689.65709	100
Slice 5	849.81965	301.44973	-697.75254	1,366	788.66047	100
Slice 6	851.06975	300.63166	-608.16334	1,695.5679	369.47285	862.10306
Slice 7	852.875	299.4503	-518.12669	1,983.3892	387.26666	903.62268
Slice 8	854.25	298.5505	-360.91605	2,204.668	399.75197	932.75531
Slice 9	855.68285	297.61284	-124.27981	2,443.0815	412.25802	961.93589
Slice 10	859.49347	296.51661	101.88255	2,160.427	261.54856	610.28061
Slice 11	864.74902	295.87226	247.48637	2,502.7244	268.80824	627.21862
Slice 12	870.3668	295.3023	408.27438	2,801.0504	260.95496	608.89475
Slice 13	876.3468	294.80674	560.1116	3,140.9244	266.94501	622.8717
Slice 14	881.1684	294.4633	665.24622	3,360.2977	266.92494	622.825
Slice 15	885.58705	294.23254	743.53221	3,579.001	271.02331	632.38754
Slice 16	891.93705	294.3249	820.64984	3,661.1951	271.31172	633.06071
Slice 17	896.475	294.59921	857.07665	3,797.8304	274.14822	639.67963
Slice 18	898.466	294.71957	870.45271	3,858.232	275.4563	642.73114
Slice 19	902.3615	295.06885	888.14283	3,897.6386	280.65881	654.87061
Slice 20	907.8205	295.63071	902.39392	4,029.8007	283.91354	662.46447
Slice 21	911.6486	296.02471	907.39282	4,122.0005	286.2655	667.95276
Slice 22	915.16832	296.54271	903.62183	4,087.4812	301.97316	704.60455
Slice 23	920.11058	297.36286	890.86739	4,168.6329	304.61813	710.77567
Slice 24	925.3316	298.22927	872.82907	4,255.8515	307.52036	717.54747
Slice 25	929.74195	299.92575	819.51863	3,276.0153	1,418.259	100

Slice 26	932.11759	301.74018	755.27225	3,112.4221	1,360.9011	100
Slice 27	935.84514	304.73328	589.28127	2,919.7684	1,400.2979	150
Slice 28	941.42875	309.37638	309.38052	2,588.8286	1,369.6306	150
Slice 29	946.2282	313.52815	57.893544	2,349.3494	1,376.8456	150
Slice 30	950.63116	317.42293	-184.49242	2,117.0548	1,272.0548	150
Slice 31	956.10691	322.37626	0	1,887.1983	1,033.2109	195
Slice 32	960.68068	326.68115	0	1,574.3452	861.92884	195
Slice 33	964.08603	330.20975	0	1,378.4757	754.69342	195
Slice 34	967.41055	333.77295	0	1,131.2557	619.3444	195
Slice 35	968.9695	335.54312	0	1,027.6619	562.62844	195
Slice 36	970.41825	337.2621	0	900.58292	493.05475	195
Slice 37	971.95	339.10609	0	778.28263	426.0973	195
Slice 38	974.4884	342.16192	0	520.74765	285.10101	195
Slice 39	977.5384	345.83363	0	312.9617	72.252902	100
Slice 40	979.6796	348.4113	0	72.847979	16.818281	100

Figure 21 **Stability of Excavation @ 90 Days Following Berm Filling – Fully Drained.**

Inward Failure - Drained

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Revision Number: 627
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/21/2013
Time: 4:58:25 PM
File Name: RMU2X1350mse21.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/21/2013
Last Solved Time: 5:33:48 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Inward Failure - Drained

Description: Drained with liner placement
Kind: SLOPE/W
Parent: MSE step5 excavation to subgrd
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6

Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Parent Analysis
Slip Surface
Direction of movement: Right to Left
Use Passive Mode: No
Slip Surface Option: Block
Critical slip surfaces saved: 1
Restrict Block Crossing: No
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °

GC-Drained

Model: Shear/Normal Fn.
Unit Weight: 118 pcf

Strength Function: normalized N^m
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear

GC OverConsolidated
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °

side slope liner
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °

Deflection surface
Model: Bedrock (Impenetrable)

STRUCTURAL FILL
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 195 psf
Phi': 28.7 °
Phi-B: 0 °

NOT ACTIVE
Model: (None)

Slip Surface Limits
Left Coordinate: (773.93733, 308.59677) ft
Right Coordinate: (1,012.8109, 349.89418) ft

Slip Surface Block
Left Grid
- Upper Left: (835.2, 302.8) ft
- Lower Left: (835.2, 290.3) ft
- Lower Right: (867.9, 289.4) ft
- X Increments: 3
- Y Increments: 3
- Starting Angle: 135 °
- Ending Angle: 180 °
- Angle Increments: 2

Right Grid
- Upper Left: (883.2, 306.2) ft
- Lower Left: (892.3, 287.5) ft
- Lower Right: (924.6, 294.7) ft

X Increments: 3
Y Increments: 3
Starting Angle: 45 °
Ending Angle: 65 °
Angle Increments: 2

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function
Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

normalized N^m

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: Mesri1
Field
tan_Phi_100kPa: .548982
power: .147
pa: 2089
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	320
Point 16	1,023.75	319.25
Point 17	897.25	319.5
Point 18	991.25	345.25
Point 19	1,000	349.5
Point 20	1,016.25	350
Point 21	997.75	348.5
Point 22	992.5	347
Point 23	978.5	349.75
Point 24	985.75	350
Point 25	972.4	344.55
Point 26	971.5	349.5
Point 27	910.4	372.6
Point 28	910.6	375.1

Point 29	895.4	371.1
Point 30	895.7	373.6
Point 31	806.4	402.8
Point 32	806.2	400.3
Point 33	791.2	398.8
Point 34	791.4	401.3
Point 35	693	431
Point 36	693	434
Point 37	844.5	307.25
Point 38	842.25	301.25
Point 39	812.5	305.5
Point 40	812.25	301.75
Point 41	732	309.25
Point 42	732	307.25
Point 43	732	303.25
Point 44	883	375
Point 45	751	276
Point 46	751	268
Point 47	854.5	305.25
Point 48	872.5	287.25
Point 49	981.25	300.5
Point 50	1,081.25	276
Point 51	1,080.75	285.5
Point 52	1,080	300.75
Point 53	1,081.25	269.75
Point 54	1,081.25	259
Point 55	812.25	308
Point 56	844.5	304.75
Point 57	851.75	304.5
Point 58	984	344.9
Point 59	732	300
Point 60	854	301
Point 61	981	297
Point 62	1,080	298
Point 63	1,195	298
Point 64	693	399.3332
Point 65	693	375
Point 66	693	349.776
Point 67	693	320

Point 68	693	309.8841
Point 69	693	307.7256
Point 70	693	303.8841
Point 71	693	300.629
Point 72	693	287.25
Point 73	693	275.7081
Point 74	693	267.6094
Point 75	693	258.2508
Point 76	883	320
Point 77	922.5817	328
Point 78	1,021.75	328
Point 79	944	335.1869
Point 80	1,020	335

Regions

	Material	Points	Area (ft²)
Region 1	NOT ACTIVE	35,33,64	1,554.8
Region 2	NOT ACTIVE	64,33,32,44,65	3,703.1
Region 3	NOT ACTIVE	44,29,27,23,26,66,65	6,228
Region 4	Bottom Liner	69,42,39,56,57,47,37,55,41,68	357.53
Region 5	side slope liner	17,77,79,25,58,24,23,26,76	490.49
Region 6	STRUCTURAL FILL	17,77,78,15,16	975.4
Region 7	Upper Till	47,17,16,15,14,13,12,10,11,9,8,7,52,49	5,551.3
Region 8	NOT ACTIVE	74,46,2,53,3,5,54,75	5,092.1
Region 9	NOT ACTIVE	73,45,1,50,4,3,53,2,46,74	3,618.8
Region 10	Deflection surface	72,48,51,6,4,50,1,45,73	5,119.8
Region 11	GC-Drained	71,59,40,38,60,61,62,63,6,51,48,72	6,390.3
Region 12	CCL	69,42,39,56,57,38,40,43,70	590.69
Region 13	NOT ACTIVE	35,33,32,44,29,27,23,24,28,30,31,34,36	773.09
Region 14	GC OverConsolidated	70,43,40,59,71	257.26
Region 15	GC OverConsolidated	38,57,47,49,52,7,63,62,61,60	1,187.5
Region 16	NOT ACTIVE	67,66,26,76	6,948.8
Region 17	side slope liner	37,47,17,76	214.47
Region 18	NOT ACTIVE	68,41,55,37,76,67	1,964.3
Region 19	STRUCTURAL FILL	77,79,80,78	622.19
Region 20	STRUCTURAL FILL	24,22,19,20,80,79,25,58	724.07

Current Slip Surface

Slip Surface: 2,305
F of S: 1.69
Volume: 3,576.9 ft³
Weight: 439,853.77 lbs
Resisting Moment: 31,787,569 lbs-ft
Activating Moment: 18,760,120 lbs-ft
Resisting Force: 156,928.45 lbs
Activating Force: 92,722.065 lbs
F of S Rank: 1
Exit: (830.33586, 307.5794) ft
Entry: (980.74421, 349.82739) ft
Radius: 78.881637 ft
Center: (828.9, 459) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	831.69472	306.29884	0	208.36257	98.226987	0.21503653
Slice 2	834.87769	303.29926	0	1,248.2849	220.1063	1,000
Slice 3	836.88002	301.45839	0	1,312.644	231.45456	1,000
Slice 4	839.65412	299.56156	-1,051.649	1,395.9115	694.62974	119.7076
Slice 5	843.375	297.01735	28.978454	1,862.0368	876.35275	151.02452
Slice 6	844.5689	296.201	134.13535	1,995.5608	887.90801	153.01571
Slice 7	846.77975	295.27251	248.48506	1,981.4534	798.18674	137.55393
Slice 8	850.33585	294.14807	404.79197	2,080.04	624.49139	107.62043
Slice 9	852.875	293.71164	476.47356	2,256.5849	657.68568	113.3409
Slice 10	854.25	293.4753	515.34623	2,352.2196	675.53294	116.41662
Slice 11	857.9797	292.83424	624.38561	2,623.9707	726.25424	125.15757
Slice 12	865.20685	291.97476	798.56884	2,967.8413	715.03602	123.22427
Slice 13	872.70175	291.45196	924.572	3,376.2389	793.71131	136.78271
Slice 14	879.7246	291.39136	990.705	3,505.1793	809.24811	139.45999
Slice 15	886.87325	291.82959	1,017.9211	3,730.9533	863.44999	148.80101
Slice 16	893.07325	292.31998	1,032.3461	3,833.3916	897.43606	154.65747
Slice 17	895.55	292.58923	1,032.8693	3,891.9925	913.28416	157.38893
Slice 18	896.475	292.68979	1,032.8852	3,913.7014	919.19188	158.4067
Slice 19	899.60675	293.03024	1,032.0241	3,990.652	940.32787	162.04959
Slice 20	906.18175	293.97146	1,017.4763	4,036.5927	984.01525	169.57848
Slice 21	914.2602	295.28333	986.05102	4,180.7585	1,032.6287	177.95583
Slice 22	920.35105	296.39296	954.29915	4,184.3122	1,083.4446	186.71317
Slice 23	926.3184	297.68441	912.46648	4,257.7459	1,116.3393	192.38223
Slice 24	932.49261	300.36448	813.56556	3,321.5415	1,447.9806	100
Slice 25	937.34546	304.09021	629.33138	3,098.6786	1,483.7335	150

Slice 26	940.90965	306.94408	456.80212	2,828.5691	1,425.1014	150
Slice 27	943.02925	308.88359	339.38374	2,617.4828	1,368.82	150
Slice 28	946.46933	312.21472	137.42372	2,416.8458	1,369.615	150
Slice 29	951.408	316.99697	-157.56192	2,155.5296	1,295.1728	150
Slice 30	956.65022	322.07315	0	1,915.2348	1,048.5604	195
Slice 31	960.79385	326.3791	0	1,549.5389	848.34779	195
Slice 32	964.8024	331.11915	0	1,275.5314	698.33303	195
Slice 33	967.8145	334.68286	0	1,062.9049	581.92343	195
Slice 34	969.8444	337.09376	0	916.58151	501.81372	195
Slice 35	971.95	339.59456	0	751.71917	411.55423	195
Slice 36	973.20015	341.07935	0	625.75748	342.59222	195
Slice 37	975.1408	343.34839	0	434.24455	237.74194	195
Slice 38	977.39065	345.9498	0	309.2388	71.393403	100
Slice 39	979.62211	348.52994	0	66.005885	15.238659	100

Figure 22 **Post Grid Stability Global– Cohesive Fill**

FINAL WALL DRAINED -GLOBAL Post Grid

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 635
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/16/2013
Time: 2:15:56 PM
File Name: RMU2X1350msepostgrid.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/16/2013
Last Solved Time: 2:25:28 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

FINAL WALL DRAINED -GLOBAL Post Grid

Description: block search with grids
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6

Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.01
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Upper Till
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC-Drained
Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: normalized N^m
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface
Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

STRUCTURAL FILL
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 195 psf
Phi': 28.7 °
Phi-B: 0 °

final cover
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf

Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

AGGREGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (825, 397.13979) ft
Left-Zone Right Coordinate: (943.75, 364.02794) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,050, 333.03428) ft
Right-Zone Right Coordinate: (1,149.8923, 316.91469) ft
Right-Zone Increment: 15
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (810.07006, 402.11077) ft
Right Coordinate: (1,185.0734, 315.0871) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	686	314.5
Coordinate 2	1,194.9	313

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function

Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

normalized N^m

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: Mesri1
Field
tan_Phi_100kPa: .548982
power: .147
pa: 2089
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25

Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350
Point 74	1,076.5	319.61364

Regions

	Material	Points	Area (ft²)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	STRUCTURAL FILL	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,74,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-Drained	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	STRUCTURAL FILL	53,54,71,70	595.93
Region 19	STRUCTURAL FILL	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22
Region 21	STRUCTURAL FILL	73,72,68,14,13,74	786.66

Current Slip Surface

Slip Surface: 1,937
F of S: 1.80
Volume: 13,940.771 ft³
Weight: 1,686,757.8 lbs
Resisting Moment: 1.28104e+008 lbs-ft
Activating Moment: 70,983,792 lbs-ft
Resisting Force: 556,685.86 lbs
Activating Force: 308,785.41 lbs
F of S Rank: 1
Exit: (1,149.6952, 316.92492) ft
Entry: (825, 397.13979) ft
Radius: 161.2852 ft
Center: (1,014.8536, 491.51552) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

Slice 1	825.71708	395.61067	0	95.620493	55.206517	0
Slice 2	829.23428	388.11044	0	515.20827	297.45563	0
Slice 3	835.05097	378.56967	0	1,219.9904	704.36178	0
Slice 4	842.46402	369.79739	0	1,686.5887	973.75246	0
Slice 5	856.27509	357.09999	0	2,517.3396	1,453.3867	0
Slice 6	874.34484	342.71495	0	3,156.8893	1,822.6309	0
Slice 7	883.4339	335.4793	0	3,473.671	2,005.5249	0
Slice 8	889.7839	330.85496	0	3,753.259	2,166.9451	0
Slice 9	896.80861	325.77422	0	4,002.8652	2,311.0553	0
Slice 10	900.3957	323.1798	-581.05223	4,604.4409	1,063.0189	100
Slice 11	904.1901	320.43544	0	4,513.5078	2,471.0734	195
Slice 12	907.06915	318.35311	-281.09458	4,700.0612	2,824.0817	150
Slice 13	909.51615	316.53612	-168.16442	4,795.5079	2,881.4319	150
Slice 14	910.5	315.77204	-120.66671	4,876.8354	2,930.2984	150
Slice 15	911.79972	314.76264	-57.919486	4,940.8832	2,968.7822	150
Slice 16	917.79057	310.11001	231.30311	5,250.8358	3,016.0395	150
Slice 17	922.90155	306.1407	478.04775	5,521.9765	3,030.6982	150
Slice 18	925.5773	304.19518	598.95606	5,775.0532	3,110.1129	150
Slice 19	930.7046	300.50163	828.49085	6,059.6286	3,020.1988	100
Slice 20	938.738	297.68526	1,002.7549	7,797.4032	2,024.1836	348.83284
Slice 21	949.3348	296.03404	1,103.8415	7,711.0405	1,976.4511	340.60817
Slice 22	960.0044	294.37149	1,205.6226	7,624.4968	1,928.2963	332.30886
Slice 23	968.4196	293.12618	1,281.7823	7,610.8224	1,862.6259	320.99183
Slice 24	971.95	292.65166	1,310.7429	7,573.0953	1,845.8714	318.10503
Slice 25	973.52895	292.43943	1,323.6954	7,549.5692	1,836.6956	316.52384
Slice 26	976.57895	292.0764	1,345.7879	7,564.9525	1,795.3286	309.39487
Slice 27	979.75	291.72761	1,366.9686	7,497.7262	1,773.5365	305.63902
Slice 28	981.125	291.57638	1,376.1527	7,464.1796	1,762.9874	303.82043
Slice 29	982.625	291.4114	1,386.1718	7,427.13	1,751.3533	301.81651
Slice 30	984.875	291.16392	1,401.2005	7,409.1378	1,743.185	300.40773
Slice 31	989.125	290.69647	1,429.5879	7,287.1556	1,705.8997	293.98277
Slice 32	996.25	289.91279	1,477.1786	7,372.3622	1,715.2398	295.59236
Slice 33	1,006.25	288.8129	1,543.9726	7,721.6335	1,785.1045	307.63192
Slice 34	1,014.375	287.91924	1,598.2427	7,772.2366	1,784.2002	307.47649
Slice 35	1,016.375	287.69926	1,611.6015	7,692.2544	1,761.1663	303.50594
Slice 36	1,017.247	287.60336	1,617.4256	7,651.6136	1,749.6793	301.52758
Slice 37	1,019.122	287.41634	1,628.7506	7,609.5864	1,716.0347	295.73009
Slice 38	1,022	287.1488	1,644.9156	7,572.2494	1,702.9325	293.47127
Slice 39	1,024.125	286.95127	1,656.851	7,569.7999	1,699.4067	292.86354

Slice 40	1,026.9343	286.69012	1,672.6296	7,430.1685	1,661.2327	286.28485
Slice 41	1,032.3854	286.26768	1,697.9874	7,205.9792	1,581.2898	272.50737
Slice 42	1,036.0762	286.03533	1,711.8075	7,023.955	1,531.1153	263.86091
Slice 43	1,038.1778	285.92244	1,718.465	6,900.5234	1,499.0735	258.3391
Slice 44	1,044.9645	285.80072	1,724.8122	6,575.86	1,416.7539	244.15269
Slice 45	1,055.6825	285.71065	1,728.4611	5,864.0231	1,236.4614	213.08271
Slice 46	1,063.5207	285.66866	1,729.6396	5,355.7219	1,105.2856	190.47738
Slice 47	1,071.25	286.70649	1,663.4572	5,019.9983	1,103.2811	190.13146
Slice 48	1,078.25	288.08621	1,576.0752	4,427.7431	960.06291	165.45038
Slice 49	1,082.625	288.94854	1,521.4615	4,291.7225	936.63508	161.41305
Slice 50	1,087.2096	289.85217	1,464.2319	4,148.381	911.74269	157.12335
Slice 51	1,095.8346	291.89832	1,334.9655	3,898.9646	913.09098	157.35569
Slice 52	1,106.125	294.46099	1,173.1625	3,481.6397	834.8795	143.87735
Slice 53	1,115.0359	296.68009	1,033.0517	3,096.0703	758.53982	130.72121
Slice 54	1,122.6862	299.52012	854.42625	3,130.7867	1,314.2573	100
Slice 55	1,134.4443	307.09716	379.45673	1,789.8454	847.44704	150
Slice 56	1,146.7666	315.03772	-118.30046	400.90501	240.88803	150

FINAL WALL DRAINED - Berm Post Grid

File Information

Title: Model City - RMU-2 XS 1350 MSE
Created By: Peter J. Carey
Last Edited By: Peter J. Carey
Revision Number: 635
File Version: 8.0
Tool Version: 8.0.10.6504
Date: 2/16/2013
Time: 2:15:56 PM
File Name: RMU2X1350msepostgrid.gsz
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\MSE-C8\
Last Solved Date: 2/16/2013
Last Solved Time: 2:18:16 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Days
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

FINAL WALL DRAINED - Berm Post Grid

Description: closer to berm region search
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6

Lambda 10: 0.8
Lambda 11: 1
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 4
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 25
F of S Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 2,000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 2 °
Resisting Side Maximum Convex Angle: 0.5 °

Materials

Waste Material

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Bottom Liner

Model: Shear/Normal Fn.
Unit Weight: 120 pcf
Strength Function: Baseliner
Phi-B: 0 °

CCL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 10 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Upper Till

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 31 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

GC-Drained

Model: Shear/Normal Fn.
Unit Weight: 118 pcf
Strength Function: normalized N^m
Phi-B: 0 °
Anisotropic Strength Fn: clay ellipse staticshear
Pore Water Pressure
Piezometric Line: 1

GC OverConsolidated

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

side slope liner

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 13 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Deflection surface

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

STRUCTURAL FILL

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 195 psf
Phi': 28.7 °
Phi-B: 0 °

final cover

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf

Phi': 30 °
Phi-B: 0 °

NOT ACTIVE

Model: (None)
Pore Water Pressure
Piezometric Line: 1

AGGRAGATE

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 48 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (980, 351.92049) ft
Left-Zone Right Coordinate: (1,016, 349.98558) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (1,050, 333.03428) ft
Right-Zone Right Coordinate: (1,149.8923, 316.91469) ft
Right-Zone Increment: 15
Radius Increments: 12

Slip Surface Limits

Left Coordinate: (810.07006, 402.11077) ft
Right Coordinate: (1,185.0734, 315.0871) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	686	314.5
Coordinate 2	1,194.9	313

Anisotropic Strength Functions

clay ellipse staticshear

Model: Spline Data Point Function

Function: Modifier Factor vs. Inclination
Curve Fit to Data: 100 %
Segment Curvature: 50 %
Y-Intercept: 0.7058887
Data Points: Inclination (°), Modifier Factor
Data Point: (-60, 1)
Data Point: (-30, 1)
Data Point: (-17.838428, 0.90468204)
Data Point: (-3, 0.706)
Data Point: (3, 0.706)
Data Point: (23.685228, 0.90009497)
Data Point: (39.261389, 1)
Data Point: (59.397364, 1)

Shear/Normal Strength Functions

Baseliner

Model: Shear/Normal Spline Data Point Function
Function: Shear Stress vs. Normal Stress
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Y-Intercept: 0
Data Points: Normal Stress (psf), Shear Stress (psf)
Data Point: (0, 0)
Data Point: (500, 235)
Data Point: (1,000, 463)
Data Point: (2,000, 899)
Data Point: (5,000, 2,057)
Data Point: (10,000, 3,515)
Data Point: (15,000, 4,430)
Estimation Properties
Intact Rock Param.: 10
Geological Strength: 100
Disturbance Factor: 0
SigmaC: 600,000 psf
SigmaC: 300,000 psf
Num. Points: 20

normalized N^m

Model: Add-In Function
Function: Shear Stress vs. Normal Stress
Assembly: GeoStudio AddIns1
Function: Mesri1
Field
tan_Phi_100kPa: .548982
power: .147
pa: 2089
Y-Intercept: -1.#IND

Points

	X (ft)	Y (ft)
Point 1	851	276.5
Point 2	851.5	268.5
Point 3	1,195	269.75
Point 4	1,195	276
Point 5	1,195	259.75
Point 6	1,195	284.25
Point 7	1,195	301.5
Point 8	1,195	315.5
Point 9	1,186.75	315
Point 10	1,102.5	319.25
Point 11	1,109.75	319
Point 12	1,085.25	319.5
Point 13	1,066	319.75
Point 14	1,036.75	320
Point 15	1,023.75	319.25
Point 16	897.25	319.5
Point 17	991.25	345.25
Point 18	1,000	349.5
Point 19	997.75	348.5
Point 20	992.5	347
Point 21	978.5	349.75
Point 22	985.75	350
Point 23	972.4	344.55
Point 24	971.5	349.5
Point 25	910.4	372.6
Point 26	910.6	375.1
Point 27	895.4	371.1
Point 28	895.7	373.6
Point 29	808	402.8
Point 30	808	400.3
Point 31	844.5	307.25
Point 32	842.25	301.25
Point 33	812.5	305.5
Point 34	812.25	301.75
Point 35	883	375
Point 36	854.5	305.25
Point 37	872.5	287.25

Point 38	981.25	300.5
Point 39	1,081.25	276
Point 40	1,080.75	285.5
Point 41	1,080	300.75
Point 42	1,081.25	269.75
Point 43	1,081.25	259
Point 44	812.25	308
Point 45	844.5	304.75
Point 46	851.75	304.5
Point 47	984	344.9
Point 48	854	301
Point 49	981	297
Point 50	1,080	298
Point 51	1,195	298
Point 52	883	320
Point 53	922.5817	328
Point 54	944	335.1869
Point 55	808	375
Point 56	808	349.66253
Point 57	808	308.07399
Point 58	808	320
Point 59	808	305.61957
Point 60	808	301.63551
Point 61	808	287.25
Point 62	808	276.285
Point 63	808	268.28358
Point 64	808	258.47271
Point 65	808	301.84813
Point 66	1,020.25	319.25692
Point 67	1,012.5	349.88462
Point 68	1,024.5	320
Point 69	1,024.5	319.25
Point 70	1,018	328
Point 71	1,016.25	335.00922
Point 72	1,023.75	320
Point 73	1,016.5	350
Point 74	1,076.5	319.61364

Regions

	Material	Points	Area (ft²)
Region 1	Waste Material	30,35,55	948.75
Region 2	Waste Material	35,27,25,21,24,56,55	3,320.7
Region 3	Bottom Liner	59,33,45,46,36,31,44,57	106.61
Region 4	side slope liner	16,53,54,23,47,22,21,24,52	490.49
Region 5	STRUCTURAL FILL	16,53,70,66	942.95
Region 6	Upper Till	36,16,66,15,69,68,14,13,74,12,10,11,9,8,7,41,38	5,550.7
Region 7	NOT ACTIVE	63,2,42,3,5,43,64	3,987
Region 8	NOT ACTIVE	62,1,39,4,3,42,2,63	2,695.9
Region 9	Deflection surface	61,37,40,6,4,39,1,62	3,825.7
Region 10	GC-Drained	60,34,32,48,49,50,51,6,40,37,61	4,848.7
Region 11	CCL	59,33,45,46,32,34,65	142.59
Region 12	final cover	30,35,27,25,21,22,26,28,29	458.66
Region 13	GC OverConsolidated	65,34,60	0.45182
Region 14	GC OverConsolidated	32,46,36,38,41,7,51,50,49,48	1,187.5
Region 15	Waste Material	56,24,52,58	3,531.2
Region 16	side slope liner	31,36,16,52	214.47
Region 17	Waste Material	57,44,31,52,58	695.37
Region 18	STRUCTURAL FILL	53,54,71,70	595.93
Region 19	STRUCTURAL FILL	22,20,18,67,71,54,23,47	667.86
Region 20	AGGRAGATE	66,15,69,68,72,73,67,71,70	119.22
Region 21	STRUCTURAL FILL	73,72,68,14,13,74	786.66

Current Slip Surface

Slip Surface: 2,289
F of S: 1.75
Volume: 517.00485 ft³
Weight: 66,986.112 lbs
Resisting Moment: 3,497,247.2 lbs-ft
Activating Moment: 1,996,644.3 lbs-ft
Resisting Force: 42,609.045 lbs
Activating Force: 24,326.308 lbs
F of S Rank: 1
Exit: (1,076.5689, 319.61274) ft
Entry: (1,014.0021, 349.92795) ft
Radius: 40.164621 ft
Center: (1,071.9585, 392.06488) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

Slice 1	1,014.5521	348.8985	-2,206.8957	54.068975	60.04968	0
Slice 2	1,015.8011	346.70463	-2,070.2277	176.17056	195.65722	0
Slice 3	1,017.3847	344.06641	-1,905.8944	307.94861	342.01158	0
Slice 4	1,019.2246	341.48616	0	528.03875	289.09277	195
Slice 5	1,021.1206	339.28999	0	611.85552	334.98111	195
Slice 6	1,023.5916	336.99333	0	803.79591	440.06541	195
Slice 7	1,026.6519	334.57942	0	860.7827	471.26477	195
Slice 8	1,029.6109	332.52282	0	1,005.513	550.50228	195
Slice 9	1,032.4685	330.82351	0	1,026.8823	562.20165	195
Slice 10	1,034.968	329.43084	0	1,105.7793	605.39649	195
Slice 11	1,037.1094	328.34479	0	1,112.4582	609.05305	195
Slice 12	1,039.3929	327.26655	0	1,171.1981	641.21221	195
Slice 13	1,041.8184	326.19612	0	1,168.1697	639.55425	195
Slice 14	1,044.2946	325.15775	0	1,201.4456	657.77225	195
Slice 15	1,046.8213	324.15146	0	1,188.0146	650.41898	195
Slice 16	1,049.2842	323.23215	0	1,217.9159	666.78945	195
Slice 17	1,051.6832	322.39983	0	1,187.357	650.05898	195
Slice 18	1,053.8304	321.68778	0	1,187.4412	650.10504	195
Slice 19	1,055.7257	321.09601	0	1,149.9151	629.5601	195
Slice 20	1,058.5958	320.28009	0	1,114.2145	610.01461	195
Slice 21	1,061.5366	319.53741	-383.40553	1,059.6088	636.67721	150
Slice 22	1,063.5734	319.09212	-355.99374	972.85209	584.54851	150
Slice 23	1,065.2959	318.76226	-335.72764	935.40711	562.0493	150
Slice 24	1,067.659	318.40246	-313.71075	801.17804	481.39634	150
Slice 25	1,070.3843	318.20523	-301.90482	706.38338	424.43795	150
Slice 26	1,072.5172	318.31596	-309.20635	501.23575	301.17282	150
Slice 27	1,075.0418	318.9777	-350.9634	274.83927	165.1401	150
Slice 28	1,076.5345	319.59841	-389.97039	43.904324	26.380379	150

ATTACHMENT 2

P.J.Carey & Associates, P.C.

CLIENT CWM

CALCULATION BY PETER CAREY

PROJECT RMU-2

CHECKED BY KLH

JOB No 154.005

APPROVED BY PJC

DATE 2 – 16 – 13

OBJECT Calculate the strip Loading for a CAT 740 articulated dump truck

From Catepillar

$$Load_{total} := 160055lb$$

Assuming 2 strip loads representing left and right of truck

$W_{tire} := 34.6in$ Width of a loaded tire based on a 29.5R25 tire on a rigid surface

Tire company says total contact are is 505 in^2

$$A := 505in^2 \qquad L_{tire} := \frac{A}{W_{tire}} \qquad L_{tire} = 1.216 \cdot ft$$

$$\frac{L_{tire}}{2} = 0.608 \cdot ft$$

The closest tires are 6.4' apart center to center. This means that the strip load can be 6.4' plus the additional contact that the tire provides outside of that center to center distance.

Assume strip load is 6.4' in length

$$Length_{load} := 6.4ft + \frac{L_{tire}}{2} \cdot 2$$

Design Surcharge load per side of vehicle

$$Surcharge := \frac{Load_{total}}{W_{tire} \cdot Length_{load} \cdot 2}$$

Add a dynamic factor to the dead load

$$F_{dynamic} := 1.5$$

$$Surcharge \cdot F_{dynamic} = 5.466 \times 10^3 \cdot \frac{lb}{ft^2}$$

this is the surcharge load per side of truck, that is why there are two loads that are each the width of the tire placed approximately 9 feet apart.

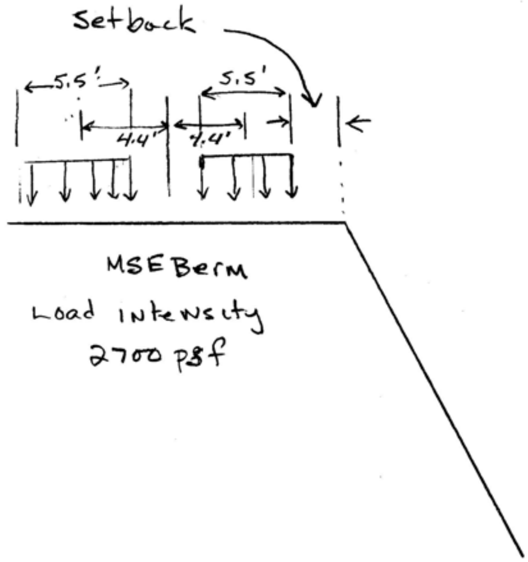
This load is applied at the ground surface and is spread laterally in both the direction normal to the wall face and parallel to the wall face with depth. The predicted spreading can be approximated by elastic stress distributions to at least a depth of 4 feet, ignoring the influence of the georeinforcement. An equivalent strip load is computed at this depth to represent a conservative approximation to be applied to the 2 dimensional stability analysis. Alternatively a 1/2 to one spreading function could also be used . Based on the use of the 1/2 to 1 spreading function the strip load of the indivual units changes to

$$\text{Surcharge}_{4ft} := \frac{\text{Load}_{total}}{\left(L_{tire} + 4ft\right)\cdot\left(\text{Length}_{load} + 4ft\right)} = 2.641 \times 10^{3}\ \frac{lb}{ft^{2}}$$

the dimension of the strips each extend to $L_{tire} + 4ft = 5.216\ ft$

and they center at 8.8 ft apart in section

for design use a 5.5 foot width surcharge of 2700 psf, as shown in the sketch below



"truckloadgraphic.jpg"

ATTACHMENT 3

Georeinforcement Grid Properties

Grid #	Outside Point Elevation (ft)	Total Length (ft)	Tensile Capacity (lbs)
1	319.5	31.5	6,800
2	321	30.5	6,800
3	322.5	30.1	5,900
4	324	31.8	5,900
5	325.5	31.4	5,900
6	327	32.0	4,900
7	328.5	31.5	4,900
8	330	10.0	1,000
9	331.5	34.9	4,900
10	333	10.0	1,000
11	334.5	36.1	4,900
12	336	10.0	1,000
13	337.5	37.4	4,900
14	339	10.0	1,000
15	340.5	36.6	3,000
16	342	10.0	1,000
17	343.5	36.4	2,300
18	345	24.0	2,300
19	346.5	20.6	3,000
20	348	18.3	3,000

ATTACHMENT 4

P.J.Carey & Associates, P.C.

CLIENT CMW

PROJECT RMU-2

JOB No: 154.002

DATE 9/08/2012

CALCULATION BY Peter J. Carey

CHECKED BY Katherine Howard

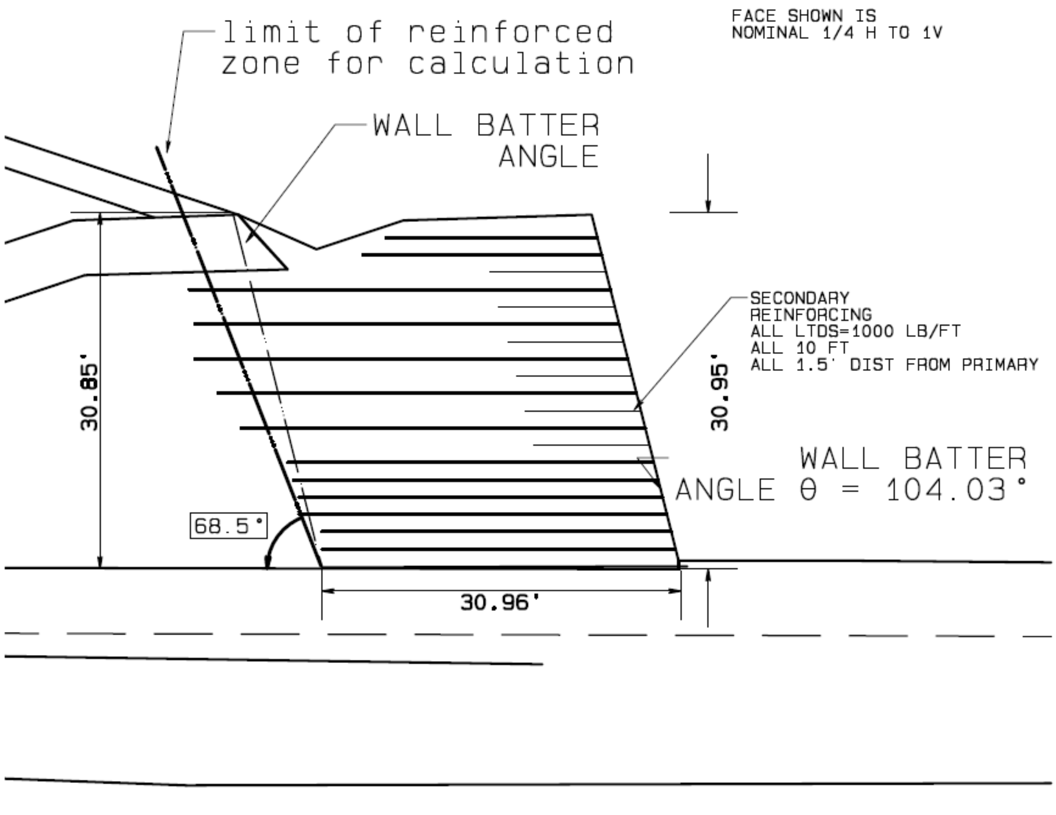
APPROVED BY Peter J. Carey

OBJECT Calculation Sliding, Eccentricity and Bearing Capacity performance of MSE Wall

Reference:

1. Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Volume 1, FHWA Publiciation # FHWA-NHI-10-024, November 2009

WALL SECTION



The sloping backfill of the waste pile is $\beta := \mathrm{atan}(.333) = 18.418 \cdot \mathrm{deg}$. in all cases, or less. Conservatively assume the waste materials and the earthen fill materials are of the same density an shear strength

Figure 4-5 in Ref 1 provides the appropriate free body diagram. The active coefficient of earth pressure can be calculated using equations 4.2 and 4.3 from Ref 1 (shown below)

$$K_{ab} = \frac{\sin^2(\theta + \phi'_b)}{\Gamma \sin^2\theta \sin(\theta - \delta)} \qquad (4\text{-}2)$$

where:

$$\Gamma = \left[1 + \sqrt{\frac{\sin(\phi'_b + \delta)\sin(\phi'_b - \beta)}{\sin(\theta - \delta)\sin(\theta + \beta)}}\right]^2 \qquad (4\text{-}3)$$

β = Nominal slope of backfill behind wall (deg)

δ = Angle of friction between retained backfill and reinforced soil, set equal to β (deg)

ϕ'_b = effective friction angle of retained backfill (deg)

$\beta = 18.418 \cdot \mathrm{deg}$ $\quad \theta := 104.036\mathrm{deg}$ $\quad \phi'_b := 28\mathrm{deg}$ $\quad \delta := \beta$ for a 0.25H:1V wall

$$\Gamma := \left(1 + \sqrt{\frac{\sin(\phi'_b + \delta) \cdot \sin(\phi'_b - \beta)}{\sin(\theta - \delta) \cdot \sin(\theta + \beta)}}\right)^2 = 1.9$$

Equation (4-3)

$$K_{ab} := \frac{\sin(\theta + \phi'_b)^2}{\Gamma \cdot \sin(\theta)^2 \cdot \sin(\theta - \delta)} = 0.309$$

Equation (4-2)

$\gamma_{backfill} := 135 \frac{\mathrm{lbf}}{\mathrm{ft}^3}$ $\quad h := 30.85\mathrm{ft}$ $\quad H := h$

$F_T := \frac{1}{2} \cdot \gamma_{backfill} \cdot h^2 \cdot K_{ab}$ $\quad F_T = 1.987 \times 10^4 \frac{1}{\mathrm{ft}} \cdot \mathrm{lbf}$ this is per foot of wall

$$F_H := \cos[\delta - (\theta - 90\mathrm{deg})] \cdot F_T = 1.981 \times 10^4 \frac{1}{\mathrm{ft}} \cdot \mathrm{lbf}$$

$$F_V := \sin[\delta - (\theta - 90\mathrm{deg})] \cdot F_T = 1.518 \times 10^3 \frac{1}{\mathrm{ft}} \cdot \mathrm{lbf}$$

these forces act at $\frac{h}{3} = 10.283\,\mathrm{ft}$ above the base of reinforcement

The above values (F's) are without any surcharge due to traffic loading and can be used for Sliding Calculations, as all surcharges are within the reinforced mass limits

Factor of Saftey Against Sliding

Resistance against Sliding

$\phi_\tau := 1.0 \qquad R_\tau := \tan(\phi'_b)$ given that the backfill has the lower phi value compared to the underlying subrage at the CWM RMU-2 location

$R_R := \phi_\tau \cdot R_\tau = 0.532$ Equation (4-4)

Driving Component

using load factored design approach $\gamma_{EH} := 1.5 \qquad \gamma_{EV} := 1$

$P_d := \gamma_{EH} \cdot F_H = 2.972 \times 10^4 \cdot \frac{lbf}{ft}$ Equation (4-11)

Resisting Component

$V_1 := L \cdot H \cdot \gamma_{backfill} = 1.289 \times 10^5 \cdot \frac{lbf}{ft} \qquad V_2 := \frac{\gamma_{backfill} \cdot L \cdot (h - H)}{2} = 0 \cdot \frac{lbf}{ft} \qquad \mu := \tan(\phi'_b)$

$R_r := \left[\gamma_{EV} \cdot (V_1 + V_2) + \gamma_{EH} \cdot (F_H)\right] \cdot \mu \qquad R_r = 8.436 \times 10^4 \cdot \frac{lbf}{ft}$ Equation (4-13)

$$CDR := \frac{R_r}{P_d} = 2.839$$

If the CDR is greater than 1.0 the result is acceptable (this is equivalent to a FS of 1.5 using the working stress FS approach).

Loads Associated with Traffic

FHWA suggests a 2 foot surcharge be added for walls to simulate surchages associated with traffic based on Table 4-4., shown below, these loads are added to the loads associated with earth pressure to evaluate Eccentricity (Overturning)

Table 4-4. Equivalent Height of Soil, h_{eq}, for Traffic Loading on Abutments Perpendicular to Traffic (Table 3.11.6.4-1, AASHTO {2007}).

Abutment Height (ft)	h_{eq} (ft)
5.0	4.0
10.0	3.0
≥ 20.0	2.0

$h_{eq} := 2.0ft$ $\qquad q_{surch} := \left(\gamma_{backfill} \cdot h_{eq}\right)$ $\qquad L = 30.96\,ft$ $\qquad h = 30.85\,ft$

$F_2 := K_{ab} \cdot q_{surch} \cdot H = 2.576 \times 10^3 \dfrac{1}{ft} \cdot lbf$ $\qquad$ Equation (4-6)

Sum Moments to determine Eccentricity

Center of Mass of the reinforced zone (earth mass) is approximately 3.7 ft on the landfill side of the center of the bottom width (L) $\sin(14.03deg) \cdot \dfrac{h}{2} = 3.739\,ft$,

taking moments about the center of the gravity load

$$e := \frac{\gamma_{EH} \cdot F_H \cdot \dfrac{h}{3} - F_V \cdot \gamma_{EH} \cdot \left[\dfrac{L}{2} - (3.7 - 2.5)ft\right] + F_2 \cdot \dfrac{h}{2}}{\gamma_{EV} \cdot V_1} = 2.426\,ft$$

this indicates the centroid is 2.449 feet on the outside of the CG of the earthmass, $\dfrac{L}{2} + 3.7ft - e = 16.754\,ft$ from the toe

this is still inside of the center of the base, so this is acceptable

Evaluation of Bearing on Foundation

calculation of e_B for use in the bearing capacity evaluation

$\gamma_{EV\_max} := 1.35$ $\qquad q_{surch} = 270 \cdot psf$ $\qquad \gamma_{LS} := 1.75$ $\qquad L = 30.96\,ft$

$$e_B := \frac{\gamma_{EH} \cdot F_H \cdot \frac{H}{3} - F_V \cdot \gamma_{EH} \cdot \left[\frac{L}{2} - (3.7 - 2.5)ft\right] + F_2 \cdot \frac{H}{2}}{\gamma_{EV\_max} \cdot V_1 + \gamma_{LS} \cdot q_{surch} \cdot L + \gamma_{EV} \cdot F_V}$$

$e_B = 1.645\,ft$ $\qquad \gamma_{EH\_max} := \gamma_{EH}$

$$q_{v\_f} := \frac{\gamma_{EV\_max} \cdot V_1 + \gamma_{LS} \cdot q_{surch} \cdot L + \gamma_{EH\_max} \cdot F_V}{L - 2 \cdot e_B} = 6.902 \times 10^3 \cdot psf$$

using the upper glacial till properties of c' =150psf and ϕ' = 31 deg

$c_f := 150psf \quad N_c := 32.7$ $\qquad L' := if\left(L - 2 \cdot e_B > L, L, L - 2 \cdot e_B\right) = 27.671\,ft$

$N_\gamma := 25.9$

$$q_n := c_f \cdot N_c + 0.5 \cdot L' \cdot 130 \frac{lbf}{ft^3} \cdot N_\gamma \qquad q_n = 5.149 \times 10^4 \cdot psf$$

$q_r := 0.65 \cdot q_n$ check to see ratio of $\frac{q_r}{q_{v\_f}} = 4.849$ this is greater than 1 its acceptable

if , conservatively the drained strength parameters of the underlying overconsolidated GC were appliec with no increase associated with embedment, the results would be acceptable given the higher effective strength parameters associated with the overconsolidated GC compared to the upper till. Deeper failures are been assessed through stability analyses

Summary

For Sliding, Eccentricity and Bearing Capacity all results are acceptable by a significant margin.

ATTACHMENT 5

P.J.Carey & Associates, P.C.

CLIENT CWM

PROJECT RMU-2 Permit

JOB No 154.005

DATE 2/11/2013

CALCULATION BY Peter J. Carey

CHECKED BY KLH

OBJECT Calculate Increase Allowed For Short Term Loading on GeoGrids - Relative to Long Term Design Strength

Reference:
FHWA-NHI-10-024 Design of Mechanically Stabilized Earth Walls and Reinforced Slopes – Vol. 1.

The reference states that dynamic loadings of short duration need not be reduced for load duration/creep considerations. Only the long term loadings associated with the soil weights and other long term static loads require this reduction. Given that PET based have less of a reductior for loads of long term duration, the ratio of the allowable total tensile loading under dynamic conditions relative to the long term design strength will be least for PET based grids.

Using the typical reduction factors for construction damage, chemical and biological attack and creep reduction for long term loads for PET based grid the total strength available dynamic loads can be determined if the minimum factor of safety of 1.5 (assumes the maximum tensile loading of the grid for static case allowed for long term conditions in the Geoslope analysis which applies a factor of safety to the grid tensile capacity when computing the overall tensile load applied).

Typical PET based grid reduction factors based on recent project completed with PET grid

$RF_{install} := 1.05$ for the type of soil anticipated

$RF_{durability} := 1.15$ for the mid range expected

$RF_{creep} := 1.55$ representing the low end of the likely values

$GridTensile_{test} := 1$ define the test strength against which the reductions are applied

overall reduction factor for LTDS $RF_{total} := RF_{install} \cdot RF_{durability} \cdot RF_{creep}$

$RF_{total} = 1.872$ $\frac{1}{RF_{total}} = 0.534$

under static condition the long term strengths developed include an overall reduction of 1/1.5

define the Factor of Safety as $FOS := 1.5$ at a minimum

$RF_{static}(FOS) := RF_{total} \cdot (FOS)$ $\qquad RF_{static}(FOS) = 2.807$

Therefore the total strength available that is not being used to support static loading is only 1/3 of the short term capacity of the grid as measured in the lab tensile test at a maximum. The remaining strengths can be used for dynamic response reduced only for durability and creep

Given the total strength, uncorrected by reduction factors cannot exceed the grid tensile strength in the test the increase in the strength allowed for dynamic loading can be computed

what remains from the long term loading once the factor safety is applied is multiplied by the creep reduction factor to become the amount of strength that could be added to the static load component of long term design expressed as a portion long term design strength

$$DynamicADD := \left(\frac{GridTensile_{test}}{RF_{total}} - \frac{GridTensile_{test}}{RF_{static}(FOS)} \right) \cdot RF_{creep} = 0.276$$

Total under dynamic loading then becomes

$$Dynamic_{tot} := \frac{1}{RF_{static}(FOS)} + DynamicADD = 0.632$$

the ratio is $\quad \dfrac{Dynamic_{tot}}{\dfrac{1}{RF_{total}}} = 1.183$ $\quad$ or 18% assuming a very low creep reduction factor

so the allowable design tension for dynamic loadings used

$\dfrac{1}{0.85} = 1.176$ $\quad$ less than the 18% minimum that is suggested as allowable (not considering the safety factor which is applied to the dynamic analysis).

if the minimum factor of safety under static loading is used

The actual Factor of Safety attained under static conditions was greater approximately 2 for failures passing through the grids

$$DynamicADD := \left(\frac{GridTensile_{test}}{RF_{total}} - \frac{GridTensile_{test}}{RF_{static}(FOS)} \right) \cdot RF_{creep} = 0.414$$

Total under dynamic loading then becomes

$$Dynamic_{tot} := \frac{1}{RF_{static}(FOS)} + DynamicADD = 0.681$$

the ratio is $\dfrac{Dynamic_{tot}}{\dfrac{1}{RF_{total}}} = 1.275$ or 28% assuming a very low creep reduction factor

note that the 33 % general recommended increase in strength for dynamic conditions is higher than computed for this example which assumed a very low creep reduction factor for PET grids and greater than used on this project but may be appropriate for HDPE grids with higher creep reductions

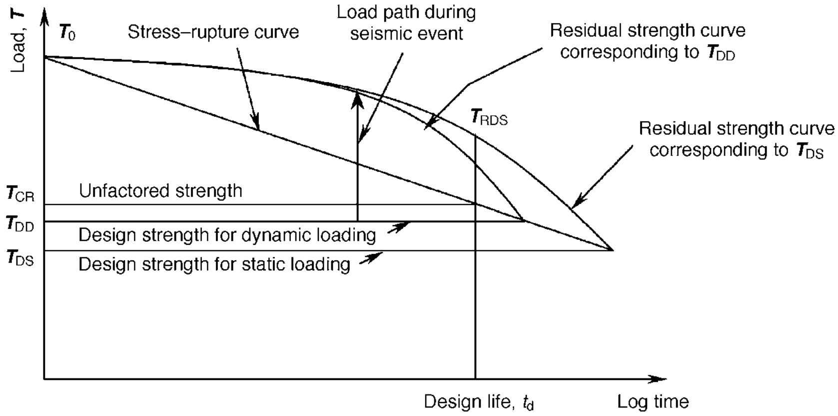


Fig. 14.4. Concept of residual strength available to reinforcement layer under dynamic loading

geosynthetic-reinforcement materials after long-term creep loading. They concluded that the rupture strength reduction of PET and polyolefin reinforcement products does not vary linearly with logarithm of time. Rather, the residual index strength of polymeric reinforcement products is always greater than what is assumed based on conventional log-linear creep-rupture curves. Residual strength curves for materials with an index tensile strength, $\boldsymbol{T}_0$, are illustrated in Fig. 14.4. The residual strength curves are assumed to intersect the conventional creep-reduced strength curve at static and dynamic design strength values, $\boldsymbol{T}_{DS}$ and $\boldsymbol{T}_{DD}$, respectively. In North American practice, the design load under seismic loading can be increased by 33%. Hence, $\boldsymbol{T}_{DD} > \boldsymbol{T}_{DS}$ in this figure. Importantly, a reinforcement layer at a value of $\boldsymbol{T}_{DD}$ can be expected to have an available residual strength $\boldsymbol{T}_{RDS} \gg \boldsymbol{T}_{DD}$. This additional strength is not considered in current limit-equilibrium methods of design and is a potential source of conservatism.

An implication of observations reported in this section to seismic design is that the available strength and stiffness of geosynthetic reinforcement products under earthquake loading is not less than conventional estimates of available reinforcement strength in static load environments and may indeed be very much greater.

14.2.2.2. In-isolation cyclic load testing

In order to determine cyclic load parameters for reinforcement models used in dynamic finite element modelling, in-isolation cyclic load tests were carried out on typical polymeric geogrid reinforcement materials (Bathurst and Cai, 1994; Cai and Bathurst, 1995). Example results are presented in Fig. 14.5 for an HDPE geogrid. The cyclic load–strain behaviour of typical HDPE and woven PET geogrid reinforcement materials exhibited two distinct features:

(*a*) non-linear hysteresis unload–reload loops
(*b*) a load–strain cap that is tangent to all initial unload–reload hysteresis curves.

At low strains or to simplify numerical computations, the hysteretic behaviour of the geosynthetic may be ignored. In this case, the relationship between axial load and axial strain for the initial loading can be assumed to take a non-linear quadratic form (Yogendrakumar *et al.*, 1991; Chalaturnyk *et al.*, 1988) expressed as:

$$\boldsymbol{T}_a = J_i \varepsilon_a \left(1 - \frac{\varepsilon_a}{2\varepsilon_{af}}\right) \tag{14.7}$$

ARCADIS

Appendix C-9

RMU-2 Initial Fill Progression

APPENDIX C-9

RMU-2 INITIAL FILL PROGRESSION

PREPARED FOR

CWM

PREPARED BY

P.J. Carey & Associates, PC

September 14, 2009
Revised 2/2013

TABLE OF CONTENTS

Figures

Attachments

1 INTRODUCTION

1.1 SCOPE OF APPENDIX C-9

This appendix addresses the stability of the waste mass and baseliner elements under the initial fill progression phase of the landfill. The material properties for the subsurface soils, structural fill, liner materials, final cover and waste materials are those presented in the Summary of Shear Strength Properties for Stability Analysis presented in Appendix A-1. These materials properties are summarized in this Appendix and appear on each of the Figures presenting stability or coupled consolidation analysis. . In addition, the analyses regarding stability during construction rely upon procedures for coupled consolidation stress that are presented in this Appendix. Stability sections at specific locations were used for the evaluation of the initial fill progression plan. The methods of section development are the same as those described in Appendix C-5.

Discussion of the assignment of the physical properties of the materials used in the analyses is also presented for each general type of analysis.

This Appendix is subdivided into two main parts, the slope stability analysis and the seismic deformation analysis.

2 TIME RATE OF LOADING

2.1 OPERATIONAL GRADING

A plan depicting the initial fill progression in Cell 20 was provided by ARCADIS. Two critical cross sections, from a stability perspective, were selected. C 20 Section OP-1 was selected to pass through the thickest underlying GC material and have the steepest operating slopes near the edge of liner. C 20 Section OP-2 was selected to pass through the temporary storage basin where the waste thickness is limited as well as traverse the waste slope where it is steeper. The fill progression plan and the location of the critical cross section analyzed are shown in Figure 1.

2.2 GENERAL MODELING APPROACH

Placement of waste materials within the landfill results in the compression of the subgrade under the liner system. The assumed rate of waste placement exceeds the rate that the GC can consolidate in response to the added loading, resulting in the development of excess pore pressures. The combination of waste placement rate, the geometry of the operational grading plan and the proposed grading and tie ins at the perimeter of Cell 20 were all included in the evaluation of the stability of the proposed initial fill progress plan. As can be seen in Figure 1, the fill progression plan includes the access roads, liner run out zones and temporary stormwater runoff areas.

The Glaciolacustrine Clay (GC) underlying RMU-2 is a lightly overconsolidated clay with a maximum past pressure that is less than the stresses that will be applied to it during the filling of RMU-2. Excess over hydrostatic pore pressures will develop in the GC in response to the placement of waste. The pore pressures will dissipate over time as the clay consolidates. The pore pressure generation and dissipation rates are a function of the rate of loading, the consolidation characteristics of the clay and the distance to a relatively free draining face. One dimensional consolidation test data was utilized to determine the consolidation characteristics of both the lightly overconsolidated GC and the more overconsolidated crust of the GC. The results of this testing are presented in Appendix A-1.

Given the influence of the drainage boundaries, the time history of loading, variation in geometry under the site and the potential for generation of shear stress related pore pressures, a two dimensional finite element modeling approach was elected to compute time related pore pressure dissipation and its impact on stability. The GeoStudio 2012 software utilized in the analysis of the site by PJCA includes coupled consolidation analysis method where the stress and seepage models are coupled to allow simulation of two dimensional systems that are drainage impeded. The result is the prediction of pore pressures at selected times that are generated due to the placement or removal of materials. The resulting pore pressures are used by the SlopeW module of GeoStudio to perform stability calculations. It should be noted that the use of a two dimensional model was adopted primarily to facilitate the pore pressures within the GC and overlying layers. The direction of drainage in these layers is primarily vertical and the values of pore pressure at a given time are mostly a function of the loading history. Pore pressure build up, to the extent it occurs, in the underlying GSS is very conservatively estimated by this approach, given that the free boundary conditions in the sand are allowing drainage both along the cross section and perpendicular to it.

2.2.1 TIME RATE OF CONSOLIDATION PROPERTIES

The compression and shear characteristics of the GC layers were described using the Modified Cam-clay model developed by Britto and Gunn. The Modified Cam-clay model incorporates the consolidation and shear behaviors into a single model, allowing plastic yielding. Input parameters for the model can be derived from φ', compression ratios (CR and RR), the initial void ratio and OCR. The coupled stress/seepage modeling used to simulate time rate of consolidation also requires the determination of permeability and assignment of drainage boundary conditions. In addition, the model requires the definition of the permeability of the layers that are either contributing to the release of pore water during compression or transmitting the released pore water to the transmissive. At this site, the main transmissive layers are the Glacial Sand and Silt and potentially the upper bedrock surface. Layers that are compressive enough to contribute to significant pore water release during compression are the CCL, the overconsolidated GC crust and the lightly overconsolidated GC. The upper till, sand and silt and lower glacial till are too stiff to contribute significant consolidation waters.

The selection of parameters for the use in the finite element modeled time rate of loading sensitive analyses was presented in Appendix A-1 and are summarized in tabular form below in Tables 2.1 and 2.2.

2.2.1 ASSIGNED BOUNDARY CONDITIONS

Drainage and stress boundary conditions were assigned in the finite element model to simulate the field conditions.

2.2.1.1 Stress Boundary Conditions

The left and right and sides of the model were assigned fixed X and free Y stress boundary conditions. These were assigned to the infinite elements at either side of the model to simulate continuous conditions beyond the limits of the mesh. The base of the model was assigned fixed X and Y boundary conditions to simulate the bedrock. No other stress boundary conditions were assigned.

2.2.1.2 Hydraulic Boundary Conditions.

Three kinds of hydraulic boundary conditions were assigned in the finite element model. These were;

- **No flow boundary –** this condition allows no flow to pass the boundary. This boundary condition was assigned at the boundary between the CCL and the Baseliner, simulating the impervious boundary created by the FML in the secondary composite liner.

- **No flow unless pressure –** this condition allows flow to exit the boundary if the pore pressure at the boundary is positive. It represents one way leakage and was subject to review in each time iteration to decide what the head should be set at to meet the boundary condition. This boundary condition simulates a ground surface and was assigned to the top of layers that would be expected to express groundwater, such as the top of the excavation.

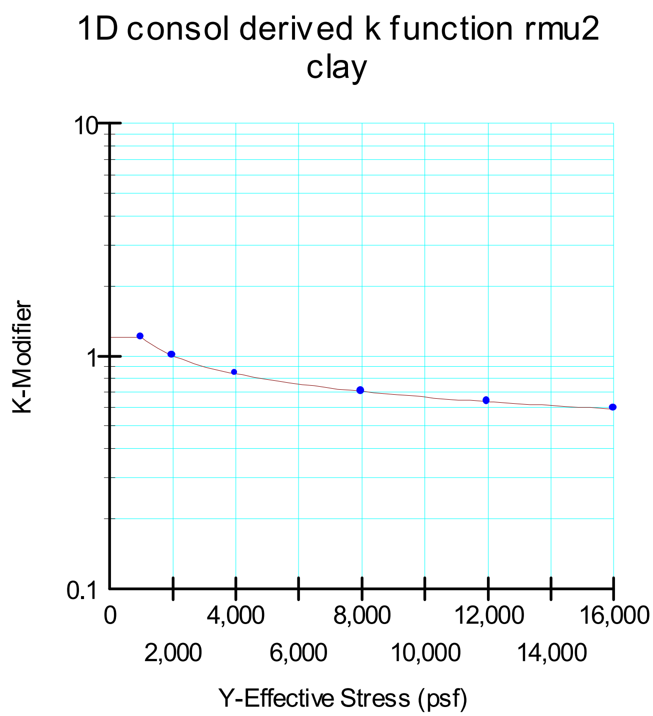
Table 2.1 : Material Properties Used for Coupled Consolidation – Stress Related

Material	Sigma Model	Total Unit Weight (pcf)	Young's Modulus (E) (psf)	Effective Young's Modulus (E') (psf)	Poisson's Ratio	Insitu Ko	O.C. Ratio	Lambda	Kappa	Initial Void Ratio	Phi'
Waste Material	Linear Elastic (Total)	111	400,000		0.45	0.81818182	-	-	-	-	-
Bottom Liner	Linear Elastic (Total)	120	400,000		0.45	-	-	-	-	-	-
CCL	Linear Elastic (w/ PWP Change)	120		1,000,000	0.334	-	-	-	-	-	-
Upper Till	Linear Elastic (w/ PWP Change)	125		300,000	0.334	0.5015015	-	-	-	-	-
GC-Drained	Soft Clay (MCC w/ PWP Change)	118			0.334	0.5015015	4	0.14	0.013	1	27 °
GC OverConsolidated	Soft Clay (MCC w/ PWP Change)	125			0.334	0.5015015	8	0.06	0.01	0.5	30 °
Sand/Silt	Linear Elastic (w/ PWP Change)	135		300,000	0.334	0.5015015	-	-	-	-	-
Lower Till	Linear Elastic (w/ PWP Change)	145		600,000	0.334	-	-	-	-	-	-
Structural Fill	Linear Elastic (w/ PWP Change)	135		100,000	0.334	0.5015015	-	-	-	-	-
UPPER SHALE	Linear Elastic (w/ PWP Change)	145		1,000,000	0.334	0.5015015	-	-	-	-	-

Table 2.2 : Material Properties Used for Coupled Consolidation - Hydraulic

Material	Permeability Function and k at saturation (horizontal Kx)	Ky/Kx Ratio	Horizontal Rotation
Waste Material	-	-	-
Bottom Liner	-	-	-
CCL	GC 5.7 E-4 ft/day	0.1	0 °
Upper Till	Upper Glacial Till k=0.0057 ft/day	1	0 °
GC-Drained	GC 5.7 E-4 ft/day	1	0 °
GC OverConsolidated	GC 5.7 E-4 ft/day	1	0 °
Sand/Silt	Silty Sand, k = 0.567 ft/day 2 E-4cm/sec	0.1	0 °
Lower Till	Till 5.67 E-4 ft/day	1	0 °
Structural Fill	Till 5.67 E-4 ft/day	1	0 °
UPPER SHALE	Upper Rock , k=0.567 ft/day	1	0 °

A stress modifying function was also assigned to the GC materials that reduced the k values with increasing vertical effective stress. This function is depicted in Attachment 2 of Appendix A-1 and presented graphically below, as entered into the GeoStudio Software.



- **Constant Head –** Constant total head boundaries maintain the head assigned to them and allow liquid to flow in either direction. Constant head boundaries were assigned to the bottom and edges of bedrock and the edges of the model representing the head levels of the GSS.

The various heads assigned were color coded and show in the key. Heads of 313 were used along the bottom of the shale and edges of the model below elevation 313.

A depiction of the FEM model with hydraulic boundary conditions is presented for in the analysis depicting liner construction in Figures 2 and 3, for Section OP-1 and Section OP-2, respectively. The boundary conditions and model mesh are identical in the later stages of the analysis except that waste materials are placed by lift above the liner. No additional boundary conditions are applied in the later model stages.

2.3 TIME RATE OF FILLING

The impact of the time rate of construction on the development and dissipation of pore pressures in the GC was investigated. The placement of waste in Cell 20 was divided into 10 horizontal lifts. The first lift extended from the top of the liner system to elevation 329. The remaining lifts were 6 feet thick. The volume per waste lift was determined by

The rate of fill placement was assumed to be instantaneous within the lift. Each lift was assigned a duration equal to the filling time determined by the volume per lift divided by the waste rate per quarter. The volume of each lift was determined using a volume between the filling plan and the top of the drainage system, within the limits of waste by elevation performed in Terramodel. This analysis was performed assuming a waste rate per quarter of 50,000 yd^3. Details of the time of filling per lift determination are provided in Attachment 1. A summary of fill times per lift is provided in the table below.

Top of Waste Lift El	Fill Time per lift @ 50,000 yd^3/qtr	Elapse Time From Beginning Waste Filling
(ft)	(days)	(days)
329	88.9	88.9
335	77.3	166.3
341	80.5	246.8
347	79.2	326.0
353	65.6	391.6
359	54.0	445.6
365	43.5	489.1
371	33.8	522.9
377	25.0	547.9
383	12.7	560.6
385	1.4	562.0

Note the elapsed time does not include the 120 days assigned for landfill cell construction

The time to complete each stage was assigned to be that based on the volume per lift divided by the waste rate (as a daily average). A total of 12 time steps were assigned for each waste lift. In this way the time to fill the lift was included in the analysis of pore pressures. Presuming the waste application is repeated from starting to ending location on each lift in similar direction, the analysis represents the uniform application of 6 foot lifts all at the average rate resulting in the maximum quarterly application rate.

The elapsed time of presented on the analyses represents the sum of time since the initial analysis prior to liner placement. A time period of 120 days was assumed between liner placement and the onset of operations. A total time period of 695 days was needed to reach the final lift shown in the operation plan, or 575 days of filling time (approximately 19 months). Each analysis presents the starting time of the lift and the duration of the lift. The elapsed time of the figure also indicates the lift step and total elapsed time of the step (see the annotated Figure 4. Each analysis, except for the initial stress determination, utilized the previous time step for the stress, deformations, and pore pressures present at the end of the previous time step. This is referred to in each analysis as the "Parent Analysis".

2.4 PREDICTED PORE PRESSURES

The pore pressures at the end of each stage of filling are depicted in coupled consolidation output figures for each section. Each lift of the analysis for both sections is presented. The pore pressure is presented in the form of contours of excess head in psf. The contour interval is documented on the Figures.

Sensitivity of the predicted pore pressures to the conductivity of the GSS was evaluated on Section OP-2. It was found that slight elevation in head resulted if the permeability of the sand were diminished by a factor of 10 to $k_x = 2 \times 10^{-5}$cm/sec (horizontal and 0.1 x k_x vertically) . This analysis was identical in all other respects to the Section OP-2 analysis presented. The final time step is presented for documentation. The changes in predicted pore pressure resulting from the lowering of the GSS permeability were small enough to still result in a factor of safety of 1.5, as discussed in Section 3.5 of this Appendix.

For the purpose of stability analyses, the pore pressures for the 4th time step following the assumed instantaneous placement of the loads was used for importation into the stability analysis for the lift. For the upper lifts (lift 9 and 10) where stability was the controlling issue, this amounted to very little time difference between the instantaneous application of the fill loads and the calculation of the pore pressures used for stability. The elapsed time between instantaneous loading and pore pressure calculation was approximately 8 and 4 days for lifts 9 and 10, respectively. This approach accounts for the time it takes to actually deposit sufficient material within the landfill to generate a fill area large enough to be modeled realistically as a 2 dimensional failure.

A final stage of consolidation was performed once the upper lift was filled to reflect conditions that would exist 1 year following the end of filling. These results were utilized in the evaluation of yield acceleration for the two sections.

A table summarizing the elapsed times per lift and waste elevation is presented below. It will be noted that the elapsed times assigned differed slightly between the two sections. The small elapsed time differences are immaterial to the results.

Table of Coupled Consolidation Analyses

Section/Analysis	Stage	Duration	Elapsed Time at end of stage	Parent Analysis Fig #	Figure #
OP-1	In-Situ	0	0	NA	5
OP-1	Liner Construction	120	120	5	6
OP-1	Waste Lift 1	88	208	6	7
OP-1	Waste Lift 2	74	282	7	8
OP-1	Waste Lift 3	79	361	8	9
OP-1	Waste Lift 4	76	437	9	10
OP-1	Waste Lift 5	66	503	10	11
OP-1	Waste Lift 6	54	557	11	12
OP-1	Waste Lift 7	44	601	12	13
OP-1	Waste Lift 8	34	635	13	14
OP-1	Waste Lift 9	25	660	14	15
OP-1	Waste Lift 10	13	673	15	16
OP-1	Waste Lift 10 1 year After Placement	365	1038	16	17
OP-2	In-Situ	0	0	NA	18
OP-2	Liner Construction	120	120	18	19
OP-2	Waste Lift 1	88	208	19	20
OP-2	Waste Lift 2	74	282	20	21

Section/Analysis	Stage	Duration	Elapsed Time at end of stage	Parent Analysis Fig #	Figure #
OP-2	Waste Lift 3	79	361	21	22
OP-2	Waste Lift 4	76	437	22	23
OP-2	Waste Lift 5	65	502	23	24
OP-2	Waste Lift 6	56	588	24	25
OP-2	Waste Lift 7	47	605	25	26
OP-2	Waste Lift 8	40	645	26	27
OP-2	Waste Lift 9	30	675	27	28
OP-2	Waste Lift 10	18	693	28	29
OP-2	Waste Lift 10 1 year After Placement	365	1058	29	30
OP-2 –GSS 0.1	Waste Lift 10	18	693	Prev step not shown	31

3 STABILITY ANALYSIS

3.1 GENERAL

This section addresses the

- method of limit equilibrium analysis
    - static with pore pressures from coupled stress analysis
    - pseudo-static analyses
- assignment of material properties
- assignment of piezometric heads
- analysis results

3.2 METHOD OF ANALYSIS

3.2.1 LIMIT EQUILIBRIUM ANALYSIS

The analysis of all sections reported in this appendix was performed using Slope/W as part of the GEOStudio 2012 software package Version 8.0.10.605 under license from GEO-SLOPE International Ltd. This software allows flexibility in the description of shear strength under both drained and undrained conditions and a significant number of analytical methods to be used. Addins were utilized to allow the use of the normalized φ' and SHANSEP models for which parameters are described in Appendix A-1. The software also allows the use of anisotropic modifiers, which were applied to soils as described in Appendix A-1 and summarized in Section 3.2.2.

All analyses presented in this report utilized the Morgenstern - Price with half sine side forces. This method places the slide mass in both force and moment equilibrium when obtaining the safety factor. The analyses, with the exception of pseudo-static analyses to determine yield acceleration, were performed allowing the software to optimize the shape of the failure surface to obtain the minimum factor of safety. Selection of this option allows the failure surface to conform to the section conditions as opposed to the rigid conformance to a circular or straight line shape block failure. Both block type and circular type failure searches were utilized as the initial search method from which software optimized automatically in the individual analysis.

For pseudo-static analyses, the failure surface possessing the minimum safety factor with no acceleration applied, using the same soil properties that were to be used for the pseudo-static analysis was entered as a fully defined failure surface. This was accomplished by copying the mid points of the slices from the static analysis into the pseudo-static analysis. No optimization was used for pseudo-static analyses.

The search method, limits of search, and type of search are all documented on the presented stability analysis figures and the text output files in Attachment 1

In addition, search zones were further focused into the areas of weaker soils by use of deflection surfaces. The assignment of a deflection surface to the GSS or LGT for analyses including subgrade failures prevents surfaces from running into these stronger layers which would have higher factors of safety and instead deflects the surface along the upper boundary of the deflection surface. In this fashion the number of trial surfaces within the weaker zone is increased. In the case of RMU-2, the difference between the strength of the GSS and the overlying GC is significant resulting in all critical failure surfaces staying above the GSS. This same technique was utilized to analyze baseliner only failures by assigning materials below the baseliner as deflection surfaces.

Directional modifier functions (Anisotropic Strength) have been utilized for the GC soils to allow the strength of the soils to be defined for steeply oriented failures in general and have the strength reduced as a function of the angle of the failure plane relative to the horizontal. The use of these functions allows the lower shear strength associated with near horizontal failures in soft clays to be included in the analysis. The software applies the reduction factor defined based on the orientation of the bottom of the slice.

The material properties assigned to each of these type of analyses are presented below.

3.2.2 MATERIAL PROPERTY ASSIGNMENTS

The material properties assigned for the stability analyses varied depending on the conditions being analyzed. In this Appendix, the conditions analyzed consisted of long term drained conditions, partially drained conditions during filling and fully consolidated undrained conditions for seismic response evaluations. Each of the material property sets are summarized below. Full explanation of the material properties is contained in Appendix A-1.

3.2.2.1 Long Term Drained Conditions

Analyses of this type were performed to determine the long term stability of initial fill progression plan under static conditions after complete consolidation of the GC. This is the condition that exists for all but the initial period following filling of a cell or during seismic events. Effective stress parameters are applied to all materials. A listing of the material assignments for these conditions is provided in Table 3-1. The rationale for choosing these parameters is provided in Appendix A-1

Pore pressures were assigned from the coupled consolidation analysis at the end of 1 year of consolidation following completion of the 10 waste lift, the upper most lift of the fill progression plan. The pore pressures present in the analysis are presented as pore pressure contours in psf on the stability figures.

3.2.2.2 Partially Drained Conditions During Filling of the Cell

These types of analyses were performed to facilitate the prediction of performance of initial fill progression plan under seismic conditions. The application of seismic loads occurs during a relatively short period (seconds or minutes) and the performance of the GC and OCG materials is best described by an undrained strength. The compacted structural fill, if clayey in nature will also respond in a fashion best described by the undrained strength. The remaining materials are best described by their effective stress parameters. The properties assigned for this type of analysis that were changed are presented

Table3.1: Material Properties Used for Drained Long Term Conditions

Material	Total Unit Weight (pcf)	c' (psf)	ϕ' (deg)	Shear Function (if used)	Directional Modifier (if applied)	Section in Appendix A-1
Waste	111	0	30			5.1
Baseliner	120			Baseliner (Shear Normal Function)		5.2
Side Slope Liner	115	0	13			5.3
Compacted Clay Liner (CCL)	120	1000	10			
Compacted Structural Fill	130	195	28.7			4.3.1
UGT	125	150	31			4.2
OGC	125	100	30			4.1.2
GC	118			Normalized Phi $q = n' \cdot Tan 28.77° \cdot \frac{100kPa}{n'}^{1-0.853}$	"clay ellipse static shear (0.706 on horizontal)	4.1.2
GSS				Deflection Surface		

Table 2.2: Material Properties Partially Drained or Consolidated Undrained (where different from Long Term Drained)

Material	Total Unit Weight (pcf)	c' (psf)	ϕ' (deg)	Shear Function (if used)	Directional Modifier (if applied)	Section in Appendix A-1
Compacted Structural Fill (cohesive)	130	363	26.3			4.3.1
OGC	125			SHANSEP S=0.34, m = 0.7 max past press. = 8000 psf	"clay ellipse static shear (0.706 on horizontal)	4.1.2
GC	118			SHANSEP S=0.34, m = 0.7 max past press. = 5000 psf	"clay ellipse static shear (0.706 on horizontal)	4.1.2

in Table 3.2. All properties not reflected in Table 3.2 are identical to those in Table 3.1

The strength of the GC materials, as described in Appendix A-1, have undrained strengths that are a function of the stress to which they have been consolidated, their maximum past pressure, the amount of shearing stress present during consolidation and the direction in which they are being sheared. Each of these factors has been incorporated in the analysis under the seismic conditions using the SHANSEP formulation with a direction modifier function that reflects the significant static shear present under the consolidated undrained state once the fill has been placed. The directional modifier assigned for this condition is the "clay ellipse staticshear, reflecting the presence of static shear during the consolidation period

Pore pressures assigned to these analyses were from the fourth of twelve equal time steps of the lift being placed from the coupled consolidation model. The pore pressures present in the analysis are presented as pore pressure contours in psf on the stability figures.

3.2.2.3 Determination of Critical Surface for Pseudo-Static and Yield Acceleration Analyses (Seismic Response)

These types of analyses were performed to facilitate the prediction of performance of initial fill progression plan under seismic conditions. The application of seismic loads occurs during a relatively short period (seconds or minutes) and the performance of the GC and OCG materials is best described by and undrained strength. The compacted structural fill, if clayey in nature will also respond in a fashion best described by the undrained strength. The remaining materials are best described by their effective stress parameters.

The material assignments for this condition were identical to those of the partially drained conditions during filling.

Pore pressures assigned for these analyses were from the coupled consolidation analysis 365 days following completion of the last waste lift (lift 10). The pore pressures present in the analysis are presented as pore pressure contours in psf on the stability figures.

3.2.3 POTENTIAL FAILURES PASSING BELOW THE BASELINER SYSTEM

The search for minimum factors of safety is dependent on the shape of the failure surface. At RMU-2 the presence of the relatively weak GC stratum and the geometry of the perimeter berm heavily influence the shape of critical failure surfaces. An initial exploration of failure surfaces was performed that identified that the lowest factors of safety were achieved by creating a deflection surface at the base of the GC layer. The assignment of the deflection surface forces all potential failure surfaces generated that would normally have proceeded to pass into the GSS or LGT, which are much stronger materials, to deflect and remain in the GC layer or until they would normally move into the overlying strata. This greatly increased the number of failure surfaces analyzed that have lower factors of safety.

3.2.4 POTENTIAL BASELINER RELATED FAILURES

Potential failures passing through the waste and along the baseliner system, either the CCL or overlying baseliner components were explored. As the factors of safety for failures of this type were higher than failures passing through subgrade at the end of each filling stage, the failures needed to be forced to stay within the liner system. Search blocks were focused on the zone around the liner and layers below the UGT were assigned as deflection surfaces.

3.3 RESULTS

The results of the stability analyses are presented in Figures 32 through 47, with the stability key presented on Figure 31. These figures are graphical representations of the stability analyses direct from the Geostudio Software. The figures depict the following:

- Geometry of the section analyzed,
- Material assignment by region number,
- Material properties by material assignment,
- Analysis method,
- Search method and limits,
- Piezometric surface used and assignment to material, including the parent analysis if pore pressures were assigned from a coupled consolidation analysis,
- Horizontal acceleration applied (pseudo-static analyses only) and,
- Factor of safety.

For the coupled consolidation analyses to determine pore pressure, the material properties and elapsed time is presented, along with excess pore pressure contours present at the elapsed time presented.

An annotated example identifying symbols and call outs is provided in Figure 2 in the form of a key. In addition, an output file for each analysis created by the software that presents the input parameters and the details of the minimum failure surface and forces, etc. is provided in Attachment 2.

The results are summarized in tabular form below, organized by the condition being analyzed with reference to the figure number it is presented in and the page in Attachment 2 the output file begins on. In addition, for the yield acceleration determination analyses, the Figure presenting the determination of the critical failure surface is referenced.

3.3.1 LONG TERM DRAINED CONDITIONS - SUBGRADE

Long term drained conditions for the initial fill progression plan were performed to demonstrate that the proposed configuration built to elevation 383 would be stable over the long term if left un-buttressed for extended periods by adjacent cells. The results are summarized in the table below.

Section Station	Figure #	Fig # of Parent Analysis	Elapsed Time	Factor of Safety
OP-1	33	18	1038	1.903
OP-2	34	31	1058	1.931

The factor of safety for long term drained conditions of the initial fill progression plan is much greater than the required 1.5.

3.3.2 PARTIALLY DRAINED CONDITIONS DURING FILLING – SUBGRADE RELATED

Stability during the filling of the initial cell, Cell 20, were performed for the two sections analyzed and the sensitivity analysis of the OP-2 section using a much reduced permeability of the GSS material. The results are summarized in the table below.

Section Station	Figure #	Waste Lift	Elapsed Time	Factor of Safety
OP-1	35	6	521	2.057
OP-1	36	9	643	1.630
OP-1	37	10	664	1.583
OP-1	38	10	1038	1.688
OP-2	39	9	655	1.584
OP-2	40	10	681	1.573
OP-2	41	10	1058	1.674
OP-2 GSS 0.1	42	10	681	1.506

All factors of safety for the design are greater than 1.5 for during filling at the maximum rate proposed.. The sensitivity analysis performed on OP-2 (OP-2 GSS) shows that the factor of safety remains above 1.5 even if the GSS layer permeability is one order of magnitude lower than indicated by site data. In addition, the analyses indicate that the factors of safety are sufficiently high through waste lift 9 to allow temporary variations in the filling rate as long as the quarterly average is consistent with the 50,000 yd^3 per quarter proposed maximum.

3.3.3 PARTIALLY DRAINED CONDITIONS DURING FILLING - BASELINER RELATED

The minimum factor of safety for failure surfaces passing along the baseliner were evaluated for the last lift using the pore pressures from the fourth of twelve time steps. The results are summarized in the table below.

Section Station	Figure #	Elapsed Time	Factor of Safety
OP-1	43	664	1.900
OP-2	44	681	2.073
OP-2 GSS	45	681	1.914

The high factors of safety possessed by this mode of failure indicates it is not a factor in the design

3.3.4 SEISMIC RESPONSE ANALYSES

The yield acceleration for failures passing into the subgrade was determined for the time period 365 days after completion of waste lift 10. The results are summarized in the table below.

Section Station	Figure #	Parent Figure # for surface	Factor of Safety	Yield Acceleration
OP-1	46	38	1.004	0.1445
OP-2	47	41	1.004	0.15

3.3.5 VARIATION IN SLOPES FROM PROPOSED PLAN

Variation in slopes from the proposed filling plan may occur at the site. At present the permit at RMU-1 allows for slopes up to 45 feet high to be as steep as 3:1. For the initial fill progression plan the total fill height is only 54 feet from the top of the initial lift to the top of the fill. As a result a shorter 2:1 slope, 33 feet high was investigated, presuming the fill times per lift remained the same. This represents the maximum fill zone that can practically be left at a 2:1 slope while maintaining access and drainage. The results of the analyses, summarized in the table below, show that if the lift heights are subject to the same time constraint of filling to reach the lift top elevation, then the factors of safety are essentially the same as those attained for the grading scheme shown in the fill progression plan.

Section Station	Figure #	Elapsed Time	Factor of Safety
OP-1	48	643	1.651
OP-1	49	664	1.587

4 SLOPE DEFORMATION ANALYSIS

4.1 GENERAL PROCEDURE

At the request of NY DEC a demonstration that the initial fill progression plan at its full height would not deform excessively under the same design event applied to the site for the final build out condition. The probability of such an event occurring during the un-buttressed operational plan life is significantly less than for the overall site. None the less, the analysis was performed exactly as described in Section 3.4 of Appendix C-5, with the exception that an additional idealized profile was generated to reflect the thickness of waste of the failure masses that were identified in the pseudo-static analyses described in 3.3.4 of this Appendix. Therefore, the details of the analysis up to that point are not repeated in this Appendix.

4.2 ADDITIONAL SHAKE ANALYSIS

4.2.1 IDEALIZED PROFILE

Site response analyses were conducted using the bedrock acceleration time histories described above and idealized soil profiles and dynamic soil properties. The stability sections as discussed in Section 3 of this appendix were reviewed to determine the thicknesses of the strata in the idealized profile at certain locations. A single idealized profile was used to simulate the initial fill progression plan potential failures into subgrade. Figure 50 presents the idealized shear wave velocity versus depth for OP Sections. The profile is summarized below:

Section	Thickness (ft)						General Description
	Waste	Fill	Upper Till	Glaciolacustrine Clay	Glaciolacustrine Sand/Silt	Lower Till	
OP	33 Waste 6 (Liner)	0	11	10	11	5	Initial Fill Progression

The properties of the materials are identical to those presented in Section 3.4 of C-5.

4.3 SHAKE RESULTS

Figure 51 presents the peak horizontal acceleration versus depth for the Sections OP. The figure contains the results for the idealized profile run for all eight (8) input motions.

4.4 For the purposes of predicting permanent deformations, the response spectra at the approximate depth of the base of the critical failure using SHAKE was extracted. The response spectra used for predicting permanent deformations are presented in Figure 52

4.4 PREDICTION OF PERMANENT DEFORMATIONS

The permanent deformations were evaluated using the procedure described in detail in Bray and Travasarou[1]. This procedure represents an evolutionary improvement over the original case study based charts presented by Makdisi and Seed[2] that are contained in the RCRA Subtitle D (258) (USEPA)[3]. The Bray and Travasarou procedure incorporates the dynamic properties of the embankment (or waste mass), the soil column properties, event magnitude and the frequency content of the earthquake event. This is achieved by utilizing the initial fundamental period of the site and the grounds spectral acceleration (Sa) (as opposed to the peak acceleration) along with yield acceleration to obtain predictions of permanent deformation. The use of more site specific variables than just the ratio of yield acceleration to peak ground acceleration and magnitude, utilized by Makdisi and Seed to develop their displacement chart, results in a better prediction for a given site.

The predicted Sa values at the degraded 1.5Ts (Sa(1.5Ts) values were determined at the base at the layer defining the base of the potential failure mass, e.g. within the Glaciolacustrine clay for failures controlled by the Glaciolacustrine clay and at the baseliner level for baseliner potential failures. They were taken to be the maximum value resulting from the eight (8) input motions for each of the respective waste heights. The table below summarizes the resulting spectral accelerations.

Table 3-6: Spectral Accelerations at Degraded Period for Idealized Profiles

Section	Waste Height (ft)	Average V_s for the Sliding Mass Soil Column (ft/s) V_s	Height Sliding Mass Soil Column (ft) H	Initial Fundamental Period (s) $T_s = 4H/V_s$	Degraded Fundamental Period (s) $1.5*T_s$	Spectral Acceleration @ Degraded Period[1] (g)
OP	33	794.9	58.5	0.29	0.44	0.17

These values along with the yield coefficient (yield acceleration (ky) expressed in g), and the earthquake magnitude were used to predict a seismic displacement.

The Bray and Travarasou procedure adopts a probabilistic approach to displacement prediction. A probability 95% that the actual displacements are less than predicted was adopted to represent the predicted displacement. In addition, the probability that the permanent displacement would exceed the

[1] Bray, J.D and Travasarou, T, “Simplified Procedure for Estimating Earthquake-Induced Devatoric Slope Displacements”, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Volume 133, No.4, April 2007.

[2] Makdisi, F.1.,and Seed,H.B., "Simplified Procedure for Estimating Dam and Embankment Earthquake Induced Defonnations," ASCE Journal of Geotechnical Engineering, Vol. 104, No. GT7, July 1978, pp. 849-867.

[3] United States Environmental Protection Agency, "RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities," April 1995.

design standard of less than 6” of movement under the design seismic event requested by the NYDEC was computed by adopting 6 inches as the “threshold” displacement. Attached Figure 53 and 54 show the calculations and methodology used to calculate the displacements and include the probability of displacements exceeding 6 inches and the displacements associated with a probability of exceedance of 1%, 5% (95% probability of being less than predicted value) and 15%. The resulting table summarizes the predicted displacements based on a 5% probability of exceedance. The normal probability of exceedance deflection is typically based on the mean plus one standard deviation (or the 85% probability of less than limit). The results from Section OP-1 were utilized as it had the lower yield acceleration.

Section	Waste Height (ft)	Cross Section	Cross Section k_y (g)	Displacement (cm)	Displacement (in)
OP	33	Sta OP-1	0.1445	0.23	.1

For the worst case section analyzed, the probability that displacements would exceed the threshold displacement of 6 inches was computed to be 0%. The yield acceleration associated with 6 inches of displacements can be estimated by inspecting the graphs on the Bray and Travarasou spreadsheet. Typically the mean value associated with 6 inches is less than 0.02 g for failures passing through the liner into the GC materials. This is considerably less than the 0.1445 g minimum value obtained from the stability analyses and underscores the degree to which seismic response is not a controlling factor in the design of the facility.

Input and Output files from the SHAKE analyses are voluminous and are provided in digital form in electronic file similar to those provided for Appendix C-5.

5 LIMITATIONS ON FILL SEQUENCING

5.1 GENERAL

The pore pressured under the initial operational cell will be monitored using vibrating wire piezometers. The results from the piezometers will allow the relationship between filling rates and pore pressures to be measured as opposed to predicted. The values obtained will be used to assess fill rates looking forward. However, it should be noted that the factor of safety at the lower lifts, such as waste lift 6 was found to be in excess of 2 with partial drainage. This clearly suggests significant flexibility is available below the 6^{th} or 7^{th} lift with regard to localized variation in the grading scheme and fill rates. In addition, the monitoring of pore pressures, which will be detailed in the O&M plan, negates the need to place restriction on the fill rates per month, provided the monitoring is done bi-weekly and examined relative to a chart that will be made available in the O&M plan connecting waste elevation and pore pressure.

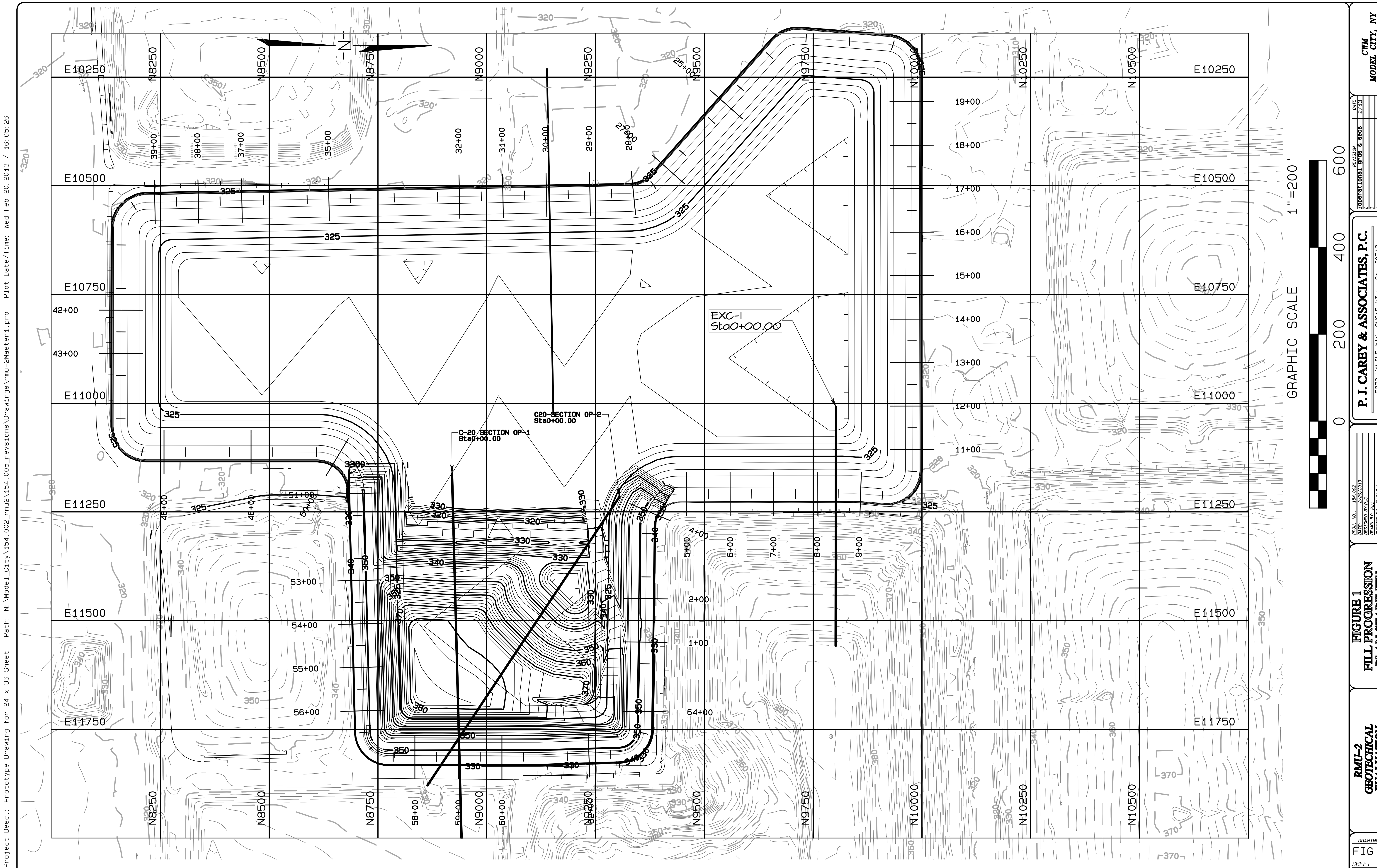
Limitations on the relative heights of the 2:1 maximum slopes were examined. The results indicate that a practical maximum vertical slope height that can be attained in this initial fill progression plan is 33 feet. Factors of safety for a time rate of filling equal to the attainments of top of lift elevations at the same elapsed times depicted for the general progression plan results in factors of safety of greater than 1.5 even when the slope is placed as close as possible to the west edge of the cell that would result in the peak elevation being no higher than the fill progression plan surface.

6 CONCLUSIONS

Based on the evaluation of the global and baseliner stability under partially drained conditions associated with a filling rate of approximately 50,000 yd^3 per quarter, the following conclusions are reached:

- The proposed maximum filling rate per quarter or slower filling rates will result in safety factors of greater than 1.5 for failures passing through the subgrade and the baseliner system.
- Failures passing through waste and along the baseliner associated with this fill progression plan have factors of safety in excess of 1.9 if the same interface shear and liner component shear strengths obtained for RMU-1 are obtained. Lower interface shear strengths could be accommodated.
- Long term factors of safety under static conditions for the fill progression plan are greater than 1.9
- .Predicted permanent displacement of the landfill mass under the design seismic event is less than ¼ inch.

FIGURES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EXC-1
Sta0+00.00
C20-SECTION OP-2
Sta0+00.00
C-20 SECTION OP-1
Sta0+00.00
GRAPHIC SCALE
1"=200'
0
200
400
600
CWM
MODEL CITY, NY
P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE WAY, SUGAR HILL, GA. 30518
FIGURE 1
FILL PROGRESSION
PLAN STABILITY
RMU-2
GEOTECHICAL
EVALUATION
DRAWING
FIG 1

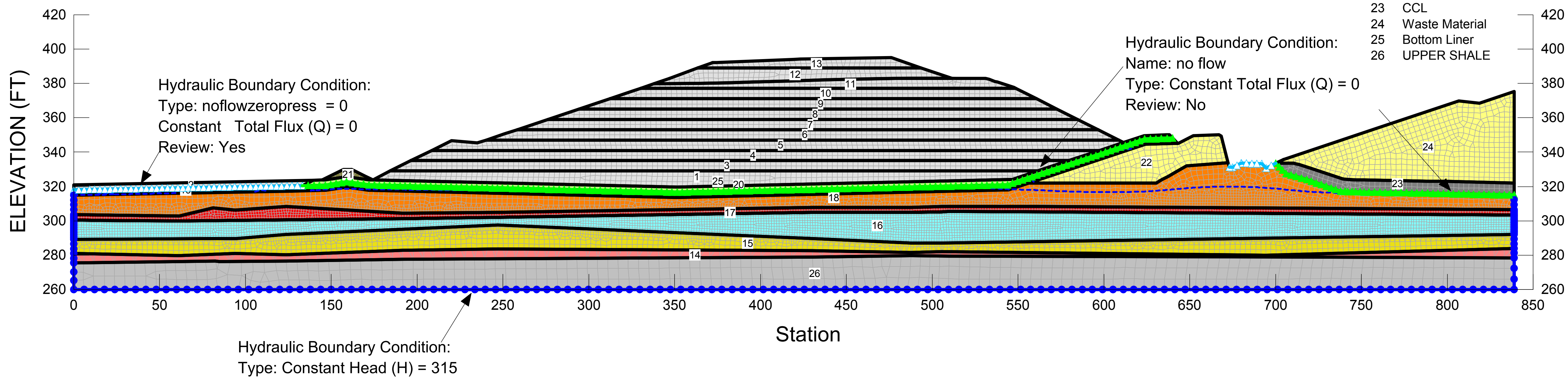
PURPOSE:

To present the mesh and hydraulic boundary conditions at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: LINER CONSTRUCTION
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1_key.gsz
Last Saved Date: 2/12/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 0 days
Duration: 120 days

REGION Material Assignments

1	NOT ACTIVE
2	NOT ACTIVE
3	NOT ACTIVE
4	NOT ACTIVE
5	NOT ACTIVE
6	NOT ACTIVE
7	NOT ACTIVE
8	NOT ACTIVE
9	NOT ACTIVE
10	NOT ACTIVE
11	NOT ACTIVE
12	NOT ACTIVE
13	NOT ACTIVE
14	Lower Till
15	Sand/Silt
16	GC-Drained
17	GC OverConsolidated
18	Upper Till
19	Structural Fill
20	CCL
21	Structural Fill
22	Waste Material
23	CCL
24	Waste Material
25	Bottom Liner
26	UPPER SHALE



Material Properties:

Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45

Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45

Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Upper Glacial Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

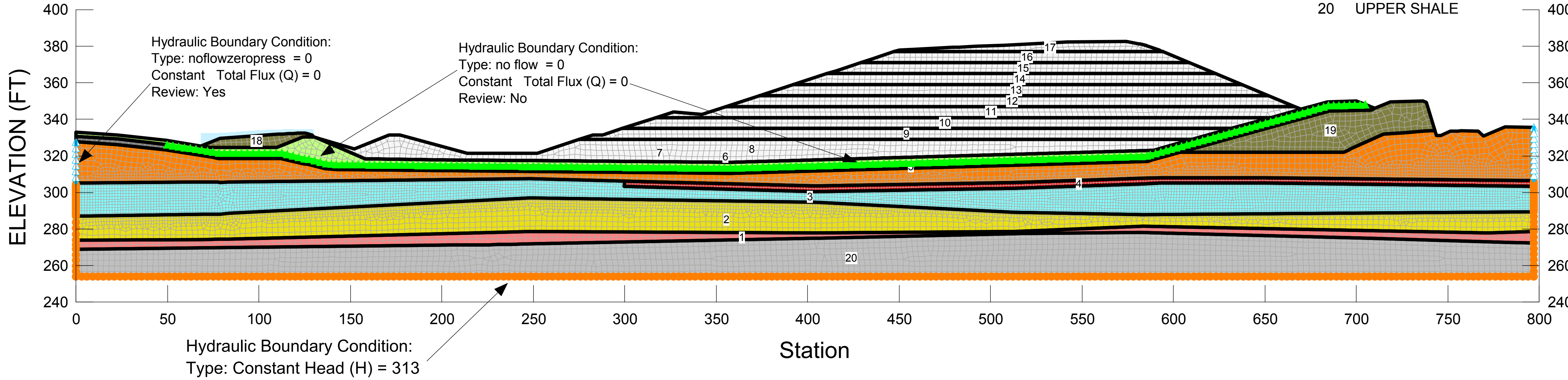
Name: NOT ACTIVE Model: (none)

PURPOSE:
To present the mesh and hydraulic boundary conditions at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: OP Step 1 - Liner Placement
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1_key.gsz
Last Saved Date: 2/17/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 0 days
Duration: 120 days
# of Steps: 15
Elapsed: 96 days

REGION Material Assignments

1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 (none)
9 (none)
10 (none)
11 (none)
12 (none)
13 (none)
14 (none)
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE



Material Properties:

Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45

Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Purpose

PURPOSE:
To determine the stress distribution and pore pressure for 557to 601 days for the placement of 7th lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT7 EL. 365
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 557 days
Duration: 44 days
# of Steps: 12
Elapsed: 601 days

Elapsed Time information for analysis

Parent Analysis Name: WASTE LIFT6 EL. 359
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis

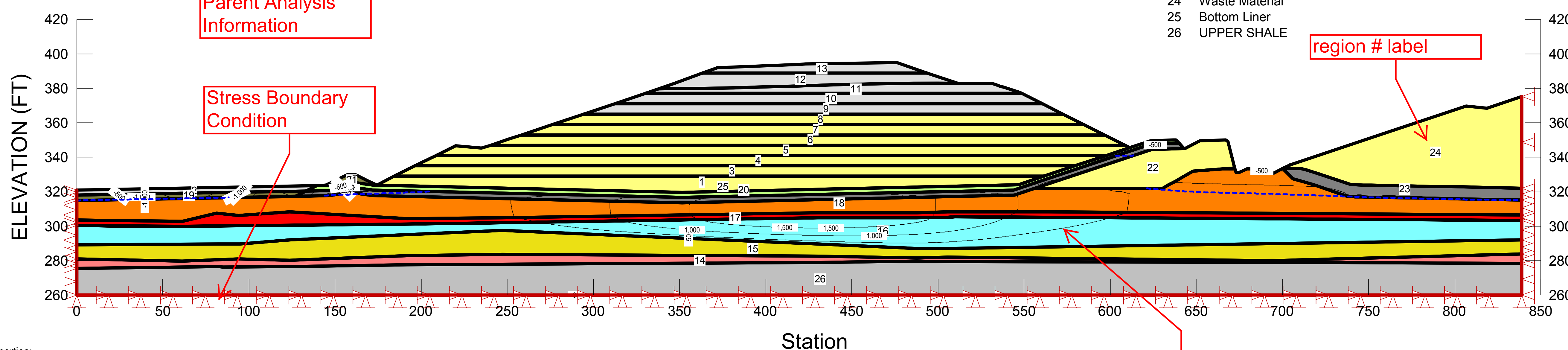
Parent Analysis Information

Contour Information

PWP Conditions Source:WASTE LIFT6 EL. 359 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Material name assigned to region



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

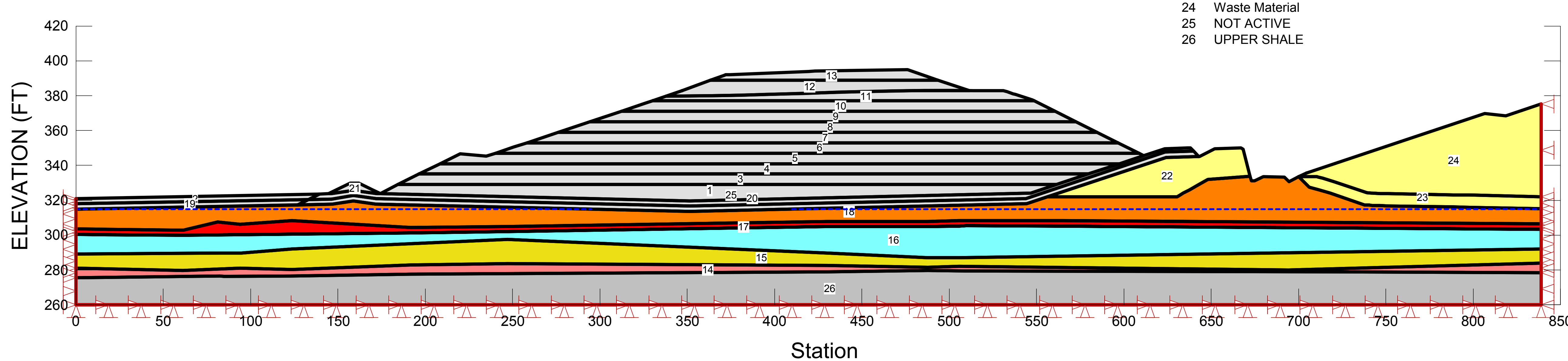
Material Property of materials used in analysis

PURPOSE:
To determine the initial stress for excavation of subgrade at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: INITIAL STRESS POST EXC.
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/12/2013
Analysis Kind: SIGMA/W
Analysis Method: Insitu
Starting Time: 0 days
Duration: 0 days

Initial PWP: Water Table
Piezometric Line 1
Coordinate: (0, 315)
Coordinate: (850, 315) ft

REGION Material Assignments
1 NOT ACTIVE
2 NOT ACTIVE
3 NOT ACTIVE
4 NOT ACTIVE
5 NOT ACTIVE
6 NOT ACTIVE
7 NOT ACTIVE
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 NOT ACTIVE
20 NOT ACTIVE
21 NOT ACTIVE
22 Waste Material
23 Waste Material
24 Waste Material
25 NOT ACTIVE
26 UPPER SHALE



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45 Insitu Ko: 0.81818182
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

PURPOSE:
To determine the stress distribution and pore pressure with liner in place at Section OP-1 at RMU-2.

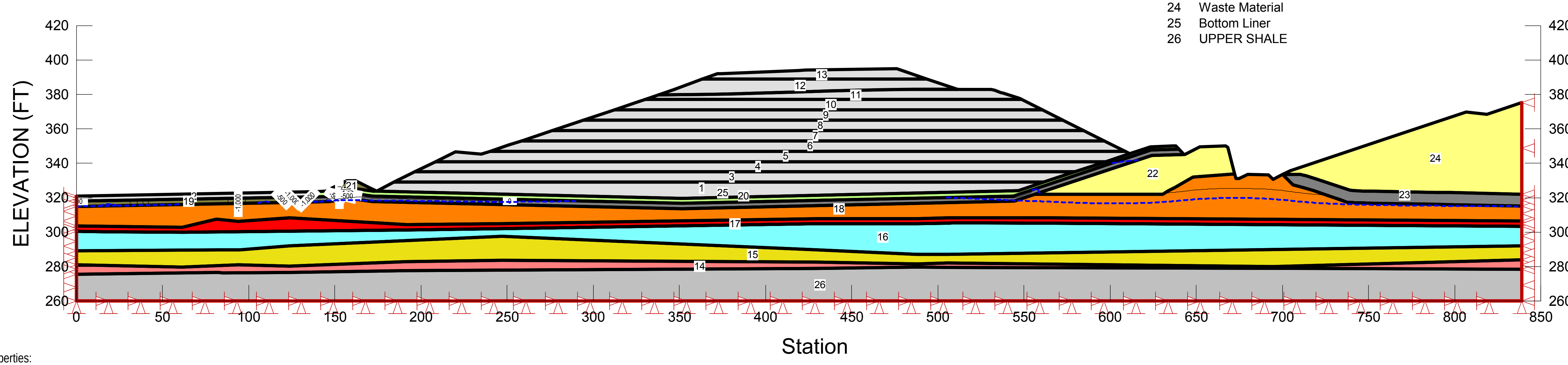
Title: Model City - RMU-2 CP-20 Section OP-1
Name: LINER CONSTRUCTION
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/12/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 0 days
Duration: 120 days
# of Steps: 10
Elapsed: 120 days

PWP Conditions Source:INITIAL STRESS POST EXC. - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments

1	NOT ACTIVE
2	NOT ACTIVE
3	NOT ACTIVE
4	NOT ACTIVE
5	NOT ACTIVE
6	NOT ACTIVE
7	NOT ACTIVE
8	NOT ACTIVE
9	NOT ACTIVE
10	NOT ACTIVE
11	NOT ACTIVE
12	NOT ACTIVE
13	NOT ACTIVE
14	Lower Till
15	Sand/Silt
16	GC-Drained
17	GC OverConsolidated
18	Upper Till
19	Structural Fill
20	CCL
21	Structural Fill
22	Waste Material
23	CCL
24	Waste Material
25	Bottom Liner
26	UPPER SHALE

Parent Analysis Name: INITIAL STRESS POST EXC.
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:

Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45

Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45

Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: NOT ACTIVE Model: (none)

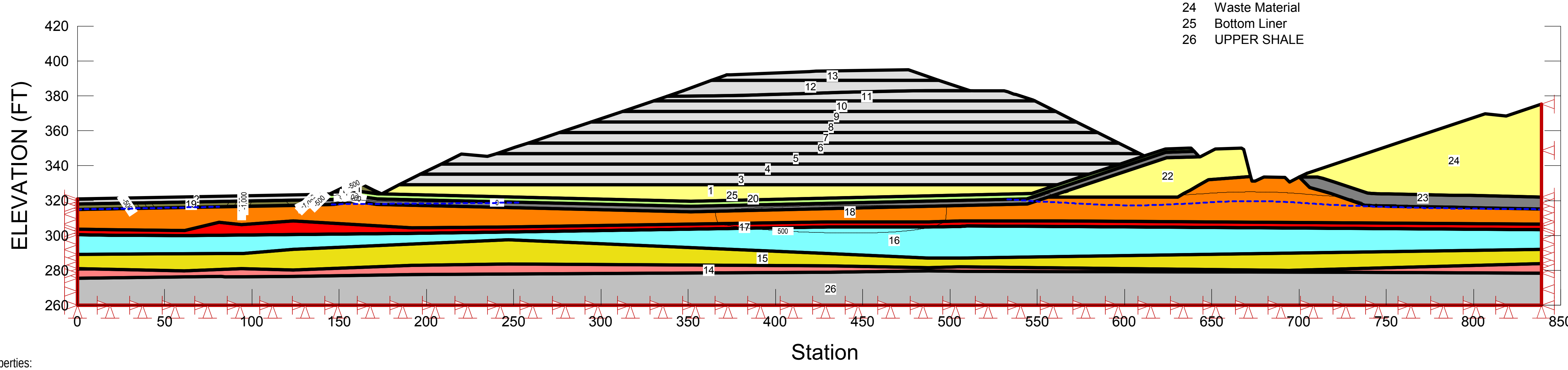
PURPOSE:
To determine the stress distribution and pore pressure for 120to 208 days for the placement of 1st lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT 1 EL. 329
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/12/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 120 days
Duration: 88 days
# of Steps: 12
Elapsed: 208 days

PWP Conditions Source:LINER CONSTRUCTION - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 NOT ACTIVE
4 NOT ACTIVE
5 NOT ACTIVE
6 NOT ACTIVE
7 NOT ACTIVE
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: LINER CONSTRUCTION
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

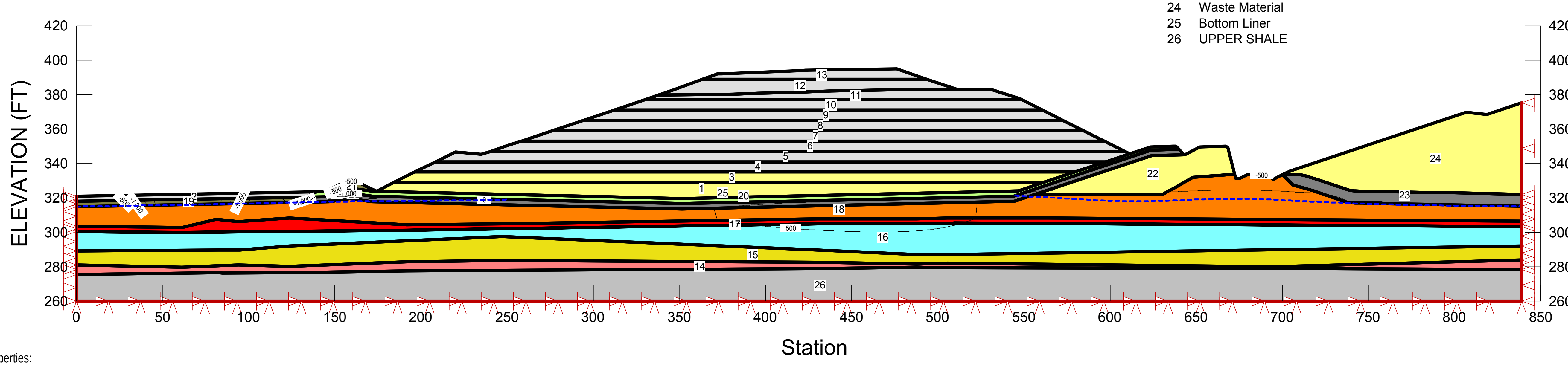
PURPOSE:
To determine the stress distribution and pore pressure for 208to 282 days for the placement of 2nd lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT 2 EL. 335
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/12/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 208 days
Duration: 74 days
# of Steps: 12
Elapsed: 282 days

PWP Conditions Source:WASTE LIFT 1 EL. 329 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 NOT ACTIVE
5 NOT ACTIVE
6 NOT ACTIVE
7 NOT ACTIVE
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT 1 EL. 329
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

PURPOSE:

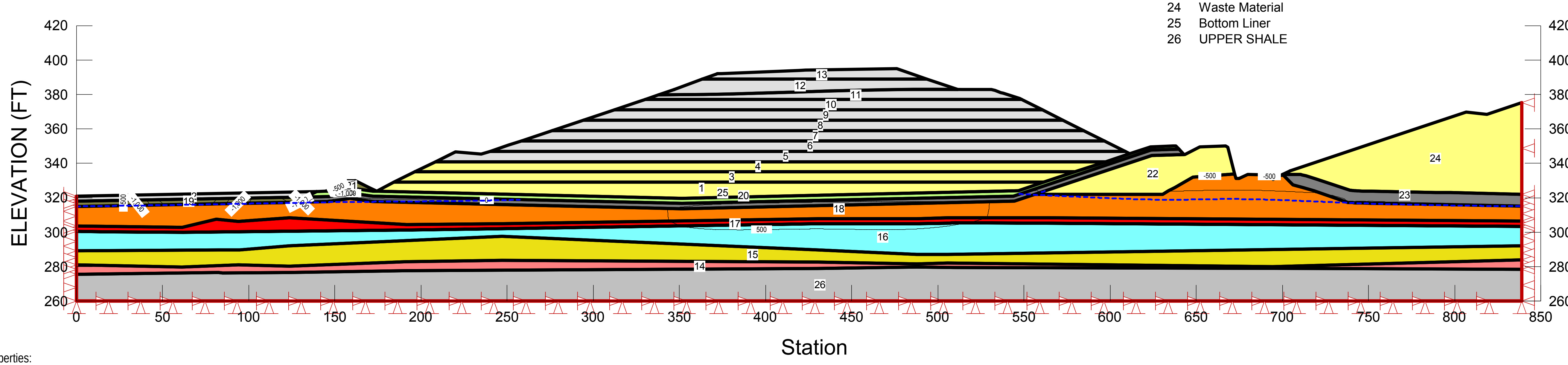
To determine the stress distribution and pore pressure for 282to 361 days for the placement of 3rd lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT3 EL. 341
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/12/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 282 days
Duration: 79 days
# of Steps: 12
Elapsed: 361 days

PWP Conditions Source:WASTE LIFT 2 EL. 335 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 NOT ACTIVE
6 NOT ACTIVE
7 NOT ACTIVE
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT 2 EL. 335
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:

Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45

Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45

Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: NOT ACTIVE Model: (none)

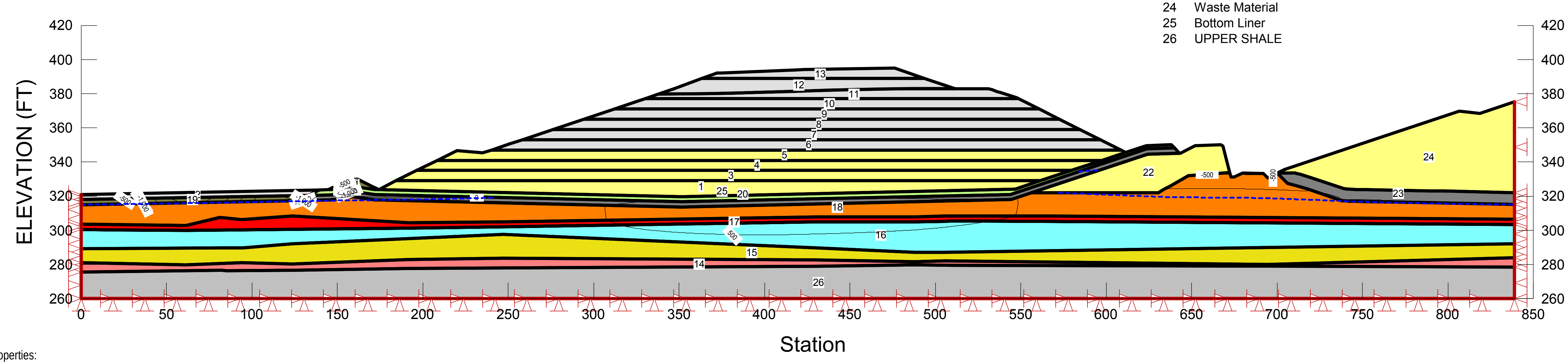
PURPOSE:
To determine the stress distribution and pore pressure for 361to 437 days for the placement of 4th lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT4 EL. 347
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/12/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 361 days
Duration: 76 days
# of Steps: 12
Elapsed: 437 days

PWP Conditions Source:WASTE LIFT3 EL. 341 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 NOT ACTIVE
7 NOT ACTIVE
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT3 EL. 341
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

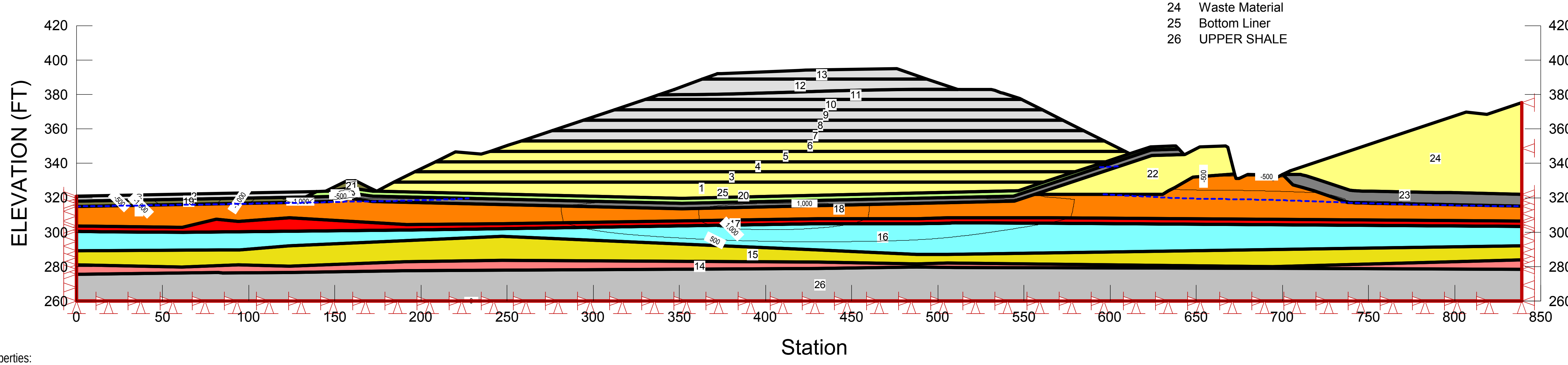
PURPOSE:
To determine the stress distribution and pore pressure for 437to 503 days for the placement of 5th lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT5 EL. 353
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 437 days
Duration: 66 days
# of Steps: 12
Elapsed: 503 days

PWP Conditions Source:WASTE LIFT4 EL. 347 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 NOT ACTIVE
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT4 EL. 347
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

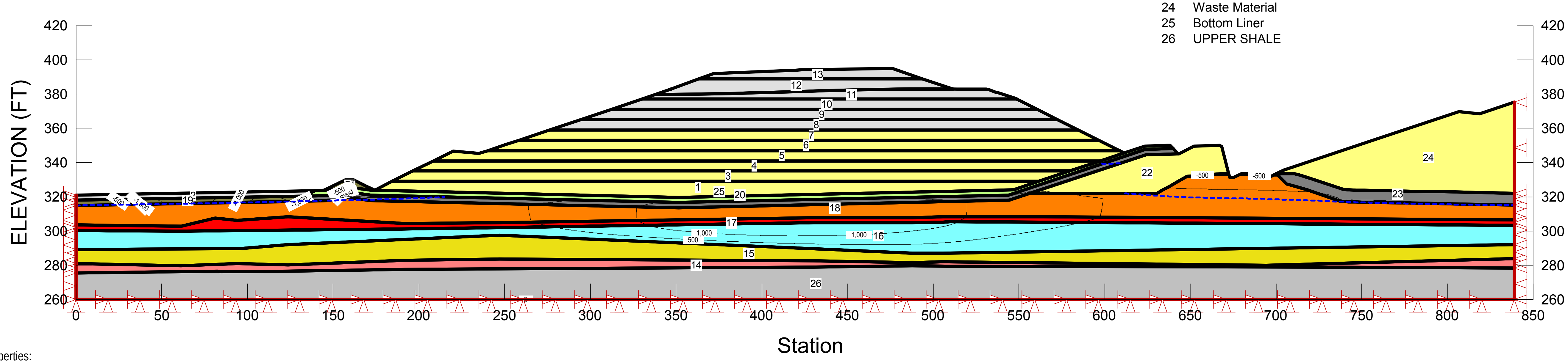
PURPOSE:
To determine the stress distribution and pore pressure for 503to 557 days for the placement of 6th lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT6 EL. 359
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 503 days
Duration: 54 days
# of Steps: 12
Elapsed: 557 days

PWP Conditions Source:WASTE LIFT5 EL. 353 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT5 EL. 353
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

PURPOSE:
To determine the stress distribution and pore pressure for 557to 601 days for the placement of 7th lift of waste at Section OP-1 at RMU-2.

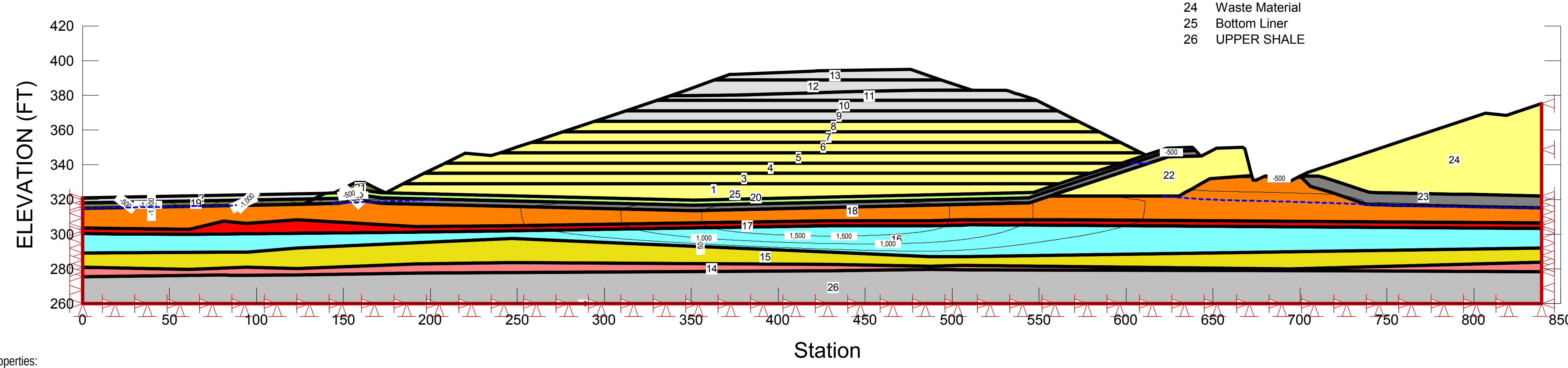
Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT7 EL. 365
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 557 days
Duration: 44 days
# of Steps: 12
Elapsed: 601 days

PWP Conditions Source:WASTE LIFT6 EL. 359 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments

1	Waste Material
2	NOT ACTIVE
3	Waste Material
4	Waste Material
5	Waste Material
6	Waste Material
7	Waste Material
8	Waste Material
9	NOT ACTIVE
10	NOT ACTIVE
11	NOT ACTIVE
12	NOT ACTIVE
13	NOT ACTIVE
14	Lower Till
15	Sand/Silt
16	GC-Drained
17	GC OverConsolidated
18	Upper Till
19	Structural Fill
20	CCL
21	Structural Fill
22	Waste Material
23	CCL
24	Waste Material
25	Bottom Liner
26	UPPER SHALE

Parent Analysis Name: WASTE LIFT6 EL. 359
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:

Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45

Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45

Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: NOT ACTIVE Model: (none)

PURPOSE:

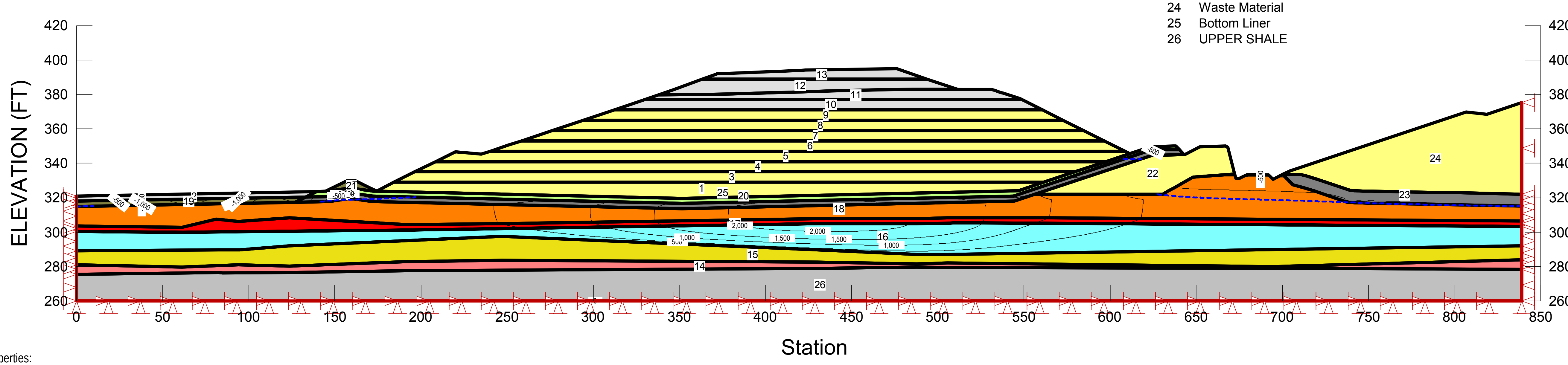
To determine the stress distribution and pore pressure for 601to 635 days for the placement of 8th lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT 8 EL. 371
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 601 days
Duration: 34 days
# of Steps: 12
Elapsed: 635 days

PWP Conditions Source:WASTE LIFT7 EL. 365 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT7 EL. 365
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:

Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45

Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45

Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1

Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

Name: NOT ACTIVE Model: (none)

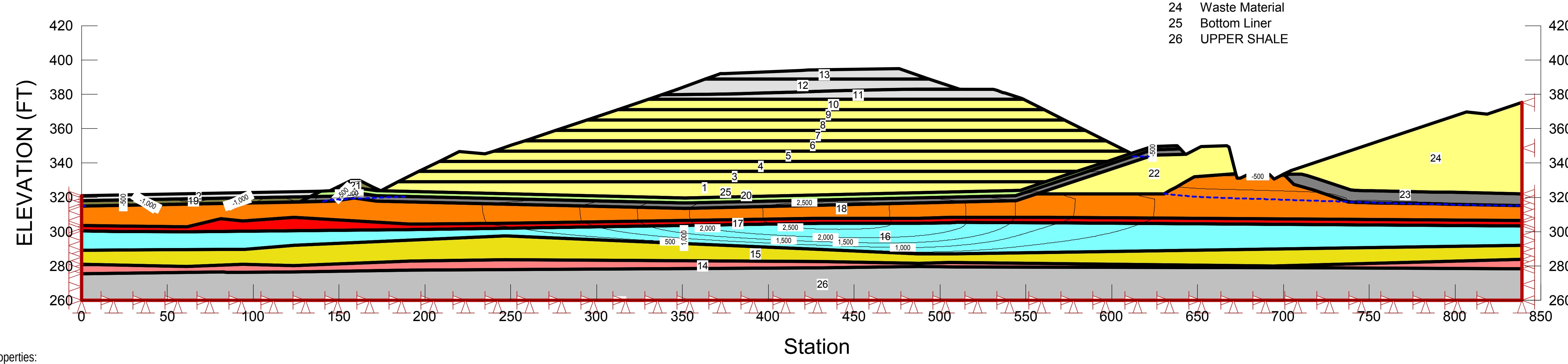
PURPOSE:
To determine the stress distribution and pore pressure for 635 to 660 days for the placement of 9th lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT 9 EL. 377
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 635 days
Duration: 25 days
# of Steps: 12
Elapsed: 660 days

PWP Conditions Source:WASTE LIFT 8 EL. 371 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT 8 EL. 371
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

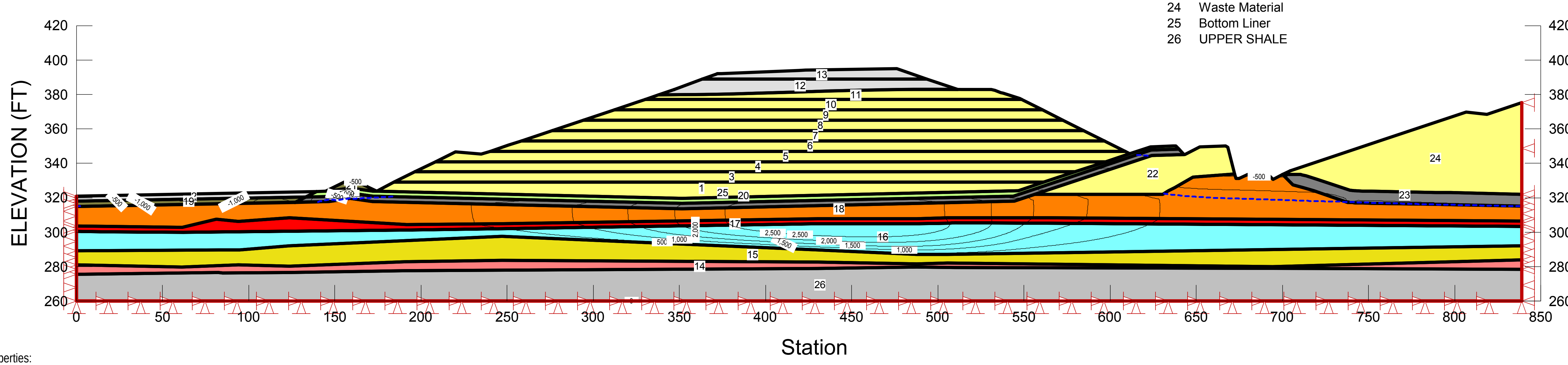
PURPOSE:
To determine the stress distribution and pore pressure for 660 to 673 days for the placement of 10th lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT 10 EL. 383
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 660 days
Duration: 13 days
# of Steps: 12
Elapsed: 673 days

PWP Conditions Source:WASTE LIFT 9 EL. 377 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT 9 EL. 377
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

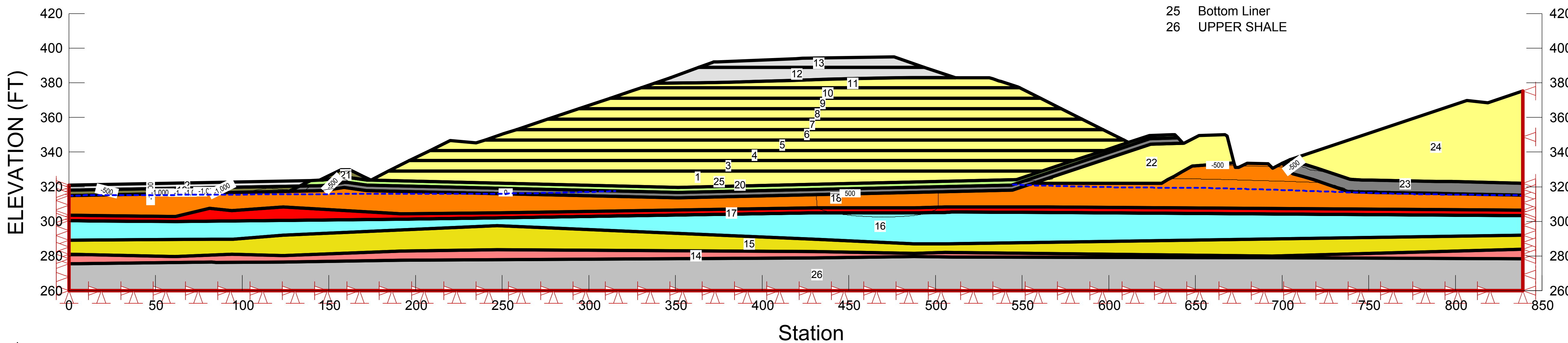
PURPOSE:
To determine the stress distribution and pore pressure for 721 to 1086 days for the placement of 10th lift of waste at Section OP-1 at RMU-2. To allow more time for consolidation.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: WASTE LIFT 10 EL. 383 - consol
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-1r1.gsz
Last Saved Date: 2/12/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 721 days
Duration: 365 days
# of Steps: 12
Elapsed: 1,086 days

PWP Conditions Source:WASTE LIFT 10 EL. 383 - SIGMA/W
Selected Contour: Excess Pore Pressure
Type: Excess PWP psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 2,500
AutoContour: No

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 NOT ACTIVE
13 NOT ACTIVE
14 Lower Till
15 Sand/Silt
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Waste Material
23 CCL
24 Waste Material
25 Bottom Liner
26 UPPER SHALE

Parent Analysis Name: WASTE LIFT 10 EL. 383
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



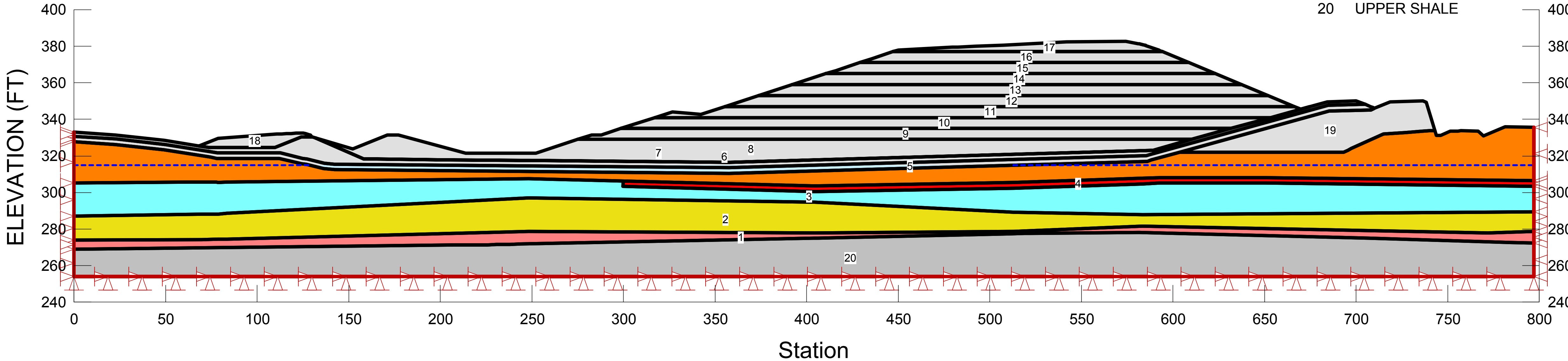
Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ra
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

PURPOSE:
To determine the initial stress for excavation of subgrade at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Insitu
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Insitu
Starting Time: 0 days
Duration: 0 days

Initial PWP: Water Table
Piezometric Line 1
Coordinate: (0, 315)
Coordinate: (850, 315) ft

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 NOT ACTIVE
7 NOT ACTIVE
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 NOT ACTIVE
15 NOT ACTIVE
16 NOT ACTIVE
17 NOT ACTIVE
18 NOT ACTIVE
19 NOT ACTIVE
20 UPPER SHALE



Material Properties:
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Insitu Ko: 0.5015015 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: NOT ACTIVE Model: (none)

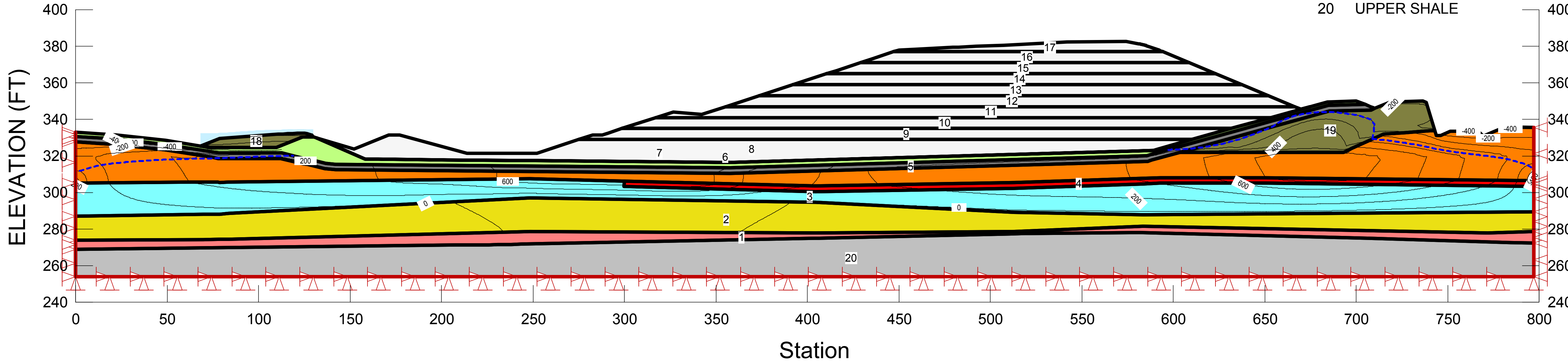
PURPOSE:
To determine the stress distribution and pore pressure with liner in place at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: OP Step 1 - Liner Placement
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 0 days
Duration: 120 days
# of Steps: 15
Elapsed: 120 days

PWP Conditions Source:Insitu - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -800
Increment by: 200
Ending Contour Value: 1,000
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 (none)
9 (none)
10 (none)
11 (none)
12 (none)
13 (none)
14 (none)
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE

Parent Analysis Name: Insitu
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

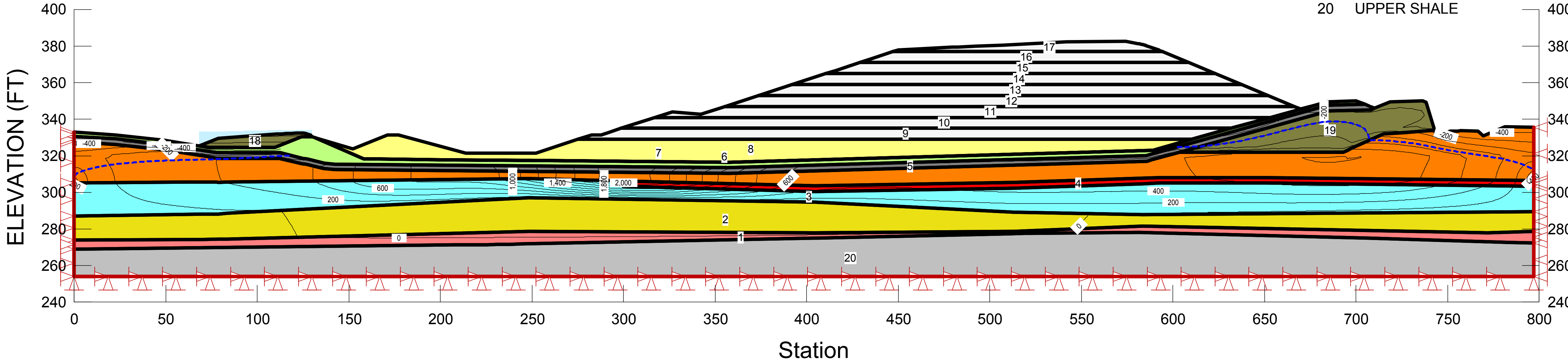
PURPOSE:
To determine the stress distribution and pore pressure for 120 to 208 days for the placement of 1st lift of waste at Section OP-1 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 1 El. 329
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 120 days
Duration: 88 days
# of Steps: 12
Elapsed: 208 days

PWP Conditions Source:OP Step 1 - Liner Placement - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -800
Increment by: 200
Ending Contour Value: 2,200
AutoContour: Yes

Parent Analysis Name: OP Step 1 - Liner Placement
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 (none)
10 (none)
11 (none)
12 (none)
13 (none)
14 (none)
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

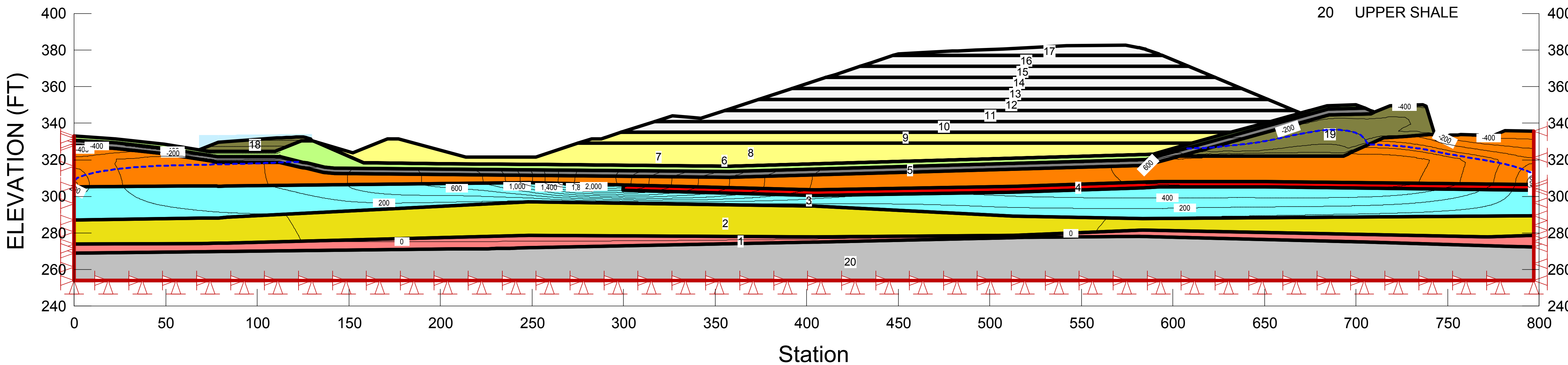
PURPOSE:
To determine the stress distribution and pore pressure for 208 to 282 days for the placement of 2nd lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 2 El. 335
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 208 days
Duration: 74 days
# of Steps: 12
Elapsed: 282 days

Parent Analysis Name: Waste Lift 1 El. 329
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis

PWP Conditions Source:Waste Lift 1 El. 329 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -800
Increment by: 200
Ending Contour Value: 2,200
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 (none)
11 (none)
12 (none)
13 (none)
14 (none)
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

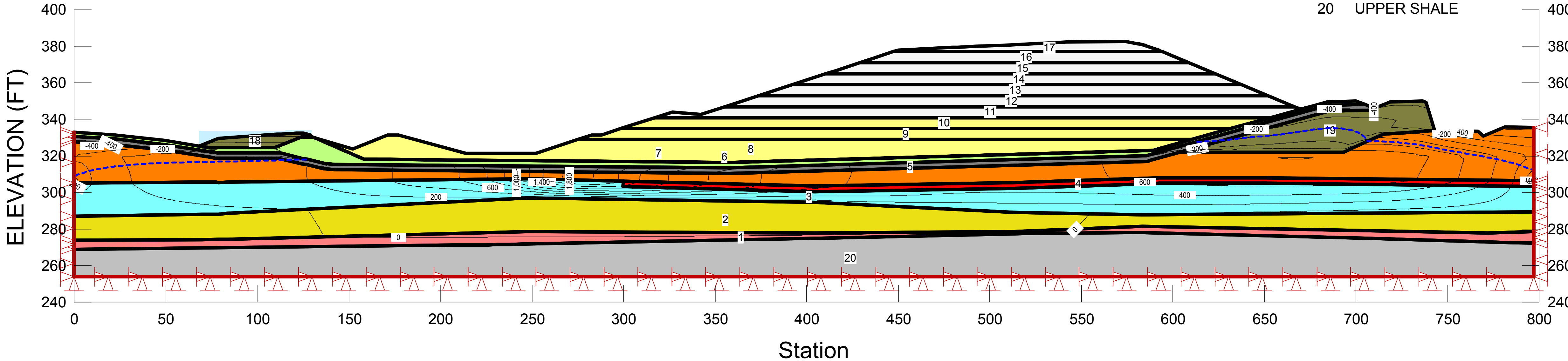
PURPOSE:
To determine the stress distribution and pore pressure for 282 to 361 days for the placement of 3rd lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 3 El. 341
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 282 days
Duration: 79 days
# of Steps: 12
Elapsed: 361 days

Parent Analysis Name: Waste Lift 2 El. 335
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis

PWP Conditions Source:Waste Lift 2 El. 335 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -800
Increment by: 200
Ending Contour Value: 2,000
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 (none)
12 (none)
13 (none)
14 (none)
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

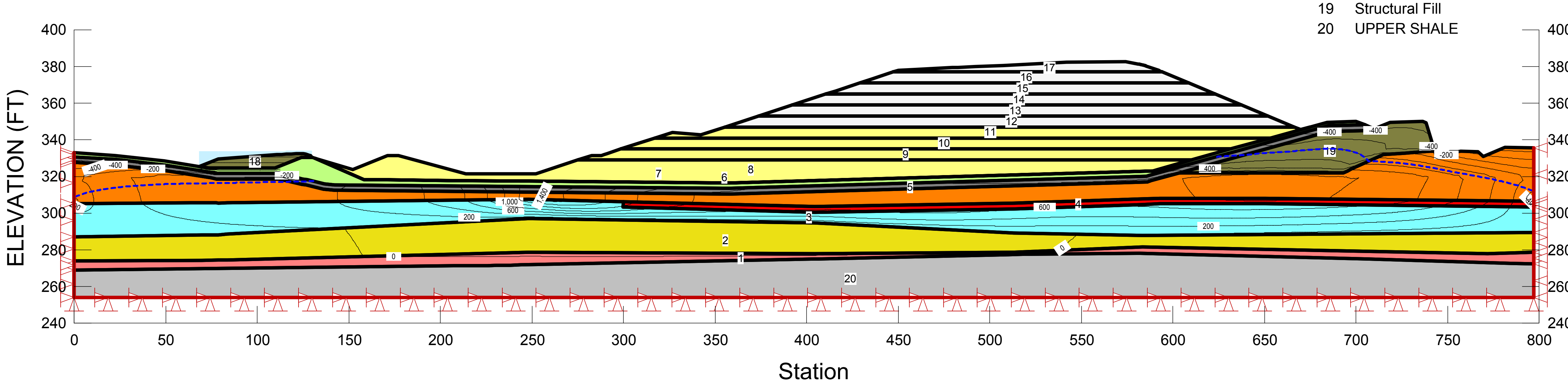
PURPOSE:
To determine the stress distribution and pore pressure for 361 to 437 days for the placement of 4th lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 4 El. 347
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 361 days
Duration: 76 days
# of Steps: 12
Elapsed: 437 days

PWP Conditions Source:Waste Lift 3 El. 341 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -800
Increment by: 200
Ending Contour Value: 1,600
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 (none)
13 (none)
14 (none)
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE

Parent Analysis Name: Waste Lift 3 El. 341
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

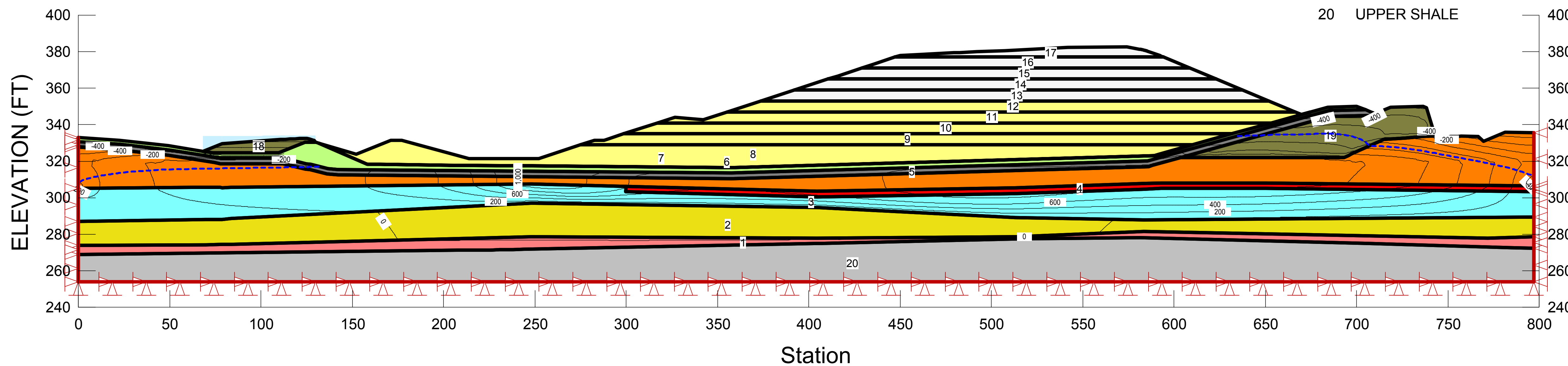
PURPOSE:
To determine the stress distribution and pore pressure for 437 to 502 days for the placement of 5th lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 5 El. 353
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 437 days
Duration: 65 days
# of Steps: 12
Elapsed: 502 days

PWP Conditions Source:Waste Lift 4 El. 347 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -800
Increment by: 200
Ending Contour Value: 1,200
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 (none)
14 (none)
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE

Parent Analysis Name: Waste Lift 4 El. 347
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

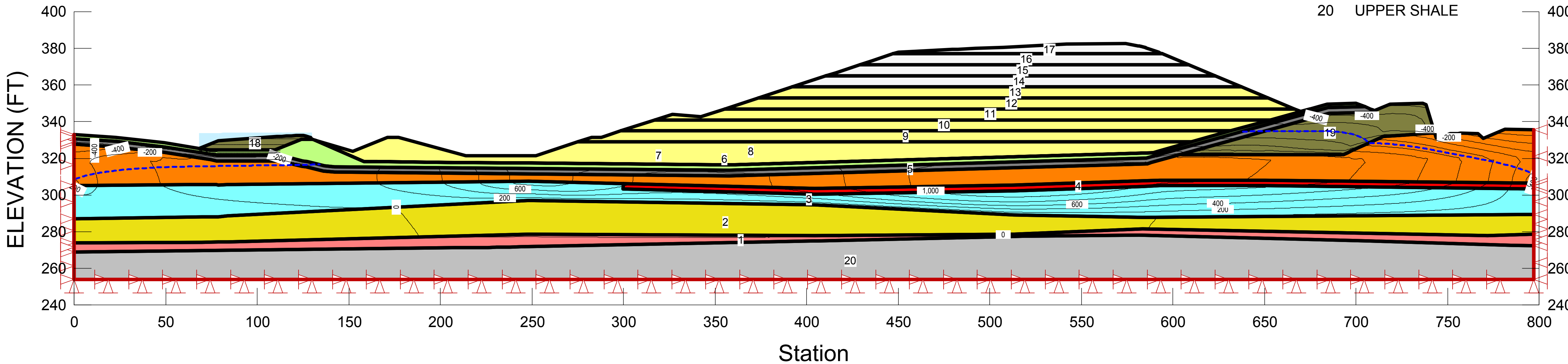
PURPOSE:
To determine the stress distribution and pore pressure for 502 to 558 days for the placement of 6th lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 6 El. 359
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 502 days
Duration: 56 days
# of Steps: 12
Elapsed: 558 days

PWP Conditions Source:Waste Lift 5 El. 353 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -800
Increment by: 200
Ending Contour Value: 1,200
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 (none)
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE

Parent Analysis Name: Waste Lift 5 El. 353
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

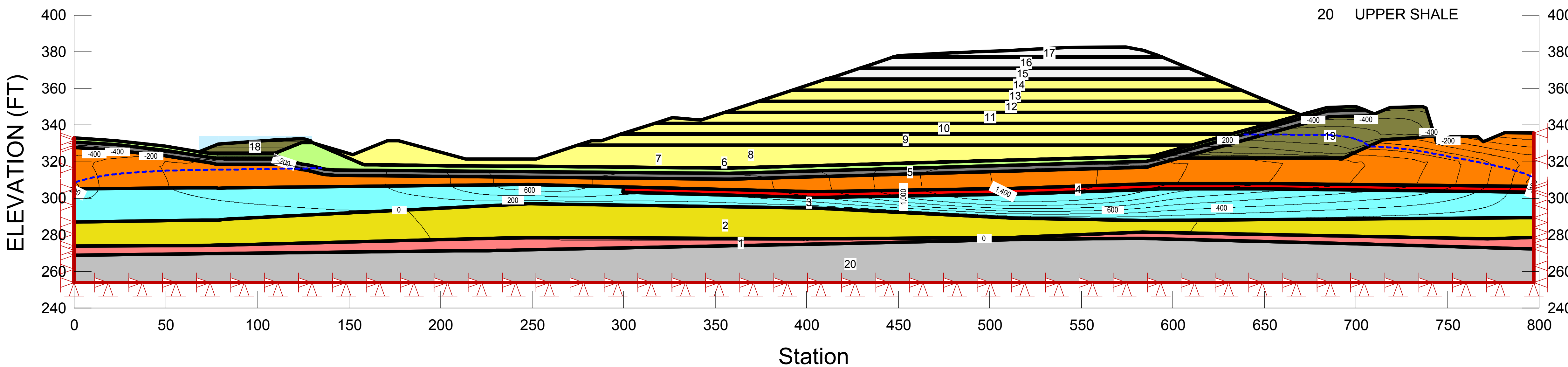
PURPOSE:
To determine the stress distribution and pore pressure for 558 to 605 days for the placement of 7th lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 7 El. 365
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 558 days
Duration: 47 days
# of Steps: 12
Elapsed: 605 days

Parent Analysis Name: Waste Lift 6 El. 359
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis

PWP Conditions Source:Waste Lift 6 El. 359 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -800
Increment by: 200
Ending Contour Value: 1,600
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 (none)
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

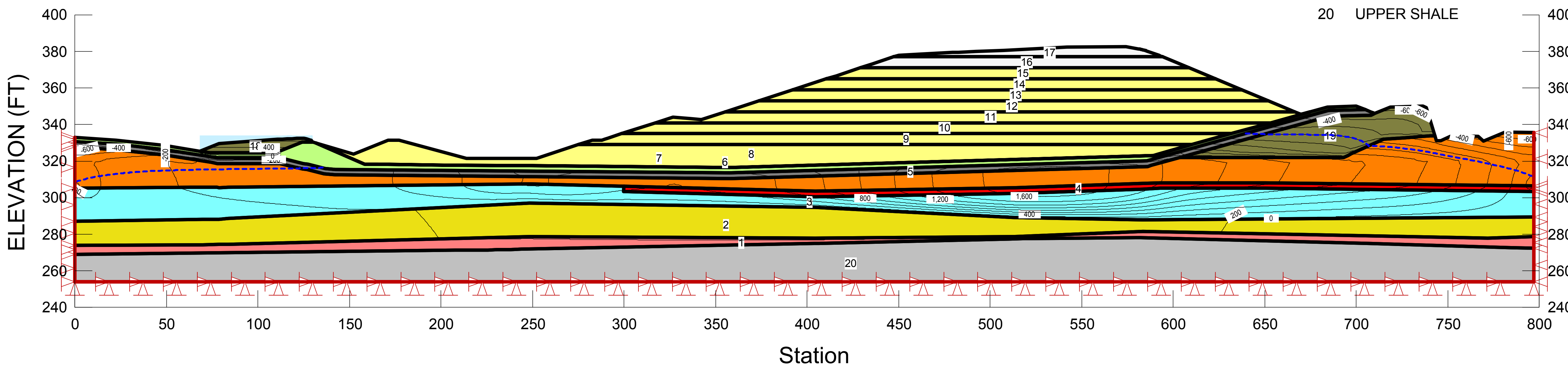
PURPOSE:
To determine the stress distribution and pore pressure for 605 to 645 days for the placement of 8th lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 8 El. 371
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 605 days
Duration: 40 days
 # of Steps: 12
 Elapsed: 645 days

Parent Analysis Name: Waste Lift 7 El. 365
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis

PWP Conditions Source:Waste Lift 7 El. 365 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -1,000
Increment by: 200
Ending Contour Value: 1,800
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 (none)
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Rati
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

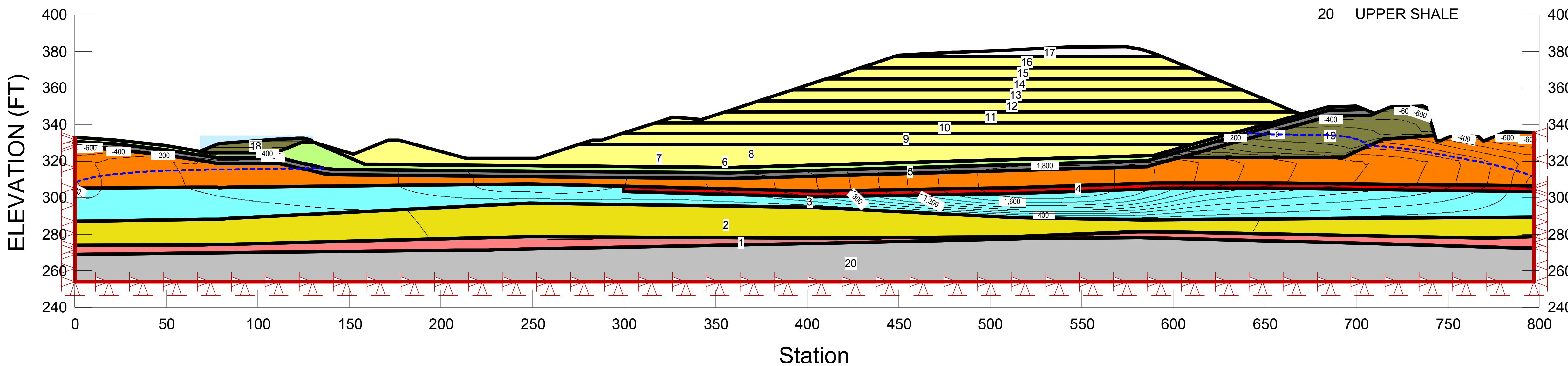
PURPOSE:
To determine the stress distribution and pore pressure for 645 to 675 days for the placement of 9th lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift 9 El. 377
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 645 days
Duration: 30 days
# of Steps: 12
Elapsed: 675 days

PWP Conditions Source:Waste Lift 8 El. 371 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -1,000
Increment by: 200
Ending Contour Value: 2,000
AutoContour: Yes

Parent Analysis Name: Waste Lift 8 El. 371
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 (none)
18 Structural Fill
19 Structural Fill
20 UPPER SHALE



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Rati
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

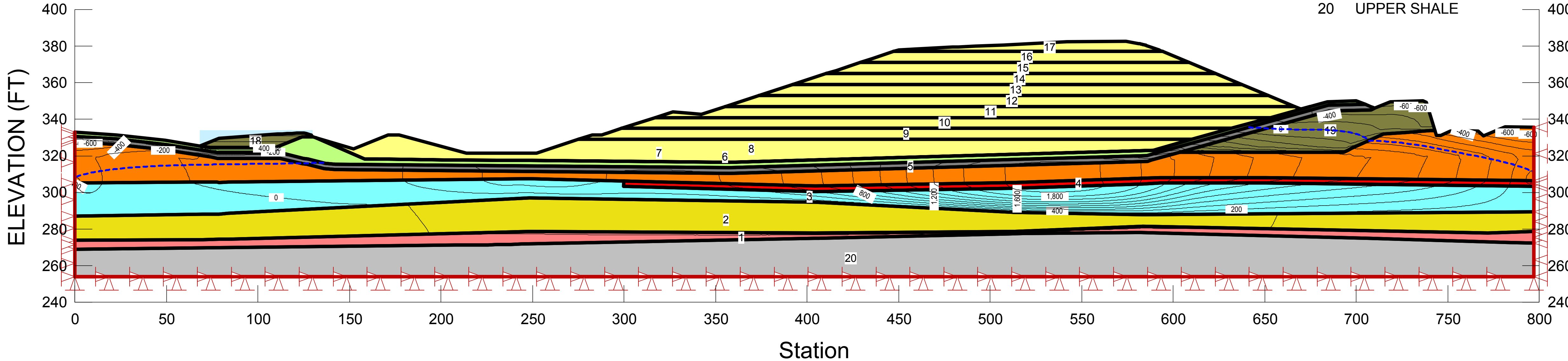
PURPOSE:
To determine the stress distribution and pore pressure for 675 to 693 days for the placement of 10th lift of waste at Section OP-2 at RMU-2.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift10 El. 383
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 675 days
Duration: 18 days
# of Steps: 12
Elapsed: 693 days

PWP Conditions Source:Waste Lift 9 El. 377 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -1,000
Increment by: 200
Ending Contour Value: 2,200
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 UPPER SHALE

Parent Analysis Name: Waste Lift 9 El. 377
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Rati
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

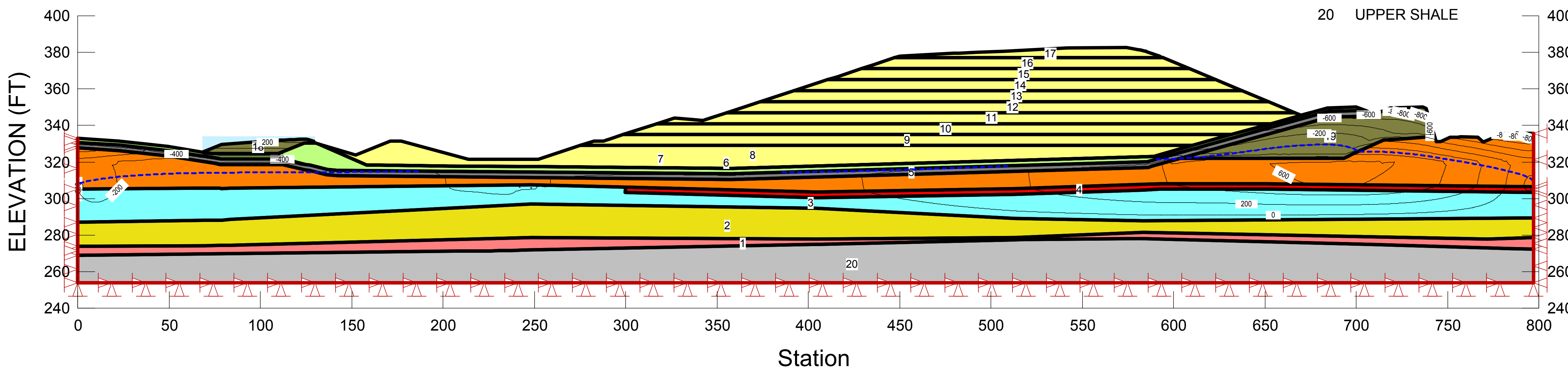
PURPOSE:
To determine the stress distribution and pore pressure for 693 to 1058 days for the placement of 10th lift of waste at Section OP-2 at RMU-2. To allow more time for consolidation.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift10 El. 383 Consolidation
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1.gsz
Last Saved Date: 2/24/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 693 days
Duration: 365 days
# of Steps: 12
Elapsed: 1,058 days

PWP Conditions Source:Waste Lift10 El. 383 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -1,200
Increment by: 200
Ending Contour Value: 800
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 UPPER SHALE

Parent Analysis Name: Waste Lift10 El. 383
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.567 ft/day 2 E-4cm/sec Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

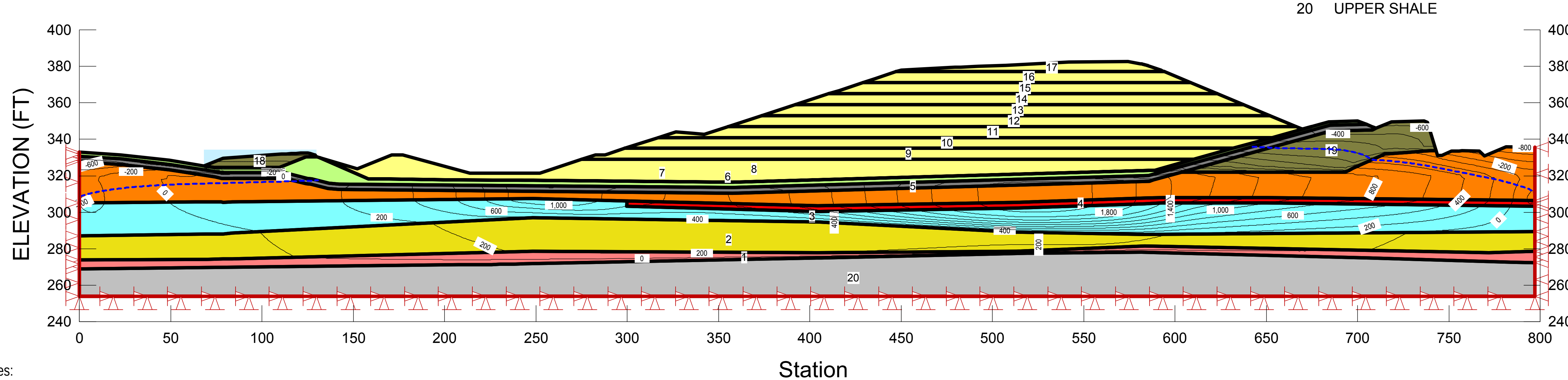
PURPOSE:
To determine the stress distribution and pore pressure for 675 to 693 days for the placement of 10th lift of waste at Section OP-2 at RMU-2. The sand/silt k value is changed to 2E-5 cm/sec from 2E-4cm/sec.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Waste Lift10 El. 383
File Name: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\C20OP-2r1_gssk.gsz
Last Saved Date: 2/23/2013
Analysis Kind: SIGMA/W
Analysis Method: Coupled Stress/PWP
Starting Time: 675 days
Duration: 18 days
# of Steps: 12
Elapsed: 693 days

PWP Conditions Source:Waste Lift 9 El. 377 - SIGMA/W
Selected Contour: Pore-Water Pressure
Type: Excess PWP psf
Starting Contour Value: -1,000
Increment by: 200
Ending Contour Value: 2,200
AutoContour: Yes

REGION Material Assignments
1 Lower Till
2 Sand/Silt
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 UPPER SHALE

Parent Analysis Name: Waste Lift 9 El. 377
Initial Stress: Parent Analysis
Initial PWP: Parent Analysis



Material Properties:
Name: Waste Material Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 111 pcf Poisson's Ratio: 0.45
Name: Bottom Liner Model: Linear Elastic (Total) Young's Modulus (E): 400,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.45
Name: CCL Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 120 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Upper Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 125 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Glacial Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC-Drained Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 4 Poisson's Ratio: 0.334 Lambda: 0.14 Kappa: 0.013 Initial Void Ratio: 1 Unit Weight: 118 pcf Phi': 27 ° Vol. WC. Function: Clay soils K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: GC OverConsolidated Model: Soft Clay (MCC w/ PWP Change) O.C. Ratio: 8 Poisson's Ratio: 0.334 Lambda: 0.06 Kappa: 0.01 Initial Void Ratio: 0.5 Unit Weight: 125 pcf Phi': 30 ° Vol. WC. Function: Clay soils OC K-Function: GC 5.7 E-4 ft/day Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Sand/Silt Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 300,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: silty sand K-Function: Silty Sand, k = 0.0567 ft/day 2 E-5cm/sec (2) Ky'/Kx' Ratio: 0.1 Rotation: 0 ° Load Response Ratio: 1
Name: Lower Till Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 600,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: Structural Fill Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 100,000 psf Unit Weight: 135 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Till Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1
Name: UPPER SHALE Model: Linear Elastic (w/ PWP Change) Effective Young's Modulus (E'): 1,000,000 psf Unit Weight: 145 pcf Poisson's Ratio: 0.334 Vol. WC. Function: Till K-Function: Upper Rock Ky'/Kx' Ratio: 1 Rotation: 0 ° Load Response Ratio: 1

PURPOSE:

To determine the critical failure surface and factor of safety after the completion of the tenth lift for Section OP-1 at RMU-2. This is estimated at Lift 6, 521 days.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift 6 - 4th step pp
File Name: C20OP-1r1.gsz
Date: 2/24/2013Time: 12:44:51 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 2.057

Analysis name in Geostudio File

PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT6 EL. 359

source of pore water pressures used in analysis

Pore Water Pressure Contour information

PWP Conditions Source:WASTE LIFT6 EL. 359 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 3,500
AutoContour: Yes

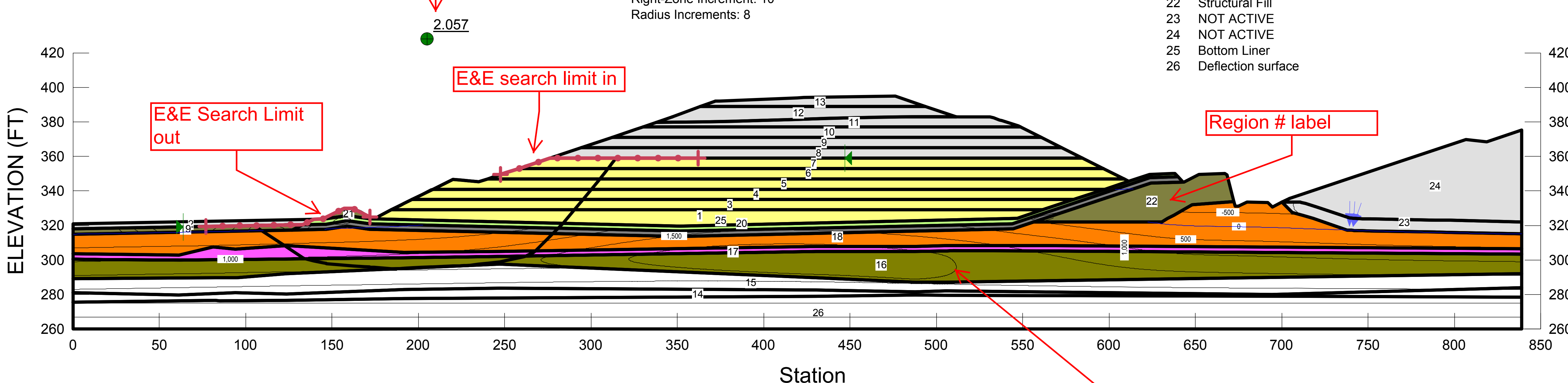
Search type and limits

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (447, 359) ft
Left-Zone Left Coordinate: (76.8668, 319.45558) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (247.4206, 349.41981) ft
Right-Zone Right Coordinate: (362, 359) ft
Right-Zone Increment: 10
Radius Increments: 8

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Deflection surface
15 Deflection surface
16 GC UNDRAINED
17 GC-Overconsolidated-UNDRAINED
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Structural Fill
23 NOT ACTIVE
24 NOT ACTIVE
25 Bottom Liner
26 Deflection surface

Material Assigned to region

Factor of Safety



Material Properties:

Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °

Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner

Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °

Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °

Name: Deflection surface Model: Bedrock (Impenetrable)

Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °

Name: NOT ACTIVE Model: (None)

Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

Material by name and properties assigned

Contour of Pore Pressure in psf at the elapsed time of the analysis

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 10th lift after virtually full consolidation for Section OP-1 at RMU-2.
This is estimated at 1038 days.

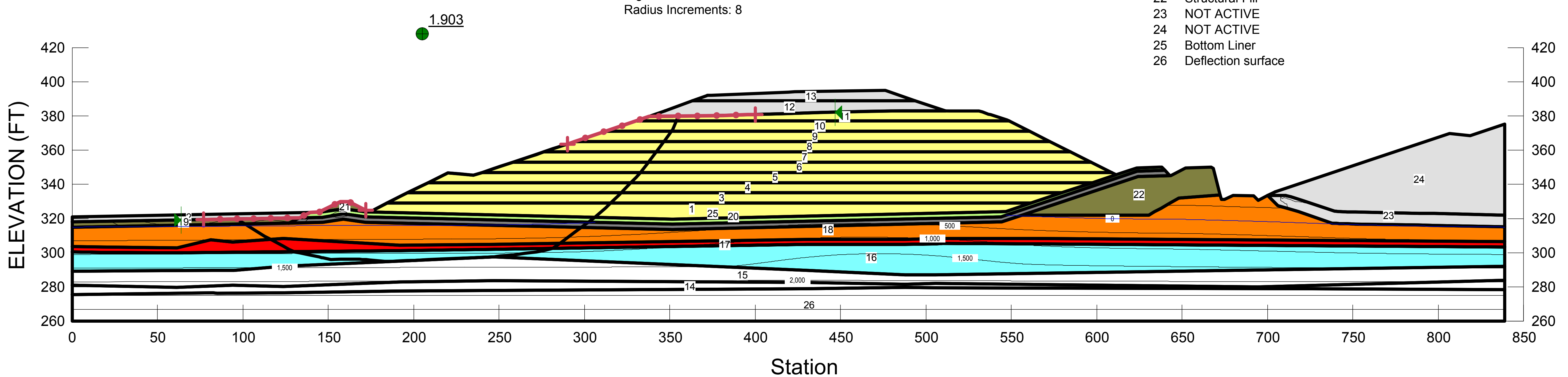
Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift10 - consolidated ESA
File Name: C20OP-1r1.gsz
Date: 2/24/2013Time: 3:48:00 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.903

PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT 10 EL. 383 - consol

PWP Conditions Source:WASTE LIFT 10 EL. 383 - consol - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 3,500
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (446.87317, 382.21462) ft
Left-Zone Left Coordinate: (76.8668, 319.45558) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (290, 363.58286) ft
Right-Zone Right Coordinate: (399.9028, 380.82588) ft
Right-Zone Increment: 10
Radius Increments: 8

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 NOT ACTIVE
13 NOT ACTIVE
14 Deflection surface
15 Deflection surface
16 GC-Drained
17 GC OverConsolidated
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Structural Fill
23 NOT ACTIVE
24 NOT ACTIVE
25 Bottom Liner
26 Deflection surface



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: GC-Drained Model: Shear/Normal Fn. Unit Weight: 118 pcf Strength Function: normalized N^m Anisotropic Strength Fn: clay ellipse staticshear
Name: GC OverConsolidated Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 100 psf Phi': 30 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 10th lift after virtually full consolidation for Section OP-2 at RMU-2.
This is estimated at 1058 days.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Slope Stability Waste Lift 10 ESA
File Name: C20OP-2r1.gsz
Date: 2/24/2013Time: 9:11:42 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.931

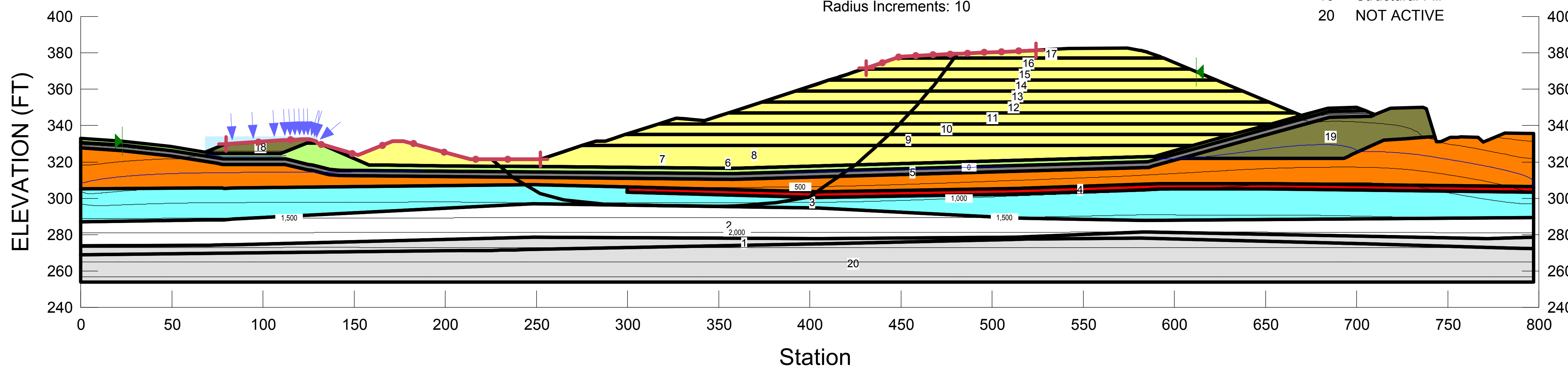
PWP Conditions Source: Parent Analysis
Parent Analysis Name: Waste Lift10 El. 383 Consolidation

1.931

PWP Conditions Source:Waste Lift10 El. 383 Consolidation - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (22.828036, 331.47357) ft
Right Coordinate: (611.93811, 369.64103) ft
Left-Zone Left Coordinate: (79.8044, 329.75699) ft
Left-Zone Right Coordinate: (252, 321.5) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (430.9718, 371.66122) ft
Right-Zone Right Coordinate: (524, 381.42062) ft
Right-Zone Increment: 10
Radius Increments: 10

REGION Material Assignments
1 NOT ACTIVE
2 Deflection surface
3 GC-Drained
4 GC OverConsolidated
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 NOT ACTIVE



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: GC-Drained Model: Shear/Normal Fn. Unit Weight: 118 pcf Strength Function: normalized N^m Anisotropic Strength Fn: clay ellipse staticshear
Name: GC OverConsolidated Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 100 psf Phi': 30 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the tenth lift for Section OP-1 at RMU-2. This is estimated at Lift 6, 521 days.

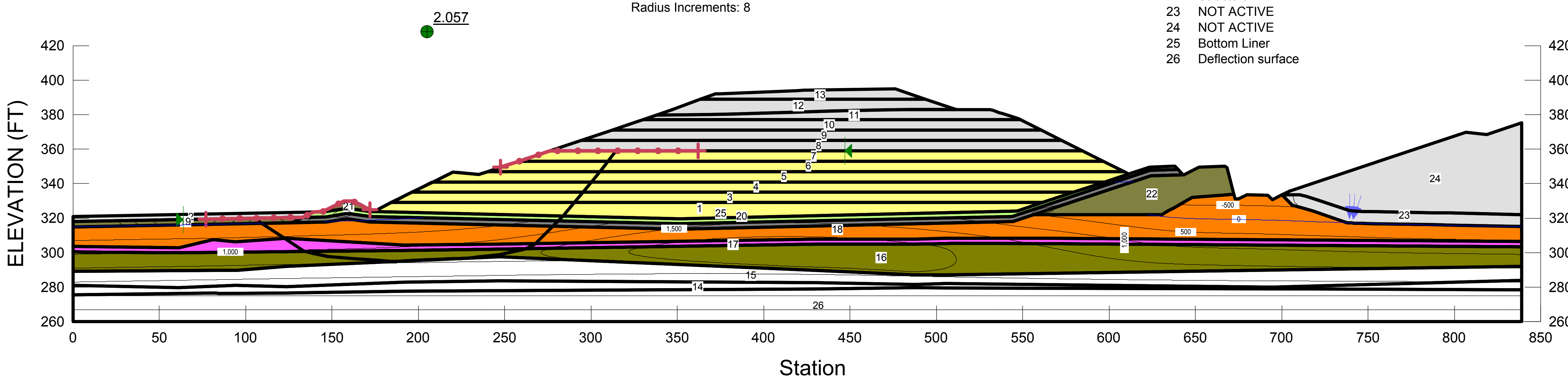
Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift 6 - 4th step pp
File Name: C20OP-1r1.gsz
Date: 2/24/2013Time: 12:44:51 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 2.057

PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT6 EL. 359

PWP Conditions Source:WASTE LIFT6 EL. 359 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 3,500
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (447, 359) ft
Left-Zone Left Coordinate: (76.8668, 319.45558) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (247.4206, 349.41981) ft
Right-Zone Right Coordinate: (362, 359) ft
Right-Zone Increment: 10
Radius Increments: 8

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 NOT ACTIVE
9 NOT ACTIVE
10 NOT ACTIVE
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Deflection surface
15 Deflection surface
16 GC UNDRAINED
17 GC-Overconsolidated-UNDRAINED
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Structural Fill
23 NOT ACTIVE
24 NOT ACTIVE
25 Bottom Liner
26 Deflection surface



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 9th lift for partially drained conditions at Section OP-1 at RMU-2. This is estimated at 643 days.

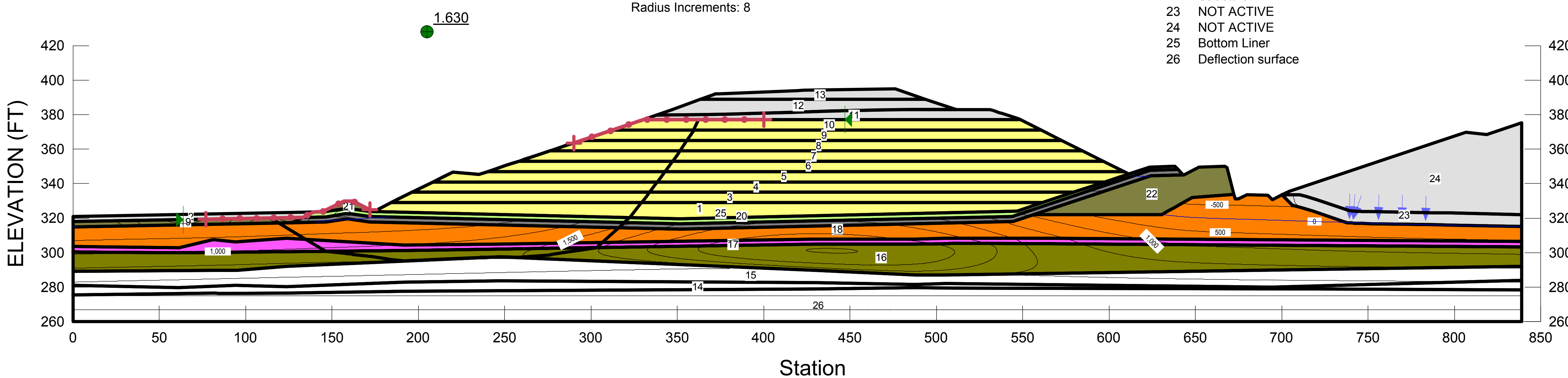
Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift 9 - 4th step pp
File Name: C20OP-1r1.gsz
Date: 2/24/2013Time: 12:44:51 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.630

PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT 9 EL. 377

PWP Conditions Source:WASTE LIFT 9 EL. 377 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (447, 377) ft
Left-Zone Left Coordinate: (76.8668, 319.45558) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (290, 363.58286) ft
Right-Zone Right Coordinate: (400, 377) ft
Right-Zone Increment: 10
Radius Increments: 8

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Deflection surface
15 Deflection surface
16 GC UNDRAINED
17 GC-Overconsolidated-UNDRAINED
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Structural Fill
23 NOT ACTIVE
24 NOT ACTIVE
25 Bottom Liner
26 Deflection surface



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the tenth lift with partially drained conditions for Section OP-1 at RMU-2. This is estimated at 664 days.

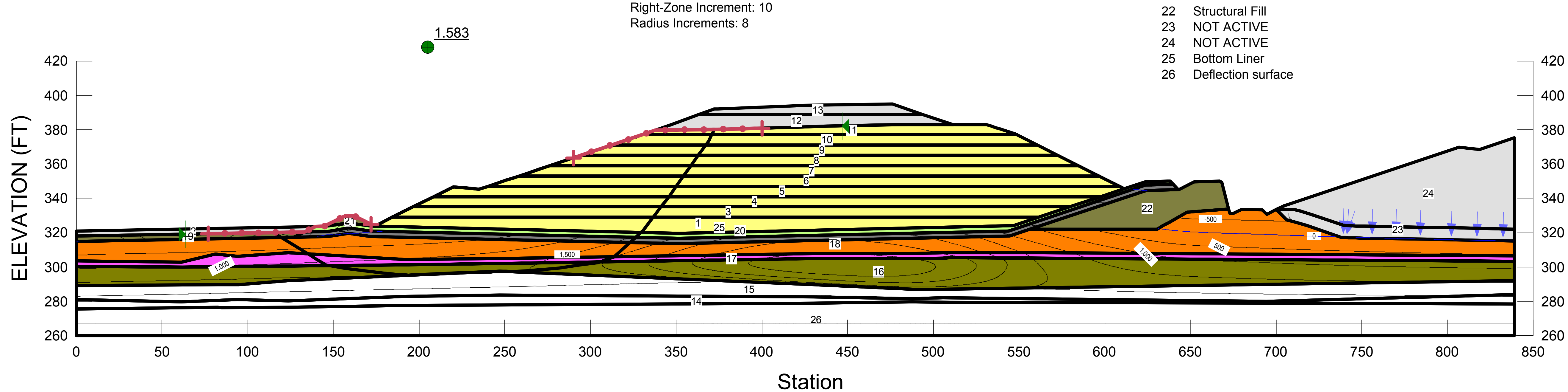
Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift10 - 4th step pp
File Name: C20OP-1r1.gsz
Date: 2/24/2013Time: 12:44:51 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.583

PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT 10 EL. 383

PWP Conditions Source:WASTE LIFT 10 EL. 383 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (446.87317, 382.21462) ft
Left-Zone Left Coordinate: (76.8668, 319.45558) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (290, 363.58286) ft
Right-Zone Right Coordinate: (399.9028, 380.82588) ft
Right-Zone Increment: 10
Radius Increments: 8

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 NOT ACTIVE
13 NOT ACTIVE
14 Deflection surface
15 Deflection surface
16 GC UNDRAINED
17 GC-Overconsolidated-UNDRAINED
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Structural Fill
23 NOT ACTIVE
24 NOT ACTIVE
25 Bottom Liner
26 Deflection surface



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 10th lift after virtually full consolidation for Section OP-1 at RMU-2.
This is estimated at 1038 days.

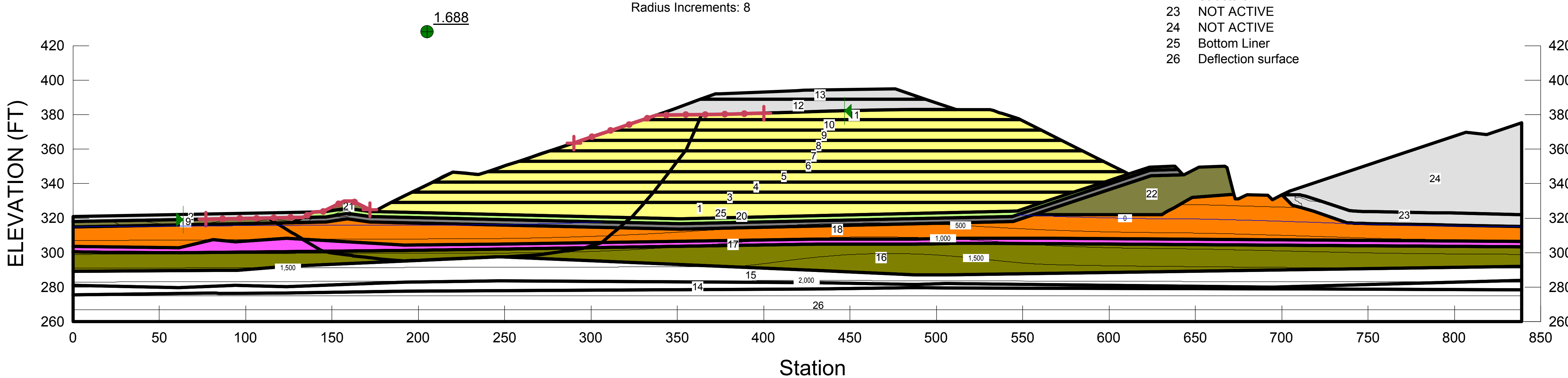
Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift10 - consolidated
File Name: C20OP-1r1.gsz
Date: 2/24/2013Time: 12:44:51 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.688

PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT 10 EL. 383 - consol

PWP Conditions Source:WASTE LIFT 10 EL. 383 - consol - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 3,500
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (446.87317, 382.21462) ft
Left-Zone Left Coordinate: (76.8668, 319.45558) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (290, 363.58286) ft
Right-Zone Right Coordinate: (399.9028, 380.82588) ft
Right-Zone Increment: 10
Radius Increments: 8

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 NOT ACTIVE
13 NOT ACTIVE
14 Deflection surface
15 Deflection surface
16 GC UNDRAINED
17 GC-Overconsolidated-UNDRAINED
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Structural Fill
23 NOT ACTIVE
24 NOT ACTIVE
25 Bottom Liner
26 Deflection surface



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 9th lift for partially drained conditions at Section OP-2 at RMU-2.
This is estimated at 655 days.

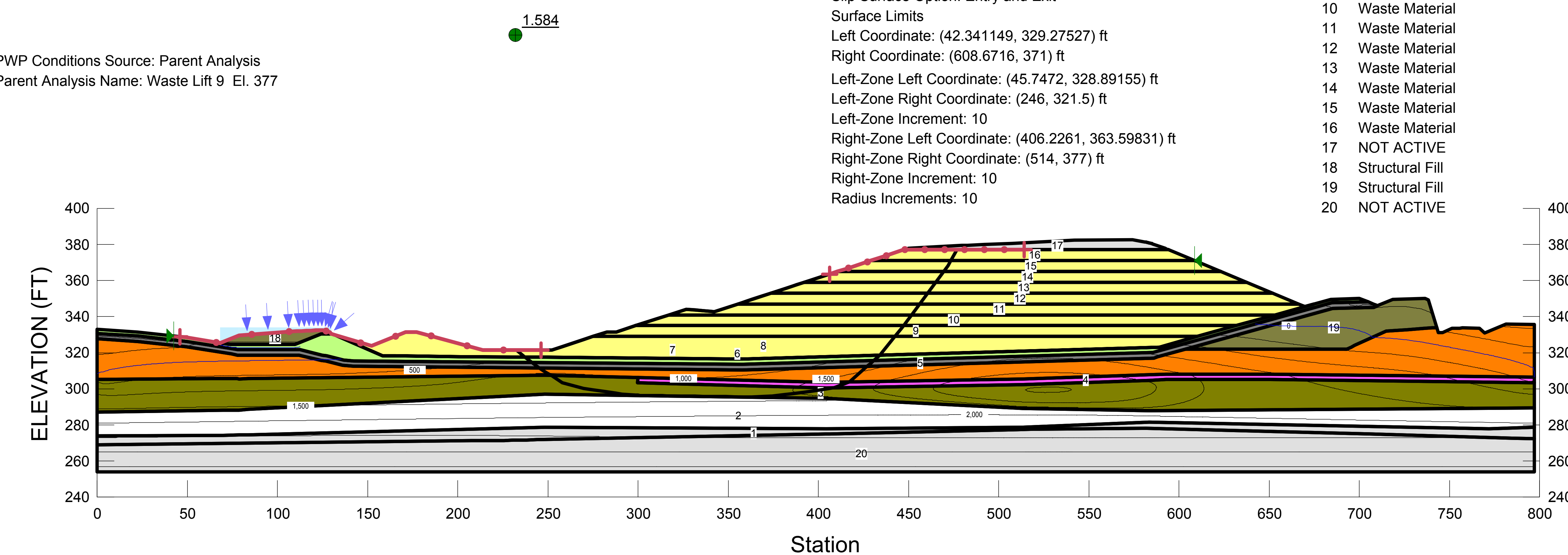
Title: Model City - RMU-2 CP-20 Section OP-2
Name: Slope Stability Waste Lift 9 -Consolidated Undrained
File Name: C20OP-2r1.gsz
Date: 2/24/2013Time: 7:16:44 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.584

PWP Conditions Source: Parent Analysis
Parent Analysis Name: Waste Lift 9 El. 377

PWP Conditions Source:Waste Lift 9 El. 377 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (42.341149, 329.27527) ft
Right Coordinate: (608.6716, 371) ft
Left-Zone Left Coordinate: (45.7472, 328.89155) ft
Left-Zone Right Coordinate: (246, 321.5) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (406.2261, 363.59831) ft
Right-Zone Right Coordinate: (514, 377) ft
Right-Zone Increment: 10
Radius Increments: 10

REGION Material Assignments
1 NOT ACTIVE
2 Deflection surface
3 GC UNDRAINED
4 GC-Overconsolidated-UNDRAINED
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 NOT ACTIVE
18 Structural Fill
19 Structural Fill
20 NOT ACTIVE



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 10th lift for partially drained conditions at Section OP-2 at RMU-2.
This is estimated at 681 days.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Slope Stability
File Name: C20OP-2r1.gsz
Date: 2/24/2013Time: 9:11:42 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.573

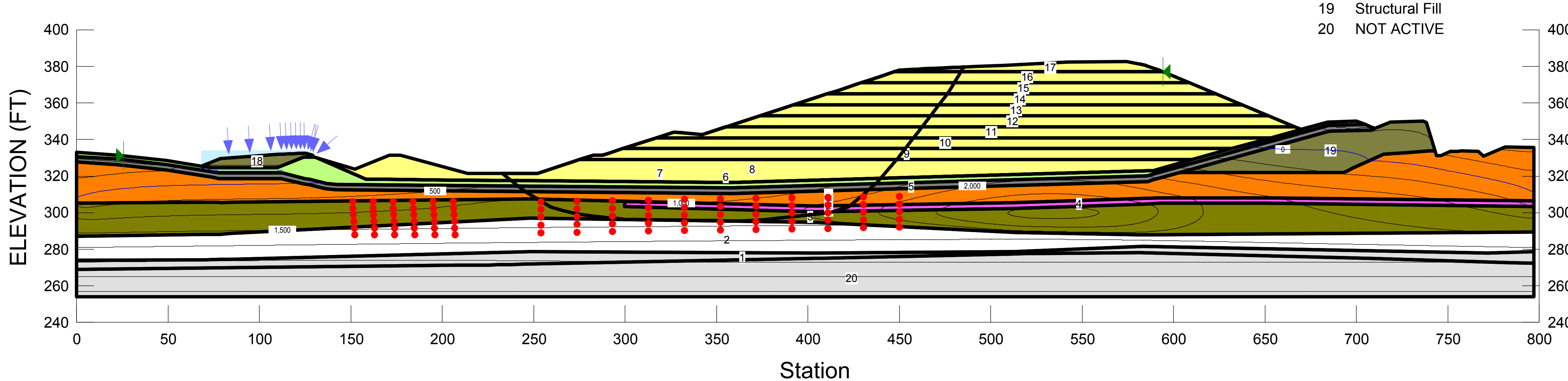
PWP Conditions Source:Waste Lift10 El. 383 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Block
Surface Limits
Left Coordinate: (25.66545, 331.15391) ft
Right Coordinate: (594.2496, 377) ft

REGION Material Assignments
1 NOT ACTIVE
2 Deflection surface
3 GC UNDRAINED
4 GC-Overconsolidated-UNDRAINED
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 NOT ACTIVE

PWP Conditions Source: Parent Analysis
Parent Analysis Name: Waste Lift10 El. 383

1.573



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 10th lift after virtually full consolidation for Section OP-2 at RMU-2.
This is estimated at 1058 days.

Title: Model City - RMU-2 CP-20 Section OP-2
Name: Lift 10 Consolidated Undrained - Static, Crit surface
File Name: C20OP-2r1.gsz
Date: 2/24/2013Time: 9:11:42 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.674

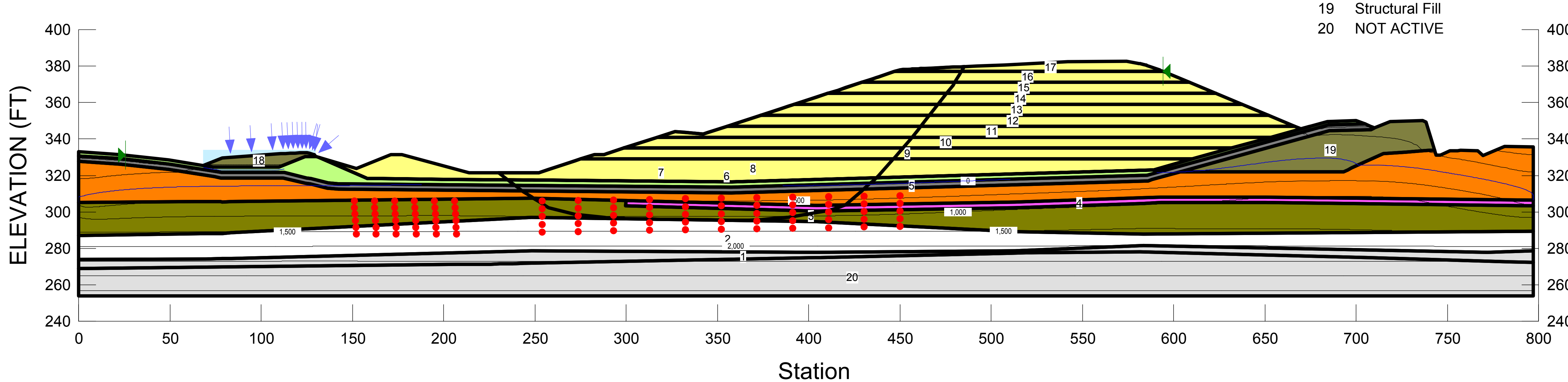
PWP Conditions Source: Parent Analysis
Parent Analysis Name: Waste Lift10 El. 383 Consolidation

1.674

PWP Conditions Source:Waste Lift10 El. 383 Consolidation - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Block
Surface Limits
Left Coordinate: (25.66545, 331.15391) ft
Right Coordinate: (594.2496, 377) ft

REGION Material Assignments
1 NOT ACTIVE
2 Deflection surface
3 GC UNDRAINED
4 GC-Overconsolidated-UNDRAINED
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 NOT ACTIVE



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 10th lift for partially drained conditions at Section OP-2 at RMU-2.
This is estimated at 681 days. The sand/silt k value is changed to 2E-5 cm/sec from 2E-4cm/sec.

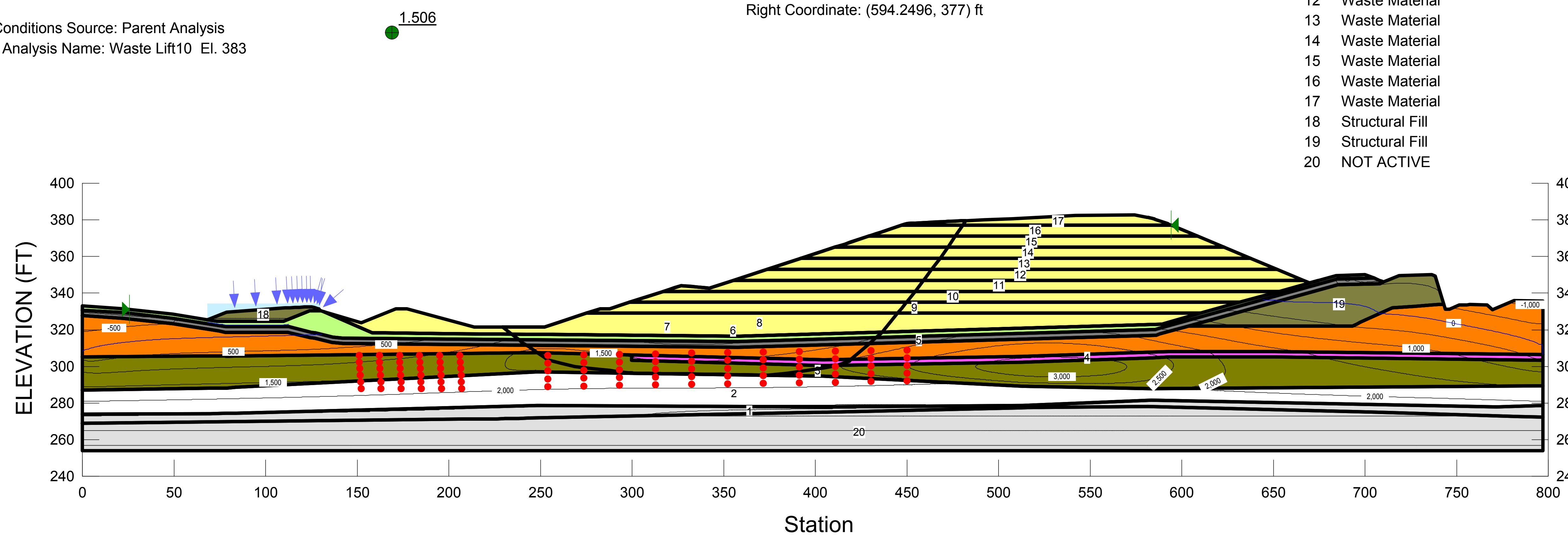
Title: Model City - RMU-2 CP-20 Section OP-2
Name: Slope Stability
File Name: C20OP-2r1_gssk.gsz
Date: 2/23/2013Time: 3:03:00 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.506

PWP Conditions Source: Parent Analysis
Parent Analysis Name: Waste Lift10 El. 383

PWP Conditions Source:Waste Lift10 El. 383 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Block
Surface Limits
Left Coordinate: (25.66545, 331.15391) ft
Right Coordinate: (594.2496, 377) ft

REGION Material Assignments
1 NOT ACTIVE
2 Deflection surface
3 GC UNDRAINED
4 GC-Overconsolidated-UNDRAINED
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 NOT ACTIVE



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the factor of safety after the completion of the tenth lift with partially drained conditions for Section OP-1 at RMU-2. This is estimated at 664 days.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift10 - 4th step pp baseliner
File Name: C20OP-1r1.gsz
Date: 2/24/2013Time: 3:20:16 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.900

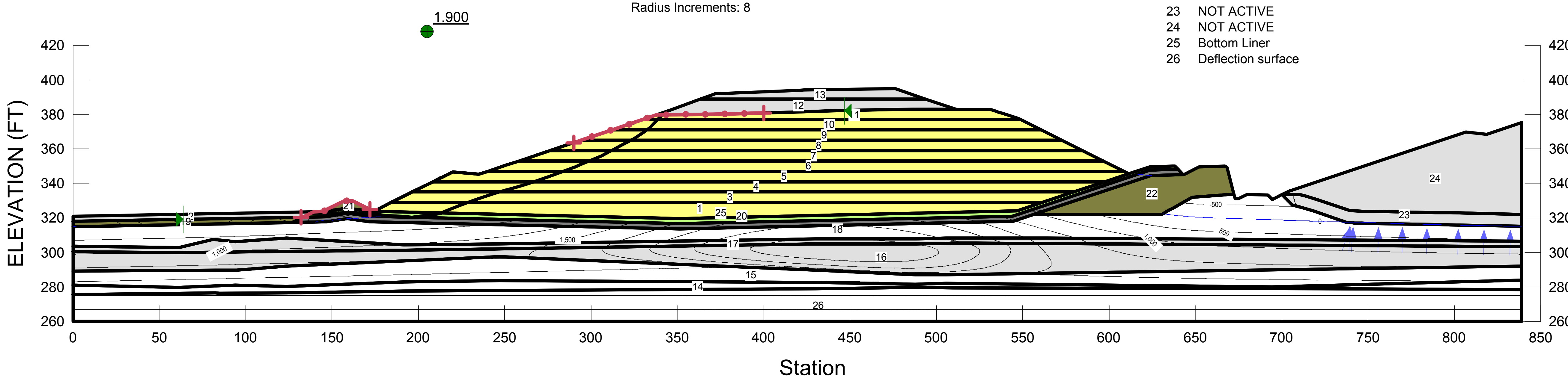
PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT 10 EL. 383

PWP Conditions Source:WASTE LIFT 10 EL. 383 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (446.87317, 382.21462) ft
Left-Zone Left Coordinate: (132, 320.48839) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 3
Right-Zone Left Coordinate: (290, 363.58286) ft
Right-Zone Right Coordinate: (399.9028, 380.82588) ft
Right-Zone Increment: 10
Radius Increments: 8

REGION Material Assignments

1	Waste Material
2	NOT ACTIVE
3	Waste Material
4	Waste Material
5	Waste Material
6	Waste Material
7	Waste Material
8	Waste Material
9	Waste Material
10	Waste Material
11	Waste Material
12	NOT ACTIVE
13	NOT ACTIVE
14	Deflection surface
15	Deflection surface
16	NOT ACTIVE
17	NOT ACTIVE
18	Deflection surface
19	Structural Fill
20	CCL
21	Structural Fill
22	Structural Fill
23	NOT ACTIVE
24	NOT ACTIVE
25	Bottom Liner
26	Deflection surface



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)

PURPOSE:
To determine the critical failure surface and factor of safety at the baseliner after the completion of the 10th lift for partially drained conditions at Section OP-2 at RMU-2. This is estimated at 681 days.

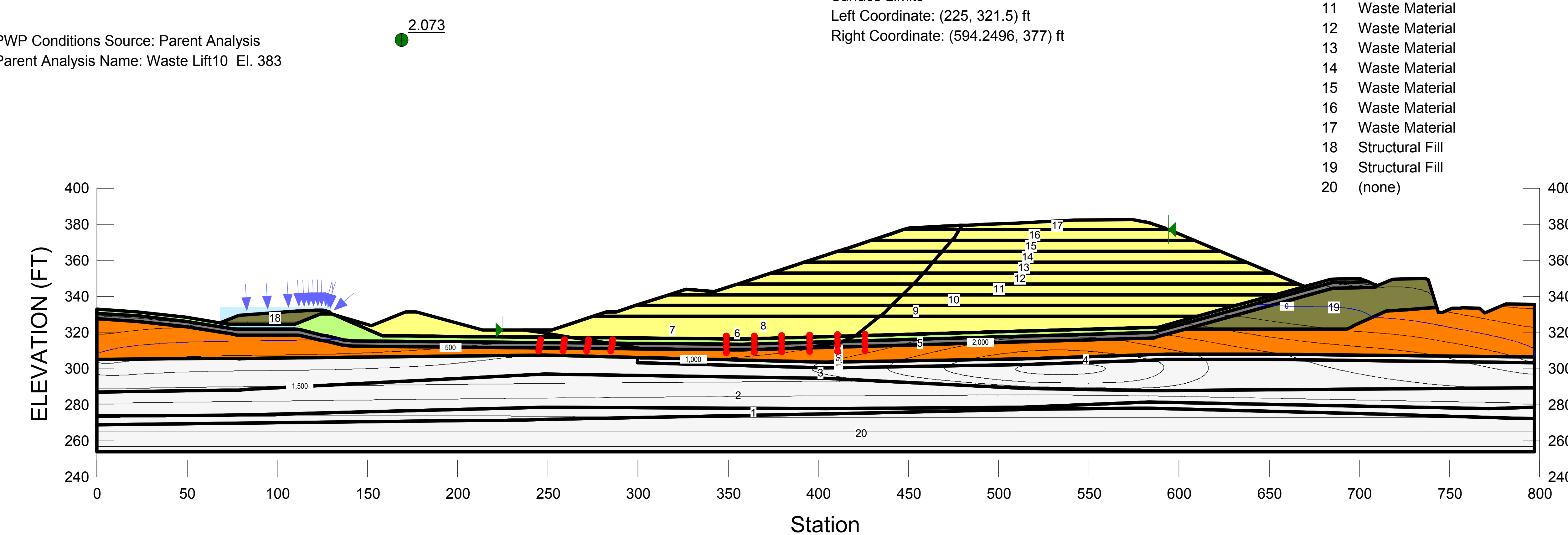
Title: Model City - RMU-2 CP-20 Section OP-2
Name: Slope Stability Waste Lift 10 @Baseliner
File Name: C20OP-2r1.gsz
Date: 2/24/2013Time: 9:11:42 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 2.073

PWP Conditions Source:Waste Lift10 El. 383 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Block
Surface Limits
Left Coordinate: (225, 321.5) ft
Right Coordinate: (594.2496, 377) ft

REGION Material Assignments
1 (none)
2 (none)
3 (none)
4 (none)
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 (none)

PWP Conditions Source: Parent Analysis
Parent Analysis Name: Waste Lift10 El. 383



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °

PURPOSE:
To determine the critical failure surface and factor of safety in the baseliner after the completion of the 10th lift for partially drained conditions at Section OP-2 at RMU-2. This is estimated at 681 days. The sand/silt k value is changed to 2E-5 cm/sec from 2E-4cm/sec.

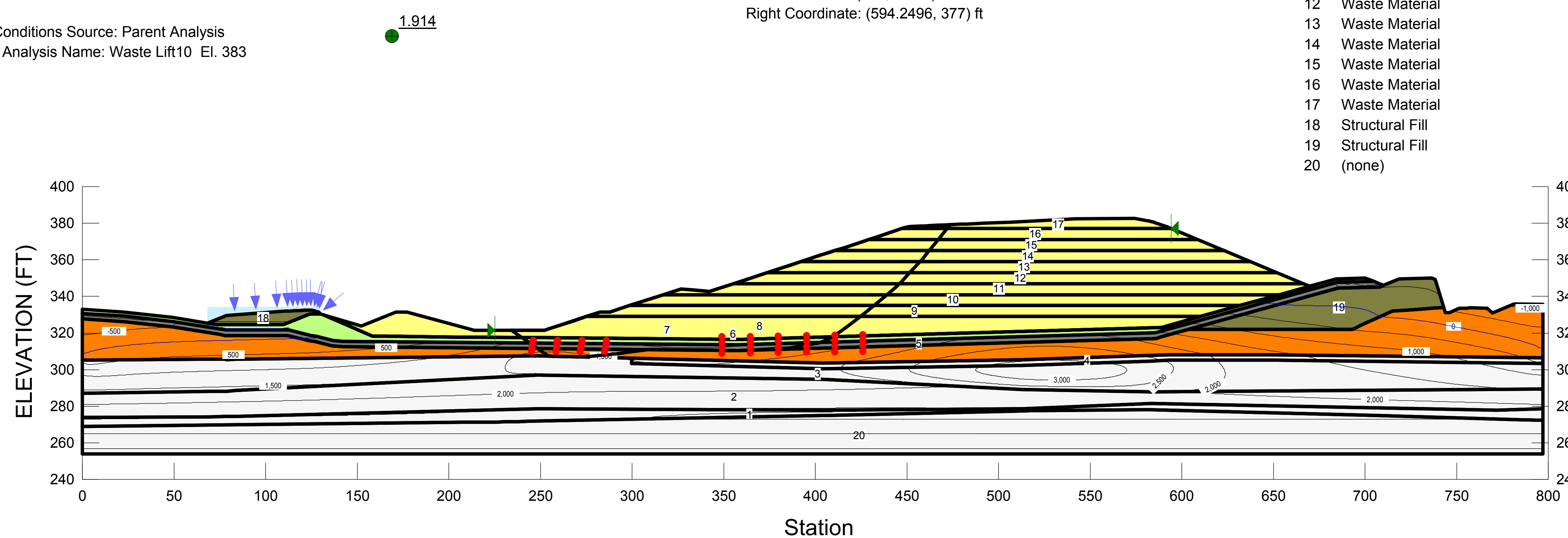
Title: Model City - RMU-2 CP-20 Section OP-2
Name: Slope Stability Waste Lift 10 @Baseliner
File Name: C20OP-2r1_gssk.gsz
Date: 2/23/2013Time: 9:11:13 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.914

PWP Conditions Source: Parent Analysis
Parent Analysis Name: Waste Lift10 El. 383

PWP Conditions Source:Waste Lift10 El. 383 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Block
Surface Limits
Left Coordinate: (225, 321.5) ft
Right Coordinate: (594.2496, 377) ft

REGION Material Assignments
1 (none)
2 (none)
3 (none)
4 (none)
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 (none)



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °

PURPOSE:
To determine the ky (yield acceleration) at the critical failure surface after the completion of the tenth lift for Section OP-1 at RMU-2. This is estimated at 1086 days.

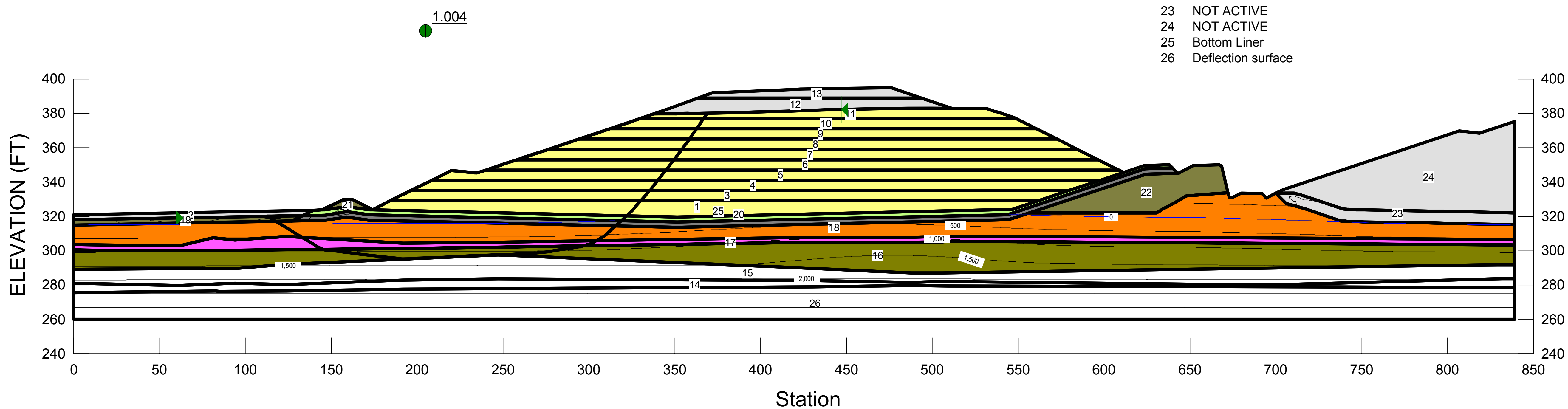
Title: Model City - RMU-2 CP-20 Section OP-1
Name: Yield Acceleration - C-20
File Name: C20OP-1r1.gsz
Date: 2/19/2013Time: 11:28:18 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: No
Slip Surface Factor of Safety: 1.004

PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT 10 EL. 383 - consol

Seismic Analysis
Horz Seismic Coef. (ky): 0.1445 g
PWP Conditions Source:WASTE LIFT 10 EL. 383 - consol - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 3,500
AutoContour: Yes

Slip Surface Option: Fully-Specified
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (446.87317, 382.21462) ft

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 NOT ACTIVE
13 NOT ACTIVE
14 Deflection surface
15 Deflection surface
16 GC UNDRAINED
17 GC-Overconsolidated-UNDRAINED
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Structural Fill
23 NOT ACTIVE
24 NOT ACTIVE
25 Bottom Liner
26 Deflection surface



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the ky (yield acceleration) at the critical failure surface after the completion of the 10th lift for Section OP-2 at RMU-2. This is estimated at 1058 days.

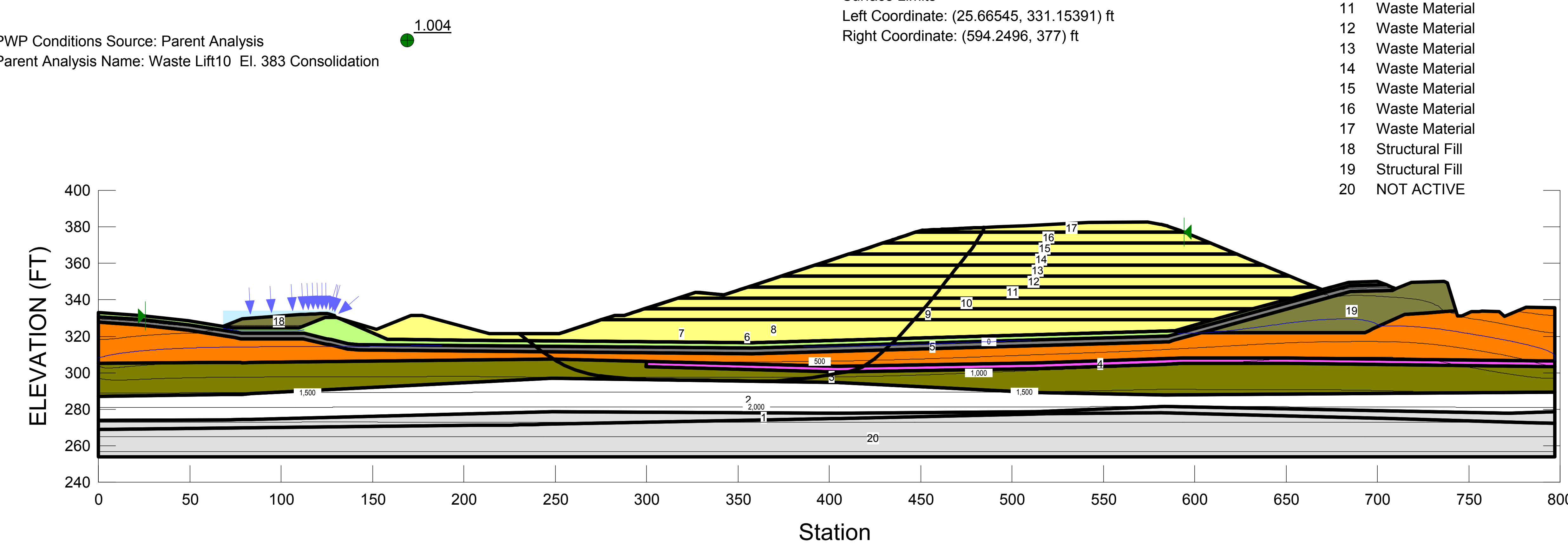
Title: Model City - RMU-2 CP-20 Section OP-2
Name: Lift 10 Consolidated Yied Acceleration
File Name: C20OP-2r1.gsz
Date: 2/24/2013Time: 9:11:42 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: No
Slip Surface Factor of Safety: 1.004

PWP Conditions Source: Parent Analysis
Parent Analysis Name: Waste Lift10 El. 383 Consolidation

Seismic Analysis
Horz Seismic Coef. (ky): 0.15 g
PWP Conditions Source:Waste Lift10 El. 383 Consolidation - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -1,500
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Fully-Specified
Surface Limits
Left Coordinate: (25.66545, 331.15391) ft
Right Coordinate: (594.2496, 377) ft

REGION Material Assignments
1 NOT ACTIVE
2 Deflection surface
3 GC UNDRAINED
4 GC-Overconsolidated-UNDRAINED
5 Upper Till
6 CCL
7 Bottom Liner
8 Waste Material
9 Waste Material
10 Waste Material
11 Waste Material
12 Waste Material
13 Waste Material
14 Waste Material
15 Waste Material
16 Waste Material
17 Waste Material
18 Structural Fill
19 Structural Fill
20 NOT ACTIVE



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the 9th lift for partially drained conditions at Section OP-1 at RMU-2 with 2:1 slope . This is estimated at 643 days.

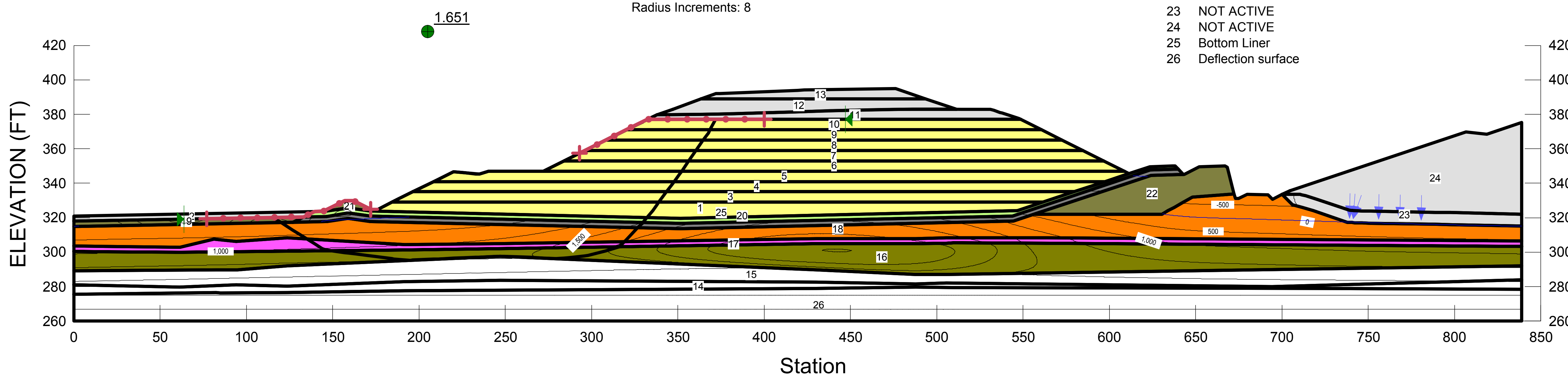
Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift 9 - 4th step pp
File Name: C20OP-1r1_variant.gsz
Date: 2/26/2013Time: 5:16:38 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.651

PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT 9 EL. 377

PWP Conditions Source:WASTE LIFT 9 EL. 377 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (447, 377) ft
Left-Zone Left Coordinate: (76.8668, 319.45558) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (293.05266, 357.51679) ft
Right-Zone Right Coordinate: (400, 377) ft
Right-Zone Increment: 10
Radius Increments: 8

REGION Material Assignments
1 Waste Material
2 NOT ACTIVE
3 Waste Material
4 Waste Material
5 Waste Material
6 Waste Material
7 Waste Material
8 Waste Material
9 Waste Material
10 Waste Material
11 NOT ACTIVE
12 NOT ACTIVE
13 NOT ACTIVE
14 Deflection surface
15 Deflection surface
16 GC UNDRAINED
17 GC-Overconsolidated-UNDRAINED
18 Upper Till
19 Structural Fill
20 CCL
21 Structural Fill
22 Structural Fill
23 NOT ACTIVE
24 NOT ACTIVE
25 Bottom Liner
26 Deflection surface



Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

PURPOSE:
To determine the critical failure surface and factor of safety after the completion of the tenth lift with partially drained conditions for Section OP-1 at RMU-2 with 2:1 slope. This is estimated at 664 days.

Title: Model City - RMU-2 CP-20 Section OP-1
Name: Waste Lift10 - 4th step pp
File Name: C20OP-1r1_variant.gsz
Date: 2/26/2013Time: 5:16:38 PM
Directory: N:\Model_City\154.002_rmu2\154.005_revsions\geoslope\operational\
Analysis Method: Morgenstern-Price
Interslice force function option: Half-Sine
Optimization: Yes
Slip Surface Factor of Safety: 1.587

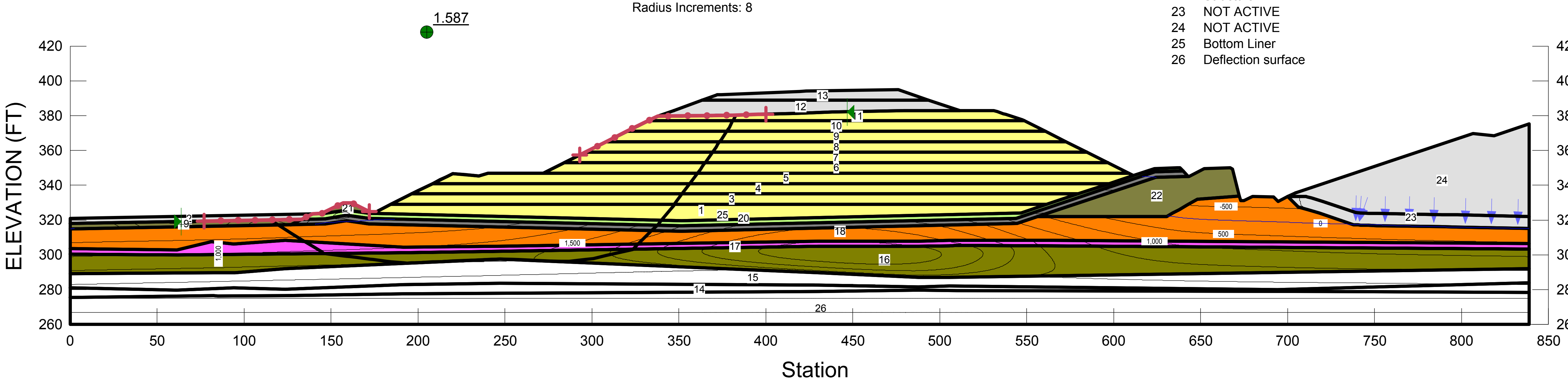
PWP Conditions Source: Parent Analysis
Parent Analysis Name: WASTE LIFT 10 EL. 383

PWP Conditions Source:WASTE LIFT 10 EL. 383 - SIGMA/W
Selected Contour: Pore Pressure
Type: Pore-Water Pressure psf
Starting Contour Value: -2,000
Increment by: 500
Ending Contour Value: 4,000
AutoContour: Yes

Slip Surface Option: Entry and Exit
Surface Limits
Left Coordinate: (63.808718, 319.21096) ft
Right Coordinate: (446.87317, 382.21462) ft
Left-Zone Left Coordinate: (76.8668, 319.45558) ft
Left-Zone Right Coordinate: (171.8639, 324.99999) ft
Left-Zone Increment: 10
Right-Zone Left Coordinate: (293.05266, 357.51679) ft
Right-Zone Right Coordinate: (399.9028, 380.82588) ft
Right-Zone Increment: 10
Radius Increments: 8

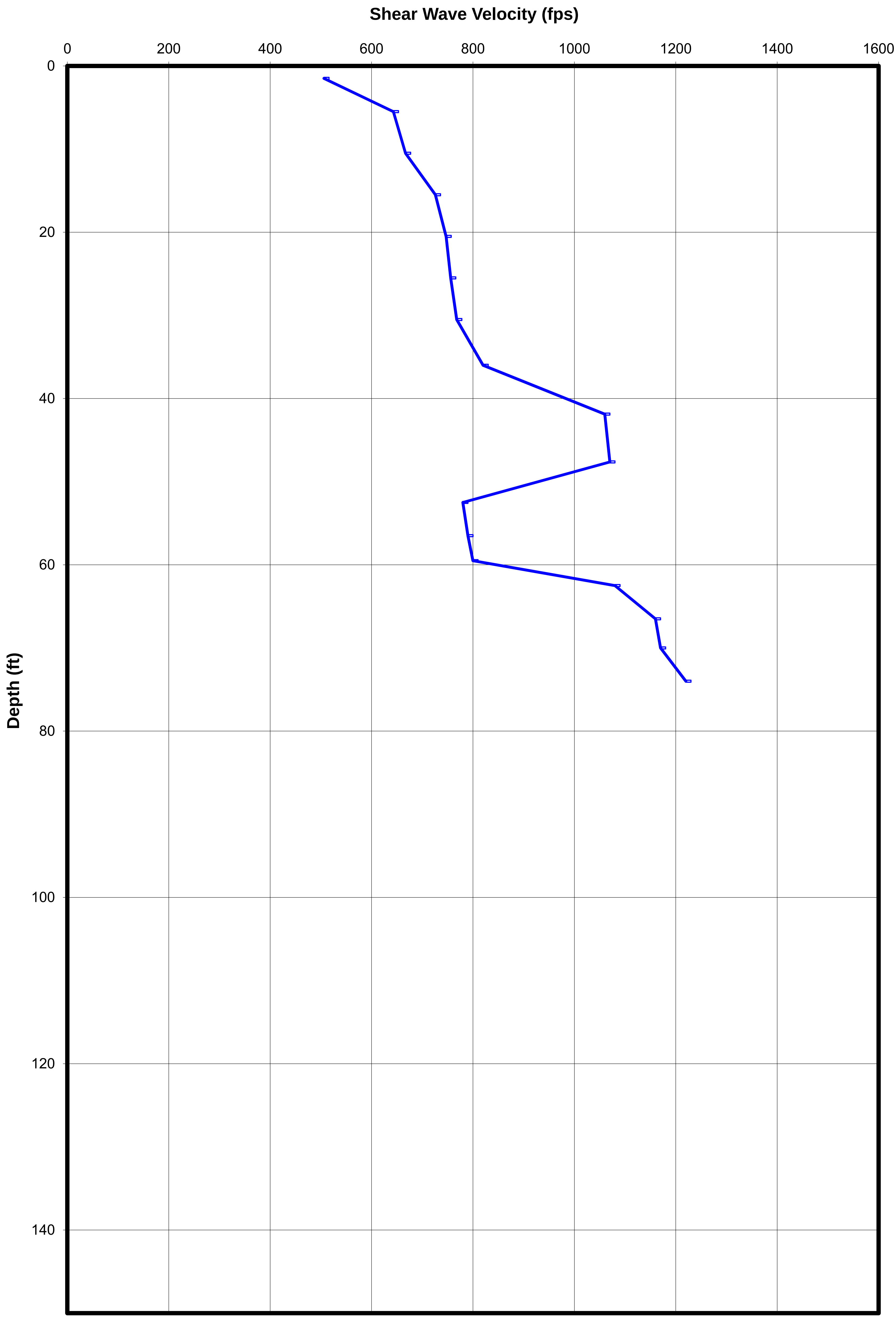
REGION Material Assignments

1	Waste Material
2	NOT ACTIVE
3	Waste Material
4	Waste Material
5	Waste Material
6	Waste Material
7	Waste Material
8	Waste Material
9	Waste Material
10	Waste Material
11	Waste Material
12	NOT ACTIVE
13	NOT ACTIVE
14	Deflection surface
15	Deflection surface
16	GC UNDRAINED
17	GC-Overconsolidated-UNDRAINED
18	Upper Till
19	Structural Fill
20	CCL
21	Structural Fill
22	Structural Fill
23	NOT ACTIVE
24	NOT ACTIVE
25	Bottom Liner
26	Deflection surface

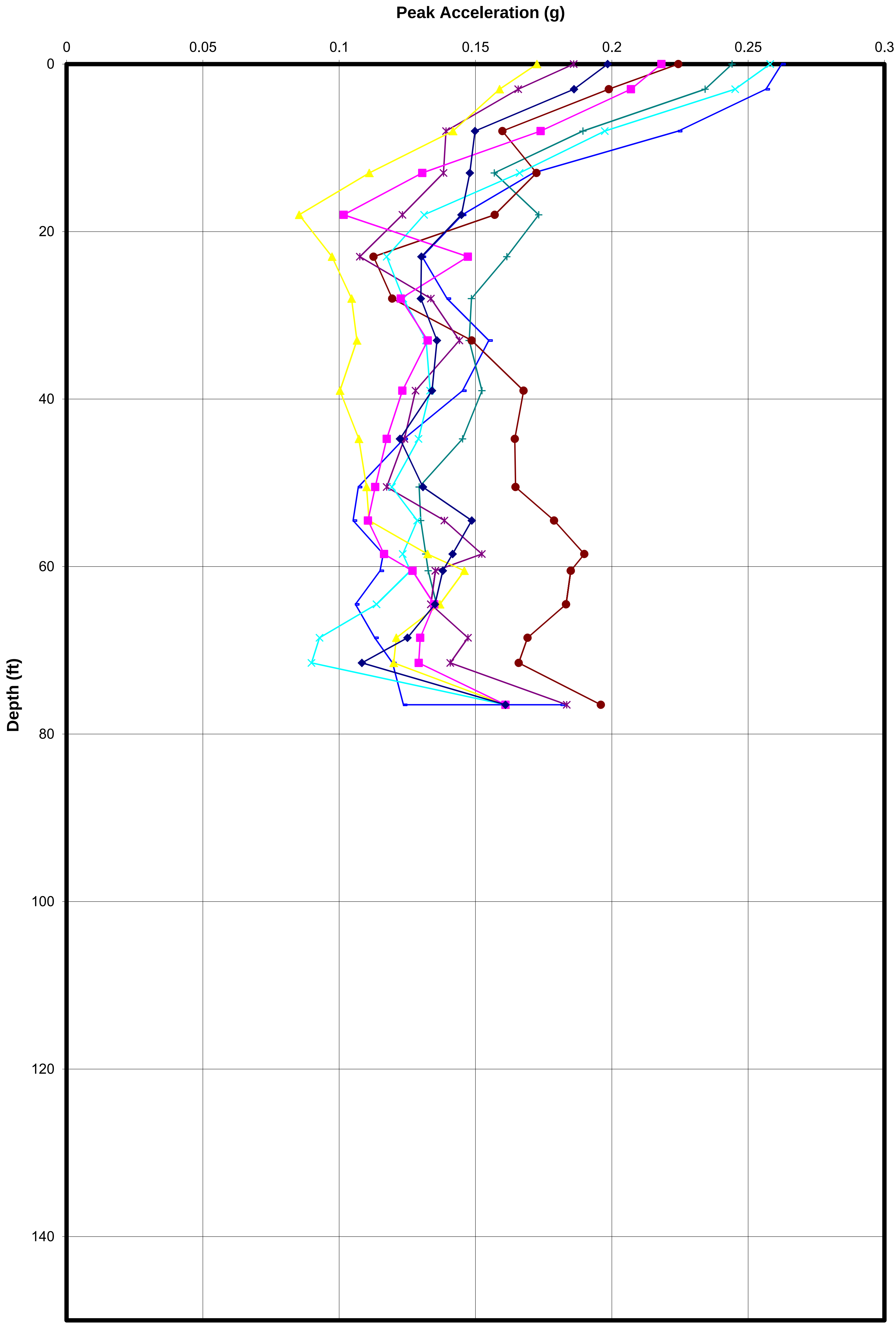


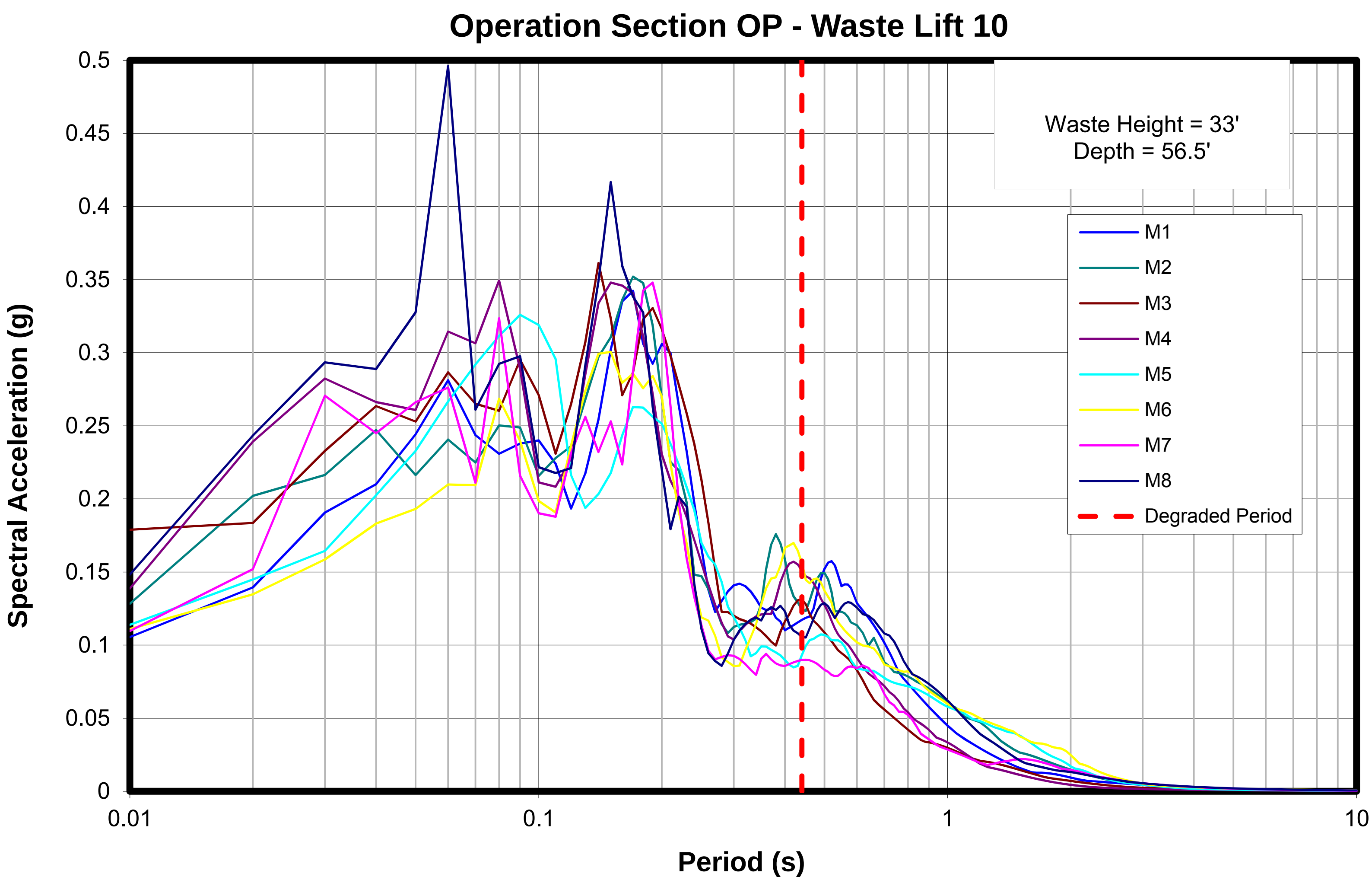
Material Properties:
Name: Waste Material Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 0 psf Phi': 30 °
Name: Bottom Liner Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: Baseliner
Name: CCL Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 1,000 psf Phi': 10 °
Name: Upper Till Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 150 psf Phi': 31 °
Name: Deflection surface Model: Bedrock (Impenetrable)
Name: Structural Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 1,000 psf Phi': 45 °
Name: NOT ACTIVE Model: (None)
Name: GC UNDRAINED Model: Shear/Normal Fn. Unit Weight: 120 pcf Strength Function: SHANSEP CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear
Name: GC-Overconsolidated-UNDRAINED Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: SHANSEP Over CONSOLIDATED UNDRAINED STATIC Anisotropic Strength Fn: clay ellipse staticshear

Section C20 OP-1



Section C20 OP




Operation Section OP - Waste Lift 10
Spectral Acceleration (g)
Period (s)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.01
0.1
1
10
Waste Height = 33'
Depth = 56.5'
M1
M2
M3
M4
M5
M6
M7
M8
Degraded Period

Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, ASCE, V. 133(4), pp. 381-392, April 2007

SEE NOTES BELOW FOR GUIDANCE IN THE USE OF SPREADSHEET

Input Parameters			
Yield Coefficient (ky)	0.1445	Based on pseudostatic analysis	
Initial Fundamental Period (Ts)	0.29	seconds	1D: Ts=4H/Vs 2D: Ts=2.6H/Vs
Degraded Period (1.5Ts)	0.44	seconds	
Moment Magnitude (Mw)	5.6		
Spectral Acceleration (Sa(1.5Ts))	0.17	g	

Additional Input Parameters			
Probability of Exceedance #1 (P1)	15	%	
Probability of Exceedance #2 (P2)	5	%	
Probability of Exceedance #3 (P3)	1	%	
Displacement Threshold (d_threshold)	15.24	cm	6 in

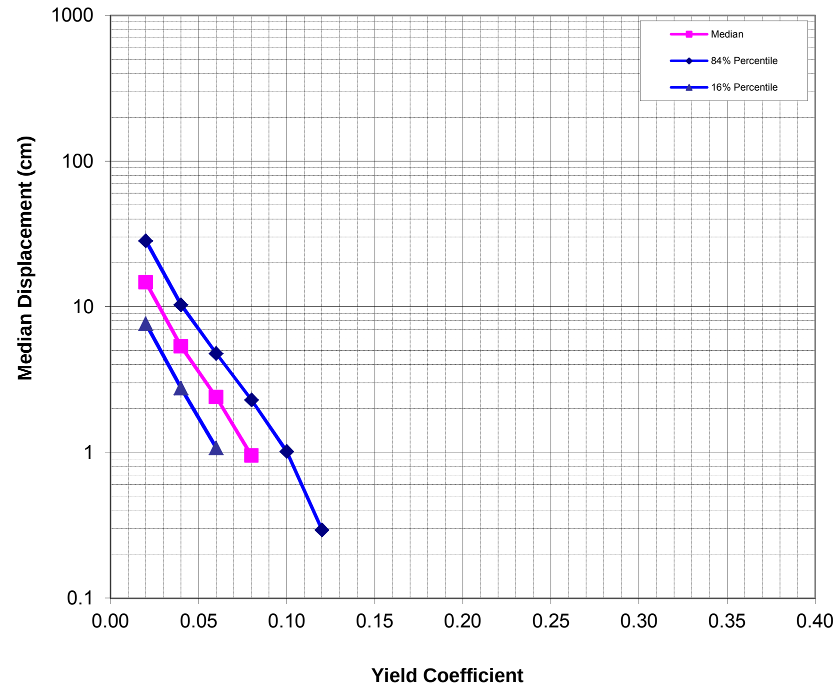
Intermediate Calculated Parameters			
Non-Zero Seismic Displacement Est (D)	0.35	cm	eq. (5) or (6)
Standard Deviation of Non-Zero Seismic D	0.66		

Results			
Probability of Negligible Displ. (P(D=0))	0.933		eq. (3)
D1	<1	cm	calc. using eq. (7)
D2	0.23	cm	calc. using eq. (7)
D3	0.70	cm	calc. using eq. (7)
P(D>d_threshold)	0.000		eq. (7)

Notes
1. Values highlighted in blue are input parameters
2. Probability of Exceedance is the desired probability of exceeding a particular displacement value.
3. Displacements D1, D2, and D3 correspond to P1, P2, and P3, respectively.
   (e.g., the probability of exceeding displacement D1 is P1)
4. Calculated seismic displacements are due to deviatoric deformation only (add in volumetrically induced movement).
5. ky may range between 0.01 and 0.5, Ts between 0 and 2 s, Sa between 0.002 and 2.7 g, M between 4.5 and 9
6. Rigid slope is assumed for Ts < 0.05 s
7. When a value for D is not calculated, D is < 1cm
8. ky may be estimated using the simplified equations shown below.
9. Examples of how Ts is estimated are shown below.
10. Vs = weighted avg. shear wave velocity for the sliding mass, e.g., for 2 layers, Vs = [(h1)(Vs1) + (h2)(Vs2)]/(h1 + h2)

Dependence on ky

ky	P(D="0")	D (cm)	Dmedian (cm)	D1 (cm)	D3 (cm)
0.020	0.00	14.7	14.7	28.4	7.7
0.04	0.00	5.4	5.4	10.3	2.8
0.06	0.07	2.6	2.4	4.8	1.1
0.08	0.31	1.4	1.0	2.3	<1
0.1	0.60	0.9	<1	1.0	<1
0.12	0.81	0.6	<1	0.3	<1
0.14	0.92	0.4	<1	<1	<1
0.17	0.98	0.2	<1	<1	<1



Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
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Journal of Geotechnical and Geonvironmental Engineering, Vol 133, No. 4, pp. 381-392, April 2007

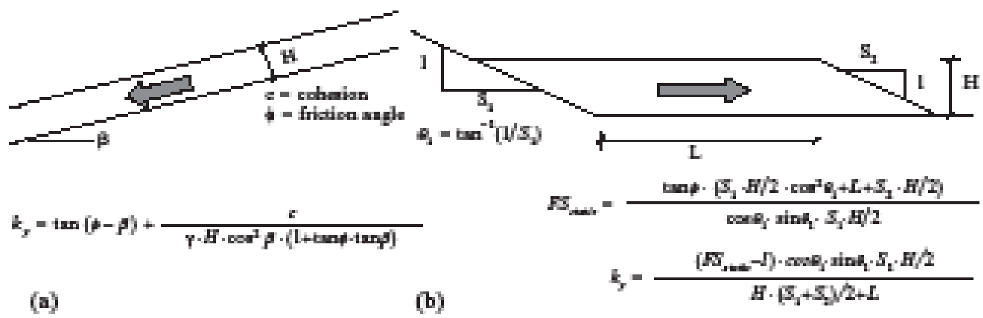

Fig. 14.1. Simplified estimates of the yield coefficient: (a) shallow sliding and (b) deep sliding

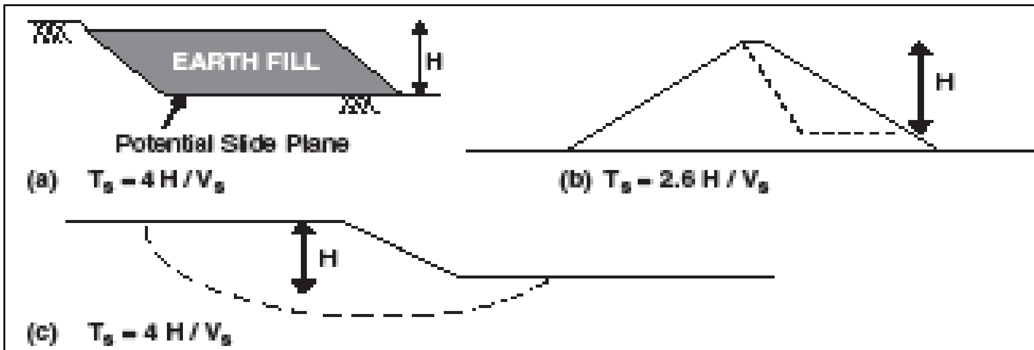

Fig. 14.4. Estimating the initial fundamental period of potential sliding blocks

Figures from Bray, J.D. (2007) “Chapter 14: Simplified Seismic Slope Displacement Procedures,” Earthquake Geotechnical Engineering, 4th Inter. Conf. on Earthquake Geotechnical Engineering - Invited Lectures, in Geotechnical, Geological, and Earthquake Engineering Series, Vol. 6, Pitilakis, Kyriazis D., Ed., Springer, Vol. 6, pp. 327-353.

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Bray&Travasarou2007-Seismic Displ Est_modelcitySC.xls

ATTACHMENT 1

P.J.Carey & Associates, P.C.

CLIENT CWM

PROJECT RMU-2 Permit

JOB No 154.005

DATE 2/11/2013

CALCULATION BY Peter J. Carey

CHECKED BY KLH

OBJECT Calculate Operational Plan for C-20 Lift times vs Elevation , plan includes roads and temporary stormwater storage

Reference: Calculated volume vs elevation from Arcadis C-20 Operation plan build out including the drainage basin but no operational road. The Filling Rate is 50,000 cy per quarter.

Import the volume vs elevation relationship

$$Vol\_v\_el := READEXCEL("C\text{-}20volumebyel.xlsx", "A3:C19", -99999)$$

using this information create a splined function that passes through each data point of the cumulative volume vs elevation curve

$i := 1..16$ covering the range from 310 to 385

$$Vol_{el_i} := \left[\sum_{n=1}^{i} \left(Vol\_v\_el^{\langle 3\rangle}\right)_n\right] \cdot yd^3$$

this sums the incremental volume per elevation range

$$El_i := \left(Vol\_v\_el^{\langle 2\rangle}\right)_i$$

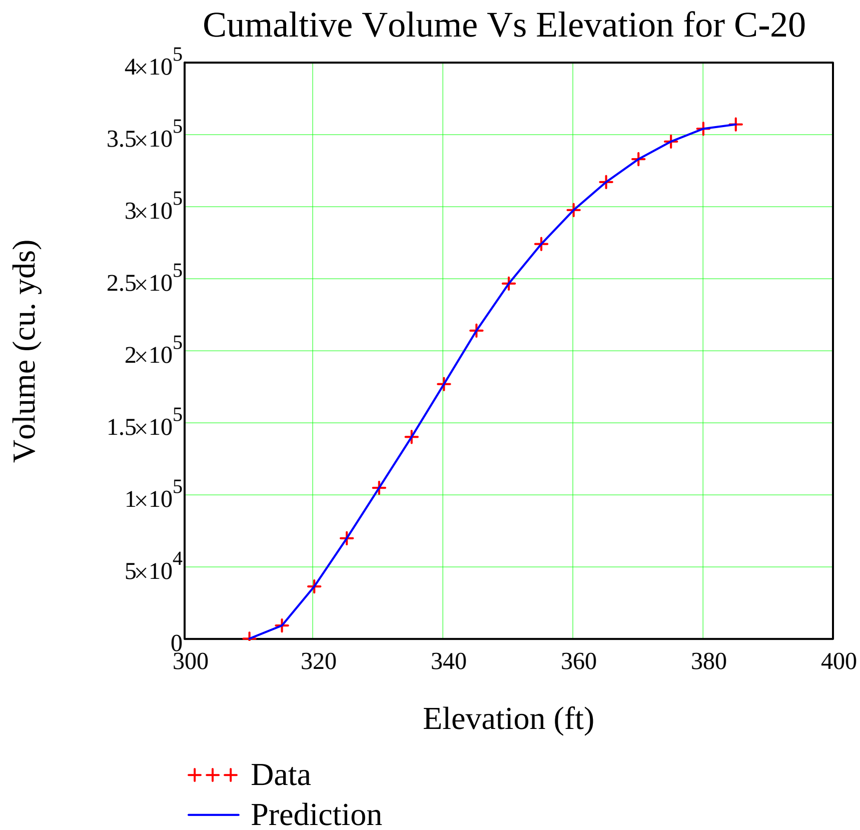
this volume includes the liner system as it is measured from subrade. the baseliner soils represent 8 feet over a cell bottom area of 3.7 acres or $V_{liner} := 3.8acre \cdot 8ft = 4.905 \times 10^4 \cdot yd^3$

using the built in splining function, define the function "Fit" that can be used to best fit the relationship

$$Fit := lspline\left(El, \frac{Vol_{el}}{yd^3}\right)$$

show the fit function below for increments of elevation used ir the Terramodel report that formed the basis of the calculation

$$Pred_{data} := interp\left(Fit, El, \frac{Vol_{el}}{yd^3}, El\right)$$



The graph above demonstrates the degree of fit is excelent

Calculate the Volume per operation stage using the Fit function and volume of the liner system at the elevations being used in the Geoslope FEM .

top lift 1 = 329, lifts are 6 foot and a total of 11 are used $\quad j := 1..11$

$$\text{Lift\_elevations}_j := 329 + (j - 1)\cdot 6$$

$$\text{Lift\_elevations}_{11} := 385$$

Lift_elevations =

	1
1	329
2	335
3	341
4	347
5	353
6	359
7	365

8	371
9	377
10	383
11	385

The incremental volume for each lift is computed as

$$LiftVol_j := if\left(j = 1, interp\left(Fit, El, \frac{Vol_{el}}{yd^3}, Lift\_elevations_j\right) - \frac{V_{liner}}{yd^3}, interp\left(Fit, El, \frac{Vol_{el}}{yd^3}, Lift\_elev\right.\right.$$

LiftVol =

	1
1	$4.872 \cdot 10^4$
2	$4.237 \cdot 10^4$
3	$4.411 \cdot 10^4$
4	$4.34 \cdot 10^4$
5	$3.594 \cdot 10^4$
6	$2.96 \cdot 10^4$
7	$2.384 \cdot 10^4$
8	$1.853 \cdot 10^4$
9	$1.369 \cdot 10^4$
10	$6.979 \cdot 10^3$
11	[illegible]

$\cdot yd^3$

the time of filling for each lift to complete a lift in total at the maximum fill rate of 50,000 cu yds per quarter is

$$Fill\_Rate_{max} := \frac{50000yd^3}{\left(\frac{365day}{4}\right)} = 547.945 \cdot \frac{yd^3}{day}$$

[illegible] calender days (not work days)

$$LiftFillTime_{min} := \frac{LiftVol}{Fill\_Rate_{max}} =$$

	1
1	88.922
2	77.331
3	80.509
4	79.199
5	65.59
6	54.024
7	43.508
8	33.81
9	24.984
10	12.737
11	1.366

$\cdot day$

total fill time is

$$Time_{total} := \sum_{j=1}^{11} LiftFillTime_{min_j}$$

$$Time_{total} = 561.979 \cdot day$$

Checking the summations to make sure they reflect the volumes in total

$$SumLiftVol := \sum_{j=1}^{11} LiftVol_j \qquad SumLiftVol = 3.079 \times 10^5 \cdot yd^3$$

$$SumLiftVol + V_{liner} = 3.57 \times 10^5 \cdot yd^3$$

$$Time_{total} \cdot Fill\_Rate_{max} = 3.079 \times 10^5 \cdot yd^3$$ all the numbers check

show the results in tablular form for elevation and lift time

$$label := \begin{pmatrix} \text{"Top Lift El"} & \text{"Fill Time"} \\ \text{"ft"} & \text{"day"} \end{pmatrix} \qquad combine := augment\left(Lift\_elevations, \frac{LiftFillTime_{min}}{day}\right)$$

$$Lift\_vs\_Fill\_Time := stack(label, combine)$$

Lift_vs_Fill_Time =

	1	2
1	"Top Lift El"	"Fill Time"
2	"ft"	"day"
3	329	88.922
4	335	77.331
5	341	80.509
6	347	79.199
7	353	65.59
8	359	54.024
9	365	43.508
10	371	33.81
11	377	24.984
12	383	12.737
13	385	1.366