July 9, 2020
Job No. 528-005-20

Rockworth Companies
4655 South 2300 East, Suite 205
Holladay, Utah 84117

Attention: Mr. Josh Cowley

Ladies and Gentlemen:

Re: Response Letter
Review of Geotechnical Study and Slope Stability Analysis
Proposed Wasatch Rock Development
6695 Wasatch Boulevard
Cottonwood Heights, Utah

As part of Cottonwood Heights Sensitive Lands Evaluation and Development Standards (SLEDS) review, Mr. Daniel Brown of GeoStrata completed a geotechnical review of the geotechnical study and slope stability analysis for the above-mentioned project dated May 13, 2020[1]. As a result of this review, several items of clarification or additional information were requested by Mr. Brown as outlined in his letter entitled "Review of Geotechnical study and Slope Stability Analysis" dated June 17, 2020. The items of clarification and our responses are provided below:

Review Comment 1

Section 2, Proposed Construction, of the May 13, 2020 Gordon geotechnical report states:

"Development plans for the site have changed since the previous geotechnical reports for the site. Development at the site is complicated by the existence of several fault lines and a buried aqueduct which render significant portions of the site as "un-buildable" for habitable structures. These fault lines and buried aqueduct have been considered from the onset when designing the latest development plans. The proposed structures have been strategically located in the "buildable" areas defined in the surface fault rupture hazard report.

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1 "Report, Geotechnical Study and Slope Stability Analysis, Proposed Wasatch Rock Development, 6695 Wasatch Boulevard, Cottonwood Heights, Utah," G^2 Job No. 528-005-20, Dated May 13, 2020.

Currently, a hotel, an apartment, condominium, senior living center, three mixed-use pads, and three retail pads are planned for the site. Additionally, Wasatch Boulevard along the western boundary of the site will be re-aligned to bi-sect the site in a generally north-south direction."

GeoStrata understands that a geologic hazards study has been completed for the site concurrently with this geotechnical study, which includes a surface fault rupture hazard assessment. GeoStrata recommends that Cottonwood Heights City request that the GeoStrata review comments regarding the surface fault rupture hazard be addressed prior to approving final buildable areas for the proposed development.

Response to Review Comment 1

A geologic hazard evaluation and surface fault rupture hazard evaluation was performed by Mr. Bill Black of Western Geologic (G^2 sub consultant). Comments regarding the surface fault rupture hazard will be addressed in a separate letter by Western Geologic.

Review Comment 2

Section 2, Proposed Construction, of the May 13, 2020 Gordon geotechnical report states:

"Maximum column and wall loads for the condominium structure are anticipated to be very large, on the order of 1,000 to 1,500 kips and 15 to 30 kips per lineal foot, respectively. Detailed structural loads will be needed to finalize geotechnical recommendations for this structure."

Following approval of buildable areas and final subdivision of lots for the subject property, GeoStrata recommends that Cottonwood Heights City request that a design level geotechnical assessment be performed for each of the proposed buildings, which incorporates detailed structural loads. This is especially critical for the proposed condominium structure

Response to Review Comment 2

G^2 is planning to provide a detailed geotechnical assessment for each proposed building with recommendations tailored to the structural loads when foundation plans or loading details become available.

Review Comment 3

Section 2, Proposed Construction, of the May 13, 2020 Gordon geotechnical report states:

"Final site grading will require cuts up to 30 feet in the northern portions of the site and fills on the order of 5 to 10 feet in the southwest portion of the site. Fills up to 35 feet in height are planned for the eastern portion of the site and will buttress the existing gravel pit cut

slope. Final site grading slopes are generally not anticipated to not exceed 50 percent or 2.0:1.0 (H:V) with localized areas of up to 56 percent or 1.8:1.0 (H:V).”

GeoStrata recommends that Cottonwood Heights City request that the project geotechnical engineer review final site grading plans to assess whether the final grading plan conforms to the slope stability analysis and recommendations presented in the May 13, 2020 Gordon geotechnical report or whether additional slope stability analysis is needed for the subject development.

Response to Review Comment 3

G^2 can review final site grading plans for conformance with the slope stability recommendations provided as final site grading plans become available.

Review Comment 4

Section 5.1, Summary of Findings, of the May 13, 2020 Gordon geotechnical report states:

“The condominium structure at Section A-A’ incorporates a deep cut for below-grade parking. A structural element must extend a minimum of 15 feet below the bottom of footings to assure an adequate factor of safety. This may consist of deep foundations, soil improvement, or a permanent shoring solution such as soil nails.”

GeoStrata recommends that Cottonwood Heights City request that internal, external, and global stability of the permanent shoring and/or retaining wall to be constructed on the uphill side of the proposed condominium structure be evaluated prior to approval for construction. This evaluation will likely be completed during final design of this structure.

Response to Review Comment 4

Internal, external, and global stability analyses will be performed in conjunction with the final design of the condominium structure and required shoring design. Shoring designs are typically provided by the specialty contractors performing the work.

Review Comment 5

Section 5.2.2, Geometry, of the May 13, 2020 Gordon geotechnical report states:

“The geometry for the slope stability models was developed from the geologic cross-sections provided with the concurrent Geologic Hazards Evaluation report. Topography was obtained from 2013 lidar data with 0.5-meter resolution. Three cross-sections (A-A’, B-B’, and C-C’) for slope stability analysis were selected based on the locations of the proposed developments and the most adverse topographic and geologic conditions.”

Based on our review of the slope stability results presented in Appendix D and review of the Western Geologic prepared geologic cross sections, the slope stability cross sections closely match the Western Geologic cross sections. If any changes to the geologic cross sections are made based on comments from our review of the Western Geologic geologic hazards study, any updated information, or otherwise, GeoStrata recommends that Cottonwood Heights City request that slope stability cross sections likewise be updated.

Response to Review Comment 5

G^2's slope stability cross-sections are based on the cross-sections provided by Western Geologic in conjunction with the Geologic Hazard Evaluation report for the project. G^2 can update slope stability cross-sections as needed if changes are made in response to the review of the Geologic Hazard Evaluation report.

Review Comment 6

Section 5.2.3, Soil Strength, of the May 13, 2020 Gordon geotechnical report states:

"The soil parameters were selected for analysis based upon direct shear test results performed on undisturbed and laboratory recompacted samples. Strength parameters for the more coarse-grained granular soils were selected based upon our experience with similar soils in the area. These coarse-grained sand and gravel soils are projected to exhibit relatively high strengths based on their performance history in gravel pit cut slopes which have been known to stand near vertical for extended periods of time. The cohesive characteristic of these granular soils may be explained by a slight cementation and interlocking of particles. Parameters of concrete washout are estimated as a hybrid between high strength soil and low-grade concrete."

Slope cross section B-B' includes a large area of 'Inferred Extents of Concrete Washout'. As the extents of this material are unknown, GeoStrata recommends that Cottonwood Heights City request that reduced strength parameters be applied to this soil unit. In our opinion, the reduced strength parameters for the 'Concrete Washout' material should be similar to the 'Site Grading Fill' soil strength parameters in order to account for the unknown extents of the materials.

Response to Review Comment 6

G^2 has performed an updated slope stability analysis for Cross-Section B-B' considering reduced strength parameters to account for the unknown extents of the concrete washout material. The results of the stability analysis indicate that the slope stability recommendations provided are still valid. Graphical results of the updated slope stability analysis are included with Appendix A of this letter.

Review Comment 7

Section 5.2.4, Analysis Results, of the May 13, 2020 Gordon geotechnical report lists recommendations for site grading

GeoStrata recommends that Cottonwood Heights City request that the applicant include these recommendations and detail drawings for benching of fill slopes into the existing slope with the final grading plan.

Response to Review Comment 7

G^2 can assist in providing a detail drawing for benching of the fill slopes into the existing slopes as final site grading plans are developed.

Review Comment 8

Cottonwood Height Code of Ordinances, Title 19, Chapter 19.72, Appendix C, Section 3.0, Submittals, Subsection (c) states:

"The results of any slope stability analyses must be submitted with pertinent backup documentation (i.e., calculations, computer output, etc.). Printouts of input data, output data (if requested), and graphical plots must be submitted for each computer-aided slope stability analysis."

GeoStrata recommends that Cottonwood Heights City request that printouts of input/output data for the near-surface and global slope stability analysis calculations be provided as required by the Cottonwood Heights Code of Ordinances.

Response to Review Comment 8

Data printouts and calculations for the near-surface and global stability analysis calculations are provided with Appendix B of this letter.

Review Comment 9

Section 5.3.1, Site Preparation, of the May 13, 2020 Gordon geotechnical report states:

"Preparation of the site must consist of the removal of all non-engineered fills, loose surficial soils, topsoil, debris, and other deleterious materials from beneath an area extending at least five feet beyond the perimeter of the proposed building, rigid pavement, and exterior flatwork areas.

The non-engineered fills may remain in flexible pavement areas as long as they are properly prepared. Proper preparation will consist of scarifying and moisture conditioning the upper

eight inches and recompacting to the requirements of structural fill. However, it should be noted that compaction of fine-grained soils (if encountered) as structural site grading fill will be very difficult, if not impossible, during wet and cold periods of the year. As an option for proper preparation and recompaction, the upper eight inches of the non-engineered fills may be removed and replaced with granular subbase over proofrolled subgrade. Even with proper preparation, flexible pavements established on non-engineered fills may experience some longterm movements. If the possibility of these movements is not acceptable, these non-engineered fills must be completely removed."

GeoStrata recommends that Cottonwood Heights City request that the recommendation to not fully remove non-engineered fills from beneath flexible pavements be modified to only include private parking and driveway areas. All city roads will require all undocumented or non-engineered fills be fully removed beneath pavements.

Response to Review Comment 9

G^2 recommends that the Cottonwood Heights City requirements for City roads be followed. City roads must be established upon structural site grading fill extending to suitable natural soils. The recommendations provided for flexible pavement site preparation in our May 13, 2020 report are still valid for all private parking and roadway areas.

Review Comment 10

Section 5.4.2, Reinforced Continuous Mat, of the May 13, 2020 Gordon geotechnical report states:

"We request that a bearing pressure distribution plan be provided to our office for review, when available."

As part of final design of the proposed structures and as recommended in Review Comment 2, GeoStrata recommends that Cottonwood Heights City request that a design level geotechnical assessment be performed for each of the proposed buildings, which incorporates detailed structural loads. As part of preparation of these reports, a review of planned building foundations and foundation loads should be completed by the geotechnical engineer.

Response to Review Comment 10

G^2 can provide a detailed geotechnical assessment for each proposed building, including the condominium structure, when final foundation loading details become available.

Review Comment 11

Cottonwood Height Code of Ordinances, Title 19, Chapter 19.72, Appendix D, Section 7.0, Submittals, Subsection (c) states:

"The results of any liquefaction analyses must be submitted with pertinent backup documentation (i.e., calculations, computer output, etc.). Printouts of input data, output data (on request), and graphical plots must be submitted for each computer aided liquefaction analysis. In addition, input data files, recorded on diskettes, CDs, or other electronic media, may be requested to facilitate the city's review."

GeoStrata recommends that Cottonwood Heights City request that printouts of input/output data for liquefaction hazard analysis calculations be provided as required by the Cottonwood Heights Code of Ordinances.

Response to Review Comment 11

Data printouts for the liquefaction analysis are provided with Appendix C of this letter.

If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

Gordon Geotechnical Engineering, Inc.

LICENSED PROFESSIONAL ENGINEER
No. 10975604
JORDAN K. CULP
7-9-20
STATE OF UTAH

Jordan K. Culp, State of Utah No. 10975604
Professional Engineer

Reviewed By:

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7-9-20
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Professional Engineer

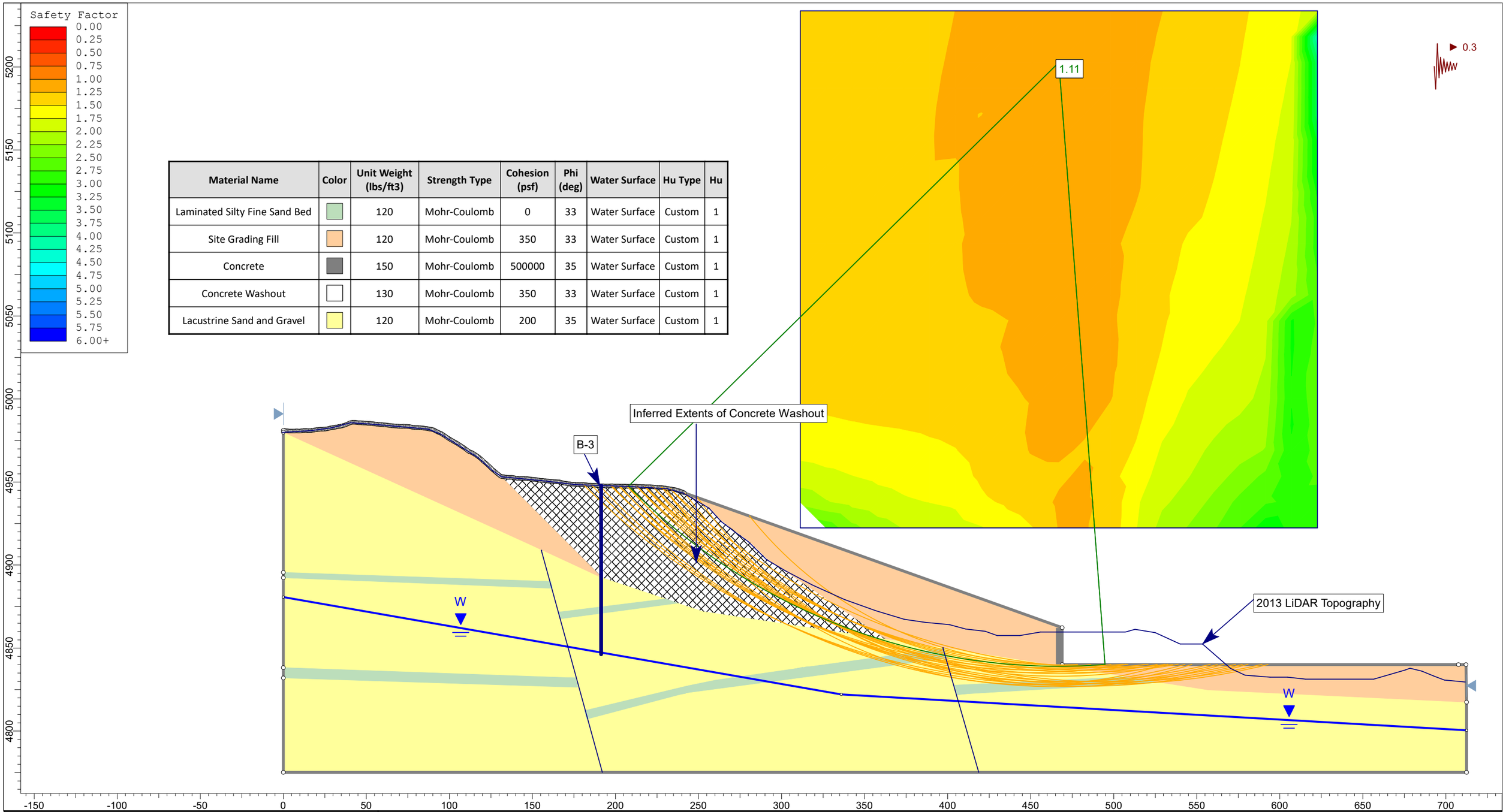
JKC/PRE:sn

Encl. Appendix A, Slope Stability Analysis
Appendix B, Stability Analysis Printouts and Calculations
Appendix C, Liquefaction Analysis Printouts

Addressee (email only)

APPENDIX A

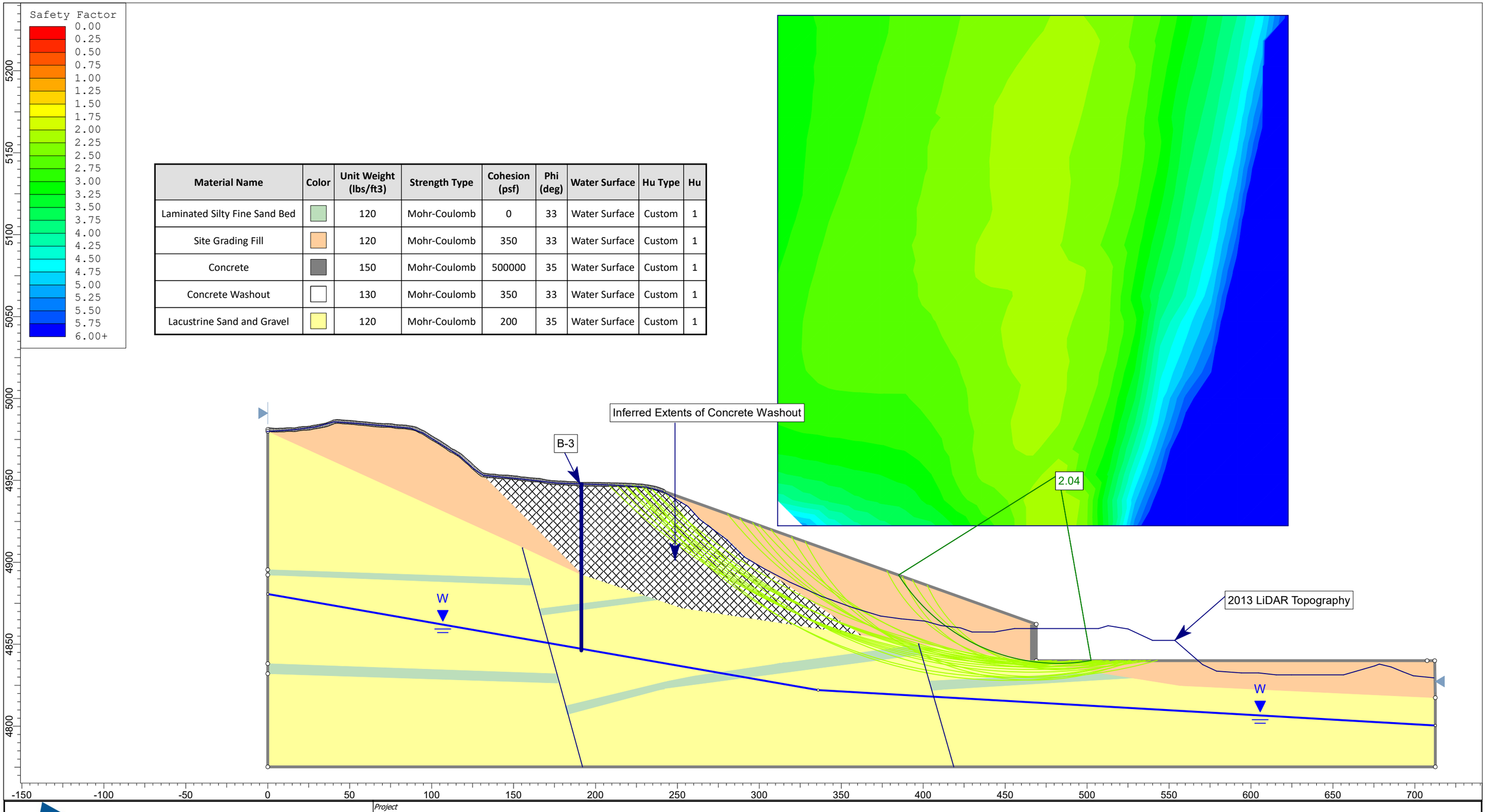
Slope Stability Analysis



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Laminated Silty Fine Sand Bed		120	Mohr-Coulomb	0	33	Water Surface	Custom	1
Site Grading Fill		120	Mohr-Coulomb	350	33	Water Surface	Custom	1
Concrete		150	Mohr-Coulomb	500000	35	Water Surface	Custom	1
Concrete Washout		130	Mohr-Coulomb	350	33	Water Surface	Custom	1
Lacustrine Sand and Gravel		120	Mohr-Coulomb	200	35	Water Surface	Custom	1

SLIDEINTERPRET 6.039

Project	Gravel Pit Development		
Analysis Description	B-B'		
Drawn By JKC	*Scale* 1:656	*Company* G2	
Date 5/11/2020, 5:21:49 PM		*File Name* B-B' Grading.slim	



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Laminated Silty Fine Sand Bed		120	Mohr-Coulomb	0	33	Water Surface	Custom	1
Site Grading Fill		120	Mohr-Coulomb	350	33	Water Surface	Custom	1
Concrete		150	Mohr-Coulomb	500000	35	Water Surface	Custom	1
Concrete Washout		130	Mohr-Coulomb	350	33	Water Surface	Custom	1
Lacustrine Sand and Gravel		120	Mohr-Coulomb	200	35	Water Surface	Custom	1

SLIDEINTERPRET 6.039

Project	Gravel Pit Development		
Analysis Description	B-B'		
Drawn By	JKC	*Scale* 1:656	*Company* G2
Date	5/11/2020, 5:21:49 PM		*File Name* B-B' Grading.slim

APPENDIX B

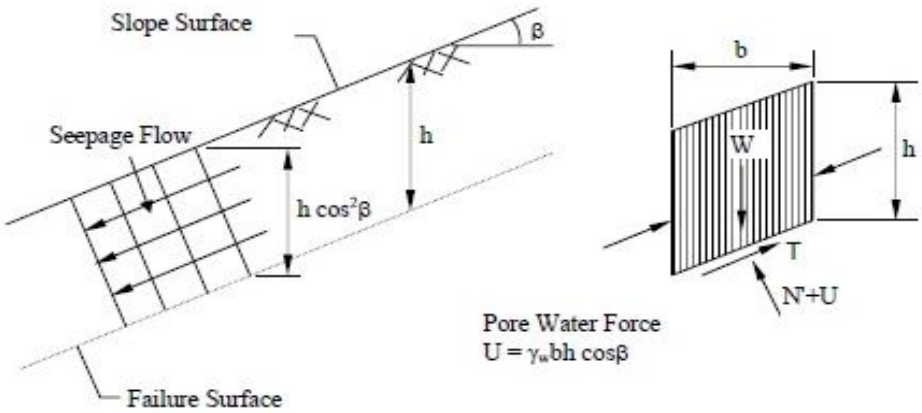
Stability Analysis Printouts and Calculations

50 percent infinite slope constructed of compacted washout fines with paralell seepage

c' (psf)	h (feet)	gamma sat (pcf)	gamma water (pcf)	slope angle (degrees)	phi' (degrees)
245	4	125	62.4	26.6	33
				0.464257581	0.575958653

Factor of Safety =	1.87

$$FS = \frac{c' + h(\gamma_{sat} - \gamma_w)(cos^2\beta)tan\phi'}{\gamma_{sat} h sin\beta cos\beta}$$

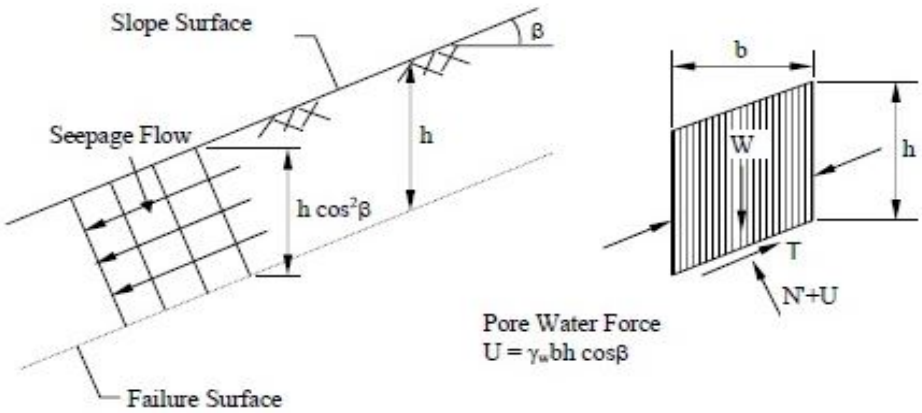


53 percent infinite slope constructed of compacted sand and gravel with paralell seepage

c' (psf)	h (feet)	gamma sat (pcf)	gamma water (pcf)	slope angle (degrees)	phi' (degrees)
175	4	125	62.4	27.9	38
				0.486946861	0.663225116

Factor of Safety =	1.59

$$FS = \frac{c' + h(\gamma_{sat} - \gamma_w)(cos^2\beta)tan\phi'}{\gamma_{sat} h sin\beta cos\beta}$$



Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: A-A' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: A-A'
Author: JKC
Company: G2
Date Created: 5/11/2020, 4:50:55 PM

General Settings

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

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
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: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.3

Material Properties

Property	Laminated Silty Fine Sand Beds	Site Grading Fill	Concrete	Lacustrine Sand and Gravel
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	150	120
Cohesion [psf]	0	350	500000	200
Friction Angle [deg]	33	33	35	36
Water Surface	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1

Global Minimums

Method: bishop simplified

FS: 0.995336
Center: 228.608, 5007.424
Radius: 185.274
Left Slip Surface Endpoint: 63.547, 4923.273
Right Slip Surface Endpoint: 314.369, 4843.194
Resisting Moment=1.03875e+008 lb-ft
Driving Moment=1.04362e+008 lb-ft
Total Slice Area=8107.05 ft2

Method: janbu simplified

FS: 0.838275
Center: 215.336, 4934.430
Radius: 109.780
Left Slip Surface Endpoint: 107.399, 4914.403
Right Slip Surface Endpoint: 276.412, 4843.208
Resisting Horizontal Force=294890 lb
Driving Horizontal Force=351782 lb
Total Slice Area=5164.25 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 3836
Number of Invalid Surfaces: 1015

Error Codes:

Error Code -103 reported for 811 surfaces
Error Code -106 reported for 15 surfaces
Error Code -108 reported for 93 surfaces
Error Code -112 reported for 12 surfaces
Error Code -114 reported for 84 surfaces

Method: janbu simplified

Number of Valid Surfaces: 3552
Number of Invalid Surfaces: 1299

Error Codes:

Error Code -103 reported for 811 surfaces
Error Code -106 reported for 15 surfaces
Error Code -108 reported for 377 surfaces
Error Code -112 reported for 12 surfaces
Error Code -114 reported for 84 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (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).
-112 = The coefficient M-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.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 0.995336

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	5.89046	3622.22	Site Grading Fill	350	33	345.904	344.291	-8.79127	0	-8.79127
2	8.06621	15681.3	Lacustrine Sand and Gravel	200	36	765.674	762.103	773.668	0	773.668
3	1.85671	5217.91	Laminated Silty Fine Sand Beds	0	33	965.608	961.104	1479.97	0	1479.97
4	11.5573	43207.3	Lacustrine Sand and Gravel	200	36	1548.66	1541.44	1846.33	0	1846.33
5	2.22312	9991.46	Laminated Silty Fine Sand Beds	0	33	1716.28	1708.28	2630.52	0	2630.52
6	11.0614	55521.9	Lacustrine Sand and Gravel	200	36	2252.21	2241.71	2810.17	0	2810.17
7	11.0614	63849.2	Lacustrine Sand and Gravel	200	36	2744.35	2731.55	3484.38	0	3484.38
8	11.0614	70199.8	Lacustrine Sand and Gravel	200	36	3179.08	3164.25	4079.94	0	4079.94
9	11.0614	74900.6	Lacustrine Sand and Gravel	200	36	3480.07	3463.84	4648.55	156.256	4492.3
10	11.0614	78175.5	Lacustrine Sand and Gravel	200	36	3650	3632.98	5170.9	445.814	4725.09
11	11.0614	80184.1	Lacustrine Sand and Gravel	200	36	3787.29	3769.63	5589.01	675.844	4913.17
12	11.0614	81043.6	Lacustrine Sand and Gravel	200	36	3893.4	3875.24	5910.39	851.847	5058.54
13	11.0614	80858.3	Lacustrine Sand and Gravel	200	36	3970.15	3951.63	6141.59	977.914	5163.67
14	11.0614	80939.2	Lacustrine Sand and Gravel	200	36	4088.46	4069.39	6382.85	1057.09	5325.76
15	11.0614	24508.1	Lacustrine Sand and Gravel	200	36	871.884	867.818	2071.31	1152.14	919.174
16	11.0614	26499.3	Lacustrine Sand and Gravel	200	36	966.636	962.128	2294.73	1245.74	1048.99
17	11.0614	27597.3	Lacustrine Sand and Gravel	200	36	1041.31	1036.46	2448.64	1297.36	1151.28
18	11.0614	27814	Lacustrine Sand and Gravel	200	36	1093.98	1088.88	2530.99	1307.55	1223.44
19	11.0614	27152	Lacustrine Sand and Gravel	200	36	1122.19	1116.95	2538.5	1276.43	1262.07
20	11.0614	25603.9	Lacustrine Sand and Gravel	200	36	1122.74	1117.51	2466.49	1203.65	1262.84
21	11.0614	23152.6	Lacustrine Sand and Gravel	200	36	1091.38	1086.29	2308.28	1088.41	1219.87
22	11.0614	19770.1	Lacustrine Sand and Gravel	200	36	1022.25	1017.48	2054.57	929.401	1125.16
23	11.0614	15415.7	Lacustrine Sand and Gravel	200	36	907.016	902.786	1692	724.7	967.303
24	11.0614	10033.5	Lacustrine Sand and Gravel	200	36	733.281	729.861	1200.97	471.681	729.288
25	11.0614	3547.99	Lacustrine Sand and Gravel	200	36	481.485	479.239	551.143	166.804	384.339

Global Minimum Query (janbu simplified) - Safety Factor: 0.838275

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	4.45825	4037.42	Site Grading Fill	350	33	287.814	241.267	-167.434	0	-167.434
2	5.33431	13083.7	Lacustrine Sand and Gravel	200	36	779.083	653.086	623.619	0	623.619
3	1.35247	4358.99	Laminated Silty Fine Sand Beds	0	33	1000.8	838.943	1291.86	0	1291.86
4	7.17582	27986.4	Lacustrine Sand and Gravel	200	36	1506.71	1263.04	1463.15	0	1463.15
5	7.17582	34769.1	Lacustrine Sand and Gravel	200	36	2116.56	1774.26	2166.78	0	2166.78

6	7.17582	39749.6	Lacustrine Sand and Gravel	200	36	2657.42	2227.65	2790.82	0	2790.82
7	7.17582	43486.1	Lacustrine Sand and Gravel	200	36	3141.25	2633.23	3349.05	0	3349.05
8	7.17582	46271.8	Lacustrine Sand and Gravel	200	36	3457.98	2898.74	3935.41	220.917	3714.49
9	7.17582	48283.5	Lacustrine Sand and Gravel	200	36	3707.6	3107.99	4457.18	454.669	4002.51
10	7.17582	49637	Lacustrine Sand and Gravel	200	36	3929.04	3293.62	4898.72	640.725	4258
11	7.17582	50416.9	Lacustrine Sand and Gravel	200	36	4126.04	3458.76	5270.17	784.87	4485.3
12	7.17582	50683.8	Lacustrine Sand and Gravel	200	36	4301.54	3605.87	5579	891.224	4687.78
13	7.17582	50470.6	Lacustrine Sand and Gravel	200	36	4456.72	3735.96	5829.61	962.766	4866.84
14	7.17582	27489	Lacustrine Sand and Gravel	200	36	2279.29	1910.67	3376.69	1022.14	2354.55
15	7.17582	15126.3	Lacustrine Sand and Gravel	200	36	1001.7	839.7	1976.61	1096.13	880.478
16	7.17582	15731.8	Lacustrine Sand and Gravel	200	36	1089.48	913.284	2121.76	1140.01	981.75
17	7.17582	15929.7	Lacustrine Sand and Gravel	200	36	1162.86	974.795	2220.76	1154.35	1066.41
18	7.17582	15722.6	Lacustrine Sand and Gravel	200	36	1220.18	1022.84	2271.9	1139.35	1132.55
19	7.17582	15107.9	Lacustrine Sand and Gravel	200	36	1259.23	1055.58	2272.41	1094.8	1177.61
20	7.17582	14077.3	Lacustrine Sand and Gravel	200	36	1276.94	1070.43	2218.16	1020.12	1198.04
21	7.17582	12616.8	Lacustrine Sand and Gravel	200	36	1268.91	1063.7	2103.07	914.281	1188.78
22	7.17582	10705	Lacustrine Sand and Gravel	200	36	1228.41	1029.74	1917.78	775.742	1142.04
23	7.17582	8312	Lacustrine Sand and Gravel	200	36	1144.44	959.357	1647.5	602.334	1045.17
24	7.17582	5396.43	Lacustrine Sand and Gravel	200	36	997.349	836.053	1266.51	391.055	875.451
25	7.17582	1901	Lacustrine Sand and Gravel	200	36	746.97	626.166	724.324	137.757	586.567

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 0.995336

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	63.5475	4923.27	0	0	0
2	69.438	4912.6	-1035.18	0	0
3	77.5042	4900.21	7105.96	0	0
4	79.3609	4897.64	10690.4	0	0
5	90.9182	4883.46	32031.9	0	0
6	93.1413	4881.03	37612	0	0
7	104.203	4870.13	60106.8	0	0
8	115.264	4860.86	81328.9	0	0
9	126.325	4852.94	99712.9	0	0
10	137.387	4846.16	115381	0	0
11	148.448	4840.39	128506	0	0
12	159.51	4835.52	138089	0	0
13	170.571	4831.47	143431	0	0
14	181.632	4828.2	144064	0	0
15	192.694	4825.66	139545	0	0
16	203.755	4823.82	141109	0	0
17	214.816	4822.66	141079	0	0
18	225.878	4822.17	139103	0	0
19	236.939	4822.34	134979	0	0
20	248	4823.17	128662	0	0
21	259.062	4824.67	120277	0	0
22	270.123	4826.86	110149	0	0
23	281.185	4829.77	98856	0	0
24	292.246	4833.42	87309.5	0	0
25	303.307	4837.88	76897.1	0	0
26	314.369	4843.19	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 0.838275

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]

1	107.399	4914.4	0	0	0
2	111.857	4897.77	-2855.58	0	0
3	117.191	4885.25	4729.11	0	0
4	118.544	4882.63	8056.74	0	0
5	125.719	4871.02	22634.5	0	0
6	132.895	4861.94	37569.4	0	0
7	140.071	4854.51	51156.1	0	0
8	147.247	4848.32	62420.9	0	0
9	154.423	4843.1	72030.3	0	0
10	161.599	4838.7	79525.6	0	0
11	168.774	4835.01	84302.6	0	0
12	175.95	4831.96	85933	0	0
13	183.126	4829.48	84103.6	0	0
14	190.302	4827.54	78582.7	0	0
15	197.478	4826.11	75310.4	0	0
16	204.653	4825.17	74524	0	0
17	211.829	4824.71	72415.7	0	0
18	219.005	4824.71	68842.1	0	0
19	226.181	4825.19	63726.5	0	0
20	233.357	4826.14	57063.2	0	0
21	240.533	4827.58	48929.9	0	0
22	247.708	4829.53	39510.7	0	0
23	254.884	4832.02	29137	0	0
24	262.06	4835.09	18366.6	0	0
25	269.236	4838.79	8141.68	0	0
26	276.412	4843.21	0	0	0

List Of Coordinates

Water Table

X	Y
0	4871.56
191.67	4843.21
314.08	4843.21
331.863	4842.32

External Boundary

X	Y
0	4818.06
332.823	4818.06
331.863	4842.32
314.08	4843.21
192.612	4843.21
192.612	4885.43
191.67	4885.43
170.003	4892.84
84.737	4922.21
84.424	4922.32
84.112	4922.37
83.799	4922.39
83.486	4922.4
83.173	4922.4
82.861	4922.41
82.548	4922.4
82.235	4922.39

81.923	4922.4	
81.61	4922.39	
81.297	4922.36	
80.985	4922.34	
80.672	4922.31	
80.359	4922.28	
80.047	4922.27	
79.734	4922.27	
79.421	4922.28	
79.109	4922.31	
78.796	4922.34	
78.483	4922.37	
78.171	4922.37	
77.858	4922.37	
77.545	4922.38	
77.233	4922.39	
76.92	4922.4	
76.607	4922.42	
76.294	4922.44	
75.982	4922.47	
75.669	4922.5	
75.356	4922.51	
75.044	4922.52	
74.731	4922.52	
74.418	4922.51	
74.106	4922.51	
73.793	4922.54	
73.48	4922.57	
73.168	4922.6	
72.855	4922.63	
72.542	4922.65	
72.23	4922.67	
71.917	4922.69	
71.604	4922.72	
71.292	4922.75	
70.979	4922.77	
70.666	4922.8	
70.354	4922.83	
70.041	4922.86	
69.728	4922.89	
69.415	4922.88	
69.103	4922.86	
68.79	4922.86	
68.477	4922.87	
68.165	4922.89	
67.852	4922.92	
67.539	4922.97	
67.227	4923.01	
66.914	4923.04	
66.601	4923.06	
66.289	4923.08	
65.976	4923.1	
65.663	4923.13	
65.351	4923.15	
65.038	4923.19	
64.725	4923.23	
64.413	4923.26	
64.1	4923.27	

SLIDEINTERPRET 6.039

Project	Gravel Pit Development		
Analysis Description	A-A'		
Drawn By	JKC	*Scale*	*Company* G2
Date	5/11/2020, 4:50:55 PM	*File Name*	A-A' Grading.slim

63.787	4923.27	
63.474	4923.27	
63.162	4923.27	
62.849	4923.29	
62.536	4923.31	
62.224	4923.33	
61.911	4923.35	
61.598	4923.37	
61.286	4923.39	
60.973	4923.41	
60.66	4923.42	
60.348	4923.44	
60.035	4923.45	
59.722	4923.46	
59.41	4923.47	
59.097	4923.48	
58.784	4923.49	
58.472	4923.48	
58.159	4923.46	
57.846	4923.42	
57.534	4923.38	
57.221	4923.32	
56.908	4923.23	
56.595	4923.12	
56.283	4923.02	
55.97	4922.93	
55.657	4922.84	
55.345	4922.74	
55.032	4922.65	
54.719	4922.56	
54.407	4922.47	
54.094	4922.4	
53.781	4922.32	
53.469	4922.24	
53.156	4922.15	
52.843	4922.05	
52.531	4921.95	
52.218	4921.84	
51.905	4921.8	
51.593	4921.79	
51.28	4921.78	
50.967	4921.78	
50.655	4921.77	
50.342	4921.77	
50.029	4921.77	
49.716	4921.78	
49.404	4921.81	
49.091	4921.85	
48.778	4921.89	
48.466	4921.92	
48.153	4921.96	
47.84	4922	
47.528	4922.03	
47.215	4922.06	
46.902	4922.08	
46.59	4922.11	
46.277	4922.15	
45.964	4922.19	

SLIDEINTERPRET 6.039

Project	Gravel Pit Development		
Analysis Description	A-A'		
Drawn By	JKC	*Scale*	*Company* G2
Date	5/11/2020, 4:50:55 PM	*File Name*	A-A' Grading.slim

45.652	4922.23	
45.339	4922.29	
45.026	4922.34	
44.714	4922.39	
44.401	4922.44	
44.088	4922.49	
43.776	4922.54	
43.463	4922.59	
43.15	4922.63	
42.837	4922.67	
42.525	4922.72	
42.212	4922.75	
41.899	4922.78	
41.587	4922.82	
41.274	4922.86	
40.961	4922.9	
40.649	4922.94	
40.336	4922.98	
40.023	4923	
39.711	4923.02	
39.398	4923.06	
39.085	4923.1	
38.773	4923.16	
38.46	4923.21	
38.147	4923.26	
37.835	4923.3	
37.522	4923.34	
37.209	4923.38	
36.897	4923.41	
36.584	4923.44	
36.271	4923.48	
35.958	4923.53	
35.646	4923.57	
35.333	4923.61	
35.02	4923.66	
34.708	4923.69	
34.395	4923.7	
34.082	4923.71	
33.77	4923.73	
33.457	4923.76	
33.144	4923.8	
32.832	4923.85	
32.519	4923.92	
32.206	4923.95	
31.894	4923.96	
31.581	4923.96	
31.268	4923.97	
30.956	4923.97	
30.643	4923.97	
30.33	4923.97	
30.017	4923.98	
29.705	4924	
29.392	4924.03	
29.079	4924.05	
28.767	4924.07	
28.454	4924.09	
28.141	4924.1	
27.829	4924.12	

rocscience	*Project* Gravel Pit Development		
	Analysis Description A-A'		
	Drawn By JKC	*Scale*	*Company* G2
SLIDEINTERPRET 6.039	*Date* 5/11/2020, 4:50:55 PM		*File Name* A-A' Grading.slim

27.516	4924.12	
27.203	4924.13	
26.891	4924.14	
26.578	4924.15	
26.265	4924.16	
25.953	4924.17	
25.64	4924.2	
25.327	4924.22	
25.015	4924.25	
24.702	4924.27	
24.389	4924.28	
24.077	4924.29	
23.764	4924.3	
23.451	4924.32	
23.138	4924.35	
22.826	4924.38	
22.513	4924.4	
22.2	4924.44	
21.888	4924.47	
21.575	4924.5	
21.262	4924.51	
20.95	4924.51	
20.637	4924.52	
20.324	4924.53	
20.012	4924.54	
19.699	4924.55	
19.386	4924.56	
19.074	4924.59	
18.761	4924.62	
18.448	4924.65	
18.136	4924.67	
17.823	4924.69	
17.51	4924.72	
17.198	4924.73	
16.885	4924.74	
16.572	4924.75	
16.259	4924.76	
15.947	4924.76	
15.634	4924.77	
15.321	4924.78	
15.009	4924.79	
14.696	4924.81	
14.383	4924.83	
14.071	4924.85	
13.758	4924.87	
13.445	4924.88	
13.133	4924.9	
12.82	4924.91	
12.507	4924.92	
12.195	4924.95	
11.882	4924.99	
11.569	4925.02	
11.257	4925.06	
10.944	4925.1	
10.631	4925.15	
10.319	4925.19	
10.006	4925.22	
9.693	4925.26	

rocscience	*Project* Gravel Pit Development		
	Analysis Description A-A'		
	Drawn By JKC	*Scale*	*Company* G2
SLIDEINTERPRET 6.039	*Date* 5/11/2020, 4:50:55 PM		*File Name* A-A' Grading.slim

9.38	4925.31
9.068	4925.35
8.755	4925.4
8.442	4925.45
8.13	4925.49
7.817	4925.52
7.504	4925.53
7.192	4925.53
6.879	4925.53
6.566	4925.54
6.254	4925.55
5.941	4925.59
5.628	4925.63
5.316	4925.67
5.003	4925.71
4.69	4925.77
4.378	4925.84
4.065	4925.9
3.752	4925.95
3.44	4925.99
3.127	4926.02
2.814	4926.04
2.501	4926.06
2.189	4926.08
1.876	4926.1
1.563	4926.13
1.251	4926.17
0.938	4926.21
0.625	4926.24
0.3127	4926.27
0	4926.29
0	4924.53
0	4905.75
0	4903.01
0	4886.21
0	4883.63

Material Boundary

X	Y
0	4924.53
79.7	4910.84
101.912	4901.81
107.25	4899.65
142.481	4885.33

Material Boundary

X	Y
0	4905.75
38.23	4914.44

Material Boundary

X	Y
0	4903.01
39.03	4911.47
38.23	4914.44

Material Boundary

X	Y
0	4883.63
43.927	4893.89
43.257	4896.27
0	4886.21

Material Boundary

X	Y
44.166	4893.14
66.919	4898.81
89.539	4901.81
101.912	4901.81

Material Boundary

X	Y
44.166	4893.14
44.849	4890.48
67.344	4895.93
89.694	4899.12
107.25	4899.65

Material Boundary

X	Y
49.197	4875.23
74.551	4880.95
96.094	4884.25
119.387	4885.35
133.892	4883.66
143.405	4882.38
143.595	4881.22

Material Boundary

X	Y
49.197	4875.23
49.613	4872.56
75.031	4878.29
96.385	4881.52
120.169	4882.72
143.82	4879.84

Material Boundary

X	Y
143.595	4881.22
143.82	4879.84
144.073	4878.29

Material Boundary

X	Y
143.595	4881.22

191.67	4871.08

Material Boundary

X	Y
144.073	4878.29
191.67	4868.47

Material Boundary

X	Y
142.481	4885.33
191.67	4873

Material Boundary

X	Y
191.67	4843.21
191.67	4868.47
191.67	4871.08
191.67	4873
191.67	4885.43

Material Boundary

X	Y
191.67	4843.21
192.612	4843.21

Material Boundary

X	Y
191.67	4843.21
191.67	4827.36
192.612	4827.36
192.612	4843.21

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: A-A' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: A-A'
Author: JKC
Company: G2
Date Created: 5/11/2020, 4:50:55 PM

General Settings

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

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
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: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Laminated Silty Fine Sand Beds	Site Grading Fill	Concrete	Lacustrine Sand and Gravel
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	150	120
Cohesion [psf]	0	350	500000	200
Friction Angle [deg]	33	33	35	36
Water Surface	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1

Global Minimums

Method: bishop simplified

FS: 1.701140
Center: 215.336, 4934.430
Radius: 109.780
Left Slip Surface Endpoint: 107.399, 4914.403
Right Slip Surface Endpoint: 276.412, 4843.208
Resisting Moment=4.50479e+007 lb-ft
Driving Moment=2.6481e+007 lb-ft
Total Slice Area=5164.25 ft2

Method: janbu simplified

FS: 1.493150
Center: 202.065, 4921.158
Radius: 94.411
Left Slip Surface Endpoint: 107.908, 4914.228
Right Slip Surface Endpoint: 255.330, 4843.208
Resisting Horizontal Force=324270 lb
Driving Horizontal Force=217171 lb
Total Slice Area=5020.57 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 3645
Number of Invalid Surfaces: 1206

Error Codes:

Error Code -103 reported for 811 surfaces
Error Code -106 reported for 15 surfaces
Error Code -108 reported for 282 surfaces
Error Code -112 reported for 14 surfaces
Error Code -114 reported for 84 surfaces

Method: janbu simplified

Number of Valid Surfaces: 3310
Number of Invalid Surfaces: 1541

Error Codes:

Error Code -103 reported for 811 surfaces
Error Code -106 reported for 15 surfaces
Error Code -108 reported for 618 surfaces
Error Code -112 reported for 13 surfaces
Error Code -114 reported for 84 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (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).
-112 = The coefficient M-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.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.70114

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	4.45825	4037.42	Site Grading Fill	350	33	227.713	387.371	57.5471	0	57.5471
2	5.33431	13083.7	Lacustrine Sand and Gravel	200	36	582.078	990.197	1087.61	0	1087.61
3	1.35247	4358.99	Laminated Silty Fine Sand Beds	0	33	708.807	1205.78	1856.74	0	1856.74
4	7.17582	27986.4	Lacustrine Sand and Gravel	200	36	1055.17	1794.99	2195.31	0	2195.31
5	7.17582	34769.1	Lacustrine Sand and Gravel	200	36	1420.19	2415.94	3049.98	0	3049.98
6	7.17582	39749.6	Lacustrine Sand and Gravel	200	36	1723.06	2931.17	3759.13	0	3759.13
7	7.17582	43486.1	Lacustrine Sand and Gravel	200	36	1977.62	3364.2	4355.15	0	4355.15
8	7.17582	46271.8	Lacustrine Sand and Gravel	200	36	2119.97	3606.37	4909.39	220.917	4688.47
9	7.17582	48283.5	Lacustrine Sand and Gravel	200	36	2217.52	3772.31	5371.53	454.669	4916.86
10	7.17582	49637	Lacustrine Sand and Gravel	200	36	2295.17	3904.4	5739.38	640.725	5098.66
11	7.17582	50416.9	Lacustrine Sand and Gravel	200	36	2355.45	4006.95	6024.68	784.87	5239.81
12	7.17582	50683.8	Lacustrine Sand and Gravel	200	36	2400.23	4083.13	6235.89	891.224	5344.66
13	7.17582	50470.6	Lacustrine Sand and Gravel	200	36	2430.24	4134.17	6377.69	962.766	5414.92
14	7.17582	27489	Lacustrine Sand and Gravel	200	36	1213.93	2065.07	3589.19	1022.14	2567.05
15	7.17582	15126.3	Lacustrine Sand and Gravel	200	36	520.584	885.587	2039.77	1096.13	943.637
16	7.17582	15731.8	Lacustrine Sand and Gravel	200	36	551.758	938.617	2156.62	1140.01	1016.61
17	7.17582	15929.7	Lacustrine Sand and Gravel	200	36	572.839	974.479	2220.33	1154.35	1065.98
18	7.17582	15722.6	Lacustrine Sand and Gravel	200	36	583.229	992.154	2229.65	1139.35	1090.3
19	7.17582	15107.9	Lacustrine Sand and Gravel	200	36	582.121	990.269	2182.51	1094.8	1087.71
20	7.17582	14077.3	Lacustrine Sand and Gravel	200	36	568.433	966.984	2075.78	1020.12	1055.66
21	7.17582	12616.8	Lacustrine Sand and Gravel	200	36	540.7	919.807	1905.01	914.281	990.729
22	7.17582	10705	Lacustrine Sand and Gravel	200	36	496.91	845.313	1663.95	775.742	888.204
23	7.17582	8312	Lacustrine Sand and Gravel	200	36	434.212	738.655	1343.72	602.334	741.389
24	7.17582	5396.43	Lacustrine Sand and Gravel	200	36	348.415	592.703	931.565	391.055	540.51
25	7.17582	1901	Lacustrine Sand and Gravel	200	36	233.02	396.399	408.077	137.757	270.32

Global Minimum Query (janbu simplified) - Safety Factor: 1.49315

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.54286	2289.56	Site Grading Fill	350	33	168.143	251.062	-152.351	0	-152.351
2	4.34634	10882.3	Lacustrine Sand and Gravel	200	36	544.624	813.205	844.006	0	844.006
3	1.1323	3783.15	Laminated Silty Fine Sand Beds	0	33	722.131	1078.25	1660.36	0	1660.36
4	6.33638	25678.1	Lacustrine Sand and Gravel	200	36	1103.52	1647.72	1992.61	0	1992.61
5	6.33638	31868.5	Lacustrine Sand and Gravel	200	36	1535.42	2292.61	2880.23	0	2880.23
6	6.33638	36267.5	Lacustrine Sand and Gravel	200	36	1888.62	2820	3606.12	0	3606.12
7	6.33638	39525.5	Lacustrine Sand and Gravel	200	36	2185.53	3263.33	4216.31	0	4216.31
8	6.33638	41947.8	Lacustrine Sand and Gravel	200	36	2355.77	3517.52	4798.1	231.933	4566.17
9	6.33638	43707.5	Lacustrine Sand and Gravel	200	36	2484.48	3709.7	5284.71	454.027	4830.68
10	6.33638	44914	Lacustrine Sand and Gravel	200	36	2591.19	3869.03	5680.71	630.718	5049.99

11	6.33638	45640.6	Lacustrine Sand and Gravel	200	36	2678.97	4000.1	5998.42	768.031	5230.39
12	6.33638	45940	Lacustrine Sand and Gravel	200	36	2750.04	4106.22	6246.63	870.183	5376.44
13	6.33638	45855.5	Lacustrine Sand and Gravel	200	36	2806.4	4190.38	6432.47	940.189	5492.28
14	6.33638	45407.2	Lacustrine Sand and Gravel	200	36	2848.78	4253.65	6559.6	980.215	5579.38
15	6.33638	45130.4	Lacustrine Sand and Gravel	200	36	2915.09	4352.67	6707.44	991.787	5715.66
16	6.33638	16677.1	Lacustrine Sand and Gravel	200	36	892.134	1332.09	2566.1	1007.91	1558.19
17	6.33638	12474.3	Lacustrine Sand and Gravel	200	36	591.934	883.846	1964.95	1023.72	941.229
18	6.33638	12342.6	Lacustrine Sand and Gravel	200	36	606.946	906.262	1984.99	1012.91	972.08
19	6.33638	11884.8	Lacustrine Sand and Gravel	200	36	610.454	911.499	1954.63	975.334	979.294
20	6.33638	11094.5	Lacustrine Sand and Gravel	200	36	601.248	897.754	1870.86	910.476	960.383
21	6.33638	9960.21	Lacustrine Sand and Gravel	200	36	577.68	862.563	1729.34	817.393	911.943
22	6.33638	8464.65	Lacustrine Sand and Gravel	200	36	537.436	802.473	1523.89	694.659	829.226
23	6.33638	6583.02	Lacustrine Sand and Gravel	200	36	477.169	712.485	1245.62	540.241	705.375
24	6.33638	4280.78	Lacustrine Sand and Gravel	200	36	391.793	585.006	881.222	351.306	529.916
25	6.33638	1509.75	Lacustrine Sand and Gravel	200	36	273.07	407.734	409.82	123.899	285.921

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.70114

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	107.399	4914.4	0	0	0
2	111.857	4897.77	-56.7236	0	0
3	117.191	4885.25	10470.2	0	0
4	118.544	4882.63	14360.7	0	0
5	125.719	4871.02	32290.8	0	0
6	132.895	4861.94	49824.6	0	0
7	140.071	4854.51	65391.4	0	0
8	147.247	4848.32	78205.5	0	0
9	154.423	4843.1	88627.8	0	0
10	161.599	4838.7	96364.5	0	0
11	168.774	4835.01	101088	0	0
12	175.95	4831.96	102616	0	0
13	183.126	4829.48	100864	0	0
14	190.302	4827.54	95819.2	0	0
15	197.478	4826.11	92254.9	0	0
16	204.653	4825.17	90445	0	0
17	211.829	4824.71	87494.5	0	0
18	219.005	4824.71	83378.4	0	0
19	226.181	4825.19	78139.1	0	0
20	233.357	4826.14	71890.1	0	0
21	240.533	4827.58	64825.2	0	0
22	247.708	4829.53	57234.6	0	0
23	254.884	4832.02	49532	0	0
24	262.06	4835.09	42297.7	0	0
25	269.236	4838.79	36351.5	0	0
26	276.412	4843.21	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.49315

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	107.908	4914.23	0	0	0
2	110.451	4898.35	-2848.26	0	0
3	114.798	4885.13	5931.22	0	0
4	115.93	4882.5	9476.75	0	0
5	122.266	4870.7	25978.5	0	0

6	128.603	4861.86	41709.8	0	0
7	134.939	4854.77	55271.4	0	0
8	141.275	4848.92	66041.2	0	0
9	147.612	4844.03	74535.5	0	0
10	153.948	4839.93	80444.2	0	0
11	160.285	4836.5	83491.2	0	0
12	166.621	4833.65	83523.1	0	0
13	172.957	4831.35	80464.7	0	0
14	179.294	4829.53	74293.4	0	0
15	185.63	4828.19	65026.4	0	0
16	191.966	4827.29	52546	0	0
17	198.303	4826.82	48076.8	0	0
18	204.639	4826.78	44395.3	0	0
19	210.976	4827.17	39773.2	0	0
20	217.312	4827.99	34297.1	0	0
21	223.648	4829.25	28119.2	0	0
22	229.985	4830.97	21471	0	0
23	236.321	4833.18	14687.6	0	0
24	242.657	4835.92	8246.23	0	0
25	248.994	4839.24	2834.12	0	0
26	255.33	4843.21	0	0	0

List Of Coordinates

Water Table

X	Y
0	4871.56
191.67	4843.21
314.08	4843.21
331.863	4842.32

External Boundary

X	Y
0	4818.06
332.823	4818.06
331.863	4842.32
314.08	4843.21
192.612	4843.21
192.612	4885.43
191.67	4885.43
170.003	4892.84
84.737	4922.21
84.424	4922.32
84.112	4922.37
83.799	4922.39
83.486	4922.4
83.173	4922.4
82.861	4922.41
82.548	4922.4
82.235	4922.39
81.923	4922.4
81.61	4922.39
81.297	4922.36
80.985	4922.34
80.672	4922.31

80.359	4922.28	
80.047	4922.27	
79.734	4922.27	
79.421	4922.28	
79.109	4922.31	
78.796	4922.34	
78.483	4922.37	
78.171	4922.37	
77.858	4922.37	
77.545	4922.38	
77.233	4922.39	
76.92	4922.4	
76.607	4922.42	
76.294	4922.44	
75.982	4922.47	
75.669	4922.5	
75.356	4922.51	
75.044	4922.52	
74.731	4922.52	
74.418	4922.51	
74.106	4922.51	
73.793	4922.54	
73.48	4922.57	
73.168	4922.6	
72.855	4922.63	
72.542	4922.65	
72.23	4922.67	
71.917	4922.69	
71.604	4922.72	
71.292	4922.75	
70.979	4922.77	
70.666	4922.8	
70.354	4922.83	
70.041	4922.86	
69.728	4922.89	
69.415	4922.88	
69.103	4922.86	
68.79	4922.86	
68.477	4922.87	
68.165	4922.89	
67.852	4922.92	
67.539	4922.97	
67.227	4923.01	
66.914	4923.04	
66.601	4923.06	
66.289	4923.08	
65.976	4923.1	
65.663	4923.13	
65.351	4923.15	
65.038	4923.19	
64.725	4923.23	
64.413	4923.26	
64.1	4923.27	
63.787	4923.27	
63.474	4923.27	
63.162	4923.27	
62.849	4923.29	
62.536	4923.31	

rocscience	*Project* Gravel Pit Development		
	Analysis Description A-A'		
	Drawn By JKC	*Scale*	*Company* G2
SLIDEINTERPRET 6.039	*Date* 5/11/2020, 4:50:55 PM		*File Name* A-A' Grading.slim

62.224	4923.33	
61.911	4923.35	
61.598	4923.37	
61.286	4923.39	
60.973	4923.41	
60.66	4923.42	
60.348	4923.44	
60.035	4923.45	
59.722	4923.46	
59.41	4923.47	
59.097	4923.48	
58.784	4923.49	
58.472	4923.48	
58.159	4923.46	
57.846	4923.42	
57.534	4923.38	
57.221	4923.32	
56.908	4923.23	
56.595	4923.12	
56.283	4923.02	
55.97	4922.93	
55.657	4922.84	
55.345	4922.74	
55.032	4922.65	
54.719	4922.56	
54.407	4922.47	
54.094	4922.4	
53.781	4922.32	
53.469	4922.24	
53.156	4922.15	
52.843	4922.05	
52.531	4921.95	
52.218	4921.84	
51.905	4921.8	
51.593	4921.79	
51.28	4921.78	
50.967	4921.78	
50.655	4921.77	
50.342	4921.77	
50.029	4921.77	
49.716	4921.78	
49.404	4921.81	
49.091	4921.85	
48.778	4921.89	
48.466	4921.92	
48.153	4921.96	
47.84	4922	
47.528	4922.03	
47.215	4922.06	
46.902	4922.08	
46.59	4922.11	
46.277	4922.15	
45.964	4922.19	
45.652	4922.23	
45.339	4922.29	
45.026	4922.34	
44.714	4922.39	
44.401	4922.44	

44.088	4922.49	
43.776	4922.54	
43.463	4922.59	
43.15	4922.63	
42.837	4922.67	
42.525	4922.72	
42.212	4922.75	
41.899	4922.78	
41.587	4922.82	
41.274	4922.86	
40.961	4922.9	
40.649	4922.94	
40.336	4922.98	
40.023	4923	
39.711	4923.02	
39.398	4923.06	
39.085	4923.1	
38.773	4923.16	
38.46	4923.21	
38.147	4923.26	
37.835	4923.3	
37.522	4923.34	
37.209	4923.38	
36.897	4923.41	
36.584	4923.44	
36.271	4923.48	
35.958	4923.53	
35.646	4923.57	
35.333	4923.61	
35.02	4923.66	
34.708	4923.69	
34.395	4923.7	
34.082	4923.71	
33.77	4923.73	
33.457	4923.76	
33.144	4923.8	
32.832	4923.85	
32.519	4923.92	
32.206	4923.95	
31.894	4923.96	
31.581	4923.96	
31.268	4923.97	
30.956	4923.97	
30.643	4923.97	
30.33	4923.97	
30.017	4923.98	
29.705	4924	
29.392	4924.03	
29.079	4924.05	
28.767	4924.07	
28.454	4924.09	
28.141	4924.1	
27.829	4924.12	
27.516	4924.12	
27.203	4924.13	
26.891	4924.14	
26.578	4924.15	
26.265	4924.16	

25.953	4924.17	
25.64	4924.2	
25.327	4924.22	
25.015	4924.25	
24.702	4924.27	
24.389	4924.28	
24.077	4924.29	
23.764	4924.3	
23.451	4924.32	
23.138	4924.35	
22.826	4924.38	
22.513	4924.4	
22.2	4924.44	
21.888	4924.47	
21.575	4924.5	
21.262	4924.51	
20.95	4924.51	
20.637	4924.52	
20.324	4924.53	
20.012	4924.54	
19.699	4924.55	
19.386	4924.56	
19.074	4924.59	
18.761	4924.62	
18.448	4924.65	
18.136	4924.67	
17.823	4924.69	
17.51	4924.72	
17.198	4924.73	
16.885	4924.74	
16.572	4924.75	
16.259	4924.76	
15.947	4924.76	
15.634	4924.77	
15.321	4924.78	
15.009	4924.79	
14.696	4924.81	
14.383	4924.83	
14.071	4924.85	
13.758	4924.87	
13.445	4924.88	
13.133	4924.9	
12.82	4924.91	
12.507	4924.92	
12.195	4924.95	
11.882	4924.99	
11.569	4925.02	
11.257	4925.06	
10.944	4925.1	
10.631	4925.15	
10.319	4925.19	
10.006	4925.22	
9.693	4925.26	
9.38	4925.31	
9.068	4925.35	
8.755	4925.4	
8.442	4925.45	
8.13	4925.49	

rocscience	*Project* Gravel Pit Development		
	Analysis Description A-A'		
	Drawn By JKC	*Scale*	*Company* G2
SLIDEINTERPRET 6.039	*Date* 5/11/2020, 4:50:55 PM		*File Name* A-A' Grading.slim

7.817	4925.52
7.504	4925.53
7.192	4925.53
6.879	4925.53
6.566	4925.54
6.254	4925.55
5.941	4925.59
5.628	4925.63
5.316	4925.67
5.003	4925.71
4.69	4925.77
4.378	4925.84
4.065	4925.9
3.752	4925.95
3.44	4925.99
3.127	4926.02
2.814	4926.04
2.501	4926.06
2.189	4926.08
1.876	4926.1
1.563	4926.13
1.251	4926.17
0.938	4926.21
0.625	4926.24
0.3127	4926.27
0	4926.29
0	4924.53
0	4905.75
0	4903.01
0	4886.21
0	4883.63

Material Boundary

X	Y
0	4924.53
79.7	4910.84
101.912	4901.81
107.25	4899.65
142.481	4885.33

Material Boundary

X	Y
0	4905.75
38.23	4914.44

Material Boundary

X	Y
0	4903.01
39.03	4911.47
38.23	4914.44

Material Boundary

X	Y
0	4883.63

43.927	4893.89
43.257	4896.27
0	4886.21

Material Boundary

X	Y
44.166	4893.14
66.919	4898.81
89.539	4901.81
101.912	4901.81

Material Boundary

X	Y
44.166	4893.14
44.849	4890.48
67.344	4895.93
89.694	4899.12
107.25	4899.65

Material Boundary

X	Y
49.197	4875.23
74.551	4880.95
96.094	4884.25
119.387	4885.35
133.892	4883.66
143.405	4882.38
143.595	4881.22

Material Boundary

X	Y
49.197	4875.23
49.613	4872.56
75.031	4878.29
96.385	4881.52
120.169	4882.72
143.82	4879.84

Material Boundary

X	Y
143.595	4881.22
143.82	4879.84
144.073	4878.29

Material Boundary

X	Y
143.595	4881.22
191.67	4871.08

Material Boundary

X	Y

144.073	4878.29
191.67	4868.47

Material Boundary

X	Y
142.481	4885.33
191.67	4873

Material Boundary

X	Y
191.67	4843.21
191.67	4868.47
191.67	4871.08
191.67	4873
191.67	4885.43

Material Boundary

X	Y
191.67	4843.21
192.612	4843.21

Material Boundary

X	Y
191.67	4843.21
191.67	4827.36
192.612	4827.36
192.612	4843.21

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: B-B' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: B-B'
Author: JKC
Company: G2
Date Created: 5/11/2020, 5:21:49 PM

General Settings

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

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
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: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.3

Material Properties

Property	Laminated Silty Fine Sand Bed	Site Grading Fill	Concrete	Concrete Washout	Lacustrine Sand and Gravel
Color					
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	150	130	120
Cohesion [psf]	0	350	500000	350	200
Friction Angle [deg]	33	33	35	33	35
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS: 1.110710
Center: 466.947, 5202.655
Radius: 363.718
Left Slip Surface Endpoint: 207.781, 4947.461
Right Slip Surface Endpoint: 494.796, 4840.005
Resisting Moment=2.7925e+008 lb-ft
Driving Moment=2.51415e+008 lb-ft
Total Slice Area=9441.51 ft2

Method: janbu simplified

FS: 1.035520
Center: 451.373, 5078.064
Radius: 252.241
Left Slip Surface Endpoint: 237.035, 4945.080
Right Slip Surface Endpoint: 534.760, 4840.005
Resisting Horizontal Force=785159 lb
Driving Horizontal Force=758228 lb
Total Slice Area=11067.8 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 3592
Number of Invalid Surfaces: 1259

Error Codes:

Error Code -103 reported for 1175 surfaces
Error Code -106 reported for 6 surfaces
Error Code -108 reported for 43 surfaces
Error Code -114 reported for 35 surfaces

Method: janbu simplified

Number of Valid Surfaces: 3489
Number of Invalid Surfaces: 1362

Error Codes:

Error Code -103 reported for 1175 surfaces
Error Code -106 reported for 6 surfaces
Error Code -108 reported for 146 surfaces
Error Code -114 reported for 35 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (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).
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.11071

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	11.3702	7987.66	Concrete Washout	350	33	462.834	514.074	252.652	0	252.652
2	11.3702	22923.8	Concrete Washout	350	33	981.804	1090.5	1140.27	0	1140.27
3	11.3702	34759.7	Concrete Washout	350	33	1420.76	1578.05	1891.03	0	1891.03
4	11.3702	42237.7	Concrete Washout	350	33	1724.59	1915.52	2410.69	0	2410.69
5	11.3702	48000.1	Concrete Washout	350	33	1977.41	2196.33	2843.1	0	2843.1
6	11.3702	52573.7	Concrete Washout	350	33	2194.18	2437.1	3213.86	0	3213.86
7	11.3702	56395.6	Concrete Washout	350	33	2388.55	2652.99	3546.29	0	3546.29
8	11.3702	59246.6	Concrete Washout	350	33	2550.15	2832.48	3822.68	0	3822.68
9	11.3702	61581.7	Concrete Washout	350	33	2694.87	2993.22	4070.2	0	4070.2
10	11.3702	63207.4	Concrete Washout	350	33	2813.79	3125.3	4273.59	0	4273.59
11	11.3702	64133.9	Concrete Washout	350	33	2905.84	3227.55	4431.04	0	4431.04
12	11.3702	64391.7	Concrete Washout	350	33	2970.89	3299.8	4542.29	0	4542.29
13	11.3702	64007.3	Concrete Washout	350	33	3008.72	3341.81	4606.98	0	4606.98
14	9.76703	54159.2	Lacustrine Sand and Gravel	200	35	3081.23	3422.35	4601.98	0	4601.98
15	9.76703	53270.4	Lacustrine Sand and Gravel	200	35	3082.55	3423.82	4604.09	0	4604.09
16	9.76703	52171.2	Lacustrine Sand and Gravel	200	35	3070.99	3410.98	4585.75	0	4585.75
17	14.6533	75425	Laminated Silty Fine Sand Bed	0	33	2680.54	2977.3	4584.63	0	4584.63
18	11.3523	55537.4	Lacustrine Sand and Gravel	200	35	2944.55	3270.54	4385.19	0	4385.19
19	11.3523	52429.1	Lacustrine Sand and Gravel	200	35	2841.12	3155.66	4221.13	0	4221.13
20	11.3523	48823.5	Lacustrine Sand and Gravel	200	35	2707.2	3006.91	4008.69	0	4008.69
21	11.3523	44726.5	Lacustrine Sand and Gravel	200	35	2541.59	2822.97	3746	0	3746
22	11.3523	40142.2	Lacustrine Sand and Gravel	200	35	2342.92	2602.31	3430.86	0	3430.86
23	11.3523	36805.6	Lacustrine Sand and Gravel	200	35	2204.99	2449.1	3212.04	0	3212.04
24	13.5672	5880.77	Site Grading Fill	350	33	575.483	639.195	445.321	0	445.321
25	13.5672	640.851	Site Grading Fill	350	33	354.764	394.04	67.8154	0	67.8154

Global Minimum Query (janbu simplified) - Safety Factor: 1.03552

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	12.1516	10608.1	Concrete Washout	350	33	461.114	477.493	196.322	0	196.322
2	12.1516	29331.3	Concrete Washout	350	33	1042.31	1079.33	1123.07	0	1123.07
3	12.1516	43813.1	Concrete Washout	350	33	1557.06	1612.37	1943.88	0	1943.88
4	12.1516	55521.9	Concrete Washout	350	33	2022.47	2094.31	2686.01	0	2686.01
5	12.1516	64662.8	Concrete Washout	350	33	2428.98	2515.26	3334.2	0	3334.2
6	12.1516	72064.2	Concrete Washout	350	33	2793.56	2892.79	3915.56	0	3915.56
7	12.1516	77770.8	Concrete Washout	350	33	3110.64	3221.13	4421.15	0	4421.15
8	11.3893	76441	Lacustrine Sand and Gravel	200	35	3428.28	3550.05	4784.36	0	4784.36

9	11.3893	78446.2	Lacustrine Sand and Gravel	200	35	3630.95	3759.92	5084.09	0	5084.09
10	11.3893	79469.5	Lacustrine Sand and Gravel	200	35	3792.93	3927.66	5323.65	0	5323.65
11	12.9774	90720.1	Laminated Silty Fine Sand Bed	0	33	3548.7	3674.75	5658.61	0	5658.61
12	11.4657	79911.5	Lacustrine Sand and Gravel	200	35	4038.03	4181.46	5686.12	0	5686.12
13	11.4657	78888.7	Lacustrine Sand and Gravel	200	35	4105.89	4251.73	5786.47	0	5786.47
14	11.4657	77069.8	Lacustrine Sand and Gravel	200	35	4132.22	4279	5825.41	0	5825.41
15	11.4657	74481.3	Lacustrine Sand and Gravel	200	35	4115.67	4261.86	5800.93	0	5800.93
16	11.7017	72565.3	Laminated Silty Fine Sand Bed	0	33	3613.68	3742.04	5762.23	0	5762.23
17	11.7017	68308.6	Laminated Silty Fine Sand Bed	0	33	3497.66	3621.9	5577.23	0	5577.23
18	11.7017	63282.3	Laminated Silty Fine Sand Bed	0	33	3333.34	3451.74	5315.22	0	5315.22
19	11.7017	57491.7	Laminated Silty Fine Sand Bed	0	33	3117.51	3228.24	4971.06	0	4971.06
20	11.7017	41568.8	Laminated Silty Fine Sand Bed	0	33	2322.66	2405.16	3703.63	0	3703.63
21	11.7017	17613.9	Laminated Silty Fine Sand Bed	0	33	1015.35	1051.42	1619.04	0	1619.04
22	11.7017	15380.1	Laminated Silty Fine Sand Bed	0	33	916.06	948.598	1460.72	0	1460.72
23	11.7017	12353.4	Laminated Silty Fine Sand Bed	0	33	761.689	788.744	1214.56	0	1214.56
24	13.0211	9176.28	Site Grading Fill	350	33	933.113	966.257	948.956	0	948.956
25	13.0211	3256.63	Site Grading Fill	350	33	619.119	641.11	448.27	0	448.27

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.11071

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	207.781	4947.46	0	0	0
2	219.152	4936.41	-71.8547	0	0
3	230.522	4926.26	7214.25	0	0
4	241.892	4916.93	19144	0	0
5	253.262	4908.33	32943.9	0	0
6	264.632	4900.4	47407.8	0	0
7	276.002	4893.09	61726.5	0	0
8	287.373	4886.36	75365.4	0	0
9	298.743	4880.17	87815.3	0	0
10	310.113	4874.49	98775.9	0	0
11	321.483	4869.29	107958	0	0
12	332.853	4864.56	115143	0	0
13	344.224	4860.27	120182	0	0
14	355.594	4856.4	122989	0	0
15	365.361	4853.41	122912	0	0
16	375.128	4850.72	121198	0	0
17	384.895	4848.31	117889	0	0
18	399.548	4845.24	115355	0	0
19	410.9	4843.28	107171	0	0
20	422.253	4841.69	97356.7	0	0
21	433.605	4840.47	86189.9	0	0
22	444.957	4839.6	74007.2	0	0
23	456.31	4839.09	61208.2	0	0
24	467.662	4838.94	47722.4	0	0
25	481.229	4839.22	41556.5	0	0
26	494.796	4840.01	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.03552

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	237.035	4945.08	0	0	0
2	249.187	4927.25	1081.28	0	0
3	261.338	4912.2	14119	0	0

4	273.49	4899.23	33556.8	0	0
5	285.641	4887.91	56035.3	0	0
6	297.793	4877.97	79073.6	0	0
7	309.945	4869.2	101074	0	0
8	322.096	4861.47	120795	0	0
9	333.486	4855.07	135326	0	0
10	344.875	4849.41	146279	0	0
11	356.264	4844.44	153370	0	0
12	369.242	4839.57	162109	0	0
13	380.707	4835.92	160517	0	0
14	392.173	4832.87	154794	0	0
15	403.638	4830.38	145034	0	0
16	415.104	4828.44	131432	0	0
17	426.806	4827.02	119115	0	0
18	438.507	4826.15	103543	0	0
19	450.209	4825.83	85258.5	0	0
20	461.911	4826.04	64950.1	0	0
21	473.613	4826.81	47423.3	0	0
22	485.314	4828.12	38704.3	0	0
23	497.016	4829.99	29869.1	0	0
24	508.718	4832.43	21698.8	0	0
25	521.739	4835.84	9068.77	0	0
26	534.76	4840.01	0	0	0

List Of Coordinates

Water Table

X	Y
0	4880.66
335.902	4822.04
712.49	4800.49

External Boundary

X	Y
0	4775.17
712.49	4775.17
712.49	4817.4
712.09	4840.01
707.49	4840.01
468.96	4840.01
468.96	4862.27
241.44	4943.5
240.74	4943.78
240.05	4944.06
239.35	4944.32
238.65	4944.57
237.96	4944.79
237.26	4945.01
236.57	4945.22
235.87	4945.4
235.18	4945.53
234.48	4945.64
233.78	4945.77
233.09	4945.91
232.39	4946.02

231.7	4946.11	
231	4946.19	
230.31	4946.31	
229.61	4946.43	
228.91	4946.54	
228.22	4946.64	
227.52	4946.69	
226.83	4946.73	
226.13	4946.73	
225.43	4946.79	
224.74	4946.87	
224.04	4946.95	
223.35	4947	
222.65	4947.04	
221.96	4947.08	
221.26	4947.13	
220.56	4947.15	
219.87	4947.15	
219.17	4947.15	
218.48	4947.17	
217.78	4947.2	
217.09	4947.23	
216.39	4947.25	
215.69	4947.29	
215	4947.31	
214.3	4947.33	
213.61	4947.36	
212.91	4947.39	
212.21	4947.42	
211.52	4947.42	
210.82	4947.4	
210.13	4947.39	
209.43	4947.41	
208.74	4947.47	
208.04	4947.47	
207.34	4947.45	
206.65	4947.45	
205.95	4947.49	
205.26	4947.5	
204.56	4947.49	
203.87	4947.51	
203.17	4947.54	
202.47	4947.56	
201.78	4947.57	
201.08	4947.59	
200.39	4947.59	
199.69	4947.6	
198.99	4947.64	
198.3	4947.67	
197.6	4947.69	
196.91	4947.68	
196.21	4947.66	
195.52	4947.64	
194.82	4947.63	
194.12	4947.64	
193.43	4947.65	
192.73	4947.67	
192.04	4947.69	

191.34	4947.69	
190.65	4947.68	
189.95	4947.77	
189.25	4947.88	
188.56	4947.97	
187.86	4948.04	
187.17	4948.1	
186.47	4948.11	
185.78	4948.11	
185.08	4948.13	
184.38	4948.15	
183.69	4948.18	
182.99	4948.23	
182.3	4948.32	
181.6	4948.44	
180.9	4948.49	
180.21	4948.49	
179.51	4948.52	
178.82	4948.55	
178.12	4948.53	
177.43	4948.52	
176.73	4948.56	
176.03	4948.61	
175.34	4948.66	
174.64	4948.68	
173.95	4948.7	
173.25	4948.77	
172.56	4948.86	
171.86	4948.95	
171.16	4949.04	
170.47	4949.13	
169.77	4949.26	
169.08	4949.38	
168.38	4949.54	
167.68	4949.72	
166.99	4949.89	
166.29	4950.04	
165.6	4950.12	
164.9	4950.17	
164.21	4950.24	
163.51	4950.27	
162.81	4950.3	
162.12	4950.35	
161.42	4950.4	
160.73	4950.47	
160.03	4950.54	
159.34	4950.61	
158.64	4950.69	
157.94	4950.76	
157.25	4950.85	
156.55	4950.91	
155.86	4950.95	
155.16	4950.99	
154.46	4951.06	
153.77	4951.19	
153.07	4951.33	
152.38	4951.47	
151.68	4951.55	

150.99	4951.6	
150.29	4951.65	
149.59	4951.72	
148.9	4951.82	
148.2	4951.91	
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144.72	4952.17	
144.03	4952.17	
143.33	4952.18	
142.64	4952.19	
141.94	4952.23	
141.24	4952.26	
140.55	4952.3	
139.85	4952.44	
139.16	4952.57	
138.46	4952.69	
137.77	4952.77	
137.07	4952.81	
136.37	4952.82	
135.68	4952.81	
134.98	4952.84	
134.29	4952.89	
133.59	4953.03	
132.9	4953.17	
132.2	4953.27	
131.5	4953.38	
130.81	4953.55	
130.11	4954.06	
129.42	4954.61	
128.72	4955.17	
128.02	4955.79	
127.33	4956.4	
126.63	4956.98	
125.94	4957.58	
125.24	4958.2	
124.55	4958.9	
123.85	4959.58	
123.15	4960.24	
122.46	4960.9	
121.76	4961.48	
121.07	4962	
120.37	4962.6	
119.68	4963.28	
118.98	4963.93	
118.28	4964.54	
117.59	4965.09	
116.89	4965.6	
116.2	4966.05	
115.5	4966.49	
114.8	4966.93	
114.11	4967.37	
113.41	4967.72	
112.72	4968.02	
112.02	4968.3	
111.33	4968.69	

rocscience	*Project* Gravel Pit Development		
	Analysis Description B-B'		
	Drawn By JKC	*Scale*	*Company* G2
SLIDEINTERPRET 6.039	*Date* 5/11/2020, 5:21:49 PM		*File Name* B-B' Grading.slim

110.63	4969.23	
109.93	4969.77	
109.24	4970.31	
108.54	4970.75	
107.85	4971.2	
107.15	4971.67	
106.46	4972.12	
105.76	4972.56	
105.06	4973.01	
104.37	4973.46	
103.67	4973.88	
102.98	4974.27	
102.28	4974.64	
101.58	4975.05	
100.89	4975.46	
100.19	4975.89	
99.497	4976.29	
98.802	4976.72	
98.106	4977.19	
97.41	4977.66	
96.714	4978.13	
96.019	4978.6	
95.323	4979.06	
94.627	4979.39	
93.931	4979.67	
93.235	4979.98	
92.54	4980.35	
91.844	4980.7	
91.148	4981.03	
90.452	4981.39	
89.756	4981.63	
89.061	4981.81	
88.365	4981.93	
87.669	4982.03	
86.973	4982.13	
86.278	4982.24	
85.582	4982.36	
84.886	4982.47	
84.19	4982.57	
83.494	4982.65	
82.799	4982.7	
82.103	4982.74	
81.407	4982.76	
80.711	4982.78	
80.015	4982.8	
79.32	4982.85	
78.624	4982.9	
77.928	4982.99	
77.232	4983.11	
76.537	4983.25	
75.841	4983.41	
75.145	4983.48	
74.449	4983.52	
73.753	4983.56	
73.058	4983.58	
72.362	4983.58	
71.666	4983.56	
70.97	4983.53	

70.274	4983.57	
69.579	4983.62	
68.883	4983.65	
68.187	4983.7	
67.491	4983.74	
66.796	4983.8	
66.1	4983.86	
65.404	4983.92	
64.708	4983.99	
64.012	4984.08	
63.317	4984.18	
62.621	4984.27	
61.925	4984.35	
61.229	4984.42	
60.533	4984.48	
59.838	4984.56	
59.142	4984.63	
58.446	4984.67	
57.75	4984.73	
57.054	4984.81	
56.359	4984.85	
55.663	4984.9	
54.967	4984.96	
54.271	4985.05	
53.576	4985.16	
52.88	4985.25	
52.184	4985.33	
51.488	4985.37	
50.792	4985.39	
50.097	4985.42	
49.401	4985.5	
48.705	4985.56	
48.009	4985.61	
47.313	4985.64	
46.618	4985.69	
45.922	4985.71	
45.226	4985.75	
44.53	4985.84	
43.835	4985.94	
43.139	4986	
42.443	4986.04	
41.747	4985.98	
41.051	4985.89	
40.356	4985.74	
39.66	4985.44	
38.964	4985.13	
38.268	4984.83	
37.572	4984.55	
36.877	4984.28	
36.181	4984.06	
35.485	4983.85	
34.789	4983.7	
34.094	4983.56	
33.398	4983.43	
32.702	4983.31	
32.006	4983.18	
31.31	4983.05	
30.615	4982.92	

29.919	4982.82
29.223	4982.7
28.527	4982.59
27.831	4982.46
27.136	4982.28
26.44	4982.12
25.744	4981.98
25.048	4981.91
24.353	4981.85
23.657	4981.81
22.961	4981.8
22.265	4981.78
21.569	4981.73
20.874	4981.66
20.178	4981.59
19.482	4981.49
18.786	4981.37
18.09	4981.26
17.395	4981.13
16.699	4980.98
16.003	4980.95
15.307	4980.98
14.612	4981.02
13.916	4981.05
13.22	4981.06
12.524	4981.04
11.828	4981
11.133	4980.92
10.437	4980.83
9.741	4980.74
9.045	4980.73
8.349	4980.77
7.654	4980.77
6.958	4980.73
6.262	4980.7
5.566	4980.69
4.871	4980.69
4.175	4980.69
3.479	4980.73
2.783	4980.79
2.087	4980.88
1.392	4980.98
0.696	4981.08
0	4981.14
0	4980.03
0	4895.56
0	4892.34
0	4838.18
0	4832.05

Material Boundary

X	Y
0	4980.03
156.102	4908.99
192.227	4892.17

Material Boundary

X	Y
0	4892.34
162.109	4886.01
161.044	4890.08
0	4895.56

Material Boundary

X	Y
0	4832.05
177.706	4826.34
176.228	4831.99
0	4838.18

Material Boundary

X	Y
165.856	4871.67
230.06	4879.61

Material Boundary

X	Y
362.716	4855.32
397.653	4850.04
505.895	4832.88

Material Boundary

X	Y
181.302	4812.58
243.472	4827.56
260	4830.91
313.226	4838.62
397.653	4850.04
400.167	4843.67
242.392	4822.76
182.778	4806.93
181.302	4812.58

Material Boundary

X	Y
403.648	4827.89
505.895	4832.88
529.006	4829.21
405.303	4821.77
403.648	4827.89

Material Boundary

X	Y
529.006	4829.21
556.832	4824.8
712.49	4817.4

Material Boundary

X	Y
468.96	4840.01
465.069	4840.01
465.069	4862.27
468.96	4862.27

Material Boundary

X	Y
130.81	4953.55
192.227	4892.17
230.06	4879.61
238.219	4876.9
253.415	4871.86
362.716	4855.32
291.486	4903.45

Material Boundary

X	Y
165.856	4871.67
166.971	4867.41
238.219	4876.9

Material Boundary

X	Y
241.44	4943.5
256.855	4934.43
264.158	4926.42
272.992	4919.7
280.531	4914.17
291.486	4903.45

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: B-B' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: B-B'
Author: JKC
Company: G2
Date Created: 5/11/2020, 5:21:49 PM

General Settings

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

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
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: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Laminated Silty Fine Sand Bed	Site Grading Fill	Concrete	Concrete Washout	Lacustrine Sand and Gravel
Color					
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	150	130	120
Cohesion [psf]	0	350	500000	350	200
Friction Angle [deg]	33	33	35	33	35
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS: 2.037720
Center: 482.521, 4953.474
Radius: 115.198
Left Slip Surface Endpoint: 384.923, 4892.275
Right Slip Surface Endpoint: 502.408, 4840.005
Resisting Moment=2.06598e+007 lb-ft
Driving Moment=1.01387e+007 lb-ft
Total Slice Area=1770.26 ft2

Method: janbu simplified

FS: 1.908990
Center: 482.521, 4922.326
Radius: 87.950
Left Slip Surface Endpoint: 402.409, 4886.032
Right Slip Surface Endpoint: 513.479, 4840.005
Resisting Horizontal Force=146044 lb
Driving Horizontal Force=76503.5 lb
Total Slice Area=1674.19 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 3260
Number of Invalid Surfaces: 1591

Error Codes:

Error Code -103 reported for 1175 surfaces
Error Code -106 reported for 6 surfaces
Error Code -107 reported for 41 surfaces
Error Code -108 reported for 330 surfaces
Error Code -112 reported for 4 surfaces
Error Code -114 reported for 35 surfaces

Method: janbu simplified

Number of Valid Surfaces: 3140
Number of Invalid Surfaces: 1711

Error Codes:

Error Code -103 reported for 1175 surfaces
Error Code -106 reported for 6 surfaces
Error Code -107 reported for 41 surfaces
Error Code -108 reported for 453 surfaces

Error Code -112 reported for 1 surface
Error Code -114 reported for 35 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (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.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-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).
-112 = The coefficient M-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.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 2.03772

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	4.69943	1478.85	Site Grading Fill	350	33	185.238	377.462	42.2885	0	42.2885
2	4.69943	4171.84	Site Grading Fill	350	33	323.59	659.386	476.413	0	476.413
3	4.69943	6395.4	Site Grading Fill	350	33	446.529	909.902	862.174	0	862.174
4	4.69943	8247.94	Site Grading Fill	350	33	555.538	1132.03	1204.22	0	1204.22
5	4.69943	9794.33	Site Grading Fill	350	33	651.858	1328.3	1506.46	0	1506.46
6	4.69943	11080	Site Grading Fill	350	33	736.505	1500.79	1772.07	0	1772.07
7	4.69943	12138.3	Site Grading Fill	350	33	810.308	1651.18	2003.64	0	2003.64
8	4.69943	12994.4	Site Grading Fill	350	33	873.933	1780.83	2203.29	0	2203.29
9	4.69943	13667.8	Site Grading Fill	350	33	927.929	1890.86	2372.72	0	2372.72
10	4.69943	14174	Site Grading Fill	350	33	972.739	1982.17	2513.32	0	2513.32
11	4.69943	14525.4	Site Grading Fill	350	33	1008.72	2055.49	2626.22	0	2626.22
12	4.69943	14732	Site Grading Fill	350	33	1036.15	2111.38	2712.3	0	2712.3
13	4.69943	14802	Site Grading Fill	350	33	1055.25	2150.3	2772.22	0	2772.22
14	4.69943	14742.2	Site Grading Fill	350	33	1066.17	2172.56	2806.49	0	2806.49
15	4.69943	14558	Site Grading Fill	350	33	1069.04	2178.4	2815.49	0	2815.49
16	4.69943	14254.1	Site Grading Fill	350	33	1063.9	2167.94	2799.39	0	2799.39
17	4.69943	13833.9	Site Grading Fill	350	33	1050.79	2141.21	2758.22	0	2758.22
18	4.69943	14430.2	Site Grading Fill	350	33	1103.13	2247.86	2922.45	0	2922.45
19	4.69943	683.08	Site Grading Fill	350	33	211.821	431.631	125.701	0	125.701
20	4.69943	874.886	Site Grading Fill	350	33	227.344	463.263	174.41	0	174.41
21	4.69943	958.03	Site Grading Fill	350	33	235.909	480.716	201.285	0	201.285
22	4.69943	932.931	Site Grading Fill	350	33	237.283	483.517	205.598	0	205.598
23	4.69943	799.462	Site Grading Fill	350	33	231.187	471.095	186.469	0	186.469
24	4.69943	556.95	Site Grading Fill	350	33	217.284	442.765	142.845	0	142.845
25	4.69943	204.157	Site Grading Fill	350	33	195.172	397.707	73.4618	0	73.4618

Global Minimum Query (janbu simplified) - Safety Factor: 1.90899

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	4.34054	1773.32	Site Grading Fill	350	33	194.746	371.767	33.5191	0	33.5191
2	4.34054	4877.05	Site Grading Fill	350	33	371.645	709.466	553.529	0	553.529
3	4.34054	7251.34	Site Grading Fill	350	33	523.586	999.521	1000.17	0	1000.17
4	4.34054	9130.3	Site Grading Fill	350	33	654.827	1250.06	1385.97	0	1385.97
5	4.34054	10637	Site Grading Fill	350	33	768.38	1466.83	1719.77	0	1719.77
6	4.34054	11846	Site Grading Fill	350	33	866.411	1653.97	2007.95	0	2007.95
7	4.34054	12806.7	Site Grading Fill	350	33	950.539	1814.57	2255.23	0	2255.23

8	4.34054	13553.5	Site Grading Fill	350	33	1021.96	1950.91	2465.18	0	2465.18
9	4.34054	14111.5	Site Grading Fill	350	33	1081.61	2064.78	2640.53	0	2640.53
10	4.34054	14499.8	Site Grading Fill	350	33	1130.19	2157.52	2783.34	0	2783.34
11	4.6888	15918.4	Lacustrine Sand and Gravel	200	35	1168.09	2229.88	2898.97	0	2898.97
12	4.6888	16009.7	Lacustrine Sand and Gravel	200	35	1199.42	2289.68	2984.37	0	2984.37
13	4.6888	15931.7	Lacustrine Sand and Gravel	200	35	1218.59	2326.27	3036.64	0	3036.64
14	4.6888	15693.8	Lacustrine Sand and Gravel	200	35	1225.78	2340.01	3056.26	0	3056.26
15	4.6888	17107.2	Lacustrine Sand and Gravel	200	35	1353.47	2583.77	3404.38	0	3404.38
16	4.6888	2766.34	Lacustrine Sand and Gravel	200	35	307.076	586.205	551.557	0	551.557
17	4.6888	3025.13	Lacustrine Sand and Gravel	200	35	332.747	635.211	621.546	0	621.546
18	4.6888	3141.94	Lacustrine Sand and Gravel	200	35	348.316	664.931	663.991	0	663.991
19	4.6888	3117.79	Lacustrine Sand and Gravel	200	35	353.309	674.463	677.604	0	677.604
20	4.6888	2952.46	Lacustrine Sand and Gravel	200	35	347.127	662.662	660.75	0	660.75
21	4.15539	2366.07	Site Grading Fill	350	33	396.012	755.983	625.159	0	625.159
22	4.15539	2023.31	Site Grading Fill	350	33	373.103	712.249	557.815	0	557.815
23	4.15539	1577.13	Site Grading Fill	350	33	340.313	649.655	461.43	0	461.43
24	4.15539	1024.23	Site Grading Fill	350	33	296.777	566.545	333.449	0	333.449
25	4.15539	360.312	Site Grading Fill	350	33	241.4	460.83	170.663	0	170.663

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 2.03772

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	384.923	4892.28	0	0	0
2	389.622	4885.35	-576.267	0	0
3	394.321	4879.37	756.437	0	0
4	399.021	4874.11	3194.67	0	0
5	403.72	4869.44	6209.75	0	0
6	408.42	4865.27	9436.52	0	0
7	413.119	4861.53	12615	0	0
8	417.819	4858.16	15556.7	0	0
9	422.518	4855.14	18124.6	0	0
10	427.217	4852.42	20219.5	0	0
11	431.917	4849.99	21771.5	0	0
12	436.616	4847.82	22734.3	0	0
13	441.316	4845.9	23080.3	0	0
14	446.015	4844.21	22798.7	0	0
15	450.715	4842.75	21892.5	0	0
16	455.414	4841.51	20377.7	0	0
17	460.113	4840.48	18282.1	0	0
18	464.813	4839.64	15644.8	0	0
19	469.512	4839.01	12317.6	0	0
20	474.212	4838.58	11378.7	0	0
21	478.911	4838.33	10354.7	0	0
22	483.611	4838.28	9258.27	0	0
23	488.31	4838.42	8116.23	0	0
24	493.01	4838.75	6969.57	0	0
25	497.709	4839.28	5874.92	0	0
26	502.408	4840.01	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.90899

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	402.409	4886.03	0	0	0
2	406.749	4877.67	-565.114	0	0

3	411.09	4871.02	1507.23	0	0
4	415.43	4865.46	4793.52	0	0
5	419.771	4860.7	8543.14	0	0
6	424.111	4856.57	12308.2	0	0
7	428.452	4852.96	15802.6	0	0
8	432.793	4849.78	18836.8	0	0
9	437.133	4846.99	21283.5	0	0
10	441.474	4844.54	23058.7	0	0
11	445.814	4842.4	24109.4	0	0
12	450.503	4840.41	24404.6	0	0
13	455.192	4838.73	23798.3	0	0
14	459.881	4837.34	22304.9	0	0
15	464.569	4836.23	19957.5	0	0
16	469.258	4835.38	16490.7	0	0
17	473.947	4834.8	15374.5	0	0
18	478.636	4834.46	14021.4	0	0
19	483.325	4834.38	12442.7	0	0
20	488.013	4834.55	10672.3	0	0
21	492.702	4834.97	8767.43	0	0
22	496.858	4835.55	6756.08	0	0
23	501.013	4836.34	4765.23	0	0
24	505.168	4837.34	2889.72	0	0
25	509.324	4838.56	1250.46	0	0
26	513.479	4840.01	0	0	0

List Of Coordinates

Water Table

X	Y
0	4880.66
335.902	4822.04
712.49	4800.49

External Boundary

X	Y
0	4775.17
712.49	4775.17
712.49	4817.4
712.09	4840.01
707.49	4840.01
468.96	4840.01
468.96	4862.27
241.44	4943.5
240.74	4943.78
240.05	4944.06
239.35	4944.32
238.65	4944.57
237.96	4944.79
237.26	4945.01
236.57	4945.22
235.87	4945.4
235.18	4945.53
234.48	4945.64
233.78	4945.77
233.09	4945.91

232.39	4946.02	
231.7	4946.11	
231	4946.19	
230.31	4946.31	
229.61	4946.43	
228.91	4946.54	
228.22	4946.64	
227.52	4946.69	
226.83	4946.73	
226.13	4946.73	
225.43	4946.79	
224.74	4946.87	
224.04	4946.95	
223.35	4947	
222.65	4947.04	
221.96	4947.08	
221.26	4947.13	
220.56	4947.15	
219.87	4947.15	
219.17	4947.15	
218.48	4947.17	
217.78	4947.2	
217.09	4947.23	
216.39	4947.25	
215.69	4947.29	
215	4947.31	
214.3	4947.33	
213.61	4947.36	
212.91	4947.39	
212.21	4947.42	
211.52	4947.42	
210.82	4947.4	
210.13	4947.39	
209.43	4947.41	
208.74	4947.47	
208.04	4947.47	
207.34	4947.45	
206.65	4947.45	
205.95	4947.49	
205.26	4947.5	
204.56	4947.49	
203.87	4947.51	
203.17	4947.54	
202.47	4947.56	
201.78	4947.57	
201.08	4947.59	
200.39	4947.59	
199.69	4947.6	
198.99	4947.64	
198.3	4947.67	
197.6	4947.69	
196.91	4947.68	
196.21	4947.66	
195.52	4947.64	
194.82	4947.63	
194.12	4947.64	
193.43	4947.65	
192.73	4947.67	

192.04	4947.69	
191.34	4947.69	
190.65	4947.68	
189.95	4947.77	
189.25	4947.88	
188.56	4947.97	
187.86	4948.04	
187.17	4948.1	
186.47	4948.11	
185.78	4948.11	
185.08	4948.13	
184.38	4948.15	
183.69	4948.18	
182.99	4948.23	
182.3	4948.32	
181.6	4948.44	
180.9	4948.49	
180.21	4948.49	
179.51	4948.52	
178.82	4948.55	
178.12	4948.53	
177.43	4948.52	
176.73	4948.56	
176.03	4948.61	
175.34	4948.66	
174.64	4948.68	
173.95	4948.7	
173.25	4948.77	
172.56	4948.86	
171.86	4948.95	
171.16	4949.04	
170.47	4949.13	
169.77	4949.26	
169.08	4949.38	
168.38	4949.54	
167.68	4949.72	
166.99	4949.89	
166.29	4950.04	
165.6	4950.12	
164.9	4950.17	
164.21	4950.24	
163.51	4950.27	
162.81	4950.3	
162.12	4950.35	
161.42	4950.4	
160.73	4950.47	
160.03	4950.54	
159.34	4950.61	
158.64	4950.69	
157.94	4950.76	
157.25	4950.85	
156.55	4950.91	
155.86	4950.95	
155.16	4950.99	
154.46	4951.06	
153.77	4951.19	
153.07	4951.33	
152.38	4951.47	

151.68	4951.55	
150.99	4951.6	
150.29	4951.65	
149.59	4951.72	
148.9	4951.82	
148.2	4951.91	
147.51	4951.98	
146.81	4952.06	
146.12	4952.12	
145.42	4952.17	
144.72	4952.17	
144.03	4952.17	
143.33	4952.18	
142.64	4952.19	
141.94	4952.23	
141.24	4952.26	
140.55	4952.3	
139.85	4952.44	
139.16	4952.57	
138.46	4952.69	
137.77	4952.77	
137.07	4952.81	
136.37	4952.82	
135.68	4952.81	
134.98	4952.84	
134.29	4952.89	
133.59	4953.03	
132.9	4953.17	
132.2	4953.27	
131.5	4953.38	
130.81	4953.55	
130.11	4954.06	
129.42	4954.61	
128.72	4955.17	
128.02	4955.79	
127.33	4956.4	
126.63	4956.98	
125.94	4957.58	
125.24	4958.2	
124.55	4958.9	
123.85	4959.58	
123.15	4960.24	
122.46	4960.9	
121.76	4961.48	
121.07	4962	
120.37	4962.6	
119.68	4963.28	
118.98	4963.93	
118.28	4964.54	
117.59	4965.09	
116.89	4965.6	
116.2	4966.05	
115.5	4966.49	
114.8	4966.93	
114.11	4967.37	
113.41	4967.72	
112.72	4968.02	
112.02	4968.3	

rocscience	*Project* Gravel Pit Development		
	Analysis Description B-B'		
	Drawn By JKC	*Scale*	*Company* G2
SLIDEINTERPRET 6.039	*Date* 5/11/2020, 5:21:49 PM		*File Name* B-B' Grading.slim

111.33	4968.69	
110.63	4969.23	
109.93	4969.77	
109.24	4970.31	
108.54	4970.75	
107.85	4971.2	
107.15	4971.67	
106.46	4972.12	
105.76	4972.56	
105.06	4973.01	
104.37	4973.46	
103.67	4973.88	
102.98	4974.27	
102.28	4974.64	
101.58	4975.05	
100.89	4975.46	
100.19	4975.89	
99.497	4976.29	
98.802	4976.72	
98.106	4977.19	
97.41	4977.66	
96.714	4978.13	
96.019	4978.6	
95.323	4979.06	
94.627	4979.39	
93.931	4979.67	
93.235	4979.98	
92.54	4980.35	
91.844	4980.7	
91.148	4981.03	
90.452	4981.39	
89.756	4981.63	
89.061	4981.81	
88.365	4981.93	
87.669	4982.03	
86.973	4982.13	
86.278	4982.24	
85.582	4982.36	
84.886	4982.47	
84.19	4982.57	
83.494	4982.65	
82.799	4982.7	
82.103	4982.74	
81.407	4982.76	
80.711	4982.78	
80.015	4982.8	
79.32	4982.85	
78.624	4982.9	
77.928	4982.99	
77.232	4983.11	
76.537	4983.25	
75.841	4983.41	
75.145	4983.48	
74.449	4983.52	
73.753	4983.56	
73.058	4983.58	
72.362	4983.58	
71.666	4983.56	

70.97	4983.53	
70.274	4983.57	
69.579	4983.62	
68.883	4983.65	
68.187	4983.7	
67.491	4983.74	
66.796	4983.8	
66.1	4983.86	
65.404	4983.92	
64.708	4983.99	
64.012	4984.08	
63.317	4984.18	
62.621	4984.27	
61.925	4984.35	
61.229	4984.42	
60.533	4984.48	
59.838	4984.56	
59.142	4984.63	
58.446	4984.67	
57.75	4984.73	
57.054	4984.81	
56.359	4984.85	
55.663	4984.9	
54.967	4984.96	
54.271	4985.05	
53.576	4985.16	
52.88	4985.25	
52.184	4985.33	
51.488	4985.37	
50.792	4985.39	
50.097	4985.42	
49.401	4985.5	
48.705	4985.56	
48.009	4985.61	
47.313	4985.64	
46.618	4985.69	
45.922	4985.71	
45.226	4985.75	
44.53	4985.84	
43.835	4985.94	
43.139	4986	
42.443	4986.04	
41.747	4985.98	
41.051	4985.89	
40.356	4985.74	
39.66	4985.44	
38.964	4985.13	
38.268	4984.83	
37.572	4984.55	
36.877	4984.28	
36.181	4984.06	
35.485	4983.85	
34.789	4983.7	
34.094	4983.56	
33.398	4983.43	
32.702	4983.31	
32.006	4983.18	
31.31	4983.05	

rocscience	*Project* Gravel Pit Development		
	Analysis Description B-B'		
	Drawn By JKC	*Scale*	*Company* G2
SLIDEINTERPRET 6.039	*Date* 5/11/2020, 5:21:49 PM		*File Name* B-B' Grading.slim

30.615	4982.92
29.919	4982.82
29.223	4982.7
28.527	4982.59
27.831	4982.46
27.136	4982.28
26.44	4982.12
25.744	4981.98
25.048	4981.91
24.353	4981.85
23.657	4981.81
22.961	4981.8
22.265	4981.78
21.569	4981.73
20.874	4981.66
20.178	4981.59
19.482	4981.49
18.786	4981.37
18.09	4981.26
17.395	4981.13
16.699	4980.98
16.003	4980.95
15.307	4980.98
14.612	4981.02
13.916	4981.05
13.22	4981.06
12.524	4981.04
11.828	4981
11.133	4980.92
10.437	4980.83
9.741	4980.74
9.045	4980.73
8.349	4980.77
7.654	4980.77
6.958	4980.73
6.262	4980.7
5.566	4980.69
4.871	4980.69
4.175	4980.69
3.479	4980.73
2.783	4980.79
2.087	4980.88
1.392	4980.98
0.696	4981.08
0	4981.14
0	4980.03
0	4895.56
0	4892.34
0	4838.18
0	4832.05

Material Boundary

X	Y
0	4980.03
156.102	4908.99
192.227	4892.17

Material Boundary

X	Y
0	4892.34
162.109	4886.01
161.044	4890.08
0	4895.56

Material Boundary

X	Y
0	4832.05
177.706	4826.34
176.228	4831.99
0	4838.18

Material Boundary

X	Y
165.856	4871.67
230.06	4879.61

Material Boundary

X	Y
362.716	4855.32
397.653	4850.04
505.895	4832.88

Material Boundary

X	Y
181.302	4812.58
243.472	4827.56
260	4830.91
313.226	4838.62
397.653	4850.04
400.167	4843.67
242.392	4822.76
182.778	4806.93
181.302	4812.58

Material Boundary

X	Y
403.648	4827.89
505.895	4832.88
529.006	4829.21
405.303	4821.77
403.648	4827.89

Material Boundary

X	Y
529.006	4829.21
556.832	4824.8
712.49	4817.4

Material Boundary

X	Y
468.96	4840.01
465.069	4840.01
465.069	4862.27
468.96	4862.27

Material Boundary

X	Y
130.81	4953.55
192.227	4892.17
230.06	4879.61
238.219	4876.9
253.415	4871.86
362.716	4855.32
291.486	4903.45

Material Boundary

X	Y
165.856	4871.67
166.971	4867.41
238.219	4876.9

Material Boundary

X	Y
241.44	4943.5
256.855	4934.43
264.158	4926.42
272.992	4919.7
280.531	4914.17
291.486	4903.45

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: C-C' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: C-C'
Author: JKC
Company: G2
Date Created: 5/11/2020, 5:40:35 PM

General Settings

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

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
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: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.3

Material Properties

Property	Concrete	Site Grading Fill	Lacustrine Fines	Lacustrine Sand and Gravel
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	150	120	120	120
Cohesion [psf]	500000	250	150	200
Friction Angle [deg]	35	38	27	36
Water Surface	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1

Global Minimums

Method: bishop simplified

FS: 1.070140
Center: 232.885, 5153.309
Radius: 292.386
Left Slip Surface Endpoint: 2.858, 4972.817
Right Slip Surface Endpoint: 213.449, 4861.569
Resisting Moment=1.05679e+008 lb-ft
Driving Moment=9.87527e+007 lb-ft
Total Slice Area=4054.15 ft2

Method: janbu simplified

FS: 0.964432
Center: 246.374, 5099.351
Radius: 273.751
Left Slip Surface Endpoint: 3.914, 4972.259
Right Slip Surface Endpoint: 334.373, 4840.130
Resisting Horizontal Force=770039 lb
Driving Horizontal Force=798437 lb
Total Slice Area=11664.6 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 4549
Number of Invalid Surfaces: 302

Error Codes:

Error Code -102 reported for 2 surfaces
Error Code -103 reported for 73 surfaces
Error Code -106 reported for 9 surfaces
Error Code -108 reported for 119 surfaces
Error Code -1000 reported for 99 surfaces

Method: janbu simplified

Number of Valid Surfaces: 4449
Number of Invalid Surfaces: 402

Error Codes:

Error Code -102 reported for 2 surfaces
Error Code -103 reported for 73 surfaces
Error Code -106 reported for 9 surfaces
Error Code -108 reported for 219 surfaces
Error Code -1000 reported for 99 surfaces

Error Codes

The following errors were encountered during the computation:

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (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).
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.07014

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	8.42367	2930.48	Site Grading Fill	250	38	258.264	276.379	33.7633	0	33.7633
2	8.42367	8347.93	Site Grading Fill	250	38	528.231	565.281	403.542	0	403.542
3	8.42367	12938.1	Site Grading Fill	250	38	775.966	830.392	742.868	0	742.868
4	8.42367	16806.6	Site Grading Fill	250	38	1001.2	1071.42	1051.37	0	1051.37
5	8.42367	20035	Site Grading Fill	250	38	1203.87	1288.31	1328.97	0	1328.97
6	8.42367	22688.3	Site Grading Fill	250	38	1384	1481.07	1575.7	0	1575.7
7	8.42367	24818.6	Site Grading Fill	250	38	1541.67	1649.8	1791.66	0	1791.66
8	8.42367	26469.1	Site Grading Fill	250	38	1676.93	1794.55	1976.94	0	1976.94
9	8.42367	27675.4	Site Grading Fill	250	38	1789.85	1915.39	2131.6	0	2131.6
10	8.42367	28467.6	Site Grading Fill	250	38	1880.42	2012.31	2255.66	0	2255.66
11	8.42367	28871.2	Site Grading Fill	250	38	1948.6	2085.28	2349.05	0	2349.05
12	8.42367	28907.8	Site Grading Fill	250	38	1994.31	2134.19	2411.66	0	2411.66
13	8.42367	28596.3	Site Grading Fill	250	38	2017.4	2158.9	2443.29	0	2443.29
14	8.42367	27952.8	Site Grading Fill	250	38	2017.67	2159.19	2443.65	0	2443.65
15	8.42367	26991.2	Site Grading Fill	250	38	1994.82	2134.74	2412.36	0	2412.36
16	8.42367	25723.8	Site Grading Fill	250	38	1948.54	2085.21	2348.96	0	2348.96
17	8.42367	24161.1	Site Grading Fill	250	38	1878.38	2010.13	2252.87	0	2252.87
18	8.42367	22312.2	Site Grading Fill	250	38	1783.85	1908.97	2123.38	0	2123.38
19	8.42367	20185.2	Site Grading Fill	250	38	1664.35	1781.09	1959.71	0	1959.71
20	8.42367	17786.9	Site Grading Fill	250	38	1519.2	1625.76	1760.89	0	1760.89
21	8.42367	15123.3	Site Grading Fill	250	38	1347.6	1442.12	1525.84	0	1525.84
22	8.42367	12199.3	Site Grading Fill	250	38	1148.64	1229.2	1253.32	0	1253.32
23	8.42367	9019.19	Site Grading Fill	250	38	921.26	985.877	941.88	0	941.88
24	8.42367	5586.36	Site Grading Fill	250	38	664.272	710.864	589.879	0	589.879
25	8.42367	1903.58	Site Grading Fill	250	38	376.308	402.702	195.449	0	195.449

Global Minimum Query (janbu simplified) - Safety Factor: 0.964432

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	18.4633	22734.9	Site Grading Fill	250	38	539.724	520.527	346.258	0	346.258
2	17.9138	58476.8	Lacustrine Sand and Gravel	200	36	1360.55	1312.16	1530.76	0	1530.76
3	17.9138	82694	Lacustrine Sand and Gravel	200	36	2065.93	1992.45	2467.1	0	2467.1
4	16.2995	89723.3	Site Grading Fill	250	38	2762.37	2664.12	3089.93	0	3089.93
5	10.6599	63911.7	Lacustrine Sand and Gravel	200	36	2994.1	2887.61	3699.18	0	3699.18
6	10.6599	66661.7	Lacustrine Sand and Gravel	200	36	3231.33	3116.4	4014.08	0	4014.08

7	2.6607	16970.8	Site Grading Fill	250	38	3554.12	3427.71	4067.29	0	4067.29
8	12.4799	80560.1	Lacustrine Sand and Gravel	200	36	3482.89	3359.01	4348	0	4348
9	12.4799	81343.7	Lacustrine Sand and Gravel	200	36	3646.67	3516.97	4565.42	0	4565.42
10	12.4799	80879	Lacustrine Sand and Gravel	200	36	3755.73	3622.15	4710.19	0	4710.19
11	8.48162	54143.3	Lacustrine Fines	150	27	2886.09	2783.44	5168.42	0	5168.42
12	11.3513	70664.8	Lacustrine Sand and Gravel	200	36	3816.37	3680.63	4790.68	0	4790.68
13	11.3513	67926.7	Lacustrine Sand and Gravel	200	36	3784.5	3649.89	4748.37	0	4748.37
14	13.5958	76676	Lacustrine Fines	150	27	2737.83	2640.45	4887.78	0	4887.78
15	16.6126	85055.2	Lacustrine Sand and Gravel	200	36	3499.17	3374.71	4369.62	0	4369.62
16	16.6126	73604.8	Lacustrine Sand and Gravel	200	36	3183.89	3070.65	3951.1	0	3951.1
17	15.3307	61328.3	Lacustrine Fines	150	27	2164.97	2087.97	3803.48	0	3803.48
18	15.3307	62922.8	Lacustrine Fines	150	27	2282.28	2201.1	4025.5	0	4025.5
19	15.3307	63106.8	Lacustrine Fines	150	27	2357.05	2273.21	4167.04	0	4167.04
20	15.3307	61707.1	Lacustrine Fines	150	27	2379.8	2295.16	4210.11	0	4210.11
21	15.3307	48297.4	Lacustrine Fines	150	27	1959.42	1889.73	3414.42	0	3414.42
22	12.9935	15142.1	Lacustrine Sand and Gravel	200	36	1264.97	1219.98	1403.88	0	1403.88
23	12.9935	10807.7	Lacustrine Sand and Gravel	200	36	1017.44	981.255	1075.31	0	1075.31
24	12.9935	5426.01	Lacustrine Sand and Gravel	200	36	669.137	645.337	612.955	0	612.955
25	4.8096	456.898	Site Grading Fill	250	38	458.442	442.136	245.923	0	245.923

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.07014

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2.85752	4972.82	0	0	0
2	11.2812	4962.57	-949.866	0	0
3	19.7049	4953.2	887.319	0	0
4	28.1285	4944.59	4630.85	0	0
5	36.5522	4936.64	9591.62	0	0
6	44.9759	4929.3	15224.8	0	0
7	53.3996	4922.49	21097.4	0	0
8	61.8232	4916.18	26865.7	0	0
9	70.2469	4910.33	32258.7	0	0
10	78.6706	4904.9	37065.9	0	0
11	87.0943	4899.86	41128.5	0	0
12	95.5179	4895.2	44332.2	0	0
13	103.942	4890.89	46602.6	0	0
14	112.365	4886.92	47900.7	0	0
15	120.789	4883.26	48220.5	0	0
16	129.213	4879.92	47586.4	0	0
17	137.636	4876.87	46052.2	0	0
18	146.06	4874.11	43700	0	0
19	154.484	4871.63	40639.8	0	0
20	162.907	4869.42	37009.6	0	0
21	171.331	4867.47	32976	0	0
22	179.755	4865.79	28734.9	0	0
23	188.178	4864.36	24513	0	0
24	196.602	4863.18	20569.9	0	0
25	205.026	4862.25	17199.9	0	0
26	213.449	4861.57	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 0.964432

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	3.9135	4972.26	0	0	0

2	22.3768	4941.98	7338.05	0	0
3	40.2907	4919.16	35444.4	0	0
4	58.2045	4900.53	69212.9	0	0
5	74.504	4886.28	95124.8	0	0
6	85.164	4878.1	112620	0	0
7	95.8239	4870.72	127823	0	0
8	98.4846	4868.99	130494	0	0
9	110.964	4861.44	144020	0	0
10	123.444	4854.75	153415	0	0
11	135.924	4848.87	158515	0	0
12	144.406	4845.3	168734	0	0
13	155.757	4841.03	167049	0	0
14	167.109	4837.33	162063	0	0
15	180.704	4833.59	166089	0	0
16	197.317	4830.03	149036	0	0
17	213.93	4827.53	128107	0	0
18	229.26	4826.14	118614	0	0
19	244.591	4825.61	104632	0	0
20	259.922	4825.94	86052.9	0	0
21	275.252	4827.13	63059.9	0	0
22	290.583	4829.19	40454	0	0
23	303.577	4831.64	25119.8	0	0
24	316.57	4834.75	11797.1	0	0
25	329.564	4838.55	2404.79	0	0
26	334.373	4840.13	0	0	0

List Of Coordinates

Water Table

X	Y
0	4850.33
192.53	4814.78
512.1	4808.85

External Boundary

X	Y
0	4775.45
443.37	4775.45
479.933	4775.45
501.665	4775.45
512.1	4775.45
512.1	4777.98
512.1	4825.89
512.1	4840.13
285.619	4840.13
285.619	4849.93
285.619	4860.07
283.166	4860.07
216.279	4860.07
0.5	4974.06
0	4974.32
0	4835.82
0	4831.97
0	4821.58
0	4812.51

Material Boundary

X	Y
0	4831.97
88.458	4839.31
89.149	4841.02
169.174	4847.22

Material Boundary

X	Y
0	4812.51
84.3867	4819.76
84.7186	4821.35
183.217	4829.66
179.883	4834.88

Material Boundary

X	Y
177.279	4838.95
199.361	4839.61

Material Boundary

X	Y
0	4821.58
86.3473	4829.12
86.6689	4830.66
177.754	4838.21

Material Boundary

X	Y
186.34	4824.78
213.94	4827.09
213.94	4819.48
213.94	4818.74
191.366	4816.91
186.34	4824.78

Material Boundary

X	Y
213.871	4829.92
307.032	4829.04
512.1	4777.98

Material Boundary

X	Y
213.871	4829.92
213.94	4827.09
214.003	4824.51
306.112	4824.51
501.665	4775.45

Material Boundary

X	Y
213.94	4819.48
306.493	4818.1
479.933	4775.45

Material Boundary

X	Y
213.94	4819.48
214.322	4811.45
306.849	4809.91
443.37	4775.45

Material Boundary

X	Y
86.517	4878.28
92.518	4874.52
97.519	4871.68
103.02	4868.48
108.52	4865.82
112.52	4864.6
116.02	4863.93
117.52	4863.9
122.02	4864.43
126.02	4865.25
129.03	4865.54
130.03	4865.67
132.03	4865.7
134.53	4865.47
137.03	4865.28
139.03	4865.12
140.03	4865.02
141.53	4864.78
144.03	4864.81
146.03	4864.89
148.03	4864.82
151.03	4864.22
153.03	4863.68
155.03	4862.59
158.03	4860.95
159.763	4859.13
162.03	4856.42
163.53	4855.01
165.03	4853.12
169.53	4849.97
172.03	4848.31
174.53	4846.35
177.53	4845.01
180.54	4844.55
184.04	4844.27
189.04	4843.96
193.54	4843.72
197.54	4843.47
201.04	4843.4
204.54	4843.14

208.54	4842.96
213.54	4842.81
220.54	4842.74
226.54	4842.81
232.55	4842.81
234.05	4842.61
236.55	4842.6
241.05	4842.56
248.05	4842.39
255.05	4842.28
261.05	4842.28
264.55	4842.08
268.05	4842.16
270.55	4842.24
272.55	4842.16
274.55	4842.55
277.55	4843.74
279.55	4844.97
283.06	4848.01

Material Boundary

X	Y
0.5	4974.06
4.41427	4970.22
6.798	4963.88
8.552	4960.07
10.468	4955.78
13.373	4949.66
17.96	4944.61
24.382	4940.79
29.886	4936.05
37.226	4930.85
43.953	4926.27
48.235	4921.07
51.751	4915.26
54.809	4909.29
57.867	4901.34
59.702	4896.91
66.583	4891.71
77.286	4884.37
86.017	4878.61
86.0366	4878.6
86.517	4878.28

Material Boundary

X	Y
283.06	4848.01
283.166	4848.09
285.619	4849.93

Material Boundary

X	Y
86.017	4878.61
86.0366	4878.6
96.658	4870.04

106.472	4864.36
114.261	4861.94
120.285	4861.17
146.915	4861.17
152.572	4859.79
157.631	4857.63
161.448	4853.81
164.452	4851.25
169.174	4847.22
174.527	4843.26
185.824	4841.26
199.361	4839.61
205.038	4838.7
211.889	4837.59
213.693	4837.23
291.744	4837.23
329.831	4838.56
355.144	4838.56
375.863	4840.04
394.322	4840.04
407.641	4838.17
432.02	4834.97
453.283	4832.4
478.09	4829.18

Material Boundary

X	Y
0	4835.82
88.998	4843.64
89.894	4845.04
164.452	4851.25

Material Boundary

X	Y
177.279	4838.95
177.754	4838.21
179.883	4834.88
211.889	4837.59

Material Boundary

X	Y
478.09	4829.18
512.1	4825.89

Material Boundary

X	Y
283.166	4860.07
283.166	4848.09
283.166	4840.13
285.619	4840.13

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: C-C' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: C-C'
Author: JKC
Company: G2
Date Created: 5/11/2020, 5:40:35 PM

General Settings

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

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
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: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Concrete	Site Grading Fill	Lacustrine Fines	Lacustrine Sand and Gravel
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	150	120	120	120
Cohesion [psf]	500000	250	150	200
Friction Angle [deg]	35	38	27	36
Water Surface	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1

Global Minimums

Method: bishop simplified

FS: 1.899350
Center: 232.885, 5153.309
Radius: 292.386
Left Slip Surface Endpoint: 2.858, 4972.817
Right Slip Surface Endpoint: 213.449, 4861.569
Resisting Moment=1.19616e+008 lb-ft
Driving Moment=6.29773e+007 lb-ft
Total Slice Area=4054.15 ft2

Method: janbu simplified

FS: 1.763680
Center: 165.438, 5018.416
Radius: 168.466
Left Slip Surface Endpoint: 3.331, 4972.566
Right Slip Surface Endpoint: 222.960, 4860.074
Resisting Horizontal Force=681268 lb
Driving Horizontal Force=386277 lb
Total Slice Area=8770.2 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 4438
Number of Invalid Surfaces: 413

Error Codes:

Error Code -102 reported for 2 surfaces
Error Code -103 reported for 73 surfaces
Error Code -106 reported for 9 surfaces
Error Code -107 reported for 13 surfaces
Error Code -108 reported for 217 surfaces
Error Code -1000 reported for 99 surfaces

Method: janbu simplified

Number of Valid Surfaces: 4307
Number of Invalid Surfaces: 544

Error Codes:

Error Code -102 reported for 2 surfaces
Error Code -103 reported for 73 surfaces
Error Code -106 reported for 9 surfaces
Error Code -107 reported for 13 surfaces

Error Code -108 reported for 348 surfaces
Error Code -1000 reported for 99 surfaces

Error Codes

The following errors were encountered during the computation:

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (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.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-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).
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.89935

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	8.42367	2930.48	Site Grading Fill	250	38	183.098	347.767	125.137	0	125.137
2	8.42367	8347.93	Site Grading Fill	250	38	369.977	702.716	579.45	0	579.45
3	8.42367	12938.1	Site Grading Fill	250	38	537.429	1020.77	986.532	0	986.532
4	8.42367	16806.6	Site Grading Fill	250	38	686.187	1303.31	1348.18	0	1348.18
5	8.42367	20035	Site Grading Fill	250	38	816.958	1551.69	1666.09	0	1666.09
6	8.42367	22688.3	Site Grading Fill	250	38	930.392	1767.14	1941.86	0	1941.86
7	8.42367	24818.6	Site Grading Fill	250	38	1027.07	1950.77	2176.89	0	2176.89
8	8.42367	26469.1	Site Grading Fill	250	38	1107.52	2103.56	2372.45	0	2372.45
9	8.42367	27675.4	Site Grading Fill	250	38	1172.17	2226.36	2529.61	0	2529.61
10	8.42367	28467.6	Site Grading Fill	250	38	1221.41	2319.89	2649.34	0	2649.34
11	8.42367	28871.2	Site Grading Fill	250	38	1255.58	2384.79	2732.4	0	2732.4
12	8.42367	28907.8	Site Grading Fill	250	38	1274.94	2421.56	2779.46	0	2779.46
13	8.42367	28596.3	Site Grading Fill	250	38	1279.71	2430.62	2791.07	0	2791.07
14	8.42367	27952.8	Site Grading Fill	250	38	1270.07	2412.31	2767.63	0	2767.63
15	8.42367	26991.2	Site Grading Fill	250	38	1246.14	2366.85	2709.45	0	2709.45
16	8.42367	25723.8	Site Grading Fill	250	38	1207.99	2294.4	2616.72	0	2616.72
17	8.42367	24161.1	Site Grading Fill	250	38	1155.68	2195.04	2489.54	0	2489.54
18	8.42367	22312.2	Site Grading Fill	250	38	1089.19	2068.75	2327.9	0	2327.9
19	8.42367	20185.2	Site Grading Fill	250	38	1008.48	1915.45	2131.67	0	2131.67
20	8.42367	17786.9	Site Grading Fill	250	38	913.449	1734.96	1900.66	0	1900.66
21	8.42367	15123.3	Site Grading Fill	250	38	803.975	1527.03	1634.52	0	1634.52
22	8.42367	12199.3	Site Grading Fill	250	38	679.875	1291.32	1332.83	0	1332.83
23	8.42367	9019.19	Site Grading Fill	250	38	540.928	1027.41	995.042	0	995.042
24	8.42367	5586.36	Site Grading Fill	250	38	386.854	734.772	620.479	0	620.479
25	8.42367	1903.58	Site Grading Fill	250	38	217.325	412.776	208.344	0	208.344

Global Minimum Query (janbu simplified) - Safety Factor: 1.76368

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	0.517316	47.1129	Site Grading Fill	250	38	71.7772	126.592	-157.955	0	-157.955
2	8.8177	11502.4	Lacustrine Sand and Gravel	200	36	310.819	548.185	479.236	0	479.236
3	8.8177	27667	Lacustrine Sand and Gravel	200	36	793.109	1398.79	1650	0	1650
4	8.8177	38392.7	Lacustrine Sand and Gravel	200	36	1182.69	2085.88	2595.69	0	2595.69
5	8.8177	46137.3	Lacustrine Sand and Gravel	200	36	1503.6	2651.87	3374.71	0	3374.71
6	8.8177	51859.2	Lacustrine Sand and Gravel	200	36	1769.25	3120.39	4019.58	0	4019.58
7	8.8177	56059.3	Lacustrine Sand and Gravel	200	36	1988.2	3506.55	4551.08	0	4551.08
8	8.8177	59040.3	Lacustrine Sand and Gravel	200	36	2166.31	3820.67	4983.43	0	4983.43

9	8.8177	61001.7	Lacustrine Sand and Gravel	200	36	2307.73	4070.09	5326.72	0	5326.72
10	8.8177	62082.6	Lacustrine Sand and Gravel	200	36	2415.49	4260.15	5588.32	0	5588.32
11	8.8177	62384.2	Lacustrine Sand and Gravel	200	36	2491.84	4394.8	5773.65	0	5773.65
12	8.8177	61982.1	Lacustrine Sand and Gravel	200	36	2538.4	4476.92	5886.67	0	5886.67
13	8.8177	60934.2	Lacustrine Sand and Gravel	200	36	2556.33	4508.54	5930.2	0	5930.2
14	8.8177	59284.8	Lacustrine Sand and Gravel	200	36	2546.4	4491.04	5906.11	0	5906.11
15	8.8177	57068.5	Lacustrine Sand and Gravel	200	36	2509.07	4425.19	5815.48	0	5815.48
16	8.8177	54311.7	Lacustrine Sand and Gravel	200	36	2444.45	4311.22	5658.61	0	5658.61
17	8.8177	51034.6	Lacustrine Sand and Gravel	200	36	2352.38	4148.85	5435.13	0	5435.13
18	8.8177	47251.6	Lacustrine Sand and Gravel	200	36	2232.42	3937.27	5143.91	0	5143.91
19	12.2219	58261.5	Lacustrine Fines	150	27	1448.32	2554.38	4718.86	0	4718.86
20	9.49803	38799.1	Site Grading Fill	250	38	1978.9	3490.14	4147.2	0	4147.2
21	9.49803	32433.6	Site Grading Fill	250	38	1721.79	3036.68	3566.79	0	3566.79
22	9.49803	25449.4	Site Grading Fill	250	38	1420.58	2505.44	2886.83	0	2886.83
23	9.49803	17833.8	Site Grading Fill	250	38	1070.83	1888.61	2097.33	0	2097.33
24	9.49803	9567.6	Site Grading Fill	250	38	666.672	1175.8	1184.96	0	1184.96
25	9.49803	2037.89	Site Grading Fill	250	38	277.438	489.312	306.305	0	306.305

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.89935

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2.85752	4972.82	0	0	0
2	11.2812	4962.57	-259.941	0	0
3	19.7049	4953.2	2053.28	0	0
4	28.1285	4944.59	6021.5	0	0
5	36.5522	4936.64	10949.3	0	0
6	44.9759	4929.3	16304.9	0	0
7	53.3996	4922.49	21680.8	0	0
8	61.8232	4916.18	26766.3	0	0
9	70.2469	4910.33	31327.6	0	0
10	78.6706	4904.9	35193.8	0	0
11	87.0943	4899.86	38246.1	0	0
12	95.5179	4895.2	40410	0	0
13	103.942	4890.89	41649	0	0
14	112.365	4886.92	41960.4	0	0
15	120.789	4883.26	41371.3	0	0
16	129.213	4879.92	39936.3	0	0
17	137.636	4876.87	37735.4	0	0
18	146.06	4874.11	34872.3	0	0
19	154.484	4871.63	31474.1	0	0
20	162.907	4869.42	27690.1	0	0
21	171.331	4867.47	23691.9	0	0
22	179.755	4865.79	19673.6	0	0
23	188.178	4864.36	15852.1	0	0
24	196.602	4863.18	12467.8	0	0
25	205.026	4862.25	9785.95	0	0
26	213.449	4861.57	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.76368

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	3.33135	4972.57	0	0	0
2	3.84866	4970.78	-320.128	0	0
3	12.6664	4947.41	8130.16	0	0

4	21.4841	4930.91	28357.4	0	0
5	30.3018	4917.82	51866.7	0	0
6	39.1195	4906.95	75270.2	0	0
7	47.9372	4897.69	96856.5	0	0
8	56.7549	4889.7	115677	0	0
9	65.5726	4882.74	131197	0	0
10	74.3903	4876.67	143130	0	0
11	83.208	4871.38	151355	0	0
12	92.0257	4866.79	155869	0	0
13	100.843	4862.83	156758	0	0
14	109.661	4859.45	154181	0	0
15	118.479	4856.63	148363	0	0
16	127.296	4854.32	139584	0	0
17	136.114	4852.52	128187	0	0
18	144.932	4851.2	114571	0	0
19	153.75	4850.36	99201.7	0	0
20	165.971	4849.95	83376	0	0
21	175.469	4850.25	63305.7	0	0
22	184.968	4851.09	43933.8	0	0
23	194.466	4852.47	26418.7	0	0
24	203.964	4854.41	12148.6	0	0
25	213.462	4856.94	2810.77	0	0
26	222.96	4860.07	0	0	0

List Of Coordinates

Water Table

X	Y
0	4850.33
192.53	4814.78
512.1	4808.85

External Boundary

X	Y
0	4775.45
443.37	4775.45
479.933	4775.45
501.665	4775.45
512.1	4775.45
512.1	4777.98
512.1	4825.89
512.1	4840.13
285.619	4840.13
285.619	4849.93
285.619	4860.07
283.166	4860.07
216.279	4860.07
0.5	4974.06
0	4974.32
0	4835.82
0	4831.97
0	4821.58
0	4812.51

Material Boundary

X	Y
0	4831.97
88.458	4839.31
89.149	4841.02
169.174	4847.22

Material Boundary

X	Y
0	4812.51
84.3867	4819.76
84.7186	4821.35
183.217	4829.66
179.883	4834.88

Material Boundary

X	Y
177.279	4838.95
199.361	4839.61

Material Boundary

X	Y
0	4821.58
86.3473	4829.12
86.6689	4830.66
177.754	4838.21

Material Boundary

X	Y
186.34	4824.78
213.94	4827.09
213.94	4819.48
213.94	4818.74
191.366	4816.91
186.34	4824.78

Material Boundary

X	Y
213.871	4829.92
307.032	4829.04
512.1	4777.98

Material Boundary

X	Y
213.871	4829.92
213.94	4827.09
214.003	4824.51
306.112	4824.51
501.665	4775.45

Material Boundary

X	Y

213.94	4819.48
306.493	4818.1
479.933	4775.45

Material Boundary

X	Y
213.94	4819.48
214.322	4811.45
306.849	4809.91
443.37	4775.45

Material Boundary

X	Y
86.517	4878.28
92.518	4874.52
97.519	4871.68
103.02	4868.48
108.52	4865.82
112.52	4864.6
116.02	4863.93
117.52	4863.9
122.02	4864.43
126.02	4865.25
129.03	4865.54
130.03	4865.67
132.03	4865.7
134.53	4865.47
137.03	4865.28
139.03	4865.12
140.03	4865.02
141.53	4864.78
144.03	4864.81
146.03	4864.89
148.03	4864.82
151.03	4864.22
153.03	4863.68
155.03	4862.59
158.03	4860.95
159.763	4859.13
162.03	4856.42
163.53	4855.01
165.03	4853.12
169.53	4849.97
172.03	4848.31
174.53	4846.35
177.53	4845.01
180.54	4844.55
184.04	4844.27
189.04	4843.96
193.54	4843.72
197.54	4843.47
201.04	4843.4
204.54	4843.14
208.54	4842.96
213.54	4842.81
220.54	4842.74

226.54	4842.81
232.55	4842.81
234.05	4842.61
236.55	4842.6
241.05	4842.56
248.05	4842.39
255.05	4842.28
261.05	4842.28
264.55	4842.08
268.05	4842.16
270.55	4842.24
272.55	4842.16
274.55	4842.55
277.55	4843.74
279.55	4844.97
283.06	4848.01

Material Boundary

X	Y
0.5	4974.06
4.41427	4970.22
6.798	4963.88
8.552	4960.07
10.468	4955.78
13.373	4949.66
17.96	4944.61
24.382	4940.79
29.886	4936.05
37.226	4930.85
43.953	4926.27
48.235	4921.07
51.751	4915.26
54.809	4909.29
57.867	4901.34
59.702	4896.91
66.583	4891.71
77.286	4884.37
86.017	4878.61
86.0366	4878.6
86.517	4878.28

Material Boundary

X	Y
283.06	4848.01
283.166	4848.09
285.619	4849.93

Material Boundary

X	Y
86.017	4878.61
86.0366	4878.6
96.658	4870.04
106.472	4864.36
114.261	4861.94
120.285	4861.17

146.915	4861.17
152.572	4859.79
157.631	4857.63
161.448	4853.81
164.452	4851.25
169.174	4847.22
174.527	4843.26
185.824	4841.26
199.361	4839.61
205.038	4838.7
211.889	4837.59
213.693	4837.23
291.744	4837.23
329.831	4838.56
355.144	4838.56
375.863	4840.04
394.322	4840.04
407.641	4838.17
432.02	4834.97
453.283	4832.4
478.09	4829.18

Material Boundary

X	Y
0	4835.82
88.998	4843.64
89.894	4845.04
164.452	4851.25

Material Boundary

X	Y
177.279	4838.95
177.754	4838.21
179.883	4834.88
211.889	4837.59

Material Boundary

X	Y
478.09	4829.18
512.1	4825.89

Material Boundary

X	Y
283.166	4860.07
283.166	4848.09
283.166	4840.13
285.619	4840.13

APPENDIX C

Liquefaction Analysis Printouts

Wasatch Rock Development B-1

Input Parameters:

Peak ground accel (g) =	0.731			
Earthquake magnitude, M =	7			
Water table depth (m) =	10.9728	36	ft	
Average γ above water table (kN/m^3) =		18.1	115	pcf
Average γ below water table (kN/m^3) =		19.6	125	pcf
Borehole diameter (mm) =	222.25	8.75	in	
Require correction for sampler liners (YES/NO) =		NO		

Rod lengths assumed equal to the depth plus 1.5 m (for the above ground extension)

SPT Sample Number	Depth (ft)	Depth (m)	Measured N	Soil Type (USCS)	Flag "Clay" "Unsaturated" "Unreliable"	Fines Content (%)	Energy Ration, ER (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60\text{-}cs}$	r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}' = 1atm	CRR	Factor of Safety	Limiting Shear Strain γ_{lim}	Para-meter F_α	Maximum Shear Strain γ_{max}	ΔH_i (ft)	ΔH_i (m)	ΔLDI_i (m)	Vertical Reconsol. Strain ε_v	ΔS_i (m)
	35.0	10.7	22	SM	Unreliable		80	1.33	1.15	1.00	1.00	33.7	193	193	0.78	26.2	0	26.2	0.85	0.404	1.14	0.89	0.322	?	?	0.076	0.158	0.000	0.500	0.152	0.000	0.000	0.000
	40.0	12.2	16	SM	Unreliable	18.5	80	1.33	1.15	1.00	1.00	24.5	222	210	0.71	17.5	4.198	21.7	0.82	0.413	1.14	0.90	0.228	?	?	0.132	0.427	0.000	2.000	0.610	0.000	0.000	0.000
		0.0						0.00	1.15	0.75	1.00	0.0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	1.01	#DIV/0!	1.14	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	5.000	1.524	#DIV/0!	#DIV/0!	#DIV/0!
		0.0						0.00	1.15	0.75	1.00	0.0	0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	1.01	#DIV/0!	1.14	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	5.000	1.524	#DIV/0!	#DIV/0!	#DIV/0!

Wasatch Rock Development B-2

Input Parameters:

Peak ground accel (g) =	0.731			
Earthquake magnitude, M =	7			
Water table depth (m) =	9.4488	31	ft	
Average γ above water table (kN/m^3) =		18.1	115	pcf
Average γ below water table (kN/m^3) =		19.6	125	pcf
Borehole diameter (mm) =	222.25	8.75	in	
Require correction for sampler liners (YES/NO) =		NO		

Rod lengths assumed equal to the depth plus 1.5 m (for the above ground extension)

SPT Sample Number	Depth (ft)	Depth (m)	Measured N	Soil Type (USCS)	Flag "Clay" "Unsaturated" "Unreliable"	Fines Content (%)	Energy Ration, ER (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for fines content	$(N_1)_{60\text{-}cs}$	r_d	CSR	MSF for sand	K_σ for sand	CRR for M=7.5 & σ_{vc}' = 1atm	CRR	Factor of Safety	Limiting Shear Strain γ_{lim}	Para-meter F_α	Maximum Shear Strain γ_{max}	ΔH_i (ft)	ΔH_i (m)	ΔLDI_i (m)	Vertical Reconsol. Strain ε_v	ΔS_i (m)
	30.0	9.1	8	GM	Unreliable		80	1.33	1.15	1.00	1.00	12.3	165	165	0.76	9.4	0	9.4	0.88	0.417	1.14	0.96	0.114	?	**?**	0.500	0.926	0.000	0.500	0.152	0.000	0.000	**0.000**
	35.0	10.7	12	CL	Clay	18.5	80	1.33	1.15	1.00	1.00	18.4	195	183	0.86	n.a.	n.a.	n.a.	0.85	0.431	1.14	0.83	n.a.	n.a.	**n.a.**	0.000	0.000	0.000	2.000	0.610	0.000	0.000	**0.000**
	40.0	12.2	39	SM			80	1.33	1.15	1.00	1.00	59.8	225	198	0.84	50.1	0	50.1	0.82	0.444	1.14	0.80	2.000	1.830	**2.00**	0.000	-1.598	0.000	5.000	1.524	0.000	0.000	**0.000**
	45.0	13.7	27	CL	Clay		80	1.33	1.15	1.00	1.00	41.4	254	213	0.82	n.a.	n.a.	n.a.	0.79	0.452	1.14	0.78	n.a.	n.a.	**n.a.**	0.000	0.000	0.000	5.000	1.524	0.000	0.000	**0.000**