

September 1, 2015

Summit Powder Mountain c/o Ms. Andrea Milner 3632 North Wolf Creek Drive Eden, Utah 84310

IGES Project No. 01628-008

Subject: Response to Review Comments - Geology Geotechnical Investigation The Ridge Nests Development Powder Mountain Resort Weber and Cache Counties, Utah

Ms. Milner:

As requested, IGES has prepared the following response to recent review comments regarding the referenced geotechnical report for the Ridge Nests development, part of the larger Powder Mountain Resort expansion project in Weber County, Utah. The review comments to be addressed were prepared by Simon Associates LLC (SA) in a letter dated August 18, 2015. The review letter by SA was intended to address Lot 13; however, in consideration that the comments by SA would also be applicable to several other lots, it is the intention of IGES to address the comments with respect to the entire Ridge Nests development. For convenience, the review comments will be presented first, followed by our response.

Comment No. 1

"In accordance with the recommendations provided in the Western Geologic (2012) development report, SA recommends Weber County request IGES perform a slope stability analysis as stipulated in the Geologic Hazard Study for the development (Western Geologic, 2012), since the slope at the building envelope is greater than 20%."

Response to Comment No. 1

The global stability of the slope was modeled using gSTABL7 slope stability software. Bishop's Method and Janbu's Simplified method was used to model the slope, as appropriate. For our analysis, we have assessed two representative sections, Section A-A' and Section B-B', illustrated on Plate 1 (*Geologic Map*) and the *Geologic Cross-Sections*, Figure 1, attached. Calculations for stability were developed by searching for the minimum factor-of-safety for both a circular-type failure and a block-type (translational) failure. For the circular analysis model, arcuate failure surfaces and homogenous earth materials were assumed. For the block analysis, anisotropic strength parameters in the bedrock was assumed, based on the apparent dip of bedding. A minimum static factor-of-safety of 1.5 and seismic factor-of-safety of 1.0 (global stability) was considered acceptable for this project considering the available information and design assumptions.

Powder Mountain Resort, Weber County, Utah Ridge Nests Development

The prevailing earth materials on the north side of the development, which forms the steepest part of the site, consist of relatively competent, moderately weathered dolomite. The software package RocLab (V. 1.033), which is based on the Hoek-Brown failure Criterion (1997) was utilized to estimate equivalent strength parameters (friction angle and cohesion) to be used in conventional limit-equilibrium slope stability software. Input parameters utilized to estimate reasonable strength parameters were as follows:

- Uniaxial Compressive Strength: 1,500 ksf
- GSI: 45 (geologic strength index)
- Mi Value: 9 (intact rock parameter)
- D: 0.7 (disturbance factor)
- MR: 425 (Modulus Ratio, used to estimate the intact rock deformation modulus, Ei)

Based on these input parameters, RocLab indicates an equivalent cohesion of 44.844 ksf and a friction angle of 20.1 degrees for the dolomite. For our analysis, IGES has conservatively reduced the estimated equivalent cohesion by approximately 20% to 35 ksf. For our anisotropic analysis, strength along bedding and/or jointing has been estimated to have a friction angle of 42 degrees and a cohesion of zero. The output file for RocLab is attached.

The surficial unit described on the geologic map as Qc-sw is undifferentiated colluvium and slope wash. This material is generally very coarse and bouldery; constituents generally have a moderate degree of angularity. As such, the strength of this material has been modeled as having a friction angle of 42 degrees and a cohesion of zero.

For the seismic (pseudo-static) assessment of the slopes, the seismic coefficient k_h is modeled as equal to 50% of the peak ground acceleration (PGA) resulting from a MCE seismic event (2PE50). From our referenced geotechnical report, the PGA resulting from a 2PE50 seismic event is taken as 0.33g. Therefore, for seismic analysis we have adopted a seismic coefficient of 0.165g.

Based on our analysis, the global stability of the north-facing natural slope meets the minimum factors-of-safety of 1.5 and 1.0 for static and seismic conditions, respectively. The results of the global stability analyses are attached.

Comment No. 2

"Figure A-2, Geotechnical Map, of the September 16, 2014 IGES report depicts "...the relative locations of the various geologic units..." described in the September 16, 2014, IGES report. SA recommends Weber County request IGES:

- a. Include, for a reasonable distance, geologic units of adjacent properties.
- b. Evaluate whether any potential off-site geologic hazards may impact the subject property; the evaluation should be completed under the direction of an engineering geologist."

Response to Comment No. 2a

A geologic investigation of Lot 13 and the immediate area surrounding the Ridge Nests subdivision was conducted by an IGES engineering geologist between August 26 and 27, 2015. Plate 1 (*Geologic Map*) is an updated, expanded version of the original Figure A-2, *Geotechnical Map*, from the IGES geotechnical report. The geologic mapping has been extended to several hundred feet in all directions from the original map, and minor modifications to the original geologic contacts have been made based upon the findings of the investigation. Additionally, bedding and jointing attitudes, and the approximate locations and orientations of identified faults are presented on the map. Two geologic cross-sections providing a representative picture of the subsurface of the property are illustrated on Figure 1. A brief description of the findings of the geologic investigation follows.

A prominent bedrock outcrop of the Dolomite Member of the Cambrian St. Charles Limestone near the southwestern corner of Lot 27 provided an understanding of the bedrock stratigraphy. At this location, approximately 45 feet of bedrock is continuously exposed, and displays four distinct lithologic units:

- 1. Unit 1: The uppermost unit is a dark gray, sparry dolomite found to contain abundant round, curved, whitish-yellow shell fragments in massive blocks. The exposed thickness of this unit at this location is approximately 3 feet.
- 2. Unit 2: Immediately underlying Unit 1 is a dark gray to light gray sparry dolomite containing faint laminations in thickly bedded blocks. Within the unit are distinct dark gray beds that contain abundant rounded *Girvanella* nodules up to 1 centimeter in diameter. Bedding becomes more prominent with depth in this unit, and this unit is seen to be approximately 10 to 12 feet thick.
- 3. Unit 3: Immediately underlying Unit 2 is a dark gray, sparry dolomite that is transitional between the overlying two units, in that it contains some laminations and curved shelly material. The unit is thickly to moderately bedded, and is distinct from the overlying units in that it contains abundant thin yellow stringers of calcium carbonate. The unit is seen to be approximately 20 to 25 feet thick.
- 4. Unit 4: The basal unit in the exposed outcrop is a light gray to pinkish gray, finely sparry dolomite with a highly variegated, mottled coloration in irregular, elongated lobes. Distinct to this unit is the presence of small vugs up to 2 inches in diameter, commonly filled with recrystallized dolomite. The exposed thickness of this unit at this location is approximately 5 feet.

Bedding at this outcrop was found to strike at N24°W and dip at 25°NE, which was largely characteristic of the bedding found on the property as a whole. Across the property, the bedrock was found to have blocky jointing, with the two major joint sets being orthogonal to one another. One joint set was parallel to the bedding, and the other was perpendicular to the bedding, dipping steeply to the southwest.

Bedrock for the property at large was found to be largely constrained between the road that forms the northern boundary of the Ridge Nests property and North Powder Mountain Road to the south. Bounding the bedrock in all directions for at least several hundred feet laterally are Quaternary deposits that consist of undifferentiated colluvium and slopewash. Clasts were

found to be exclusively Precambrian quartzite and conglomerate, rounded to subrounded, and up to 6 feet in diameter. These clasts were found to be in a variety of colors, but graded between pink and tan and gray. Total thickness of the Quaternary colluvial/slopewash deposits on and immediately surrounding the property is unknown, but is noted by Sorenson and Crittenden, Jr (1979) to be between 0 and 30 meters thick. When present on the property, these deposits appear to be a relatively thin veneer of possibly 5 feet or less, as the transitions to the bedrock are abrupt.

Response to Comment No. 2b

No landslide deposits were found either on the property or in the immediate vicinity of the property. It is therefore concluded that landslide risk is low and are not expected to adversely impact the subject property.

A semi-continuous exposure of bedrock is present along the southern side of the road that forms the northern boundary for the Ridge Nests property. Along this road, two faults were identified, near the northwest corner of Lot 10 and in between Lots 10 and 11, respectively (see Plate 1 and representative photos on Figure 2). The fault adjacent to the northwest corner of Lot 10 was found to be a subvertical normal fault that juxtaposed Unit 1 and Unit 3, with a minimum of approximately 10 feet of offset (Photo 1). Along the fault trace was a dark red silty material, possibly gouge, that was found linearly along the exposed road cut from the base of the exposed outcrop to just below a large pine tree sitting atop the outcrop (Photo 2). The west side (footwall) of the fault contained bedding that had been tilted in a manner not seen elsewhere on the property, steeply dipping (>45°) to the southeast, while the east side (hanging wall) of the fault contained bedding attitudes that were similar to the bedrock elsewhere on the property (dipping between 15 and 25° to the northeast). This fault is considered to be inactive, due to several factors:

- 1. The fault extends up to, but not through, the overlying soil profile.
- 2. Abundant vegetation is present above the fault trace, and is not offset or disturbed in any way.
- 3. The topographic surface has a consistent slope across the fault trace, and there is no evident associated fault scarp.
- 4. The bedrock is Cambrian in age, and has likely undergone much deformation since deposition, including faulting. The fact that the footwall block shows such drastic deformation not seen elsewhere on the property suggests that the displacement happened in the ancient geologic past, and subsequent geomorphic processes have returned the bedrock block back to stable topographic conditions across the fault trace.

A second possible fault was encountered approximately 60 feet east of the first fault along the road, between Lots 10 and 11. This possible fault had a much gentler dip (32°NE) than the first, though it passed through an area of disrupted, highly weathered bedrock which did not have clear-cut offset or deformation (Photo 3). However, a couple blocks west of the feature seen in the photo show abnormally tilted bedding akin to that seen in the first fault, though these may just have been artificially rotated during road excavation. A dark red to gray silty material, possibly fault gouge, was found along a linear trace from the base of the slope to the base of a highly weathered bedrock overlay, found immediately below the topsoil. It is possible that this

feature is merely a joint that has been infilled with surficial materials. If it is indeed a fault, the fault is considered inactive for the same reasons specified above.

Based on the geologic evidence presented on the attached *Geologic Map* (Plate 1) and the associated geologic cross-sections, and the slope stability assessment presented herein, the following conclusions are made:

- 1. The stability of the slopes are not adversely impacted by the geologic, stratigraphic, or hydrologic conditions observed.
- 2. There are no evident potential on-site or off-site geologic hazards that can adversely affect the subject property, and the site is considered suitable for development from a geologic hazards standpoint.
- 3. The site is considered suitable for development from a geotechnical perspective, provided the recommendations presented in the referenced 2014 geotechnical report and subsequent addenda are incorporated into the design and construction of the project.

Closure

We appreciate the opportunity to provide you with our services. If you have any questions please contact the undersigned at your convenience (801) 748-4044.



David A. Glass, P.E. Senior Geotechnical Engineer

Attachments:

References Figure 1 – Geologic Cross-Sections Figure 2 – Photos (Normal Faults) Plate 1 – Geologic Map Slope Stability Analysis RocLab Output



Peter E. Doumit, P.G., C.P.G. Senior Geologist

References

- Hoek, E., and Brown, E.T., 1997, Practical Estimates of Rock Mass Strength, in International Journal of Rock Mechanics & Mining Science & Geomechanics Abstracts, 34(8), 1165-1186.
- IGES, Inc., 2014, Geotechnical Investigation, The Ridge Nests Development, Powder Mountain Resort, Weber and Cache Counties, Utah Project No. 01628-008, dated September 16, 2014.
- IGES, Inc., 2015a, Response to Review Comments, Geotechnical Investigation, The Ridge Nests Development, Powder Mountain Resort, Weber and Cache Counties, Utah Project No. 01628-008, dated April 7, 2015.
- IGES, Inc., 2015b, Addendum to Geotechnical Report, The Ridge Nests Development, Powder Mountain Resort, Weber and Cache Counties, Utah Project No. 01628-008, dated August 18, 2015.
- Sorensen, M.L., and Crittenden, M.D., Jr., 1979, Geologic map of the Huntsville quadrangle, Weber and Cache Counties, Utah: U.S. Geological Survey Geologic Quadrangle Series Map GQ-1503, scale 1:24,000.
- Western Geologic, 2012, Report: Geologic Hazards Reconnaissance, Proposed Area 1 Mixed-Use Development, Powder Mountain Resort, Weber County, Utah, dated August 28, 2012.



material, some laminations; thickly to moderately bedded; abundant yellow CaCO3 stringers. 4) Light gray dolomite with vugs; highly variegated, mottled coloration.

			FIGURE 1							
			CROSS	S-SEC	TIONS					
0	6	0	GEOLOGIC INVESTIGATION							
			THE RIDGE NESTS DEVELOPMEN							
			POWDER MO	OUNTAI	N RESORT					
			WEBER COUNTY, UTAH							
			DATE: 8/31/2015	SCALE:	AICES'					
			FILE: 01628-008	1"=30'	VIGES					

South







Geotechnical Investigation The Ridge Nests Development Powder Mountain Resort Weber County, Utah

SITE PHOTOS

Figure

2





Summit/Ridge Nests; A-A'; Static

C:\DOCUME~1\DAVIDG\DESKTOP\01628008\A1.PL2 Run By: DAG 9/1/2015 1:42PM



		*** GSTABL	.7 ***			10	0.00	8712.00	146.00	8776.0	0	1
	** GSTABL7	by Garry H.	Gregory, P	.E. **		11	140.00	0770.00	1/0.00	0/03.0	0	T
** Original Versio	n 1.0, Janua	ry 1996; Cu	urrent Versi	on 2.002,	1	User Speci	fied Y-Orig	in = 87	700.00(ft)			
(All	Rights Reser	ved-Unautho	orized Use P	rohibited)		ISOTROPIC S	OIL PARAMET	ERS				
**************************************	************* SLOPE STABIL op, Simplifi	ITY ANALYSI ed Janbu, c	SYSTEM	d of Slices.		2 Type(s)	of Soil					
(Includes Spe Including Pie Nonlinear Und	ncer & Morge r/Pile, Rein rained Shear	nstern-Pric forcement, Strength,	e Type Anal Soil Nail, Curved Phi	ysis) Tieback, Envelope,		Soil Tota Type Unit No. (pcf	l Saturate Wt. Unit Wt) (pcf)	d Cohesion . Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water Surfaces, Pseudo-Static Earthquake, and Applied Force Options.				1	1 145. 2 135.	0 150.0 0 140.0	35000.0 0.0	20.0 42.0	0.00 0.00	0.0 0.0	0 0	
Analysis Run Date: Time of Run: Run By:	9/1/20 1:42PM DAG	15 I				A Critical Technique	Failure Su For Generat	rface Search ing Circula	ning Methc r Surfaces	od, Using s, Has Bee	A Random n Specifi	ed.
Input Data Filename: C:Al. Output Filename: C:Al.OUT Unit System: English						2500 Trial	Surfaces H	ave Been Ger	nerated.			
Plotted Output Filen	ame: C:Al.P	PLT				50 Surfa Along The	ce(s) Initi Ground Surf	ate(s) From ace Between and	Each Of X = 80. X = 170.	50 Poin .00(ft) .00(ft)	ts Equall	y Spaced
PROBLEM DESCRIPTION:	Summit/Rid	lge Nests; A	A-A'; Static			Each Surfa	ce Terminat	es Between and	X = 190. X = 320.	00(ft) 00(ft)		
BOUNDARY COORDINATES						Unless Fur At Which A	ther Limita Surface Ex	tions Were I tends Is Y	Imposed, T = 0.	The Minimu .00(ft)	m Elevati	on
9 Top Boundari 11 Total Boundari	es es					25.00(ft)	Line Segmen	ts Define Ea	ach Trial	Failure S	urface.	
Boundary X-Left No. (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd		Following Failure Su	Is Displaye rfaces Eval	d The Most (uated.	Critical C)f The Tri	al	
$\begin{array}{ccccccc} 1 & 0.00 \\ 2 & 146.00 \\ 3 & 170.00 \\ 4 & 176.00 \\ 5 & 179.00 \\ 6 & 228.00 \end{array}$	8717.00 8781.00 8783.00 8784.00 8793.00 8817.00	146.00 170.00 176.00 179.00 228.00 264.00	8781.00 8783.00 8784.00 8793.00 8817.00 8810.00	2 2 1 1 1		* * Safety	Factors Ar	e Calculated	d By The M	Nodified B	ishop Met	hod * *
7 264.00 8 282.00 9 298.00	8810.00 8804.00 8804.00	282.00 298.00 350.00	8804.00 8804.00 8792.00	1 1 1		Total Numb	er of Trial	Surfaces Ev	valuated =	= 2500		

Statistical Data On All Valid FS Values: FS Max = 187.868 FS Min = 27.754 FS Ave = 58.595 Standard Deviation = 26.045 Coefficient of Variation = 44.45 %

**** END OF GSTABL7 OUTPUT ****

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	8752.07
2	101.75	8739.73
3	125.44	8731.77
4	150.22	8728.47
5	175.18	8729.95
6	199.40	8736.16
7	221.98	8746.87
8	242.12	8761.70
9	259.06	8780.08
10	272.18	8801.36
11	274.16	8806.61

Circle Center At X = 155.00 ; Y = 8858.94 ; and Radius = 130.56

Factor of Safety *** 27.754 ***

Individual data on the 17 slices

			Water	Water	Tie	Tie	Earthqu	ıake	
			Force	Force	Force	Force	Ford	ce Sur	charge
Slice	Width	Weight	Top	Bot	Norm	Tan	Hor	Ver	Load
No.	(ft)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
1	5.0	1678.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	16.8	31833.5	0.0	0.0	0.	0.	0.0	0.0	0.0
3	23.7	105486.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	20.6	136369.9	0.0	0.0	0.	0.	0.0	0.0	0.0
5	4.2	31918.2	0.0	0.0	0.	0.	0.0	0.0	0.0
6	19.8	151921.4	0.0	0.0	Ο.	0.	0.0	0.0	0.0
7	5.2	40286.7	0.0	0.0	Ο.	0.	0.0	0.0	0.0
8	0.8	6405.8	0.0	0.0	Ο.	0.	0.0	0.0	0.0
9	3.0	25210.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	20.4	190607.4	0.0	0.0	Ο.	0.	0.0	0.0	0.0
11	22.6	219461.5	0.0	0.0	Ο.	0.	0.0	0.0	0.0
12	6.0	57951.4	0.0	0.0	Ο.	0.	0.0	0.0	0.0
13	14.1	121033.3	0.0	0.0	Ο.	0.	0.0	0.0	0.0
14	16.9	102466.0	0.0	0.0	Ο.	0.	0.0	0.0	0.0
15	4.9	18920.8	0.0	0.0	Ο.	0.	0.0	0.0	0.0
16	8.2	16489.8	0.0	0.0	0.	0.	0.0	0.0	0.0
17	2.0	849.6	0.0	0.0	0.	0.	0.0	0.0	0.0

Summit/Ridge Nests; A-A'; Pseudo-Static

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*** GSTABL7 ***	10 0.00 8712.00 146.00 8776.00 1 11 146.00 8776.00 170.00 8783.00 1
** GSTABL7 by Garry H. Gregory, P.E. **	
** Original Version 1.0, January 1996; Current Version 2.002, 1	User Specified Y-Origin = 8700.00(ft)
(All Rights Reserved-Unauthorized Use Prohibited)	ISOTROPIC SOIL PARAMETERS
**************************************	2 Type(s) of Soil
Modified Bishop, Simplified Janbu, or GLE Method of Slices. (Includes Spencer & Morgenstern-Price Type Analysis) Including Pier/Pile, Reinforcement, Soil Nail, Tieback, Nonlinear Undrained Shear Strength, Curved Phi Envelope, Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water	Soil Total Saturated Cohesion Friction Pore Pressure Piez. Type Unit Wt. Unit Wt. Intercept Angle Pressure Constant Surface No. (pcf) (pcf) (psf) (deg) Param. (psf) No.
Surfaces, Pseudo-Static Earthquake, and Applied Force Options.	1 145.0 150.0 35000.0 20.0 0.00 0.0 0 2 135.0 140.0 0.0 42.0 0.00 0.0 0

Analysis Run Date: 9/1/2015 Time of Run: 1:57PM Run Bv: DAG	A Horizontal Earthquake Loading Coefficient Of0.170 Has Been Assigned
Input Data Filename: C:A1P. Output Filename: C:A1P.OUT Unit System: English	A Vertical Earthquake Loading Coefficient Of0.000 Has Been Assigned
Plotted Output Filename: C:AlP.PLT 1	Cavitation Pressure = 0.0(psf)
	Trial Failure Surface Specified By 11 Coordinate Points
PROBLEM DESCRIPTION: Summit/Ridge Nests; A-A'; Pseudo-Static	Point X-Surf Y-Surf No. (ft) (ft)
BOUNDARY COORDINATES	1 80.00 8752.07 2 101.75 8739.73 3 125.44 8731.77 4 150.22 8728.47
9 Top Boundaries 11 Total Boundaries	5 175.18 8729.95 6 199.40 8736.16 7 221.98 8746.87 8 242.12 8761.70
Boundary X-Left Y-Left X-Right Y-Right Soil Type No. (ft) (ft) (ft) Below Bnd	9 259.06 8780.08 10 272.18 8801.36 11 274.16 8806.61
1 0.00 8717.00 146.00 8781.00 2 2 146.00 8781.00 170.00 8783.00 2	Circle Center At X = 155.00 ; Y = 8858.95; and Radius = 130.57
3 170.00 8783.00 176.00 8784.00 1 4 176.00 8784.00 179.00 8793.00 1 5 179.00 8793.00 228.00 8817.00 1 6 228.00 8817.00 264.00 8810.00 1 7 264.00 8810.00 282.00 8804.00 1 8 282.00 8804.00 298.00 8804.00 1	\star \star Factor Of Safety Is Calculated By The Modified Bishop Method \star \star

9

298.00

8804.00

350.00

8792.00

1

Factor Of Safety For The Preceding Specified Surface = 18.492

Table 1 - Individual Data on the 17 Slices

			Water Force	Water Force	Tie Force	Tie Force	Earthqu Forc	ake Sur	charge
Slice	Width	Weight	qoT	Bot	Norm	Tan	Hor	Ver	Load
No.	(ft)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
1	5.0	1678.0	0.0	0.0	0.0	0.0	285.3	0.0	0.0
2	16.8	31849.7	0.0	0.0	0.0	0.0	5414.5	0.0	0.0
3	23.7	105456.4	0.0	0.0	0.0	0.0	17927.6	0.0	0.0
4	20.6	136383.8	0.0	0.0	0.0	0.0	23185.2	0.0	0.0
5	4.2	31885.7	0.0	0.0	0.0	0.0	5420.6	0.0	0.0
6	19.8	151943.4	0.0	0.0	0.0	0.0	25830.4	0.0	0.0
7	5.2	40285.1	0.0	0.0	0.0	0.0	6848.5	0.0	0.0
8	0.8	6405.8	0.0	0.0	0.0	0.0	1089.0	0.0	0.0
9	3.0	25210.5	0.0	0.0	0.0	0.0	4285.8	0.0	0.0
10	20.4	190649.4	0.0	0.0	0.0	0.0	32410.4	0.0	0.0
11	22.6	219387.1	0.0	0.0	0.0	0.0	37295.8	0.0	0.0
12	6.0	57994.2	0.0	0.0	0.0	0.0	9859.0	0.0	0.0
13	14.1	121052.6	0.0	0.0	0.0	0.0	20578.9	0.0	0.0
14	16.9	102471.3	0.0	0.0	0.0	0.0	17420.1	0.0	0.0
15	4.9	18906.4	0.0	0.0	0.0	0.0	3214.1	0.0	0.0
16	8.2	16500.0	0.0	0.0	0.0	0.0	2805.0	0.0	0.0
17	2.0	849.0	0.0	0.0	0.0	0.0	144.3	0.0	0.0
		*** T _blo	2 Dogo	Ctrogg	Data on t	-ho 17	Clicost!	*	

'Table 2 - Base Stress Data on the 17 Slices*

Slice	Alpha	X-Coord.	Base	Available	Mobilized
No.	(deg)	Slice Cntr	Leng.	Shear Strength	Shear Stress
*		(ft)	(ft)	(psf)	(psf)
1	-29.56	82.49	5.72	312.52	-136.22
2	-29.56	93.36	19.29	36093.93	-812.12
3	-18.57	113.60	24.99	36864.02	-1342.02
4	-7.59	135.72	20.74	37512.71	-865.57
5	-7.59	148.11	4.26	37849.31	-977.06
б	3.39	160.11	19.81	37751.86	456.22
7	3.39	172.59	5.19	37786.53	468.86
8	14.38	175.59	0.85	37653.34	1937.37
9	14.38	177.50	3.10	37867.54	2037.36
10	14.38	189.20	21.06	38208.71	2250.41
11	25.38	210.69	24.99	38179.86	3764.24
12	36.37	224.99	7.48	37956.21	4606.27
13	36.37	235.06	17.54	37575.75	4096.16
14	47.33	250.59	25.00	36423.81	3016.47
15	58.34	261.53	9.41	35267.12	1714.98
16	58.34	268.09	15.59	34628.68	904.28
17	69.35	273.17	5.61	33411.05	150.27

Sum of the Resisting Forces (including Pier/Pile, Tieback, Reinforcing Soil Nail, and Applied Forces if applicable) = 8322990.00 (lbs)

Average Available Shear Strength (including Tieback, Pier/Pile, Reinforcing, Soil Nail, and Applied Forces if applicable) = 36090.45(psf)

Sum of the Driving Forces = 450097.31 (lbs)

Average Mobilized Shear Stress = 1951.73(psf)

Total length of the failure surface = 230.61(ft)

CAUTION - Factor Of Safety Is Calculated By The Modified Bishop Method. This Method Is Valid Only If The Failure Surface Approximates A Circular Arc.

**** END OF GSTABL7 OUTPUT ****

Summit/Ridge Nests; A-A'; Static; bedding 24 deg apparent dip

C:\DOCUME~1\DAVIDG\DESKTOP\01628008\A2.PL2 Run By: DAG 9/1/2015 2:15PM

*** GSTABL7 ***	10 0.00 8712.00 146.00 8776.00 1
** GSTABL7 by Garry H. Gregory, P.E. **	11 140.00 5770.00 170.00 5765.00 1
** Original Margian 1.0. January 1006; Current Margian 2.002	User Specified Y-Origin = 8700.00(ft)
December 2001 **	
(All Rights Reserved-Unauthorized Use Prohibited)	ISOTROPIC SOIL PARAMETERS
**************************************	2 Type(s) of Soil
(Includes Spencer & Morgenstern-Price Type Analysis) Including Pier/Pile, Reinforcement, Soil Nail, Tieback, Nonlinear Undrained Shear Strength, Curved Phi Envelope, Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water	Soil Total Saturated Cohesion Friction Pore Pressure Piez. Type Unit Wt. Unit Wt. Intercept Angle Pressure Constant Surface No. (pcf) (pcf) (psf) (deg) Param. (psf) No.
Surfaces, Pseudo-Static Earthquake, and Applied Force Options.	1 145.0 150.0 35000.0 20.0 0.00 0.0 0 2 135.0 140.0 0.0 42.0 0.00 0.0 0
Analysis Run Date:9/1/2015Time of Run:2:15PMRun By:DAG	ANISOTROPIC STRENGTH PARAMETERS 1 soil type(s)
Input Data Filename: C:22. Output Filename: C:22.0UT Unit System: English	Soil Type 1 Is Anisotropic
	Number Of Direction Ranges Specified = 3
Plotted Output Filename: C:a2.PLT	
	Direction Counterclockwise Cohesion Friction Range Direction Limit Intercept Angle No. (deg) (psf) (deg)
PROBLEM DESCRIPTION: Summit/Ridge Nests; A-A'; Static; beddin g 24 deg apparent dip	1 20.0 35000.00 20.00
	2 30.0 0.00 42.00 3 90.0 35000.00 20.00
	ANISOTROPIC SOIL NOTES:
BOUNDARY COORDINATES	 An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
9 Top Boundaries 11 Total Boundaries	 (2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack. (3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.
Boundary X-Left Y-Left X-Right Y-Right Soil Type No. (ft) (ft) (ft) (ft) Below Bnd	Janhus Empirical Coef is being used for the case of a 5 nhi both > 0
1 0.00 8717.00 146.00 8781.00 2 1 2 146.00 8781.00 170.00 8783.00 2 1 3 170.00 8783.00 176.00 8784.00 1	Jambus Empirical Coer is being used for the case of "C & phi both > 0
4176.008784.00179.008793.0015179.008793.00228.008817.0016228.008817.00264.008810.0017264.008810.00282.008804.001	A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
8 282.00 8804.00 298.00 8804.00 1 9 298.00 8804.00 350.00 8792.00 1	2000 Trial Surfaces Have Been Generated.

	2	3.0	2962.6	0.0	0.0	0.	0.	0.0	0.0	0.0
2 Boxes Specified For Generation Of Central Block Base	4	48.0	108070.3	0.0	0.0	0.	0.	0.0	0.0	0.0
	5	17.9	32032.9	0.0	0.0	0.	0.	0.0	0.0	0.0
	6	5.1	2580.8	0.0	0.0	0.	0.	0.0	0.0	0.0

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 35.0

Y-Left X-Right

(ft)

180.00

Y-Right

8785.00

(ft)

Height (ft)

10.00

**** END OF GSTABL7 OUTPUT ****

2	230.00	8800.00	280.00	8790.00	20.00

Following Is Displayed The Most Critical Of The Trial Failure Surfaces Evaluated.

(ft)

180.00 8785.00

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Evaluated = 2000

Statistical Data On All Valid FS Values: FS Max = 494.331 FS Min = 15.586 FS Ave = 123.714 Standard Deviation = 69.420 Coefficient of Variation = 56.11 %

Failure Surface Specified By 4 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	174.31	8783.72
2	180.00	8780.10
3	245.90	8806.51
4	250.98	8812.53

Factor of Safety *** 15.586 ***

Box

No.

1

X-Left

(ft)

Individual data on the 6 slices

			Water Force	Water Force	Tie Force	Tie Force	Earthqu Ford	lake Suro	charge
Slice No.	Width (ft)	Weight (lbs)	Top (lbs)	Bot (lbs)	Norm (lbs)	Tan (lbs)	Hor (lbs)	Ver (lbs)	Load (lbs)
1	1.7	166.5	0.0	0.0	0.	0.	0.0	0.0	0.0

Summit/Ridge Nests; A-A'; Pseudo-Static; bedding 24 deg apparent dip

C:\DOCUME~1\DAVIDG\DESKTOP\01628008\A2P.PLT Run By: DAG 9/1/2015 2:16PM

				*** GSTABL	7 ***			10 11	0.00	8712.00	146.00	8776.0	00	1
		*	* GSTABL7 1	by Garry H.	Gregory, P	P.E. **		11	140.00	0770.00	170.00	0705.0	50	-
**	Original \	/ersion	1.0, Janua	ry 1996; Cu	rrent Versi	on 2.002,	1	User Specif:	ied Y-Origi	.n = 8	3700.00(ft)			
December 2001		(All Ri	ghts Reser	ved-Unautho	rized Use F	rohibited)		ISOTROPIC SO	IL PARAMETH	IRS				
SLOPE STABILITY ANALYSIS SYSTEM Modified Bishop, Simplified Janbu, or GLE Method of Slices. (Includes Spencer & Morgenstern-Price Type Analysis) Including Pier/Pile, Reinforcement, Soil Nail, Tieback, Nonlinear Undrained Shear Strength, Curved Phi Envelope, Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water Surfaces, Pseudo-Static Earthquake, and Applied Force Options.								2 Type(s) (Soil Total Type Unit W No. (pcf) 1 145.0 2 135.0	Saturated Saturated Unit Wt. (pcf) 150.0 140.0	Cohesior Intercept (psf) 35000.0 0.0	n Friction 2 Angle 1 (deg) 20.0 42.0	Pore Pressure Param. 0.00 0.00	Pressure Constant (psf) 0.0 0.0	Piez. Surface No. 0 0
Anal Time Run J Inpu Outpu Unit	ysis Run Da of Run: By: t Data File ut Filename System:	ate: ename: e:	9/1/20 2:16PM DAG C:a2p. C:a2p. Englis	15 OUT h				ANISOTROPIC : 1 soil : Soil Type :	STRENGTH PA Cype(s) L Is Anisot	RAMETERS				
Plot	ted Output	Filenam	e: C:a2p.1	PLT				Number Of D:	irection Ra	inges Speci	lfied = 3			
PROBJ	LEM DESCRIE	PTION:	Summit/Rid bedding 24	ge Nests; A deg appare	-A'; Pseudo nt dip	-Static;		Direction Range No. 1 2 3	Countercl Directic (deg 20. 30. 90.	ockwise on Limit) 0 0 0	Cohesion Intercept (psf) 35000.00 0.00 35000.00	Fric An (c	ction ngle deg) 20.00 42.00 20.00	
BOUNI 1.	DARY COORDI 9 Top Bou 1 Total Bou	INATES Indaries Indaries						ANISOTROPIC (1) An in C and (2) An in C equ (3) An in C equ	SOIL NOTES nput value l/or Phi to nput value ual to zero nput value	s: of 0.01 fo be ignore of 0.02 fo o, with no of 0.03 fo b, with wat	or C and/or ed in that : or Phi will water weigh or Phi will	Phi will range. set both ht in the set both	l cause An n Phi and e tension n Phi and	niso crack.
Bound	dary X- c. (-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd		0.04		, witchi wat	,er wergne .			
	1 2 14 3 17 4 17 5 17 6 22	0.00 46.00 70.00 76.00 79.00 28.00	8717.00 8781.00 8783.00 8784.00 8793.00 8817.00	146.00 170.00 176.00 179.00 228.00 264.00	8781.00 8783.00 8784.00 8793.00 8817.00 8810.00	2 2 1 1 1 1		A Horizonta Of0.170 Has A Vertical 1 Of0.000 Has	l Earthquak Been Assig Earthquake Been Assig	te Loading med Loading Co med	Coefficient	t		
	7 26 8 28 9 29	54.00 32.00 98.00	8810.00 8804.00 8804.00	282.00 298.00 350.00	8804.00 8804.00 8792.00	1 1 1		Cavitation 1	Pressure =	0.0(psf	-)			

Janbu's Empirical Coef. is being used for the case of $\ \ c$ & phi both > 0

Trial Failure Surface Specified By 4 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	174.31	8783.72
2	180.00	8780.10
3	245.90	8806.51
4	250.98	8812.53

Janbu's Empirical Coefficient (fo) = 1.030

* * Factor Of Safety Is Calculated By The Simplified Janbu Method * *

Soil Nail, and Applied Forces if applicable) = 842917.00 (lbs)

Average Available Shear Strength (including Tieback, Pier/Pile, Reinforcing, Soil Nail, and Applied Forces if applicable) = 9845.24(psf)

Sum of the Driving Forces = 81132.47 (lbs)

Average Mobilized Shear Stress = 947.62(psf)

Total length of the failure surface = 85.62(ft)

**** END OF GSTABL7 OUTPUT ****

Factor Of Safety For The Preceding Specified Surface = 10.700

Table 1 - Individual Data on the 6 Slices

			Water Force	Water Force	Tie Force	Tie Force	Earthqu Forc	ake e Suro	charge
Slice	Width	Weight	Top	Bot	Norm	Tan	Hor	Ver	Load
No.	(ft)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
1	1.7	166.1	0.0	0.0	0.0	0.0	28.2	0.0	0.0
2	3.0	2962.6	0.0	0.0	0.0	0.0	503.6	0.0	0.0
3	1.0	1859.9	0.0	0.0	0.0	0.0	316.2	0.0	0.0
4	48.0	108070.3	0.0	0.0	0.0	0.0	18372.0	0.0	0.0
5	17.9	32020.4	0.0	0.0	0.0	0.0	5443.5	0.0	0.0
б	5.1	2581.7	0.0	0.0	0.0	0.0	438.9	0.0	0.0
		***Table	2 - Base	Stress	Data on t	the 6	Slices**	*	

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-32.46	175.15	2.00	42440.65	-38.64
2	-32.46	177.50	3.56	42832.72	-388.34
3	-32.46	179.50	1.19	43217.36	-731.41
4	21.84	204.00	51.71	2112.71	1192.82
5	21.84	236.95	19.28	1678.61	947.73
б	49.85	248.44	7.88	52450.32	444.15

Sum of the Resisting Forces (including Pier/Pile, Tieback, Reinforcing

1

Safety Factors Are Calculated By The Modified Bishop Method

Summit/Ridge Nests; B-B'; Static

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GSTABL7

*** GSTABL7 ***								10		126.00	8797.00	144.00	8806.00		1
			** GSTABL7	by Garry H.	Gregory, P	.E. **		11		156.00	8806.00	240.00	8810.00		1
	** Origina	l Version	1 0 .Tanua	rv 1996: Cu	rrent Versi	on 2 002		14		240.00	8800.00	250.00	8797.00		1
December 20	01 **	ti version	1.0, Uanua	1y 19907 Cu	TTENC VEIST	011 2.002,		15		37 00	8751 00	52 00	8759 00		1
Decompet Do	01	(All R	ights Reser	ved-Unautho	rized Use P	rohibited)		16		52.00	8759.00	70.00	8765.00		1
		(1111 10	igned neder	vea onaaono	11100 050 1	10111010000)		17		70.00	8765.00	74.00	8769.00		1
******	******	*****	* * * * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * *	****	1	User	Specifie	d Y-Origi	in = 87	700.00(ft)			
		S	LOPE STABIL	TTY ANALYST	S SYSTEM		T								
	Modif	ied Bisho	p, Simplifi	ed Janbu, o	r GLE Metho	d of Slices.									
	(Incl	udes Spen	cer & Morge	nstern-Pric	e Type Anal	ysis)		ISOTRO	PIC SOIL	PARAMETH	ERS				
	Inclu	ding Pier	/Pile, Rein	forcement,	Soil Nail,	Tieback,									
	Nonli	near Undr	ained Shear	Strength,	Curved Phi	Envelope,	2 Time (s) of Soil								
	Aniso	tropic So	11, Fiber-R	einforced S arthquako	oil, Bounda	ry Loads, Water		2 Ty	pe(s) of	Soll					
	Sulla	ices, rseu	10-Static E	ai cliquake,	and Appried	Force options.									
********	* * * * * * * * * * *	*******	* * * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * *	*****		Soil	Total	Saturated	d Cohesion	Friction	Pore P	ressure	Piez.
								Type	Unit Wt.	Unit Wt	. Intercept	Angle 1	Pressure C	onstant	Surface
_								No.	(pcf)	(pcf)	(psf)	(deg)	Param.	(psf)	No.
A	nalysis Run	Date:	9/1/20 2:04DM	15				1	145 0	150 0	25000 0	20.0	0 00	0 0	0
E.	un By:		DAG					2	135 0	140 0	35000.0	42 0	0.00	0.0	0
I	nput Data F	'ilename:	C:B1.				1	-	100.0	110.0	0.0	12.0	0.00	0.0	0
0	utput Filen	name:	C:B1.0	UT											
U	nit System:		Englis	h											
_								A Cri	tical Fa	ilure Sui	face Search	hing Metho	d, Using A	Random	
P	lotted Outp	out Filena	me: C:BI.P	L.I.				Techn	lique For	Generati	ing Circulai	r Surfaces	, Has Been	Specifi	ed.
								2500	Trial Su	rfaces Ha	ave Been Ger	nerated.			
P	ROBLEM DESC	CRIPTION:	Summit/Rid	ge Nests; B	-B'; Static										
								50 Along	Surface(: The Gro	s) Initia und Surfa	ate(s) From ace Between	Each Of $X = 0.0$	50 Point 00(ft)	s Equall	y Spaced
								-			and	X = 90.	00(ft)		
В	OUNDARY COC	RDINATES						Each	Surface '	Terminate	es Between	X = 110.	00(ft)		
											and	X = 240.	00(ft)		
	13 Top	Boundarie	5												
	17 Total	Boundarie	5					IInles	e Furthe	r Limitat	iong Were	Imposed T	he Minimum	Flowsti	07
								At Wh	ich A Su	rface Ext	ends Is Y	= 0.0	00(ft)	BICVACI	011
B	oundary	X-Left	Y-Left	X-Right	Y-Right	Soil Type									
	No.	(ft)	(ft)	(ft)	(ft)	Below Bnd									
								25.00	(ft) Lin	e Segment	ts Define Ea	ach Trial 1	Failure Su	rface.	
	1	0.00	8735.00	20.00	8745.00	2									
	2	20.00	8745.00	37.00	8756.00	2									
	3 4	37.00	8763 00	52.00	8769 00	2									
		74 00	8769 00	82 00	8771 00	∠ 1		Follo	wing Tel	Displayer	The Most (Critical O	f The Tria	1	
	6	82.00	8771.00	88.00	8775.00	1		Failu	re Surfa	ces Evalı	ated.	official O		-	
	7	88.00	8775.00	94.00	8784.00	1									
	8	94.00	8784.00	98.00	8786.00	1									
	9	98.00	8786.00	126.00	8797.00	1		* * S	afety Fa	ctors Are	e Calculated	d By The Mo	odified Bi	shop Met	hod * *

	13	0.9	9968.9	0.0	0.0	0.	0.	0.0	0.0	0.0
	14	3.1	33069.8	0.0	0.0	Ο.	0.	0.0	0.0	0.0
	15	21.5	239502.8	0.0	0.0	Ο.	0.	0.0	0.0	0.0
Total Number of Trial Surfaces Evaluated = 2500	16	6.5	74906.4	0.0	0.0	Ο.	0.	0.0	0.0	0.0
	17	16.8	194408.9	0.0	0.0	Ο.	0.	0.0	0.0	0.0
Statistical Data On All Valid FS Values:	18	1.2	14547.2	0.0	0.0	Ο.	0.	0.0	0.0	0.0
FS Max = 200.988 FS Min = 23.224 FS Ave = 46.199	19	12.0	137645.2	0.0	0.0	0.	0.	0.0	0.0	0.0
Standard Deviation = 19.596 Coefficient of Variation = 42.42 %	20	8.1	87187.7	0.0	0.0	Ο.	0.	0.0	0.0	0.0
	21	18.7	168011.6	0.0	0.0	Ο.	0.	0.0	0.0	0.0
	22	15.4	93680.7	0.0	0.0	Ο.	0.	0.0	0.0	0.0
Failure Surface Specified By 12 Coordinate Points	23	11.7	32874.5	0.0	0.0	Ο.	0.	0.0	0.0	0.0
	24	2.3	1303.3	0.0	0.0	Ο.	Ο.	0.0	0.0	0.0

**** END OF GSTABL7 OUTPUT ****

Point	X-Surf	Y-Surf
No.	(ft)	(ft)
1	0 00	8735 00
2	21.71	8722.60
3	45.27	8714.24
4	69.94	8710.18
5	94.93	8710.57
6	119.47	8715.38
7	142.76	8724.46
8	164.07	8737.52
9	182.74	8754.16
10	198.15	8773.83
11	209.84	8795.94
12	212.19	8803.31

Circle Center At X = 80.18 ; Y = 8849.65 ; and Radius = 139.90

Factor of Safety *** 23.224 ***

Individual data on the 24 slices

			Water	Water	Tie	Tie	Earthqu	uake	abargo
Slice	Width	Weight	Top	Bot	Norm	Tan	Hor	Ver	Load
No.	(ft)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
1	4.4	1393.5	0.0	0.0	0.	0.	0.0	0.0	0.0
2	15.6	28923.5	0.0	0.0	0.	0.	0.0	0.0	0.0
3	1.7	5495.5	0.0	0.0	0.	Ο.	0.0	0.0	0.0
4	15.3	68450.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	8.3	50225.7	0.0	0.0	0.	0.	0.0	0.0	0.0
6	6.7	46330.9	0.0	0.0	0.	0.	0.0	0.0	0.0
7	17.9	139273.8	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.1	532.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	4.0	33721.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	8.0	69244.3	0.0	0.0	0.	0.	0.0	0.0	0.0
11	6.0	54449.8	0.0	0.0	0.	0.	0.0	0.0	0.0
12	6.0	60024.9	0.0	0.0	0.	0.	0.0	0.0	0.0

B1

Summit/Ridge Nests; B-B'; Pseudo-Static

C:\DOCUME~1\DAVIDG\DESKTOP\01628008\B1P.PLT Run By: DAG 9/1/2015 2:17PM

				*** GSTABL	.7 ***			1	0	126.00	8797.00	144.00	8806.0	00	1
			**	br. Cower II	Charge T	רדי ++		1	2	144.00	0010.00	240.00	0010.0	0	1
			GSIABL/	Dy Gally H.	Gregory, E	P.E. ""		1.	2	130.00	0010.00	240.00	0000.0	0	1
			1 0 -	1005.0				1.	3	240.00	8800.00	250.00	8/9/.0	0	1
	** Origii	nal Version	1.0, Janua	ry 1996; Cu	irrent Versi	lon 2.002,		1.	4	0.00	8730.00	37.00	8751.0	00	1
December	2001 **							1	5	37.00	8751.00	52.00	8759.0	00	1
		(All R	ights Reser	ved-Unautho	orized Use H	Prohibited)		10	6	52.00	8759.00	70.00	8765.0	00	1
								1'	7	70.00	8765.00	74.00	8769.0	00	1
*******	* * * * * * * * * * * * *	*********	***********	**************************************	**************************************	****	1	User	Specifi	ed Y-Origi	n = 8	700.00(ft)		
	Mod: (Inc Inc	ified Bisho cludes Spen luding Pier	p, Simplifi cer & Morge /Pile, Reir	ed Janbu, constern-Pric	or GLE Metho e Type Anal Soil Nail, Curved Phi	od of Slices. Lysis) Tieback, Fruciono		ISOTRO	OPIC SOI	L PARAMETE	RS				
	Anis	sotropic So faces, Pseu	il, Fiber-F do-Static F	einforced S arthquake,	and Applied	ary Loads, Water d Force Options.		2 T <u>r</u>	ype(s) o	f Soil					
******	*********	*******	*********	*******	*******	****		Soil Type No.	Total Unit Wt (pcf)	Saturated . Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
	Analysis Ru	un Date:	9/1/20	15											
	Time of Rui	n:	2:17PM	1				1	145.0	150.0	35000.0	20.0	0.00	0.0	0
	Run By:		DAG					2	135.0	140.0	0.0	42.0	0.00	0.0	0
	Input Data	Filename:	C:blp.												
	Output File	ename:	C:blp.	OUT											
	Unit System	m :	Englis	sh											
	Plotted Out	tput Filena	me: C:blp.	PLT				A Hor Of0.1	rizontal 170 Has	Earthquak Been Assig	e Loading ned	Coefficien	nt		
								A Ve Of0.0	rtical E 000 Has	arthquake Been Assig	Loading Co ned	efficient			
	PROBLEM DES	SCRIPTION:	Summit/Rid	lge Nests; B	B-B'; Pseudo	o-Static	1	Cavi	tation P	ressure =	0.0(psf)			
								Tria	l Failur	e Surface	Specified	By 12 Cooi	rdinate Po	oints	
		OODTNATEO													
	BOUNDARI CO	OORDINAIES						De	int	V Curve	V Curef				
	10	D						PO.	1110	A-SULL	I-SUII				
	13 Top	Boundarie	S					N	0.	(It)	(It)				
	17 Tota.	l Boundarie	S												
								-	1	0.00	8735.00				
								:	2	21.71	8722.60				
	Boundary	X-Left	Y-Left	X-Right	Y-Right	Soil Type			3	45.27	8714.24				
	No.	(ft)	(ft)	(ft)	(ft)	Below Bnd			4	69.94	8710.18				
								!	5	94.93	8710.57				
	1	0.00	8735.00	20.00	8745.00	2			б	119.47	8715.38				
	2	20.00	8745.00	37.00	8756.00	2			7	142.76	8724.46				
	2	37 00	8756 00	52 00	8763 00	2			8	164 07	8737 52				
	4	52 00	8763 00	74 00	8769 00	2			a a	182 74	8754 16				
	-	74 00	0760 00	/1.00	0703.00	1		1	- 0	100 15	0772 02				
	5	/4.00	0/09.00	02.00	0//1.00	1		11	1	120.12	0//3.03				
	6	82.00	8771.00	88.00	8775.00	1		1.	1 O	209.84	8795.94				
	7	88.00	8775.00	94.00	8784.00	1		1:	2	212.19	8803.31				
	8	94.00	8784.00	98.00	8786.00	1									
	9	98.00	8786.00	126.00	8797.00	1		Circ	le Cente	r At X =	80.18 ;	Y = 8849	.66; and H	Radius =	139.91

 \star \star Factor Of Safety Is Calculated By The Modified Bishop Method \star \star

Factor Of Safety For The Preceding Specified Surface = 15.853

Table 1 - Individual Data on the 24 Slices

			Water	Water	Tie	Tie	Earthqu	lake	
a1 :	121 24.1	TT - C - Is to	Force	Force	Force	Force	FOIG	le Sur	Jiarge
Slice	wiath	weight	Top	BOT	Norm	Tan	Hor	ver	Load
NO.	(It)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
1	4.4	1393.9	0.0	0.0	0.0	0.0	237.0	0.0	0.0
2	15.6	28915.2	0.0	0.0	0.0	0.0	4915.6	0.0	0.0
3	1.7	5506.8	0.0	0.0	0.0	0.0	936.2	0.0	0.0
4	15.3	68427.1	0.0	0.0	0.0	0.0	11632.6	0.0	0.0
5	8.3	50240.6	0.0	0.0	0.0	0.0	8540.9	0.0	0.0
6	6.7	46305.8	0.0	0.0	0.0	0.0	7872.0	0.0	0.0
7	17.9	139304.0	0.0	0.0	0.0	0.0	23681.7	0.0	0.0
8	0.1	500.4	0.0	0.0	0.0	0.0	85.1	0.0	0.0
9	4.0	33722.3	0.0	0.0	0.0	0.0	5732.8	0.0	0.0
10	8.0	69245.4	0.0	0.0	0.0	0.0	11771.7	0.0	0.0
11	6.0	54448.9	0.0	0.0	0.0	0.0	9256.3	0.0	0.0
12	6.0	60022.4	0.0	0.0	0.0	0.0	10203.8	0.0	0.0
13	0.9	9934.3	0.0	0.0	0.0	0.0	1688.8	0.0	0.0
14	3.1	33101.9	0.0	0.0	0.0	0.0	5627.3	0.0	0.0
15	21.5	239530.2	0.0	0.0	0.0	0.0	40720.1	0.0	0.0
16	6.5	74863.1	0.0	0.0	0.0	0.0	12726.7	0.0	0.0
17	16.8	194411.2	0.0	0.0	0.0	0.0	33049.9	0.0	0.0
18	1.2	14537.0	0.0	0.0	0.0	0.0	2471.3	0.0	0.0
19	12.0	137640.1	0.0	0.0	0.0	0.0	23398.8	0.0	0.0
20	8.1	87144.3	0.0	0.0	0.0	0.0	14814.5	0.0	0.0
21	18.7	168081.1	0.0	0.0	0.0	0.0	28573.8	0.0	0.0
22	15.4	93633.2	0.0	0.0	0.0	0.0	15917.6	0.0	0.0
23	11.7	32886.2	0.0	0.0	0.0	0.0	5590.7	0.0	0.0
24	2.4	1303.4	0.0	0.0	0.0	0.0	221.6	0.0	0.0
			-						

Table 2 - Base Stress Data on the 24 Slices

Slice	Alpha	X-Coord.	Base	Available	Mobilized
No.	(deg)	Slice Cntr	Leng.	Shear Strength	Shear Stress
*		(ft)	(ft)	(psf)	(psf)
1	-29.73	2.20	5.06	295.43	-124.01
2	-29.73	12.20	17.98	36148.28	-794.23
3	-29.73	20.85	1.97	36652.78	-1354.29
4	-19.54	29.35	16.22	36929.70	-1406.37
5	-19.54	41.14	8.78	37516.75	-1907.15
6	-9.35	48.64	6.82	37646.56	-1093.20
7	-9.35	60.97	18.18	37969.71	-1240.83
8	0.90	69.97	0.06	38022.06	1201.68

9	0.90	72.00	4.00	38054.82	147.82
10	0.90	78.00	8.00	38136.72	143.30
11	0.90	85.00	6.00	38289.22	152.53
12	0.90	91.00	6.00	38627.20	167.05
13	0.90	94.46	0.93	38873.98	236.05
14	11.09	96.46	3.13	38750.11	2055.61
15	11.09	108.74	21.88	38885.66	2108.61
16	21.30	122.74	7.01	38825.21	3889.09
17	21.30	134.38	17.99	38873.99	3929.26
18	31.50	143.38	1.45	38722.12	5267.13
19	31.50	150.00	14.07	38631.20	5114.63
20	31.50	160.04	9.46	38390.19	4817.70
21	41.71	173.40	25.01	37509.21	4474.27
22	51.93	190.45	24.99	36152.02	2952.30
23	62.13	203.99	25.01	34524.71	1165.00
24	72.31	211.01	7.74	32837.45	168.84

Sum of the Resisting Forces (including Pier/Pile, Tieback, Reinforcing Soil Nail, and Applied Forces if applicable) = 9422019.00 (lbs)

Average Available Shear Strength (including Tieback, Pier/Pile, Reinforcing, Soil Nail, and Applied Forces if applicable) = 36556.73(psf)

Sum of the Driving Forces = 594333.94 (lbs)

Average Mobilized Shear Stress = 2305.97(psf)

Total length of the failure surface = 257.74(ft)

CAUTION - Factor Of Safety Is Calculated By The Modified Bishop Method. This Method Is Valid Only If The Failure Surface Approximates A Circular Arc.

**** END OF GSTABL7 OUTPUT ****

Summit/Ridge Nests; B-B'; Static; bedding 17 deg apparent dip

C:\DOCUME~1\DAVIDG\DESKTOP\01628008\B2.PL2 Run By: DAG 9/1/2015 2:17PM

				*** GSTABL	7 ***			10		126.00	8797.00	144.00	8806.	00	1
			++ 0000007	has Garrier II				10		144.00	0010.00	130.00	0010.	0	1
			** GSIABL/	by Garry H.	Gregory, P	.E. **		12		156.00	8810.00	240.00	8800.	0	1
								13		240.00	8800.00	250.00	8/9/.	00	1
	** Origina	al Version	1.0, Janua	ry 1996; Cu.	rrent Versi	on 2.002,		14		0.00	8730.00	37.00	8751.	00	1
December 2	001 **							15		37.00	8751.00	52.00	8759.	00	1
		(All R	ights Reser	ved-Unautho	rized Use P	rohibited)		16		52.00	8759.00	70.00	8765.	00	1
								17		70.00	8765.00	74.00	8769.	00	1
								User Sp	pecifie	d Y-Origi	in = 8	3700.00(ft))		
******	* * * * * * * * * * * *	* * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * *	******	1								
		S	LOPE STABIL	ITY ANALYSI	S SYSTEM										
	Modii	fied Bisho	p, Simplifi	ed Janbu, o	r GLE Metho	d of Slices.									
	(Inc.	ludes Spen	cer & Morge	nstern-Pric	e Type Anal	ysis)		ISOTROPI	IC SOIL	PARAMETI	ERS				
	Inclu	uding Pier	/Pile, Rein	forcement,	Soil Nail,	Tieback,									
	Nonl:	inear Undr	ained Shear	Strength,	Curved Phi	Envelope,									
	Aniso Surfa	otropic So aces, Pseu	il, Fiber-R do-Static E	einforced S arthquake,	oil, Bounda and Applied	ry Loads, Water Force Options.		2 Туре	e(s) of	Soil					
*******	* * * * * * * * * * * * *	* * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * * * * * * * * *		Soil T	Total	Saturated	d Cohesion	Friction	Pore	Dreggure	Diez
								Type Ur	nit Wt	IIni+ W+	Intercent	Angle	Dregure	Constant	Surface
								No ((nof)	(ncf)	(nef)	(deg)	Daram	(pef)	No
	Analycic Pu	n Data:	9/1/20	15				10. ((pcr)	(per)	(Par)	(ueg)	raram.	(Par)	110.
	Timo of Dun	· Date.	2·17DM	1.0				1 1	145 0	150 0	35000 0	20 0	0 00	0 0	0
	Dun Dur	•	Z-I/PM	L				2 1	125 0	140.0	33000.0	20.0	0.00	0.0	0
	Turnit Data I	Eilonomo:	DAG C·h2					2 1	133.0	140.0	0.0	42.0	0.00	0.0	0
	niput Data i	Filenane.	C·D2.												
	Output File	name.	C.D2.0	101											
	Unit System	•	Englis	n				3 M T COMP.							
			and and a					ANISOTRO	JPIC SI	RENGIH PA	ARAMETERS				
	Plotted Out	put Filena	me: C:D2.P	'L'T'				1 5	SOIL TY	pe(s)					
								Soil Ty	ype 1	Is Anisot	tropic				
	PROBLEM DESC	CRIPTION:	Summit/Rid g 17 deg a	ge Nests; B pparent dip	-B'; Static	; beddin		Number	Of Dir	ection Ra	anges Speci	fied = 3			
			5					Discorti		Gauntaur		Gabaaian			
								Directi		Dimenti	LOCKWISE	Conesion			
								Range	2	Directio		Intercept	_ A	lgre	
								NO.		(deg	3)	(psr)	((ieg)	
	BOUNDARY COO	ORDINATES						1		10	-	25000 00		00 00	
	10 -							Ţ		12.	. 5	35000.00	5	20.00	
	13 Top	Boundarie	S					2		22.	.5	0.00)	42.00	
	17 Total	Boundarie	S					3		90.	.0	35000.00	J	20.00	
								ANISOTE	ROPIC S	OTL NOTES	s:				
	Boundary	X-Left	Y-Left	X-Right	Y-Right	Soil Type		(1)	An inc	out value	of 0.01 fc	or C and/or	r Phi wil	l cause A	niso
	No.	(ft.)	(ft.)	(ft.)	(ft.)	Below Bnd		(=)	C and/	or Phi to	o be ignore	d in that	range.		
		(20)	(20)	(20)	(20)	_010" Dild		(2)	An inr	nit value	of 0 02 fc	r Phi will	 L set boti	n Phi and	
	1	0 00	8735 00	20 00	8745 00	2		(2)	C omin	1 to zer	- with no	water woid	h+in+h	- tongion	arack
	1 2	20 00	8745 00	20.00	8756 00	2		())	An in-	ut volue	of 0 03 fo	water werg	111 L11 eat bat1	Dhi and	CLACK.
	2	20.00	0756 00	57.00	9762 00	2		(3)		l to good	or u.us IC	or woight	in the t	n Fill alla	aak
	3	57.00	0762 00	52.00	0760 00	2			c equa	u to zero	, with wat	er werdur	III LINE TO	Ension cr	ack.
	4	52.00	0/03.00	/4.00	0/09.00	1									
	5	/4.00	8/09.00	8∠.UU	8//1.UU	1		T].	There is a		da hadaan			1	d hat is a
	ь	82.00	8//1.00	88.00	8//5.00	1	-	Janbus	Empiri	.cai Coef	is peing u	isea ior th	ie case o	L C & ph	1 DOTN > 0
	./	88.00	8775.00	94.00	8784.00	1	1								
	8	94.00	8784.00	98.00	8786.00	1									
	9	98.00	8786.00	126.00	8797.00	1									

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

2000 Trial Surfaces Have Been Generated.

2 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is $30.0\,$

Box	X-Left	Y-Left	X-Right	Y-Right	Height
No.	(ft)	(ft)	(ft)	(ft)	(ft)
1	80.00	8763.00	96.00	8784.00	0.00
2	156.00	8800.00	200.00	8795.00	15.00

Following Is Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Evaluated = 2000

Statistical Data On All Valid FS Values: FS Max = 460.234 FS Min = 7.500 FS Ave = 60.740 Standard Deviation = 57.325 Coefficient of Variation = 94.38 %

Failure Surface Specified By 4 Coordinate Points

Point	X-Surf	Y-Surf
No.	(ft)	(ft)
-	04 50	
T	84.70	8772.80
2	86.67	8771.75
3	189.44	8803.62
4	191.25	8805.80

Factor of Safety *** 7.500 ***

Individual data on the 9 slices

			Water Force	Water Force	Tie Force	Tie Force	Earthqu Ford	uake ce Suro	charge
Slice	Width	Weight	qoT	Bot	Norm	Tan	Hor	Ver	Load
No.	(ft)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
1	2.0	337.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.3	502.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	6.0	5573.4	0.0	0.0	0.	0.	0.0	0.0	0.0
4	4.0	6006.2	0.0	0.0	0.	0.	0.0	0.0	0.0
5	28.0	48291.8	0.0	0.0	0.	0.	0.0	0.0	0.0
6	18.0	38528.1	0.0	0.0	0.	0.	0.0	0.0	0.0
7	12.0	28902.0	0.0	0.0	0.	0.	0.0	0.0	0.0
8	33.4	46425.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	1.8	315.2	0.0	0.0	0.	0.	0.0	0.0	0.0

**** END OF GSTABL7 OUTPUT ****

Summit/Ridge Nests; B-B'; Pseudo-Static; bedding 17 deg apparent dip

C:\DOCUME~1\DAVIDG\DESKTOP\01628008\B2P.PLT Run By: DAG 9/1/2015 2:18PM

				*** GSTABL	7 ***			10 11		126.00 144.00	8797.00 8806.00	144.00 156.00	8806.0 8810.0	00	1 1
			** GSTABL7	by Garry H.	Gregory, P	.E. **		12		156.00	8810.00	240.00	8800.0	00	1
	** Origin	al Version	1 0 .Tanua	ry 1996: Cu	rrent Versi	2 0 0 2 0 0 2		13		240.00	8800.00	250.00	8797.0	00	1
December 2	0119110 001 **	ai version	1.0, Uallua	19 19907 Cu	TTENC VELST	511 2.002,		15		37 00	8751 00	52 00	8759 (10	1
December 2	501	ם ווג)	ichta Bogor	uod_Unautho	rized Use D	rohibitod)		16		52 00	8759 00	70 00	8765 (10	1
		(AII R	ignus keser	ved-onauciio	rized use P	compred)		17		70.00	8765.00	74.00	8769.0	00	1
								Ilger	Specifier	d V-Origi	n = 8'	700 00(f+)			
******	* * * * * * * * * * * *	* * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * *	* * * * * * * * * * * * * * * *	1	UBCI	opecified	a i origi		/00.00(IC)			
		S	LOPE STABIL	ITY ANALYSI	S SYSTEM										
	Modii	tied Bisho	p, Simplifi	ed Janbu, o	r GLE Metho	d of Slices.			DIA COTI		D.C.				
	(Inc.	ludes Spen	cer & Morge	nstern-Pric	e Type Anal	ysis)	1	LSOTRO	PIC SOIL	PARAMETE	RS				
	Inclu	laing Pier	/Pile, Rein	forcement,	Soli Nall,	Fleback,									
	NOILL.	thear undr	il Fibor-P	strength,	curved Phi	Envelope, Ny Looda Wator		2 17.	mo(g) of	Soil					
	Surfa	aces, Pseu	do-Static E	arthquake,	and Applied	Force Options.		2 I Y	pe(s) or	3011					
******	* * * * * * * * * * * *	* * * * * * * * * *	* * * * * * * * * * *	******	******	* * * * * * * * * * * * * * * * * *		Soil	Total S	Saturated	Cohesion	Friction	Pore	Pressure	Piez.
								Type	Unit Wt.	Unit Wt.	Intercept	Angle	Pressure	Constant	Surface
								No.	(pcf)	(pcf)	(jsf)	(deq)	Param.	(psf)	No.
i	Analysis Ru	n Date:	9/1/20	15					11 - 7	1	11			11.00	
	Time of Run	:	2:18PM	1				1	145.0	150.0	35000.0	20.0	0.00	0.0	0
1	Run By:		DAG					2	135.0	140.0	0.0	42.0	0.00	0.0	0
	Input Data I	Filename:	C:b2p.												
(Output File	name:	C:b2p.	OUT											
τ	Jnit System	:	Englis	h											
			- 1.0				1	ANISOT	ROPIC STI	RENGTH PA	RAMETERS				
]	Plotted Out	put Filena	me: C:b2p.	PLT				1	. soil ty	pe(s)					
								Soil	Type 1	Is Anisot	ropic				
1	PROBLEM DES	CRIPTION:	Summit/Rid	ge Nests; B	-B'; Pseudo	-Static;		Numbe	r Of Dire	ection Ra	nges Speci	fied = 3			
			bedding 17	deg appare	nt dip										
								Direc	tion (Countercl	ockwise	Cohesion	. Fric	ction	
								Ran	ıge	Directic	on Limit	Intercept	. Ar	ıgle	
								No).	(deg	r)	(psf)	(c	leg)	
1	BOUNDARY COO	ORDINATES						-		10	F	25000 00		20.00	
	12	Dermalanta	_					1		12.	5	35000.00		20.00	
	13 lop 17 Total	Boundarie	s					∠ 3		22. 90.	0	35000.00)	20.00	
								3 NT CO		OTI NOUTO					
	Downdown	V Toft	V Toft	V Dight	V Dicht	Coil Trmo		ANISO (1	A An input	JIL NOIES	of 0 01 for	and (and	Dhi will		niao
1	No	(ft)	(f+)	(f+)	(f+)	Below Brd		(1	C and/	ut Vaiue or Phitc	be ignored	in that	range	L Cause A	IIISO
	110.	(10)	(10)	(10)	(10)	DCTOM DIIG		()) An inn	ut value	of 0 02 for	r Phi will	set both) Phi and	
	1	0 00	8735 00	20 00	8745 00	2		12	C emia	l to zero	. with no v	water weig	ht in the	tension	crack
	2	20.00	8745.00	37.00	8756.00	2		(3) An inp	ut value	of 0.03 for	r Phi will	set both	1 Phi and	
	3	37.00	8756.00	52.00	8763.00	2		, 5	C equal	l to zero	, with wate	er weight	in the te	ension cr	ack.
	4	52.00	8763.00	74.00	8769.00	2			-			5			
	5	74.00	8769.00	82.00	8771.00	1									
	6	82.00	8771.00	88.00	8775.00	1									
	7	88.00	8775.00	94.00	8784.00	1									
	8	94.00	8784.00	98.00	8786.00	1		A Hor	izontal 1	Earthquak	e Loading (Coefficien	ıt		
	9	98.00	8786.00	126.00	8797.00	1		Of0.1	70 Has Be	een Assig	ned				

A Vertica	l Earthquake	Loading Coefficient	1	-28.05	85.68	2.23	41414.95	-54.87
Of0.000 H	as Been Assi	gned	2	17.23	87.33	1.39	335.81	172.92
		-	3	17.23	91.00	6.28	827.36	426.02
Cavitatio	n Pressure =	0.0(psf)	4	17.23	96.00	4.19	1337.32	688.61
		-	5	17.23	112.00	29.32	1536.06	790.95
			6	17.23	135.00	18.85	1906.30	981.59
Janbu's E	mpirical Coe	f. is being used for the case of $c \& phi both > 0$	7	17.23	150.00	12.56	2145.01	1104.51
	-		8	17.23	172.72	35.01	1236.44	636.67
			9	50.36	190.35	2.84	50321.15	152.76
Trial Fai	lure Surface	Specified By 4 Coordinate Points	Si	um of the Re oil Nail, ar	esisting Force nd Applied For	es (including rces if applic	Pier/Pile, Tieback, cable) = 397547.47 (Reinforcing lbs)
Point	X-Surf	Y-Surf						
No.	(ft)	(ft)	A	verage Avail	able Shear S	rength (inclu	ding Tieback, Pier/P	ile, Reinforcing,
			S	oil Nail, ar	nd Applied For	rces if applic	able) = 3528.51(ps	f)
1	84.70	8772.80						
2	86.67	8771.75						
3	189.44	8803.62	St	um of the Dr	iving Forces	= 83964.20) (lbs)	
4	191.25	8805.80						
Janbu's E	mpirical Coe	fficient (fo) = 1.007	A	verage Mobil	ized Shear S	cress = 74	15.24(psf)	
* * Facto:	r Of Safety	Is Calculated By The Simplified Janbu Method \star \star	Т	otal length	of the failu	re surface =	112.67(ft)	

**** END OF GSTABL7 OUTPUT ****

Factor Of Safety For The Preceding Specified Surface = 4.768

Table 1 - Individual Data on the 9 Slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthqu Forc Hor (lbs)	ake e Suro Ver (lbs)	charge Load (lbs)
1	2.0	337.5	0.0	0.0	0.0	0.0	57.4	0.0	0.0
2	1.3	501.5	0.0	0.0	0.0	0.0	85.3	0.0	0.0
3	6.0	5574.3	0.0	0.0	0.0	0.0	947.6	0.0	0.0
4	4.0	6006.7	0.0	0.0	0.0	0.0	1021.1	0.0	0.0
5	28.0	48295.8	0.0	0.0	0.0	0.0	8210.3	0.0	0.0
6	18.0	38530.6	0.0	0.0	0.0	0.0	6550.2	0.0	0.0
7	12.0	28903.7	0.0	0.0	0.0	0.0	4913.6	0.0	0.0
8	33.4	46428.2	0.0	0.0	0.0	0.0	7892.8	0.0	0.0
9	1.8	314.7	0.0	0.0	0.0	0.0	53.5	0.0	0.0
		***Table	2 - Base	Stress	Data on t	he 9	Slices**	*	

Slice	Alpha	X-Coord.	Base	Available	Mobilized
No.	(deg)	Slice Cntr	Leng.	Shear Strength	Shear Stress
*		(ft)	(ft)	(psf)	(psf)

1

Analysis of Rock Strength using RocLab

