GEOTECH
CONSULTANTS, INC.

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Seattle, Washington 98102
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February 28, 2023

JN 22007

Dorothy Strand
6950 Southeast Maker Street
Mercer Island, Washington 98040
via email: *kcra2005@yahoo.com*

Subject: **Review of Plans and Response to Geotechnical Review Comments**
Proposed New Residence
6950 Southeast Maker Street
Mercer Island, Washington

Reference: Geotechnical Engineering Study, same project; Geotech Consultants, Inc.; March 21, 2022.

Dear Ms. Strand:

This letter is intended to provide our revised slope stability analyses that address the one-in-2,475-year earthquake (2 percent chance of occurring in 50 years), as required by Mercer Island's geotechnical reviewer. This is a stronger earthquake than we used in our slope stability analyses for our above-referenced *Geotechnical Engineering Study*. Additionally, we have been collaborating with Jeffrey Almeter during the preparation of the latest drawings, which are summarized below. We have also completed a review of the geotechnical aspects of these plans.

For our review, we were provided with the following:

1. Architectural plans dated February 20, 2023; Jeffrey Almeter.
2. Shoring plan and details dated January 30, 2023; Buker Engineering.
3. Civil plans dated February 7, 2023; Goldsmith Land Development Services.
4. Structural drawings dated February 2, 2023; D.S. Engineering.

The foundations for the new residence will bear on dense glacial till soils. Cantilever soldier pile shoring has been incorporated along the eastern, upslope, side of the excavation for the driveway and the southern portion of the house. The soldier piles along the driveway, to the south of the house, will be faced with concrete and will provide permanent support. The existing basement wall of the current house will remain in place to provide excavation shoring north of the soldier piles. The excavation shoring is shown on sheets SH1, SH2, and C-2.

As depicted on sheets C-2 and C-3, the eastern basement wall of the new house will be backfilled to provide permanent lateral support, with the backfill sloping up to the face of the lower wall located at the eastern property line. This is intended to provide appropriate permanent stability for that wall.

A new storm drain will be installed to the west of the house, extending southward to Southeast Maker Street. In order to install this storm drain, a section of the 4-foot rockery located along the southern edge of the lot will have to be removed and be rebuilt. This is illustrated on sheets C-2 and C-3. Removal and proper reconstruction of this small section of rockery will not adversely affect stability of the site or neighboring properties.

Updated Slope Stability Analyses: Attached to this letter are the results of our slope stability analyses through the residence and the western yard and manmade steep slope. For our analyses, we utilized the peak ground motions of the Maximum Considered Earthquake, which has a probability of occurring once in 2,475-years.

Not surprisingly, the slope stability analyses confirmed that a deep failure would not extend into the competent glacial till underneath the proposed residence in the worst case scenario (during a seismic event). At the western extent of your planned house, which is essentially the same as the west edge of the existing residence, the theoretical critical failure surface would extend only 4.5 feet below the existing grade.

Based on the provided drawings, the basement floor for your new residence has a finish floor elevation of 226.47 feet, which is 4 feet below the existing grade. The western footing for the new house will be bottomed at least 12 inches below the finish floor elevation, based on the Foundation Plan (sheet S2.0) and detail 101/S1.1. As a result, as a minimum, the western footing of the new house will bear below the critical slope stability failure surface. In addition, this footing (as well as the remainder of the house) will bear directly on competent glacial till that is not susceptible to instability.

Considering the above discussion, the residence will be protected against being undermined by a theoretical slope failure in the event of the low-probability Maximum Considered Earthquake. No additional mitigation measures are needed to protect your house for the design seismic event.

Review of Plans:

The plans that we reviewed have incorporated our recommendations for shoring, foundations, and permanent stability.

Statement of Risk: In order to satisfy the City of Mercer Island's requirements, a statement of risk is needed. As such, we make the following statement:

Provided the recommendations in this report are followed, it is our professional opinion that the recommendations presented in this report for the planned alterations will render the development as safe as if it were not located in a geologically hazardous area, and will not adversely impact critical areas on adjacent properties.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

Marc R. McGinnis, P.E.
Principal

2/28/2023

Attachment: Updated Slope Stability Analyses

cc: **Jeffrey Almeter**
via email: jeffrey.almeter@gmail.com

MRM:kg

22007 - Strand

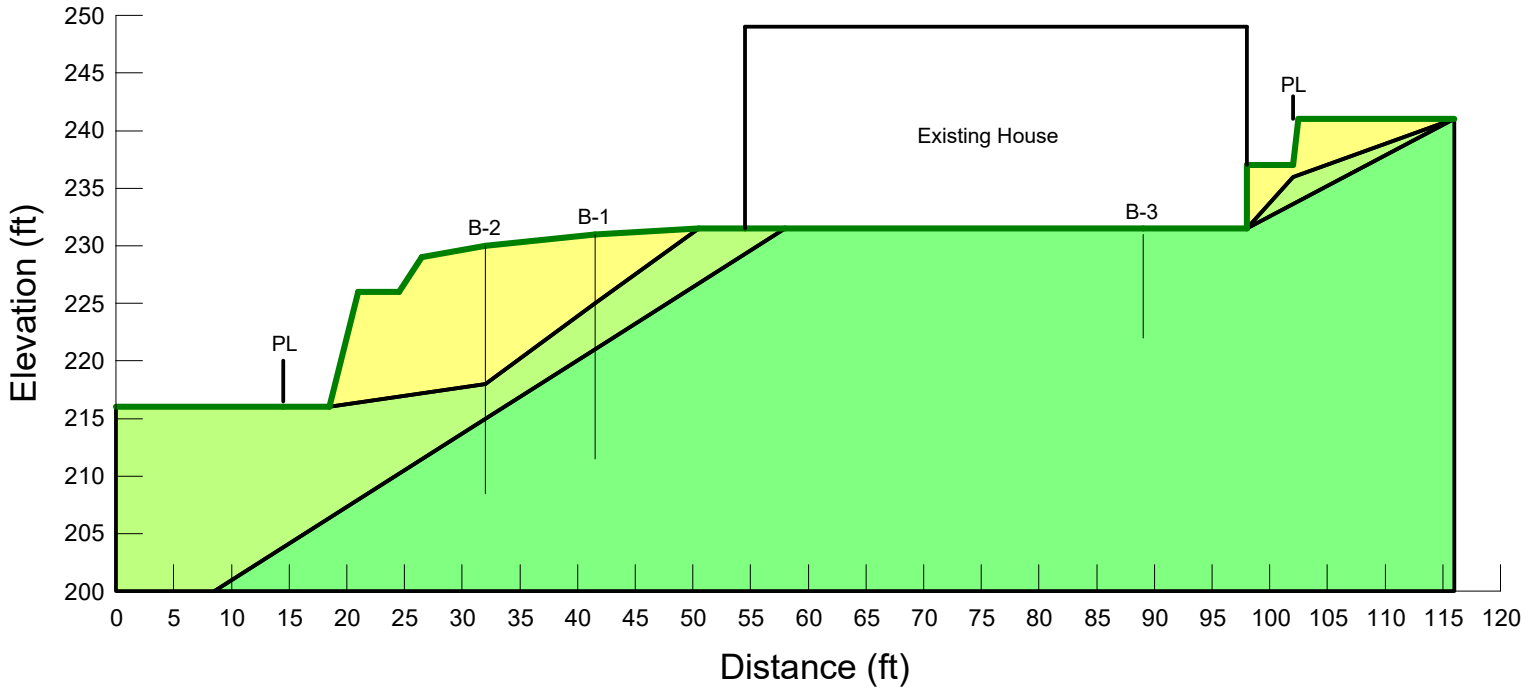
Cross Section A - A

Materials
- Loose FILL
- Medium-Dense Silty SAND
- Dense GLACIAL TILL

Name: Loose FILL
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Medium-Dense Silty SAND
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Dense GLACIAL TILL
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °



00538

22007 - Strand

Static

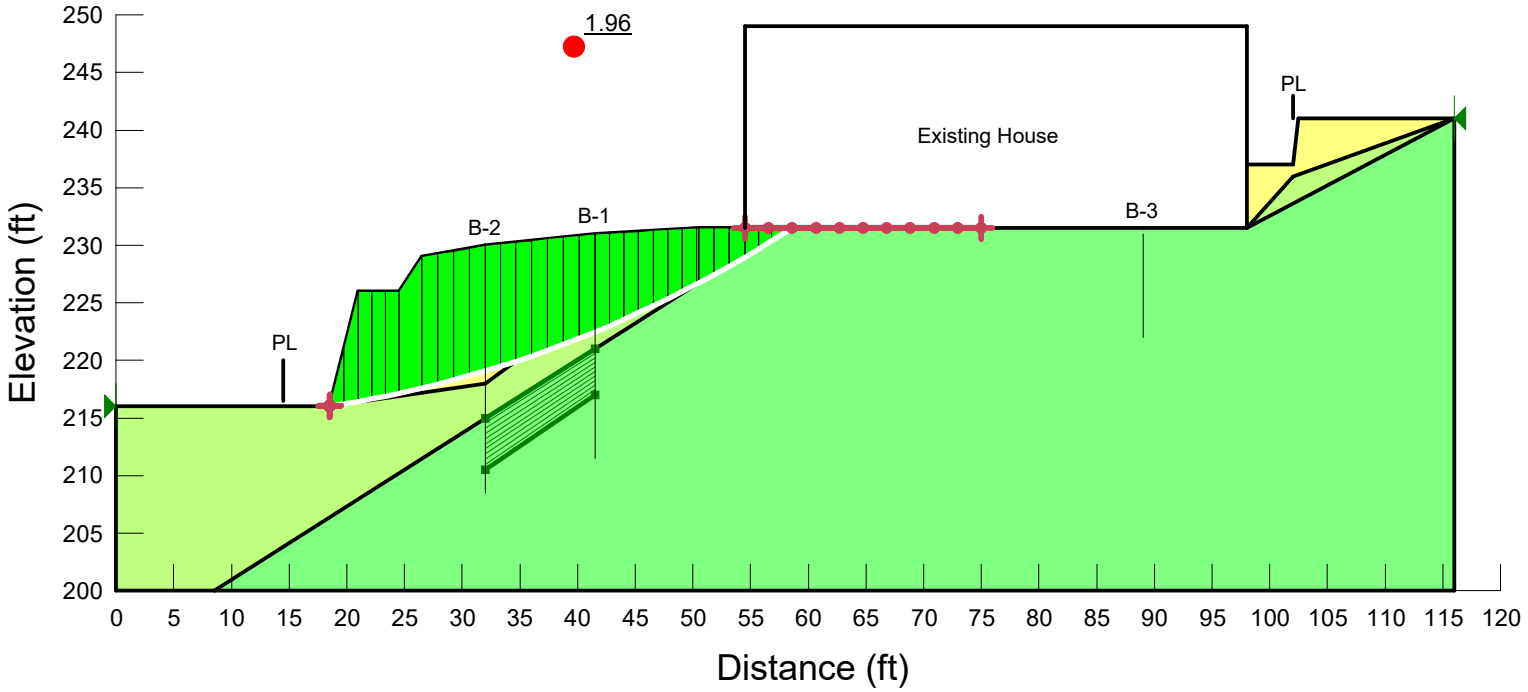
Materials

- Loose FILL
- Medium-Dense Silty SAND
- Dense GLACIAL TILL

Name: Loose FILL
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Medium-Dense Silty SAND
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Dense GLACIAL TILL
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °



Static

File Information

File Version: 8.15
Title: 22007 Slope Stability Analysis
Created By: Adam Moyer
Last Edited By: Adam Moyer
Revision Number: 19
Date: 2/21/2022
Time: 1:46:57 PM
Tool Version: 8.15.6.13446
File Name: 22007 Slope Stability Analysis - Strand.gsz
Directory: C:\Users\AdamM\Geotech Consultants\Shared Documents - Documents\2022 Jobs\22007 Strand (MRM)\
Last Solved Date: 2/21/2022
Last Solved Time: 1:47:00 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Static

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
PWP Conditions Source: (none)
Slip Surface
Direction of movement: Right to Left
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 1
Resisting Side Maximum Convex Angle: 1 °
Driving Side Maximum Convex Angle: 5 °

Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Loose FILL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Medium-Dense Silty SAND

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °

Dense GLACIAL TILL

Model: Mohr-Coulomb
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (18.5, 216) ft
Left-Zone Right Coordinate: (18.52409, 216.09635) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (54.5, 231.5) ft
Right-Zone Right Coordinate: (75, 231.5) ft
Right-Zone Increment: 10

Radius Increments: 10

Slip Surface Limits

Left Coordinate: (0, 216) ft
Right Coordinate: (116, 241) ft

Points

	X (ft)	Y (ft)
Point 1	0	216
Point 2	14.5	216
Point 3	18.5	216
Point 4	21	226
Point 5	24.5	226
Point 6	26.5	229
Point 7	32	230
Point 8	41.5	231
Point 9	54.5	231.5
Point 10	89	231.5
Point 11	98	231.5
Point 12	98	237
Point 13	102	237
Point 14	102.5	241
Point 15	116	241
Point 16	0	200
Point 17	116	200
Point 18	41.5	225
Point 19	41.5	221
Point 20	41.5	211.5
Point 21	32	218
Point 22	32	215
Point 23	32	208.5
Point 24	89	228
Point 25	89	222
Point 26	50.5	231.5
Point 27	8.5	200
Point 28	58	231.5
Point 29	102	236

Regions

	Material	Points	Area (ft^2)
Region 1	Loose FILL	3,4,5,6,7,8,26,18,21	243.75
Region 2	Medium-Dense Silty SAND	1,16,27,22,19,28,9,26,18,21,3,2	439.88
Region 3	Dense GLACIAL TILL	27,22,19,28,10,11,15,17	2,692.9
Region 4	Loose FILL	11,12,13,14,15,29	47

Region 5	Medium-Dense Silty SAND	11,29,15	21.5

Current Slip Surface

Slip Surface: 24
F of S: 1.96
Volume: 299.85379 ft³
Weight: 36,328.752 lbs
Resisting Moment: 2,337,459.4 lbs-ft
Activating Moment: 1,193,750.5 lbs-ft
Resisting Force: 21,342.102 lbs
Activating Force: 10,899.49 lbs
F of S Rank (Analysis): 1 of 1,331 slip surfaces
F of S Rank (Query): 1 of 1,331 slip surfaces
Exit: (18.5, 216) ft
Entry: (58.6, 231.5) ft
Radius: 102.6123 ft
Center: (2.3753023, 317.33744) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	19.125	216.10341	0	275.4314	159.02039	0
Slice 2	20.375	216.31818	0	826.53313	477.19913	0
Slice 3	21.583333	216.54071	0	1,090.2522	629.45742	0
Slice 4	22.75	216.77005	0	1,065.331	615.06911	0
Slice 5	23.916667	217.01348	0	1,037.2777	598.87254	0
Slice 6	25.5	217.37006	0	1,164.5122	672.33146	0
Slice 7	27.1875	217.77271	0	1,296.1973	748.35986	0
Slice 8	28.5625	218.12551	0	1,276.3126	736.87941	0
Slice 9	29.9375	218.49869	0	1,252.3514	723.0454	0
Slice 10	31.3125	218.89249	0	1,224.7447	707.10667	0
Slice 11	32.6504	219.29542	0	1,189.4182	686.71092	0
Slice 12	33.951199	219.70661	0	1,147.1327	662.29737	0
Slice 13	35.291439	220.15061	0	1,103.87	744.56968	0
Slice 14	36.671119	220.62889	0	1,057.7084	713.43329	0
Slice 15	38.050799	221.12933	0	1,009.7027	681.0531	0
Slice 16	39.43048	221.65228	0	960.27525	647.71384	0
Slice 17	40.81016	222.19812	0	909.77919	613.65381	0
Slice 18	42.131406	222.74217	0	857.46396	578.36674	0
Slice						

19	43.394218	223.2829	0	803.57102	542.01549	0
Slice 20	44.65703	223.84381	0	749.33631	505.43373	0
Slice 21	45.919842	224.42528	0	694.75797	468.62017	0
Slice 22	47.182654	225.02768	0	639.76934	431.52987	0
Slice 23	48.445466	225.65144	0	584.24149	394.07586	0
Slice 24	49.708278	226.29698	0	527.98643	356.13134	0
Slice 25	50.419842	226.66773	0	473.00619	396.89932	100
Slice 26	51.166667	227.07055	0	431.44994	362.02949	100
Slice 27	52.5	227.80413	0	355.43915	298.24886	100
Slice 28	53.833333	228.5638	0	277.54412	232.88717	100
Slice 29	55.083333	229.29947	0	202.59002	169.99321	100
Slice 30	56.25	230.00858	0	130.48333	109.48851	100
Slice 31	57.416667	230.73921	0	56.091374	47.066251	100
Slice 32	58.3	231.30499	0	-3.909711	-3.2806371	100

22007 - Strand

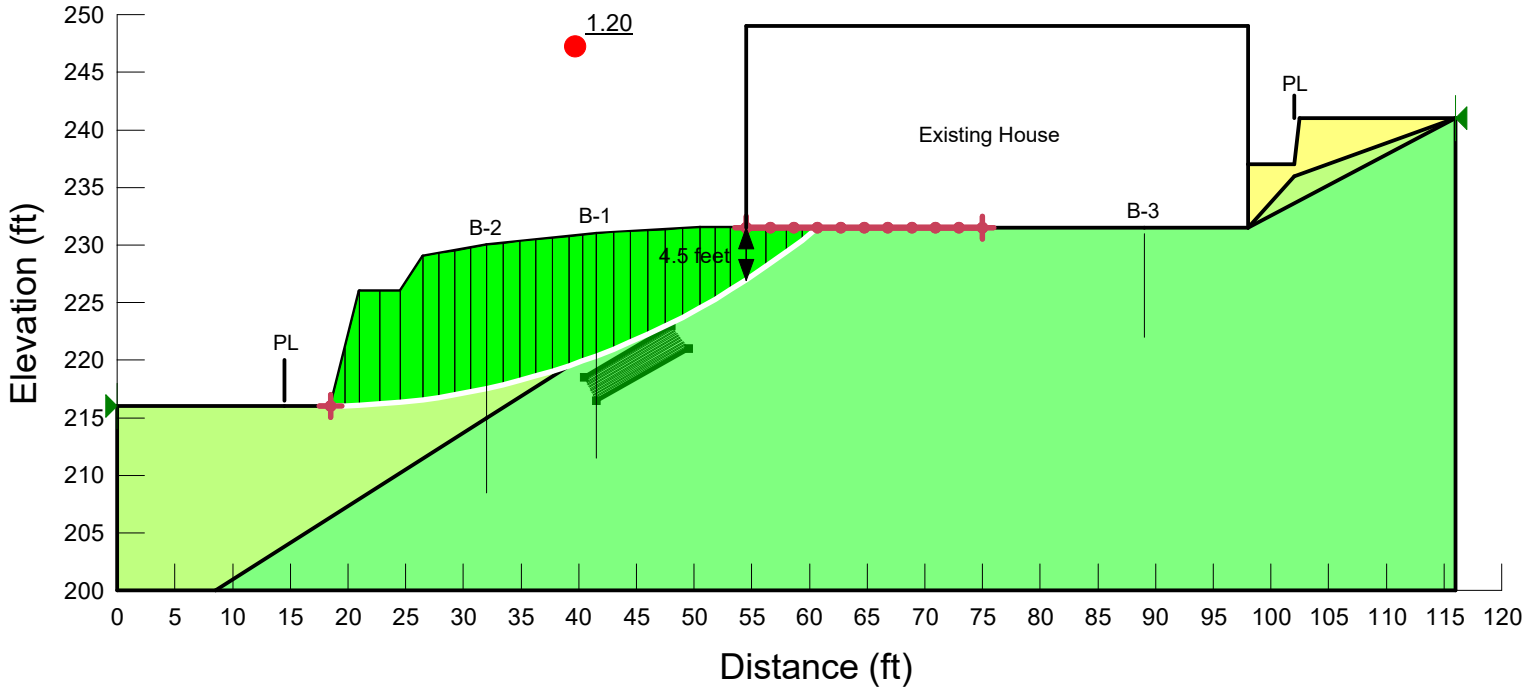
Seismic

Materials
- Loose FILL
- Medium-Dense Silty SAND
- Dense GLACIAL TILL

Name: Loose FILL
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Medium-Dense Silty SAND
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Dense GLACIAL TILL
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °



Seismic

File Information

File Version: 8.15
Title: 22007 Slope Stability Analysis
Created By: Adam Moyer
Last Edited By: Adam Moyer
Revision Number: 27
Date: 12/6/2022
Time: 9:33:42 AM
Tool Version: 8.15.6.13446
File Name: 22007 Slope Stability Analysis - Strand.gsz
Directory: C:\Users\AdamM\Geotech Consultants\Shared Documents - Documents\2022 Jobs\22007 Strand (MRM)\
Last Solved Date: 12/6/2022
Last Solved Time: 9:33:44 AM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Seismic

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
PWP Conditions Source: (none)
Slip Surface
Direction of movement: Right to Left
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 1
Resisting Side Maximum Convex Angle: 1 °
Driving Side Maximum Convex Angle: 5 °

Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Loose FILL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Medium-Dense Silty SAND

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °

Dense GLACIAL TILL

Model: Mohr-Coulomb
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Point
Left Coordinate: (18.5, 216) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (54.53757, 231.5) ft
Right-Zone Right Coordinate: (75, 231.5) ft
Right-Zone Increment: 10
Radius Increments: 20

Slip Surface Limits

Left Coordinate: (0, 216) ft
Right Coordinate: (116, 241) ft

Seismic Coefficients

Horz Seismic Coef.: 0.333

Points

	X (ft)	Y (ft)
Point 1	0	216
Point 2	14.5	216
Point 3	18.5	216
Point 4	21	226
Point 5	24.5	226
Point 6	26.5	229
Point 7	32	230
Point 8	41.5	231
Point 9	54.5	231.5
Point 10	89	231.5
Point 11	98	231.5
Point 12	98	237
Point 13	102	237
Point 14	102.5	241
Point 15	116	241
Point 16	0	200
Point 17	116	200
Point 18	41.5	225
Point 19	41.5	221
Point 20	41.5	211.5
Point 21	32	218
Point 22	32	215
Point 23	32	208.5
Point 24	89	228
Point 25	89	222
Point 26	50.5	231.5
Point 27	8.5	200
Point 28	58	231.5
Point 29	102	236

Regions

	Material	Points	Area (ft²)
Region 1	Loose FILL	3,4,5,6,7,8,26,18,21	243.75

Region 2	Medium-Dense Silty SAND	1,16,27,22,19,28,9,26,18,21,3,2	439.88
Region 3	Dense GLACIAL TILL	27,22,19,28,10,11,15,17	2,692.9
Region 4	Loose FILL	11,12,13,14,15,29	47
Region 5	Medium-Dense Silty SAND	11,29,15	21.5

Current Slip Surface

Slip Surface: 64
F of S: 1.20
Volume: 366.33984 ft³
Weight: 45,090.459 lbs
Resisting Moment: 2,099,761.6 lbs-ft
Activating Moment: 1,748,576.3 lbs-ft
Resisting Force: 29,487.391 lbs
Activating Force: 24,560.961 lbs
F of S Rank (Analysis): 1 of 231 slip surfaces
F of S Rank (Query): 1 of 231 slip surfaces
Exit: (18.5, 216) ft
Entry: (60.676299, 231.5) ft
Radius: 67.551467 ft
Center: (17.612953, 283.54564) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	19.125	216.01399	0	306.17435	206.51721	0
Slice 2	20.375	216.05357	0	951.95445	642.10139	0
Slice 3	21.875	216.13446	0	1,340.734	904.33652	0
Slice 4	23.625	216.26798	0	1,436.7037	969.06889	0
Slice 5	25.5	216.46374	0	1,707.9574	1,152.0318	0
Slice 6	27.1875	216.67976	0	1,933.645	1,304.26	0
Slice 7	28.5625	216.89114	0	1,920.7018	1,295.5297	0
Slice 8	29.9375	217.13166	0	1,844.2389	1,243.9549	0
Slice 9	31.3125	217.40163	0	1,709.1672	1,152.8478	0
Slice 10	32.716233	217.70833	0	1,523.048	1,027.3088	0
Slice 11	34.148698	218.05347	0	1,308.2256	882.40931	0
Slice 12	35.581163	218.43196	0	1,096.3045	739.46674	0
Slice 13	37.013629	218.84436	0	906.90543	611.71544	0
Slice 14	38.446094	219.29135	0	751.81302	507.10429	0
Slice 15	39.746745	219.72626	0	1,072.3714	899.82648	100
Slice 16	40.915582	220.14375	0	930.25772	780.57891	100
Slice	42.25	220.65234	0	794.82159	666.9345	100

17						
Slice 18	43.75	221.26086	0	676.02524	567.25253	100
Slice 19	45.25	221.9119	0	588.63268	493.92146	100
Slice 20	46.75	222.6068	0	524.68908	440.26641	100
Slice 21	48.25	223.34711	0	476.74321	400.03506	100
Slice 22	49.75	224.1345	0	438.4964	367.94217	100
Slice 23	51.166667	224.92177	0	403.31875	338.42462	100
Slice 24	52.5	225.70544	0	366.58469	307.60108	100
Slice 25	53.833333	226.53107	0	326.72002	274.15064	100
Slice 26	55.375	227.54462	0	272.74354	228.859	100
Slice 27	57.125	228.76577	0	197.6255	165.82748	100
Slice 28	58.669075	229.90904	0	110.76831	92.945651	100
Slice 29	60.007224	230.96059	0	12.083116	10.138938	100