

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name: TCC Paula - sem berma-NC.slim
Slide Modeler Version: 7.026
Project Title: SLIDE - An Interactive Slope Stability Program
Date Created: 27/11/2017, 18:27:22

General Settings

Units of Measurement: Metric Units
Time Units: days
Permeability Units: meters/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 21
Maximum Support Properties: 20

Analysis Options

Slices Type: Vertical

Analysis Methods Used

GLE/Morgenstern-Price with interslice force function: Bishop simplified
Half Sine
Janbu simplified
Spencer

Number of slices: 10
Tolerance: 0.005
Maximum number of iterations: 75
Check malpha < 0.2: Yes
Create Interslice boundaries at intersections with water tables and piezos: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight [kN/m3]: 9.81
Use negative pore pressure cutoff: Yes
Maximum negative pore pressure [kPa]: 0
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
 Search Method: Slope Search
 Number of Surfaces: 5000
 Upper Angle: Not Defined
 Lower Angle: Not Defined
 Composite Surfaces: Disabled
 Reverse Curvature: Invalid Surfaces
 Minimum Elevation: Not Defined
 Minimum Depth: Not Defined
 Minimum Area: Not Defined
 Minimum Weight: Not Defined

Seismic

Advanced seismic analysis: No
 Staged pseudostatic analysis: No

Loading

1 Distributed Load present

Distributed Load 1

Distribution: Constant
 Magnitude [kPa]: 20
 Orientation: Vertical

Material Properties

Property	Argila arenosa	Aterro	Estaca	Argila arenosa dura
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	20	17	25	22
Cohesion [kPa]	50	20	400	100
Friction Angle [deg]	25	15	50	50
Water Surface	None	None	None	None
Ru Value	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.679680
Center:	14.484, 19.303
Radius:	10.308
Left Slip Surface Endpoint:	5.527, 14.200
Right Slip Surface Endpoint:	10.000, 10.021
Left Slope Intercept:	5.527 14.200
Right Slope Intercept:	10.000 14.200
Resisting Moment:	2999.66 kN-m
Driving Moment:	1785.86 kN-m
Total Slice Area:	11.2312 m2
Surface Horizontal Width:	4.47322 m
Surface Average Height:	2.51077 m

Method: janbu simplified

FS	1.595530
Center:	14.484, 19.303
Radius:	10.308
Left Slip Surface Endpoint:	5.527, 14.200
Right Slip Surface Endpoint:	10.000, 10.021
Left Slope Intercept:	5.527 14.200
Right Slope Intercept:	10.000 14.200
Resisting Horizontal Force:	228.567 kN
Driving Horizontal Force:	143.254 kN
Total Slice Area:	11.2312 m2
Surface Horizontal Width:	4.47322 m
Surface Average Height:	2.51077 m

Method: spencer

FS	1.872680
Center:	14.484, 19.303
Radius:	10.308
Left Slip Surface Endpoint:	5.527, 14.200
Right Slip Surface Endpoint:	10.000, 10.021
Left Slope Intercept:	5.527 14.200
Right Slope Intercept:	10.000 14.200
Resisting Moment:	3344.33 kN-m
Driving Moment:	1785.86 kN-m
Resisting Horizontal Force:	262.115 kN
Driving Horizontal Force:	139.968 kN
Total Slice Area:	11.2312 m2
Surface Horizontal Width:	4.47322 m
Surface Average Height:	2.51077 m

Method: gle/morgenstern-price

FS	1.724850
Center:	14.484, 19.303
Radius:	10.308
Left Slip Surface Endpoint:	5.527, 14.200
Right Slip Surface Endpoint:	10.000, 10.021
Left Slope Intercept:	5.527 14.200
Right Slope Intercept:	10.000 14.200
Resisting Moment:	3080.34 kN-m
Driving Moment:	1785.86 kN-m
Resisting Horizontal Force:	239.232 kN
Driving Horizontal Force:	138.697 kN
Total Slice Area:	11.2312 m2
Surface Horizontal Width:	4.47322 m
Surface Average Height:	2.51077 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 2345
 Number of Invalid Surfaces: 2655

Error Codes:

Error Code -105 reported for 2 surfaces
 Error Code -106 reported for 9 surfaces
 Error Code -108 reported for 83 surfaces
 Error Code -112 reported for 90 surfaces
 Error Code -114 reported for 2470 surfaces
 Error Code -123 reported for 1 surface

Method: janbu simplified

Number of Valid Surfaces: 2135
 Number of Invalid Surfaces: 2865

Error Codes:

Error Code -105 reported for 2 surfaces
 Error Code -106 reported for 9 surfaces
 Error Code -108 reported for 293 surfaces
 Error Code -112 reported for 90 surfaces
 Error Code -114 reported for 2470 surfaces
 Error Code -123 reported for 1 surface

Method: spencer

Number of Valid Surfaces: 1950
 Number of Invalid Surfaces: 3050

Error Codes:

Error Code -105 reported for 2 surfaces
 Error Code -106 reported for 9 surfaces
 Error Code -108 reported for 399 surfaces
 Error Code -111 reported for 79 surfaces
 Error Code -112 reported for 90 surfaces
 Error Code -114 reported for 2470 surfaces
 Error Code -123 reported for 1 surface

Method: gle/morgenstern-price

Number of Valid Surfaces: 2005
 Number of Invalid Surfaces: 2995

Error Codes:

Error Code -105 reported for 2 surfaces
 Error Code -106 reported for 9 surfaces
 Error Code -108 reported for 411 surfaces
 Error Code -111 reported for 12 surfaces
 Error Code -112 reported for 90 surfaces
 Error Code -114 reported for 2470 surfaces
 Error Code -123 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

- 105 = More than two surface / slope intersections with no valid slip surface.
- 106 = Average slice width is less than $0.0001 \times$ (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- 108 = Total driving moment or total driving force < 0.1 . This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
- 111 = safety factor equation did not converge
- 112 = The coefficient $M\text{-}\alpha = \cos(\alpha)(1 + \tan(\alpha)\tan(\phi)/F) < 0.2$ for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
- 114 = Surface with Reverse Curvature.
- 123 = Surface radius equal or less than the internal cutoff of 0.01.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.67968

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Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.469246	2.98087	-57.8761	Aterro	20	15	12.8521	21.5875	5.92456	0	5.92456	26.3936	26.3936
2	0.469246	8.46755	-53.2432	Aterro	20	15	14.8178	24.8891	18.2464	0	18.2464	38.0849	38.0849
3	0.469246	13.1319	-49.0724	Aterro	20	15	16.5272	27.7605	28.9625	0	28.9625	48.0235	48.0235
4	0.469246	17.1772	-45.2294	Aterro	20	15	18.0417	30.3042	38.4558	0	38.4558	56.6425	56.6425
5	0.469246	20.7275	-41.6323	Aterro	20	15	19.3989	32.5839	46.9637	0	46.9637	64.2064	64.2064
6	0.469246	23.8653	-38.227	Aterro	20	15	20.6243	34.6423	54.646	0	54.646	70.8915	70.8915
7	0.469246	26.6489	-34.975	Aterro	20	15	21.7362	36.5099	61.6157	0	61.6157	76.8214	76.8214
8	0.469246	29.1208	-31.8479	Aterro	20	15	22.7477	38.2089	67.9566	0	67.9566	82.0872	82.0872
9	0.469246	31.3134	-28.8239	Aterro	20	15	23.6691	39.7565	73.7324	0	73.7324	86.7574	86.7574
10	0.25	25.731	-26.5585	Estaca	400	50	229.823	386.029	-11.7231	0	-11.7231	103.155	103.155

Global Minimum Query (janbu simplified) - Safety Factor: 1.59553

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.469246	2.98087	-57.8761	Aterro	20	15	13.3822	21.3518	5.04482	0	5.04482	26.3582	26.3582
2	0.469246	8.46755	-53.2432	Aterro	20	15	15.4511	24.6527	17.3641	0	17.3641	38.0505	38.0505
3	0.469246	13.1319	-49.0724	Aterro	20	15	17.2528	27.5274	28.0926	0	28.0926	47.9904	47.9904
4	0.469246	17.1772	-45.2294	Aterro	20	15	18.8509	30.0772	37.6086	0	37.6086	56.611	56.611
5	0.469246	20.7275	-41.6323	Aterro	20	15	20.2847	32.3649	46.1464	0	46.1464	64.1765	64.1765
6	0.469246	23.8653	-38.227	Aterro	20	15	21.5809	34.4329	53.8643	0	53.8643	70.8633	70.8633
7	0.469246	26.6489	-34.975	Aterro	20	15	22.7581	36.3113	60.8744	0	60.8744	76.795	76.795
8	0.469246	29.1208	-31.8479	Aterro	20	15	23.8305	38.0222	67.2595	0	67.2595	82.0626	82.0626
9	0.469246	31.3134	-28.8239	Aterro	20	15	24.8084	39.5825	73.083	0	73.083	86.735	86.735
10	0.25	25.731	-26.5585	Estaca	400	50	238.54	380.598	-16.2799	0	-16.2799	102.956	102.956

Global Minimum Query (spencer) - Safety Factor: 1.87268

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.469246	2.98087	-57.8761	Aterro	20	15	11.8768	22.2414	8.36516	0	8.36516	27.2808	27.2808
2	0.469246	8.46755	-53.2432	Aterro	20	15	12.851	24.0658	15.1739	0	15.1739	32.3792	32.3792
3	0.469246	13.1319	-49.0724	Aterro	20	15	13.936	26.0977	22.7568	0	22.7568	38.8293	38.8293
4	0.469246	17.1772	-45.2294	Aterro	20	15	15.004	28.0977	30.2209	0	30.2209	45.3455	45.3455
5	0.469246	20.7275	-41.6323	Aterro	20	15	16.0408	30.0393	37.467	0	37.467	51.7249	51.7249
6	0.469246	23.8653	-38.227	Aterro	20	15	17.048	31.9254	44.5063	0	44.5063	57.9347	57.9347
7	0.469246	26.6489	-34.975	Aterro	20	15	18.0288	33.7621	51.3609	0	51.3609	63.973	63.973
8	0.469246	29.1208	-31.8479	Aterro	20	15	18.9861	35.5548	58.0512	0	58.0512	69.845	69.845
9	0.469246	31.3134	-28.8239	Aterro	20	15	19.9223	37.308	64.5943	0	64.5943	75.5574	75.5574
10	0.25	25.731	-26.5585	Estaca	400	50	290.161	543.378	120.308	0	120.308	265.347	265.347

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.72485

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.469246	2.98087	-57.8761	Aterro	20	15	12.6666	21.848	6.89691	0	6.89691	27.0705	27.0705
2	0.469246	8.46755	-53.2432	Aterro	20	15	14.1077	24.3336	16.1733	0	16.1733	35.0611	35.0611
3	0.469246	13.1319	-49.0724	Aterro	20	15	14.9207	25.736	21.4072	0	21.4072	38.6154	38.6154
4	0.469246	17.1772	-45.2294	Aterro	20	15	15.4863	26.7116	25.0479	0	25.0479	40.6587	40.6587
5	0.469246	20.7275	-41.6323	Aterro	20	15	16.6512	28.7207	32.5462	0	32.5462	47.3466	47.3466
6	0.469246	23.8653	-38.227	Aterro	20	15	18.4862	31.8859	44.359	0	44.359	58.9203	58.9203
7	0.469246	26.6489	-34.975	Aterro	20	15	20.6645	35.6431	58.381	0	58.381	72.837	72.837
8	0.469246	29.1208	-31.8479	Aterro	20	15	23.4416	40.4332	76.2579	0	76.2579	90.8194	90.8194
9	0.469246	31.3134	-28.8239	Aterro	20	15	27.0451	46.6487	99.4541	0	99.4541	114.337	114.337
10	0.25	25.731	-26.5585	Estaca	400	50	247.96	427.693	23.2373	0	23.2373	147.181	147.181

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.67968

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Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	5.52678	14.2	0	0	0
2	5.99603	13.4527	-1.59097	0	0
3	6.46528	12.8244	2.93299	0	0
4	6.93452	12.2832	10.8673	0	0
5	7.40377	11.8102	20.6087	0	0
6	7.87301	11.3931	31.1122	0	0
7	8.34226	11.0235	41.652	0	0
8	8.81151	10.6952	51.6991	0	0
9	9.28075	10.4037	60.8549	0	0
10	9.75	10.1455	68.8102	0	0
11	10	10.0206	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.59553

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	5.52678	14.2	0	0	0
2	5.99603	13.4527	-2.50764	0	0
3	6.46528	12.8244	1.15277	0	0
4	6.93452	12.2832	8.26244	0	0
5	7.40377	11.8102	17.2086	0	0
6	7.87301	11.3931	26.9399	0	0
7	8.34226	11.0235	36.7251	0	0
8	8.81151	10.6952	46.0317	0	0
9	9.28075	10.4037	54.4578	0	0
10	9.75	10.1455	61.6915	0	0
11	10	10.0206	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.87268

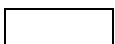
Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	5.52678	14.2	0	0	0
2	5.99603	13.4527	0.673292	0.476186	35.2699
3	6.46528	12.8244	4.17019	2.94936	35.2698
4	6.93452	12.2832	9.94028	7.03026	35.2698
5	7.40377	11.8102	17.1881	12.1563	35.2699
6	7.87301	11.3931	25.2811	17.88	35.2698
7	8.34226	11.0235	33.7242	23.8514	35.2698
8	8.81151	10.6952	42.1162	29.7867	35.2699
9	9.28075	10.4037	50.12	35.4473	35.2698
10	9.75	10.1455	57.4426	40.6262	35.2698
11	10	10.0206	0	0	0

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.72485

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	5.52678	14.2	0	0	0
2	5.99603	13.4527	-0.799353	-0.278998	19.2405
3	6.46528	12.8244	2.73033	1.80336	33.4444
4	6.93452	12.2832	7.30233	6.57845	42.0147
5	7.40377	11.8102	11.8713	12.3971	46.2412
6	7.87301	11.3931	17.6194	18.9463	47.0782
7	8.34226	11.0235	25.3262	25.088	44.7293
8	8.81151	10.6952	34.7776	27.7966	38.6342
9	9.28075	10.4037	45.9875	24.0016	27.5608
10	9.75	10.1455	58.957	11.1069	10.6689
11	10	10.0206	0	0	0

List Of Coordinates

Distributed Load



X	Y
0	14.2
9.75	14.2

External Boundary

X	Y
0	14.2
0	10
0	4
0	0
0	-10.0862
20	-10.0862
20	0
20	4
20	10
10	10
10	12.25
10	14.2
9.75	14.2

Material Boundary

X	Y
10	6.2
10	10

Material Boundary

X	Y
9.75	6.2
9.75	10
9.75	14.2

Material Boundary

X	Y
9.75	6.2
9.75	4
9.75	0
9.75	-3.8
10	-3.8
10	0
10	4
10	6.2

Material Boundary

X	Y
0	10
9.75	10

Material Boundary

X	Y
0	4
9.75	4

Material Boundary

X	Y
10	4
20	4