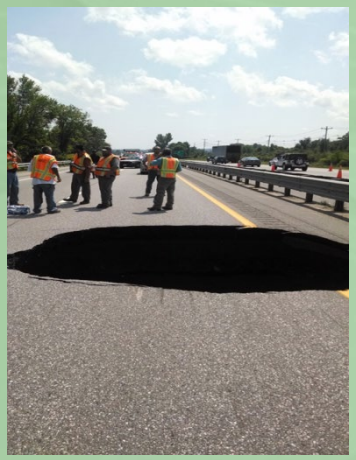
A-GaME

Advanced Geotechnical Methods in Exploration

Enhancing Site Characterization



Krystle Pelham
Engineering Geologist
NH Dept. of Transportation
Bureau of Materials and Research

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Geotechnical Engineering Section Perspective

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NHDOT Geotechnical Section Function

- Subsurface Investigation
- Lab testing
- Geotechnical Design/Analysis
- Geotechnical Data Reports and Design recommendations
- Construction Assistance/Verification
- Standards and Specification
- Performance Monitoring
- Geotechnology and ***Innovation Implementation***

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Geotechnical Section Involvement

- Scoping
- Pre-Design
- Final-Design
- Pre-Bid
- Pre-Construction
- Construction
- Post-Construction
- In Service
- Forensic/Litigation

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Goals:

Why enhance site characterization – Adding project Value

- Improve site subsurface characterization
- Acquire better soil and rock properties
- Better information on foundations
- Less environmental impact – non invasive
- Safer more economical impact
- More accurate bids for construction
- Fewer claims, change orders, cost overruns

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Conventional….

TEST BORING REPORT
STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION

PROJECT NAME NEW IPSWICH 14465 BRIDGE NO. 157/093
DESCRIPTION NH Rt 123-124 over Souhegan River

BORING NO. B301
SHEET NO. 1 OF 2
STA. OFF.
BASELINE
ELEVATION (ft) 921.0
START/END 2/27/12 / 2/29/12
DRILLER Walter (NHB)
INSPECTOR Joshua Szmyt
CLASSIFIER Joshua Szmyt
EAST/NORTH (ft) 940867/91286

GROUNDWATER: DATE | TIME | DEPTH (ft) | ELEV. (ft) | BOTTOM OF CASING | BOTTOM OF HOLE

EQUIPMENT: TYPE: S | P/U | NX; SIZE I.D. (in): 1.375 | 5 | 1.875; HAMMER WT. (lb): 140 | DRILL RIG; HAMMER FALL (in): 30 | D50 ATV; HAMMER TYPE: Safety

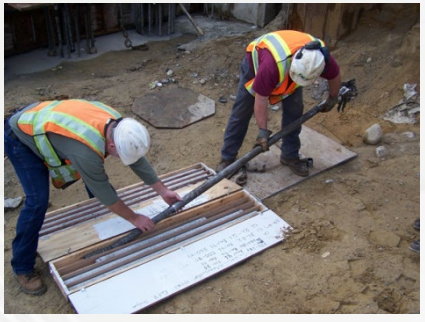
DEPTH (ft)	STRATUM CHANGE DEPTH	STRATUM CHANGE ELEVATION	BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) (%)	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS	STRATUM SYMBOL
0	0.7	920.3	120 66 22 21	B-1	0.8 [40]	0.0 – 2.0	Top 8 inches: Very dense, light brown, FINE to COARSE SAND, little Gravel, trace Silt. -FILL- Bottom 2 inches: Very dense, light brown, FINE to MEDIUM SAND, little Gravel, trace Silt.	
5			5 7 10 6	B-2	0.6 [30]	3.0 – 5.0	Medium dense, light brown, silty FINE SAND, little Gravel. -GLACIAL TILL-	
10			81 100/0.3	B-3	0.5 [62]	5.0 – 5.5	Very dense, light brown, silty FINE SAND, little Gravel.	
15	13.5	907.5	100/0.3	B-4	0.1 [33]	13.4 – 13.7	Very dense, light brown, silty FINE SAND, some Gravel (rock in tip). -APPROXIMATE BEDROCK SURFACE- Advanced roller bit to 14.5 feet below ground surface and began coring rock.	
				C-1	4.8 [96]	14.5 – 19.3	Hard, slightly weathered, moderately fractured, gray with white, fine grained, GNEISS with biotite schist layers, fractures low angle, very close, rough, planar, discolored. RQD 2.6 / 5.0 = 52%	
20				C-2	4.8 [96]	19.3 – 24.1	Very hard, slightly weathered, slightly fractured, gray and white, medium grained, GNEISS with biotite schist layers, fractures low angle, close, rough, planar, discolored, open. RQD = 3.8 / 5.0 = 76%	

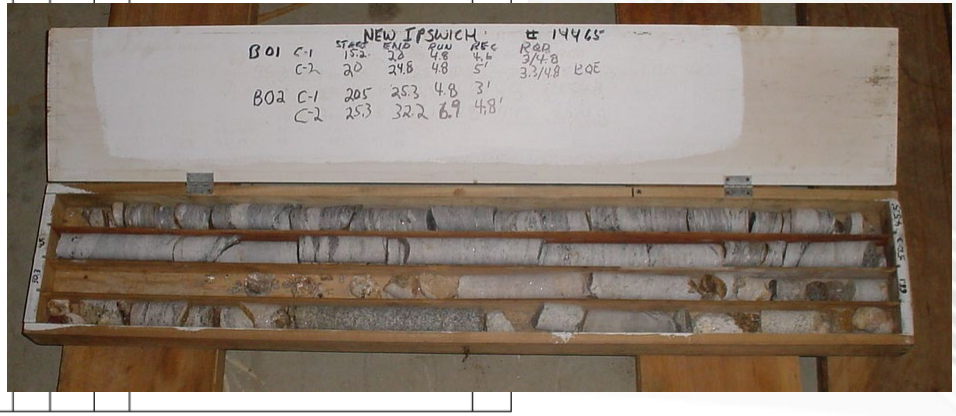
TEST BORING REPORT
STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION

PROJECT NAME NEW IPSWICH 14465 BRIDGE NO. 157/093
DESCRIPTION NH Rt 123-124 over Souhegan River

BORING NO. B301
SHEET NO. 2 OF 2
STA. OFF.
BASELINE
ELEVATION (ft) 921.0

DEPTH (ft)	STRATUM CHANGE DEPTH	STRATUM CHANGE ELEVATION	BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) (%)	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS	STRATUM SYMBOL
30				C-4	4.5 [90]	29.5 – 34.0	Hard, fresh, slightly fractured, gray and white, medium grained, GNEISS with biotite schist layer, fractures low angle, close, rough, planar, tight. RQD = 3.9 / 5.0 = 78%	
35				C-5	5.0 [100]	34.0 – 39.0	Hard, fresh, slightly fractured, white and gray, medium grained, GNEISS with biotite/muscovite schist layers, fractures low angle, close, rough, planar, tight. RQD = 3.5 / 5.0 = 70%	
40				C-6	4.9 [98]	39.5 – 44.5	Hard, fresh, slightly fractured to massive, white and gray, medium grained, GNEISS with biotite/muscovite schist layers, fractures low angle, moderate, rough, undulating, tight. RQD = 4.6 / 5.0 = 92%	
45						44.5	Bottom of Exploration @ 44.5 ft (El. 876.5)	





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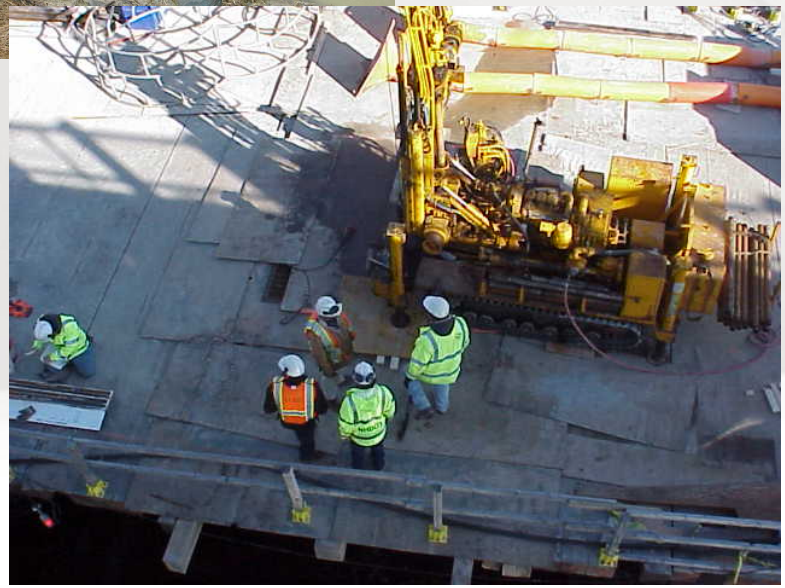

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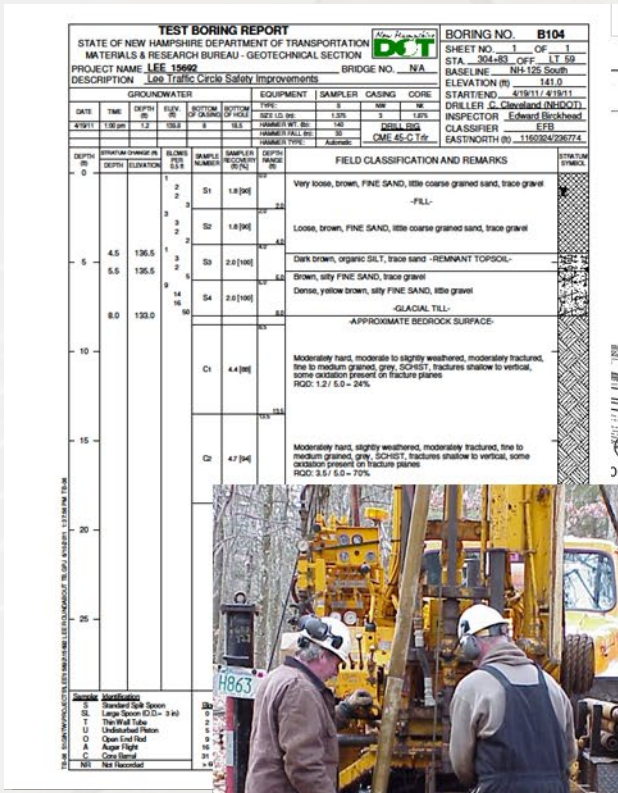
Department of Transportation



TEST BORING REPORT

STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION

BORING NO. **B104**

PROJECT NAME LEE 15692 BRIDGE NO. N/A
DESCRIPTION Lee Traffic Circle Safety Improvements

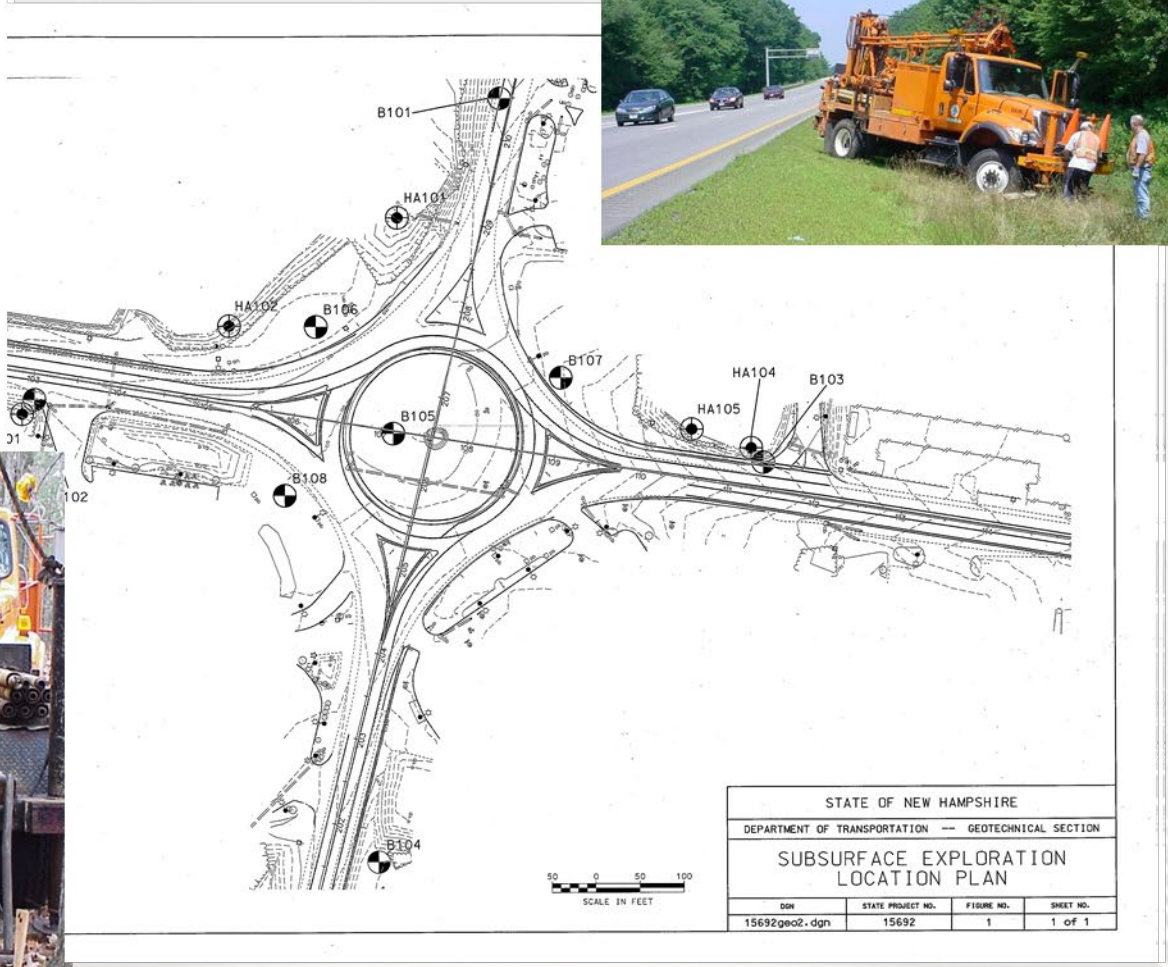
SHEET NO. 1 OF 1
STA. 304+83 OFF. LT 59
BASELINE NH-125 South
ELEVATION (ft) 141.0
START/END 4/19/11 / 4/19/11
DRILLER C. Cleveland (NHDOT)
INSPECTOR Edward Birckhead
CLASSIFIER EFB
EAST/NORTH (ft) 1160324/236774

GROUNDWATER				EQUIPMENT	SAMPLER	CASING	CORE
DATE	TIME	DEPTH (ft)	ELEV (ft)	TYPE:	S	NW	NE
4/19/11	1:00 pm	1.2	139.8	SIZE I.D. (in):	1.375	3	1.875
				HAMMER WT. (lb):	140	DRILL RIG	
				HAMMER FALL (in):	30	CME 45-C Trlr	
				HAMMER TYPE:	Automatic		

DEPTH (ft)	STRATUM CHANGE (ft) DEPTH	STRATUM CHANGE (ft) ELEVATION	BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) (%)	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS	STRATUM SYMBOL
0			1 2 2	S1	1.8 [90]	0.0 - 2.0	Very loose, brown, FINE SAND, little coarse grained sand, trace gravel -FILL-	
			3 3 2	S2	1.8 [90]	2.0 - 4.2	Loose, brown, FINE SAND, little coarse grained sand, trace gravel	
5	4.5	136.5	1 3 2	S3	2.0 [100]	4.2 - 6.2	Dark brown, organic SILT, trace sand -REMNANT TOPSOIL-	
	5.5	135.5	5			6.2 - 8.2	Brown, silty FINE SAND, trace gravel	
			9 14 16	S4	2.0 [100]		Dense, yellow brown, silty FINE SAND, little gravel -GLACIAL TILL-	
	8.0	133.0	50			8.2 - 8.5	-APPROXIMATE BEDROCK SURFACE-	
10				C1	4.4 [88]	8.5 - 13.5	Moderately hard, moderate to slightly weathered, moderately fractured, fine to medium grained, grey, SCHIST, fractures shallow to vertical, some oxidation present on fracture planes RQD: 1.2' / 5.0 = 24%	
15				C2	4.7 [94]	13.5 - 18.5	Moderately hard, slightly weathered, moderately fractured, fine to medium grained, grey, SCHIST, fractures shallow to vertical, some oxidation present on fracture planes RQD: 3.5' / 5.0 = 70%	
20								
25								

Sampler Identification

S	Standard Split Spoon
SL	Large Spoon (O.D. = 3 in)
T	Thin-Wall Tube
U	Undisturbed Piston
O	Open End Rod
A	Auger Flight
C	Core Barrel
NR	Not Recorded



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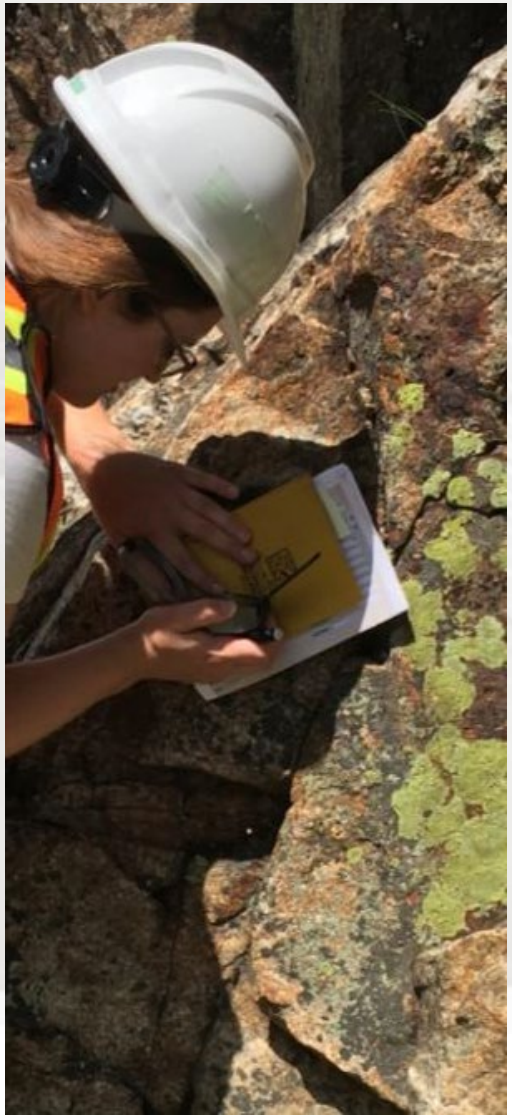

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Then there is the A-GaME…

Highway issues where alternative methods of investigation can help…

- Depth and rippability of bedrock
- Presence and location of objects
- Nature of shallow geologic layers – peat, sand, clay
- Depth of bridge foundations
- Rock slope stability analysis

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Using more tools in the geotechnical tool box…

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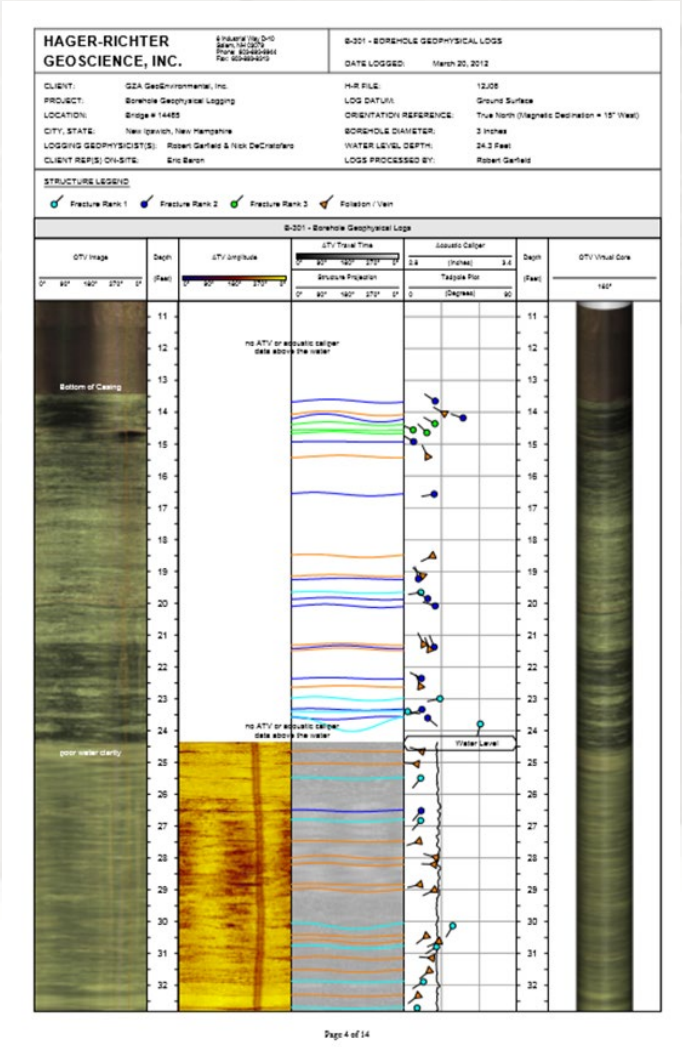
Using more tools in the geotechnical tool box…



Acoustic/optical Televiewers

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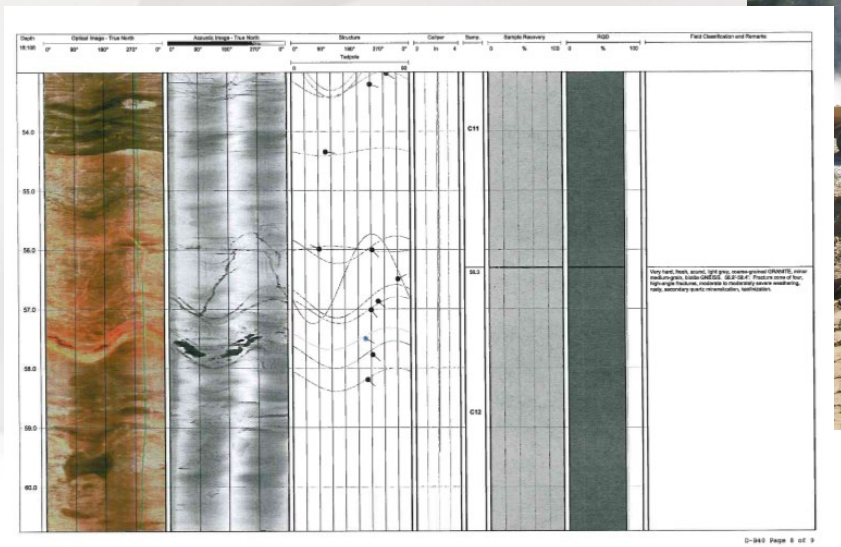
Using more tools in the geotechnical tool box…



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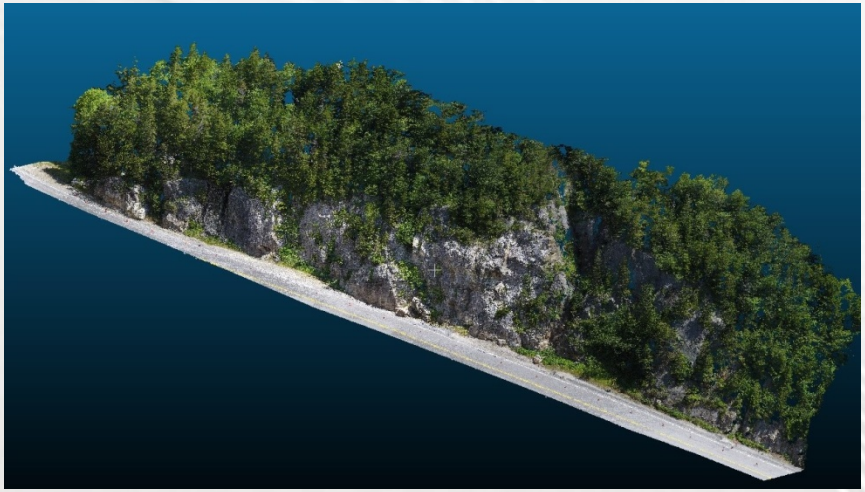
Using more tools in the geotechnical tool box…



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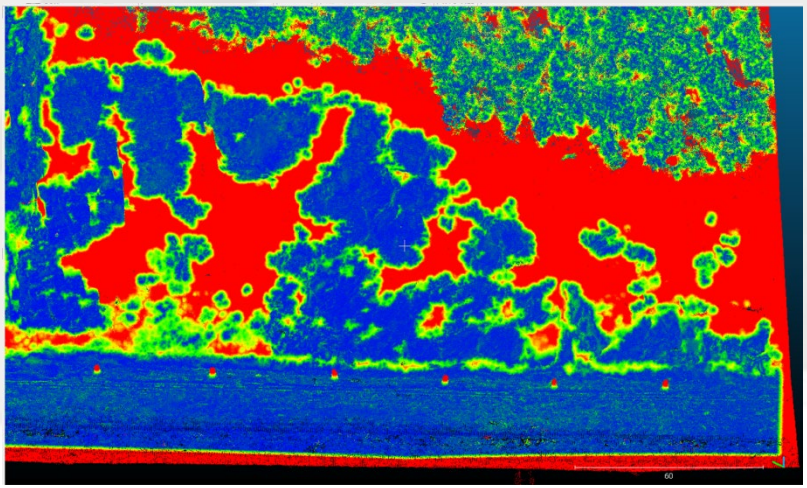

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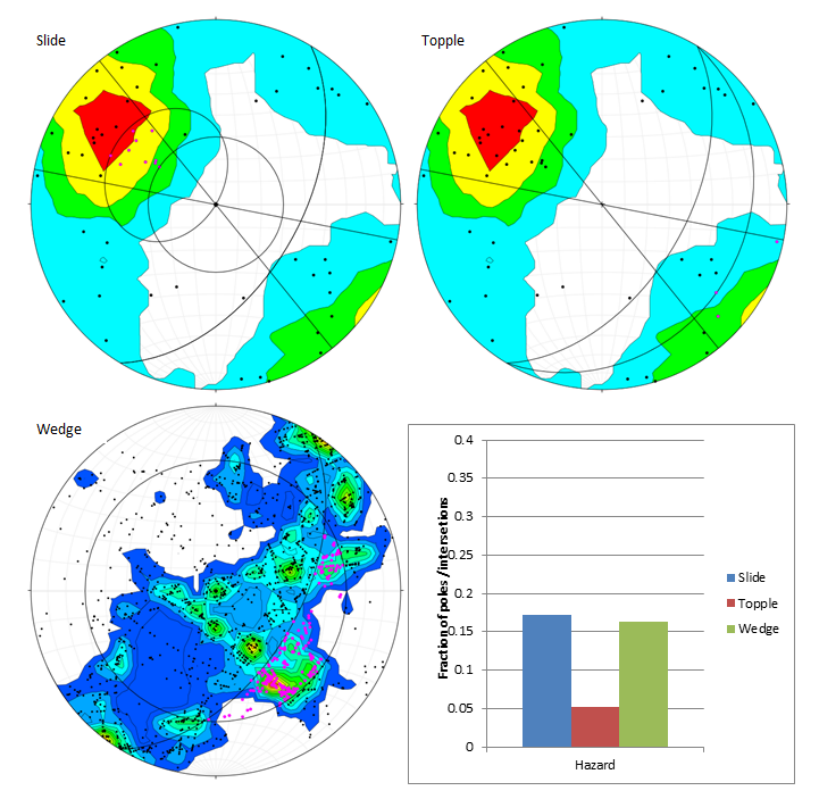

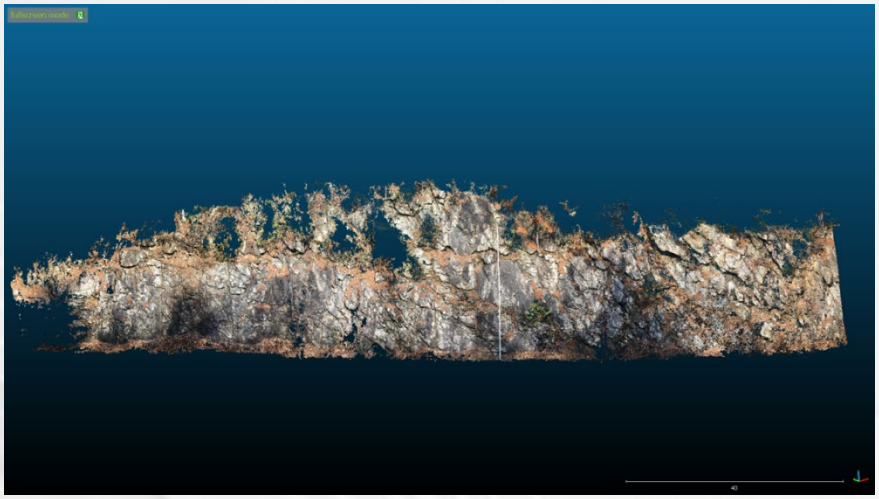

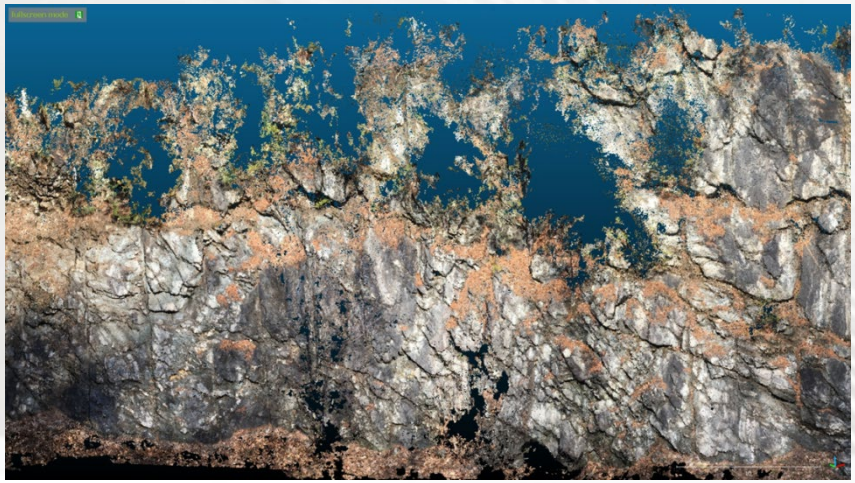

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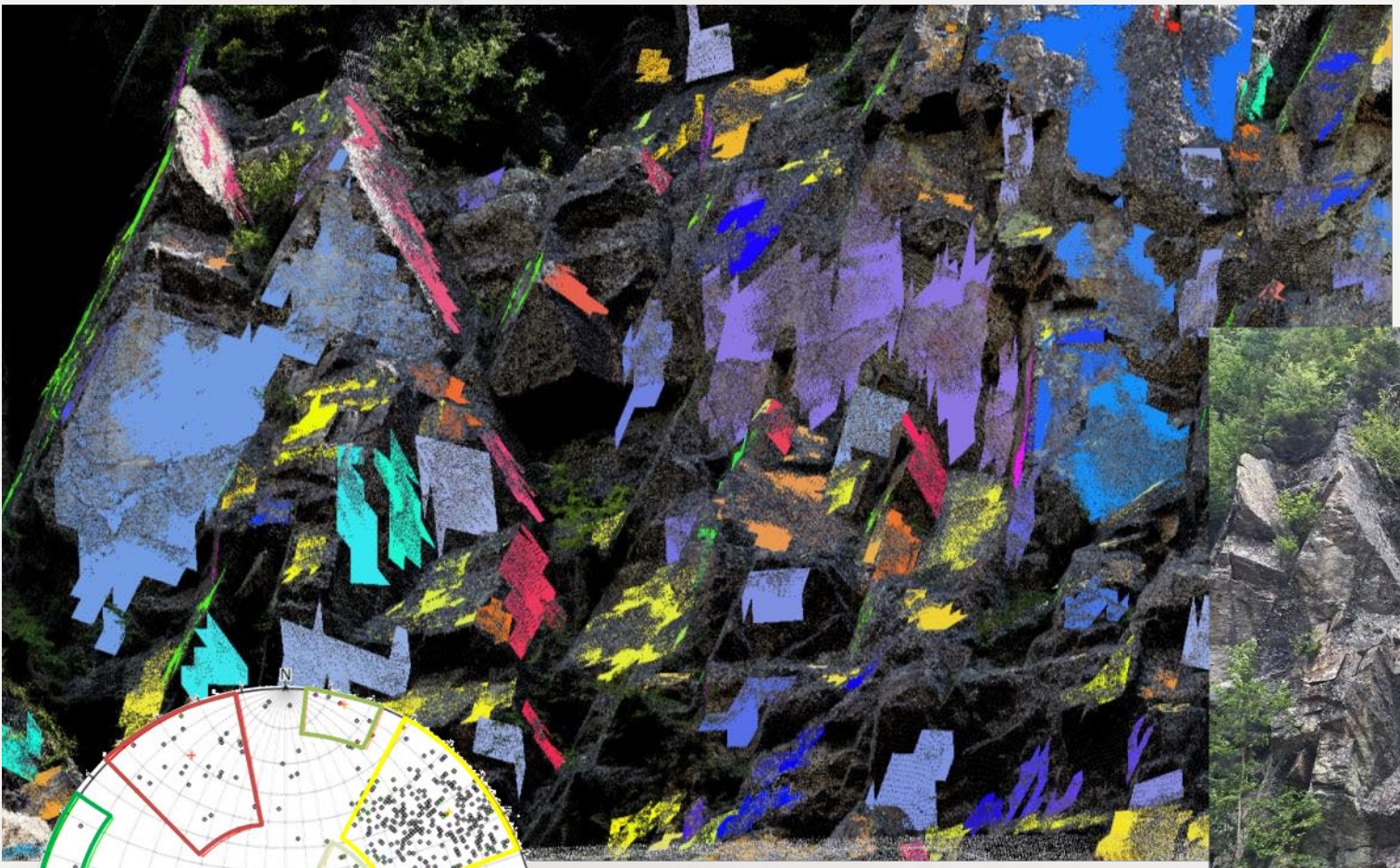

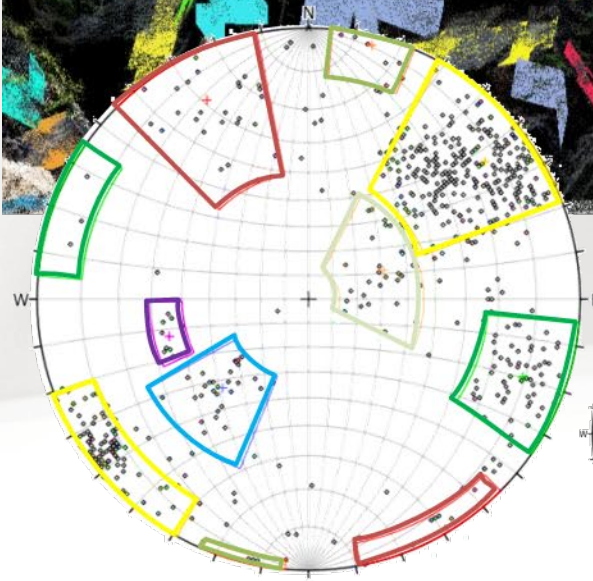

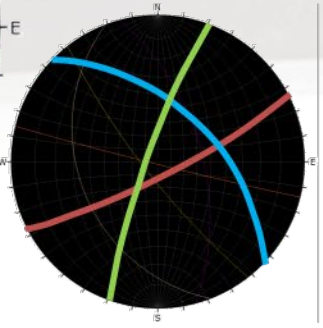

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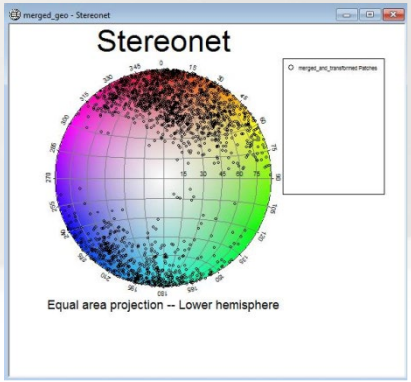
merged_geo - Stereonet
Stereonet
merged_and_transformed Patches
Equal area projection -- Lower hemisphere

Enhanced, Effective, Site Characterization

better defining site variability

- Many methods available for using geophysics
- Not limited to the 5 Featured “most universal” technologies
- Minimally invasive
- Economical
- Excellent screening tool
- Proven results
- Applicability/Availability
- Minimizes the unknowns in construction – claims, change orders, overruns

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Questions?

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