ENGINEERING CONSULTING SERVICES

"One Firm. One Mission."

HISTORIC ROCK / SOIL WALL STABILIZATION CASE STUDY – TENNESSEE CAPITAL HILL, NASHVILLE, TN

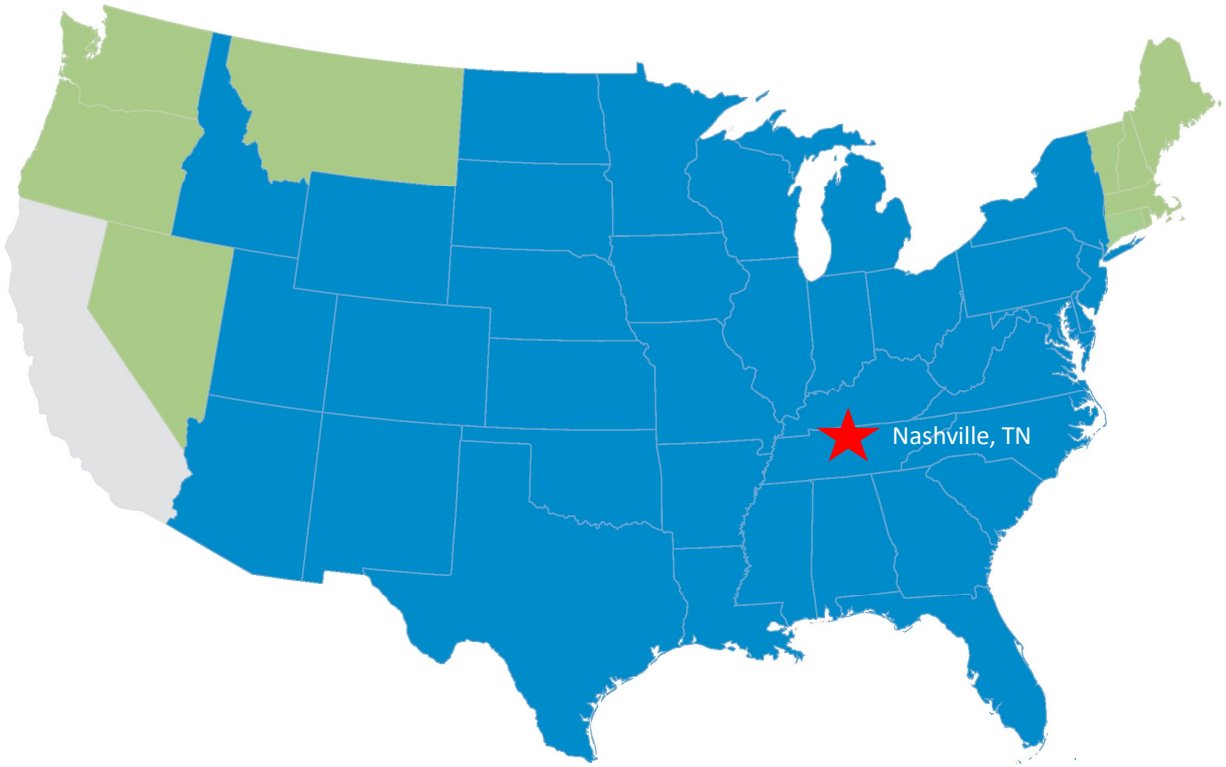
Presented By: John D. Godfrey, Jr., P.E.

PREPARED FOR THE 54th STGEC CONFERENCE 2025
Williamsburg, Virginia
September 16, 2025

OUTLINE

- Location and History
- Team
- Geotechnical Exploration
- Design 2014
- Design 2020
- RFI’s
- Soil Nail Construction
- Slope Failure
- Performance and Proof Testing
- Wall Photos 2025
- Questions

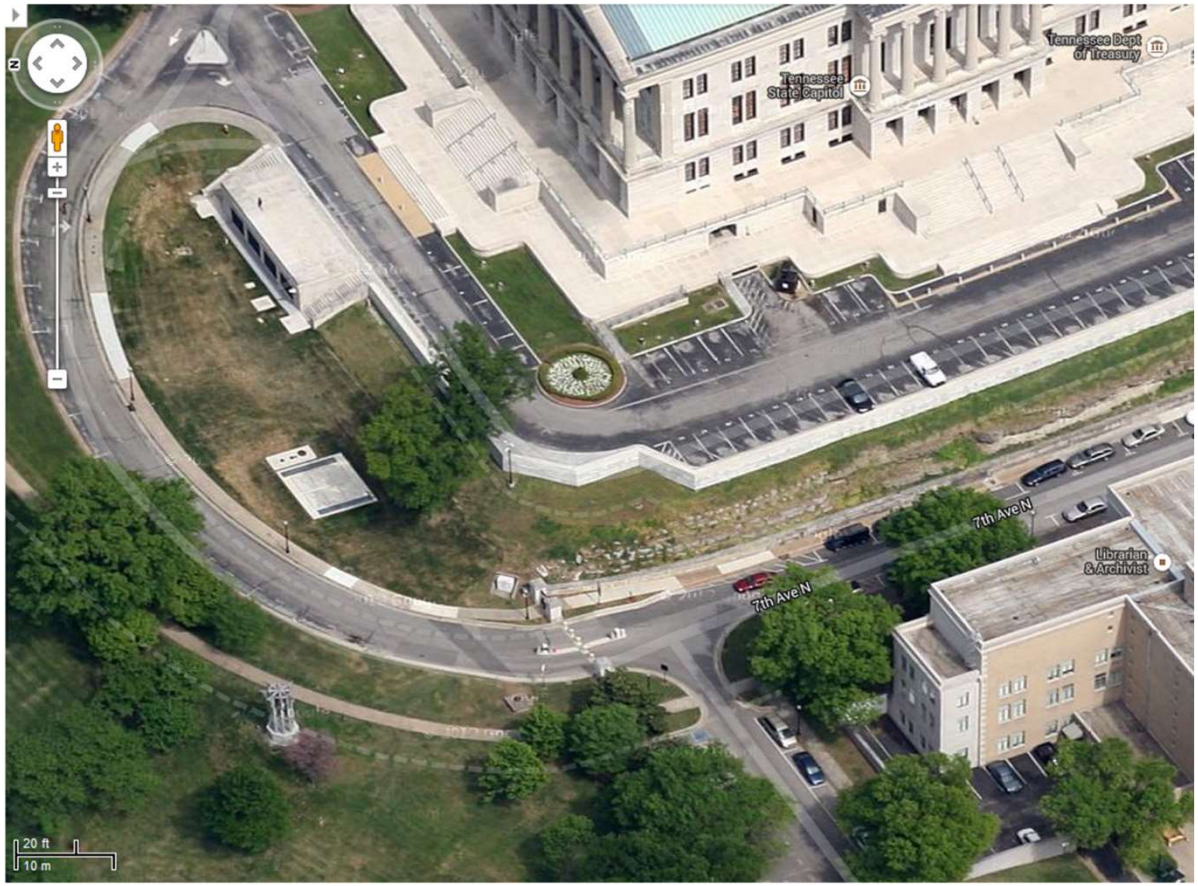
LOCATION



LOCATION

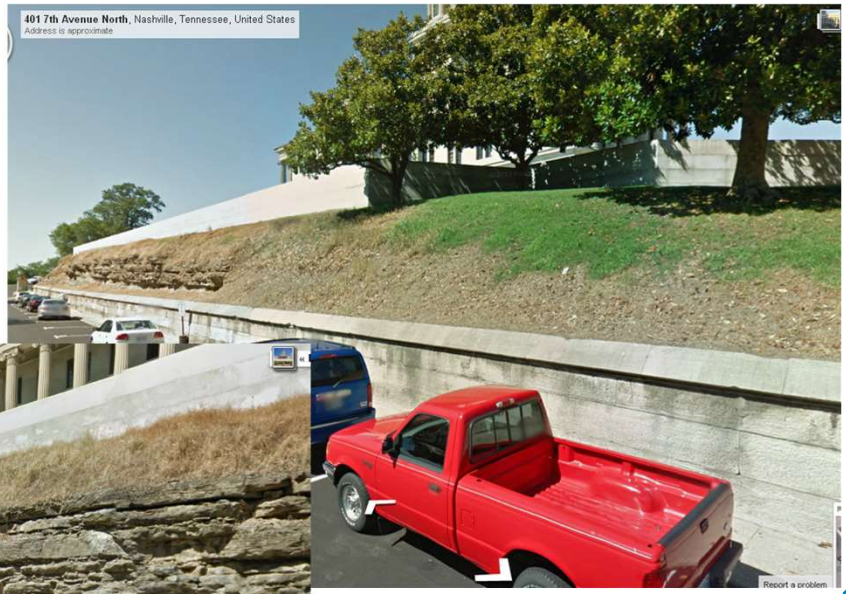

6th Ave N
Tennessee State Capitol
7th Ave N
7th Ave N
7th Ave N
50 ft
20 m

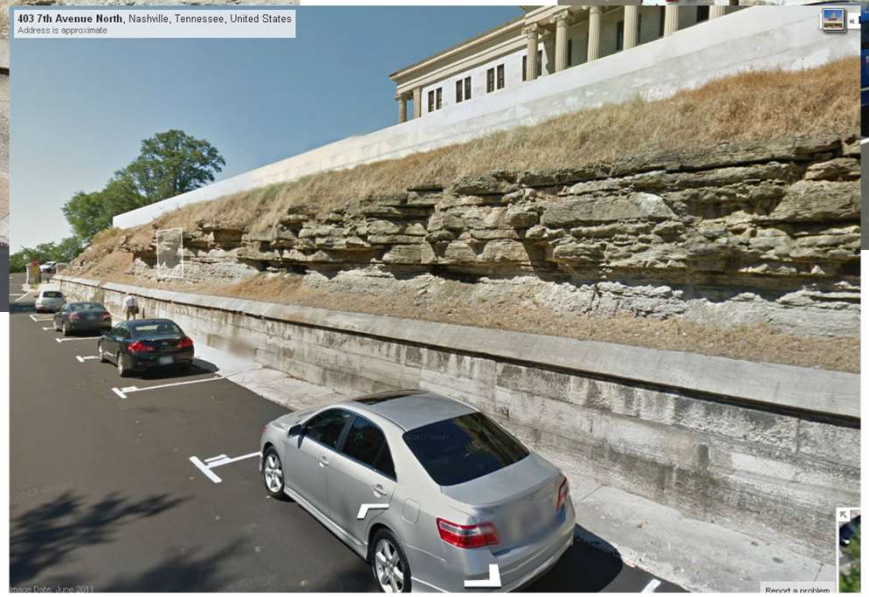
LOCATION


Tennessee Dept of Treasury
Tennessee State Capitol
7th Ave N
7th Ave N
Librarian & Archivist
20 ft
10 m

LOCATION – DISTRESSED PORTION (2014)

LOCATION – STREET LEVEL WALL VIEW (2014)





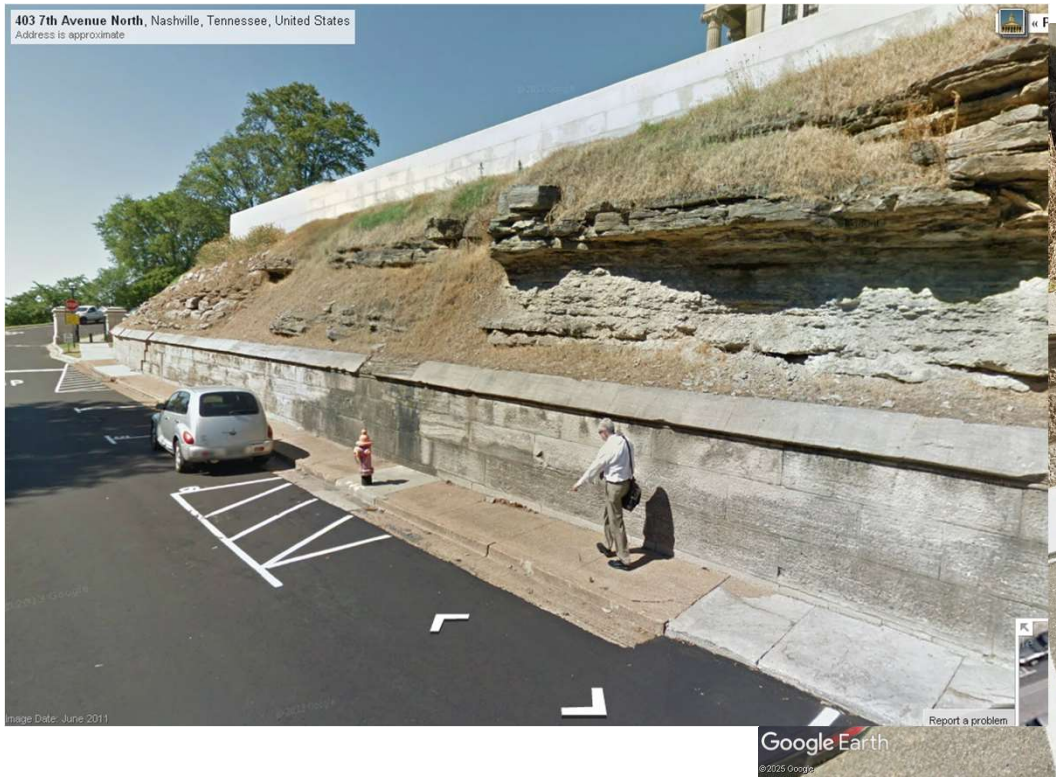
HISTORY

1864 PHOTO

The State Capitol was constructed between 1845 and 1859. It was designed in Greek Revival style by architect William Strickland (1788-1854). Strickland died before construction was completed and was interred in the walls of the north portico. His son, Francis W. Strickland, oversaw the completion of the project.
The building was constructed of Tennessee Limestone and underwent major restoration from 1956-1960. The original capitol location was to be in the geographical center of the State, Murfreesboro, but some wealthy Nashvillian's bought the current capitol property for $30,000 dollars and then sold it to the State for $1 dollar if they build in Nashville.

HISTORY

Primary Goal: Maintain the Historical Components of the Existing Wall and Stabilize the Rock Slope



TEAM

Tennessee State Government

Owner

Geotechnical and
Soil Nail Wall Designer

Soil Nail Contractor

Hodgson Douglas
Landscape Architect

GEOTECHNICAL EXPLORATION

PROJECT INFORMATION:

- Site Location: 7th Avenue N. & Charlotte Avenue, Nashville, Tennessee
- Project Scope: Landscape Upgrades (New Construction):
  - (6) sets of sidewalks/stairs
    - (3) sets along the NW slope of Capitol Hill
    - (3) sets along the SE slope of Capitol Hill
  - Belvedere feature (NW of the State Capitol Building)

  Retaining Wall (To be repaired)
  - Gravity retaining wall (runs along the NE edge of 7th Ave N)
  - 85 feet long distressed section of wall (NW end of wall)
  - Maximum wall height of approximately 6 feet
  - Apparent sliding and/or rotation
  - Repair/reconstruction of distressed wall is required
- Site Conditions: Grassed slopes, rock outcrops, exposed boulders in fill slope

GEOTECHNICAL EXPLORATION

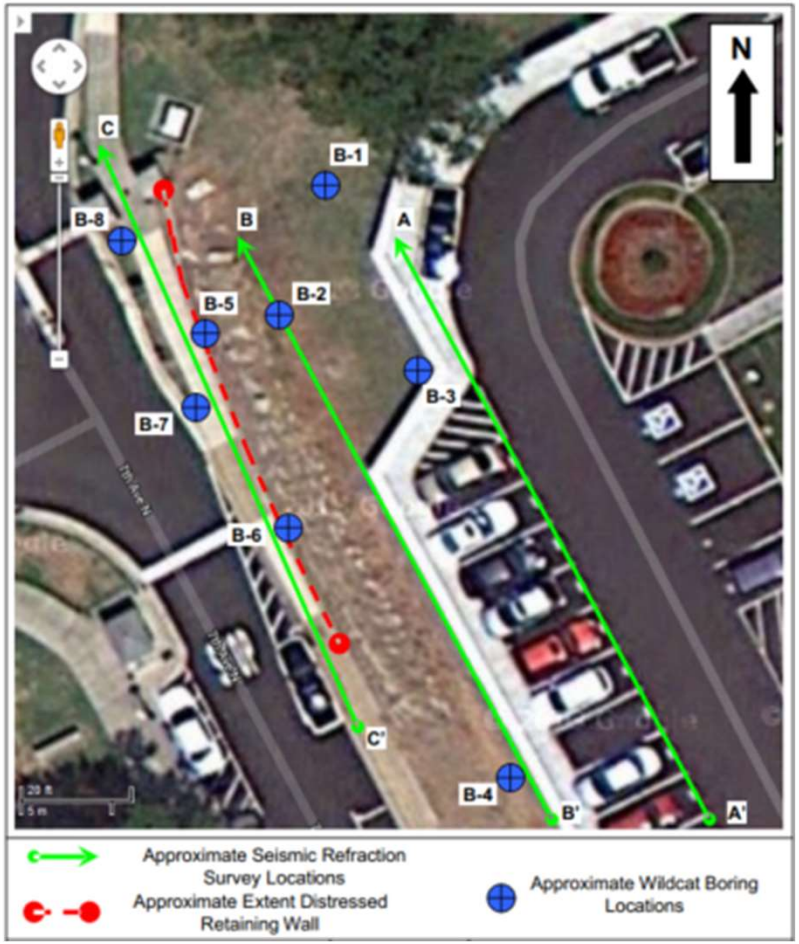
SUBSURFACE CONDITIONS:

- Field Exploration: (16) Wildcat™ penetrometer borings (to penetration refusal)
  (16) Hand augers (to auger refusal)
- Surface Material: Topsoil = 3 to 12 inches (at areas of our exploration)
- Existing Fill: Approximate depths ranging from 1 to at least 10.5 feet
  Some augers refused due to apparent cobbles and gravel in fill
  CLAY (CL), with varying amounts of sand
- Natural Soils: CLAY (CL), with varying amounts of sand and gravel
- Hand Auger Refusal: Encountered from approximately 0.3 to 6 feet
- Wildcat Refusal: Encountered from approximately 1 to 10.5 feet
- Groundwater: Not encountered during this exploration

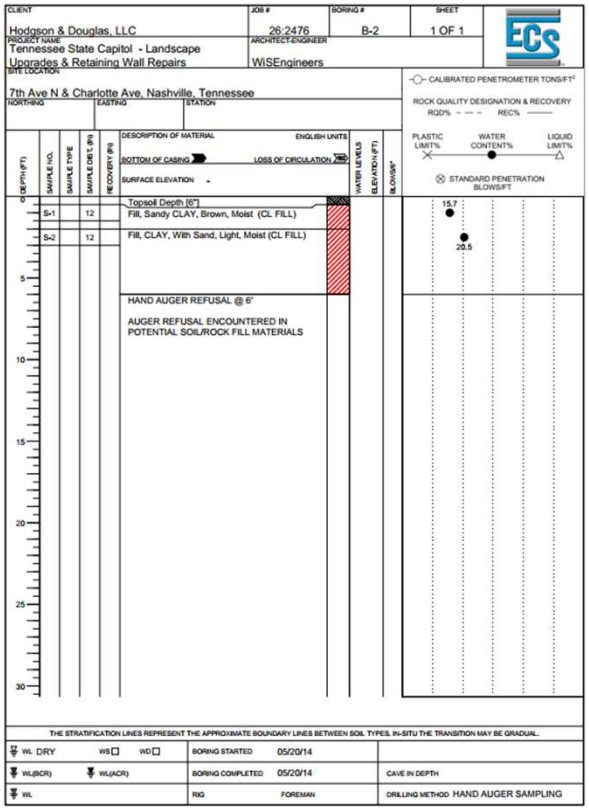
POTENTIAL GEOTECHNICAL CONCERNS:

- Presence of existing man-placed fill at the site (with oversized rock material)
- Presence of shallow irregular rock profile
- Gravity retaining wall distress/instability

GEOTECHNICAL EXPLORATION



GEOTECHNICAL EXPLORATION



CLIENT	JOB #	BORING #	SHEET
Hodgson & Douglas, LLC	26:2476	B-2	1 OF 1
PROJECT NAME: Tennessee State Capitol - Landscape Upgrades & Retaining Wall Repairs	ARCHITECT-ENGINEER: WiSEngineers		

SITE LOCATION: 7th Ave N & Charlotte Ave, Nashville, Tennessee

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY RQD% - - - REC%

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION: -

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/FT
0					Topsoil Depth [6"]			
	S-1		12		Fill, Sandy CLAY, Brown, Moist (CL FILL)			15.7
	S-2		12		Fill, CLAY, With Sand, Light, Moist (CL FILL)			20.5
5					HAND AUGER REFUSAL @ 6'			
					AUGER REFUSAL ENCOUNTERED IN POTENTIAL SOIL/ROCK FILL MATERIALS			
10								
15								
20								
25								
30								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL DRY WS☐ WD☐	BORING STARTED 05/20/14	
WL(BCR) WL(ACR)	BORING COMPLETED 05/20/14	CAVE IN DEPTH
WL	RIG FOREMAN	DRILLING METHOD HAND AUGER SAMPLING

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

ECS Central, PLLC
318 Seaboard Lane #208
Franklin, TN 37067

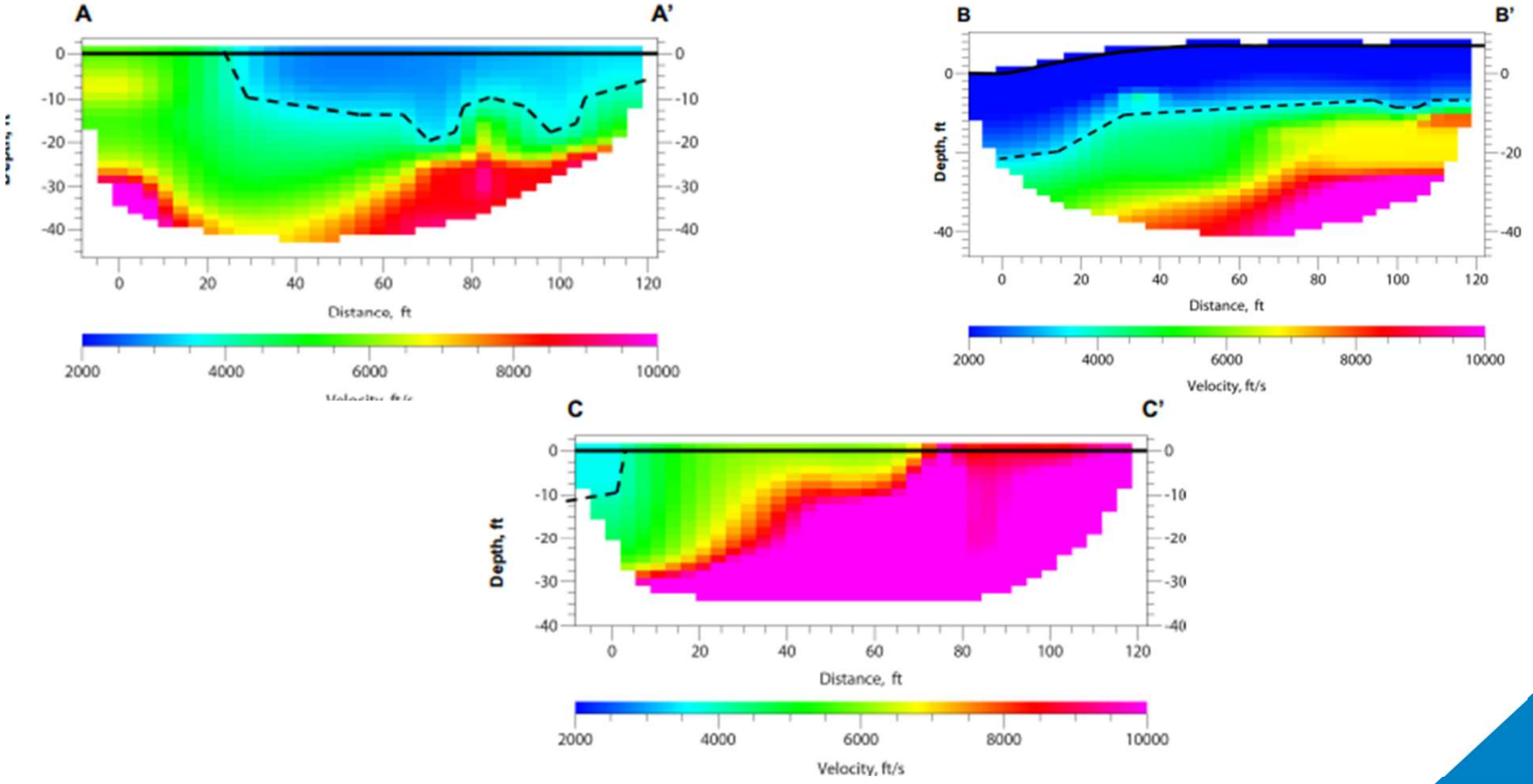
PROJECT NUMBER: 26:2476
DATE STARTED: 05-20-2014
DATE COMPLETED: 05-20-2014

HOLE #: B-2
CREW: B. Nguyen/C. Hills
PROJECT: TN State Capital - Landscape Upgrades & Ret. Wall Repairs
ADDRESS: 7th Ave N & Charlotte Ave
LOCATION: Nashville, Tennessee

SURFACE ELEVATION: -
WATER ON COMPLETION: DRY
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
	4	17.8	*****	5	LOOSE	MEDIUM STIFF
	1	4.4	*	1	VERY LOOSE	VERY SOFT
1 ft	2	8.9	**	2	VERY LOOSE	SOFT
	2	8.9	**	2	VERY LOOSE	SOFT
	2	8.9	**	2	VERY LOOSE	SOFT
2 ft	2	8.9	**	2	VERY LOOSE	SOFT
	2	8.9	**	2	VERY LOOSE	SOFT
	2	8.9	**	2	VERY LOOSE	SOFT
3 ft	3	13.3	***	3	VERY LOOSE	SOFT
1 m	23	102.1	**********	25+	MEDIUM DENSE	VERY STIFF
	9	34.7	*********	9	LOOSE	STIFF
4 ft	4	15.4	****	4	VERY LOOSE	SOFT
	5	19.3	*****	5	LOOSE	MEDIUM STIFF
	8	30.9	********	8	LOOSE	MEDIUM STIFF
5 ft	10	38.6	**********	11	MEDIUM DENSE	STIFF
	11	42.5	**********	12	MEDIUM DENSE	STIFF
	16	61.8	**********	17	MEDIUM DENSE	VERY STIFF
6 ft	19	73.3	**********	20	MEDIUM DENSE	VERY STIFF
	10	38.6	**********	11	MEDIUM DENSE	STIFF
2 m	20	77.2	**********	22	MEDIUM DENSE	VERY STIFF
7 ft	21	71.8	**********	20	MEDIUM DENSE	VERY STIFF
	50	171.0	**********	25+	DENSE	HARD
8 ft						
9 ft						
3 m 10 ft						
11 ft						
12 ft						
4 m 13 ft						

GEOTECHNICAL EXPLORATION



GEOTECHNICAL EXPLORATION

Retaining Wall Repairs:

- Existing limestone block gravity retaining wall along the NE edge of 7th Ave N.
- 85 foot long distressed section of wall (NW end of 7th Ave N)
- Maximum wall height of approximately 6 feet

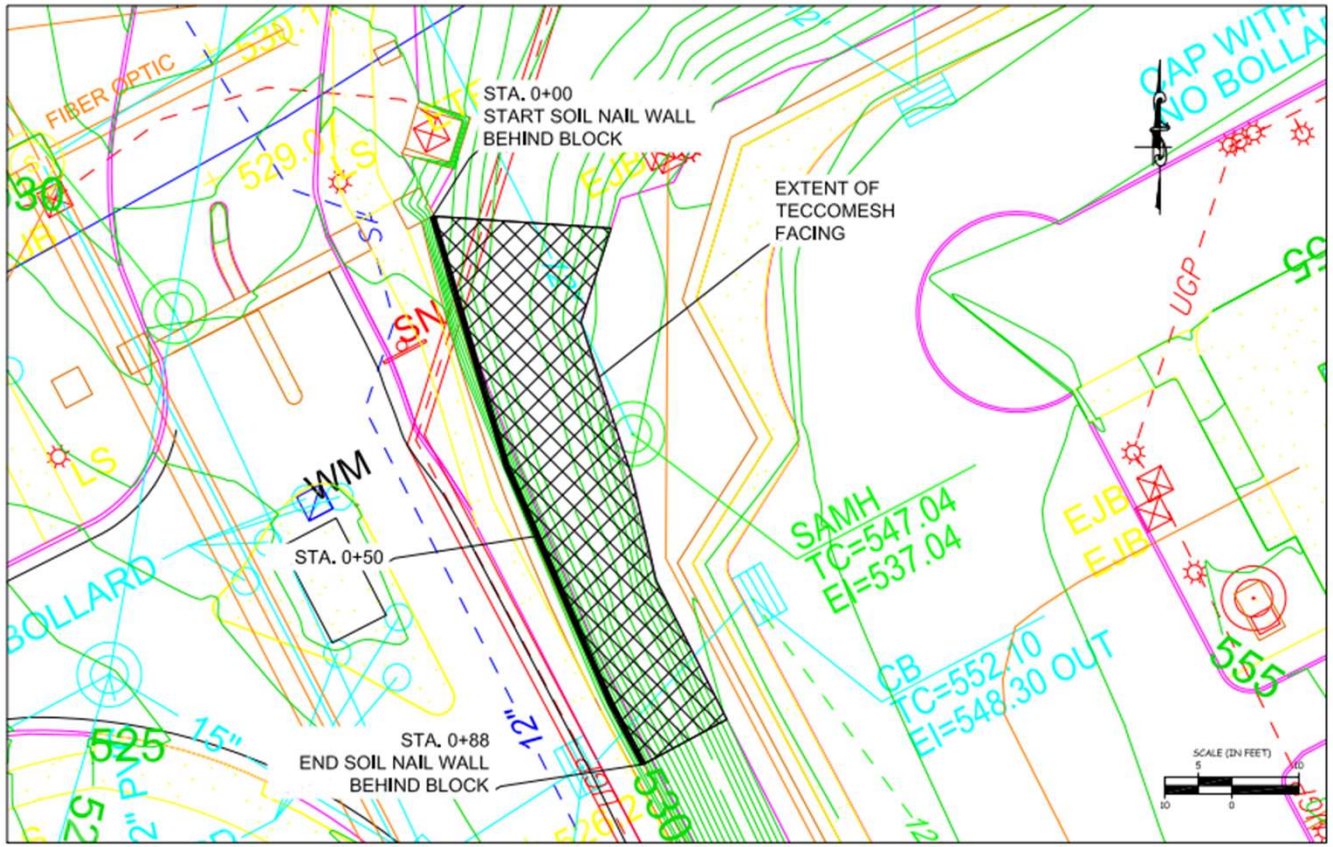
Photo 3: Distressed wall conditions (Source – Right Photo: Google Maps, 2014)

GEOTECHNICAL EXPLORATION

GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

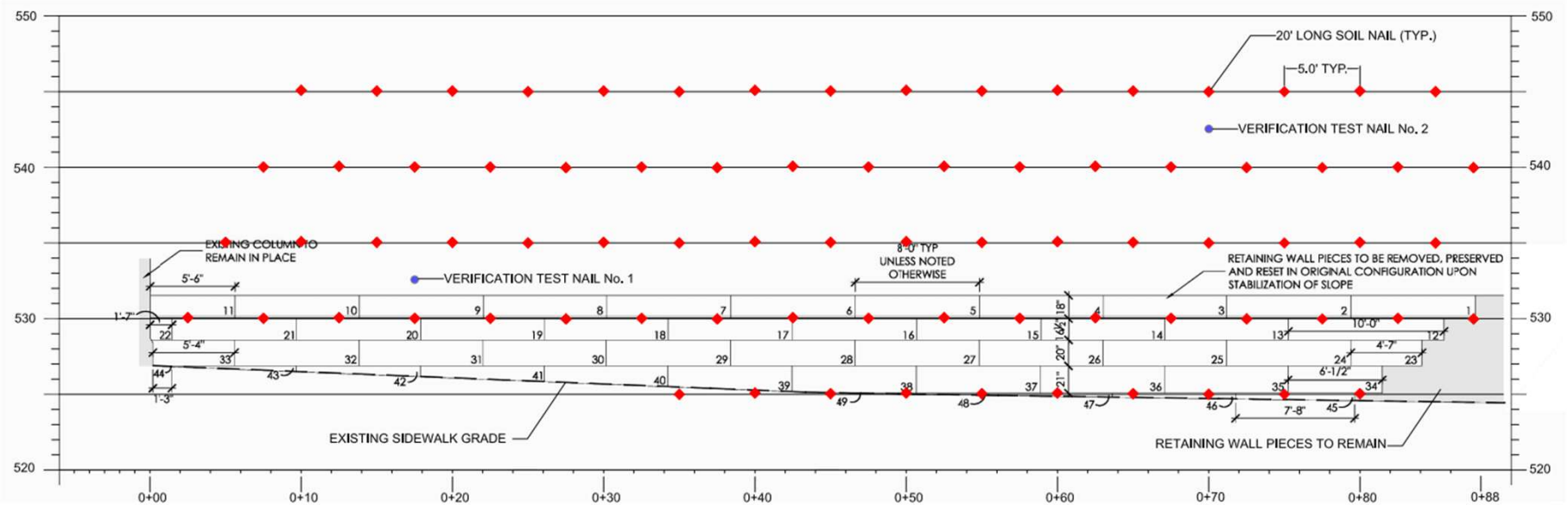
- The increase in lateral pressure could have resulted from the settlement/movement of fill behind the wall due to self-weight settlement or the raveling of soil into voids associated with boulder laden fill.
- Hydrostatic pressure buildup behind the wall could have attributed to the failure.
- The existing instability can be adequately remedied using a technique known as soil nailing.
- The limestone blocks can be strategically removed as the soil nailing progresses in a top-down manner.
- Based on the composition of the slope materials and the steep existing slope geometry, it is our opinion that these conditions indicate a high potential for long term instability of the slope.

2014 SOIL NAIL DESIGN



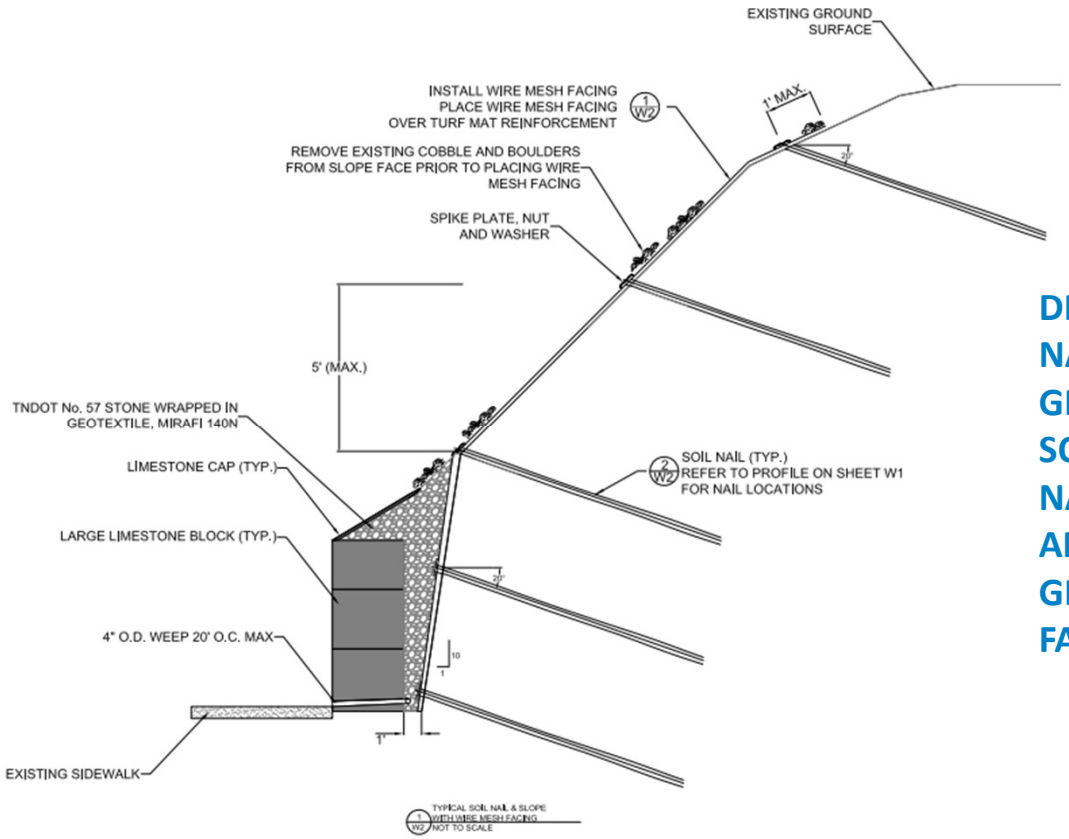
SITE PLAN

2014 SOIL NAIL DESIGN



SOIL NAIL SLOPE PROFILE
SCALE: 1"=3'

2014 SOIL NAIL DESIGN



DESIGN:

NAIL – NO. 9 GR. 75 ALL THREAD

GROUT-ROCK BOND – 75 PSI (F.S. 2.0)

SOIL NAIL SPACING – 5 X 5 FT

NAIL LENGTH – 20 FT

ANGLE FROM HORIZONTAL – 20 DEGREES

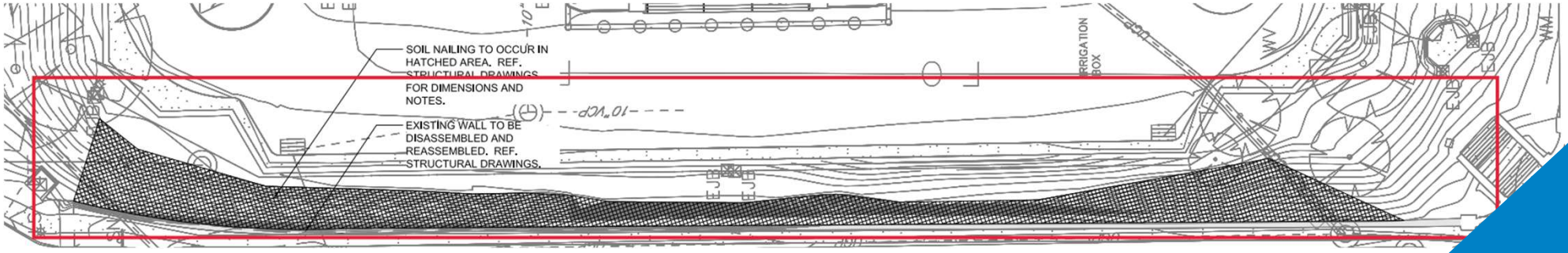
GROUT - 2,500 PSI

FACING – TECCO WIRE MESH OVER TURF MAT

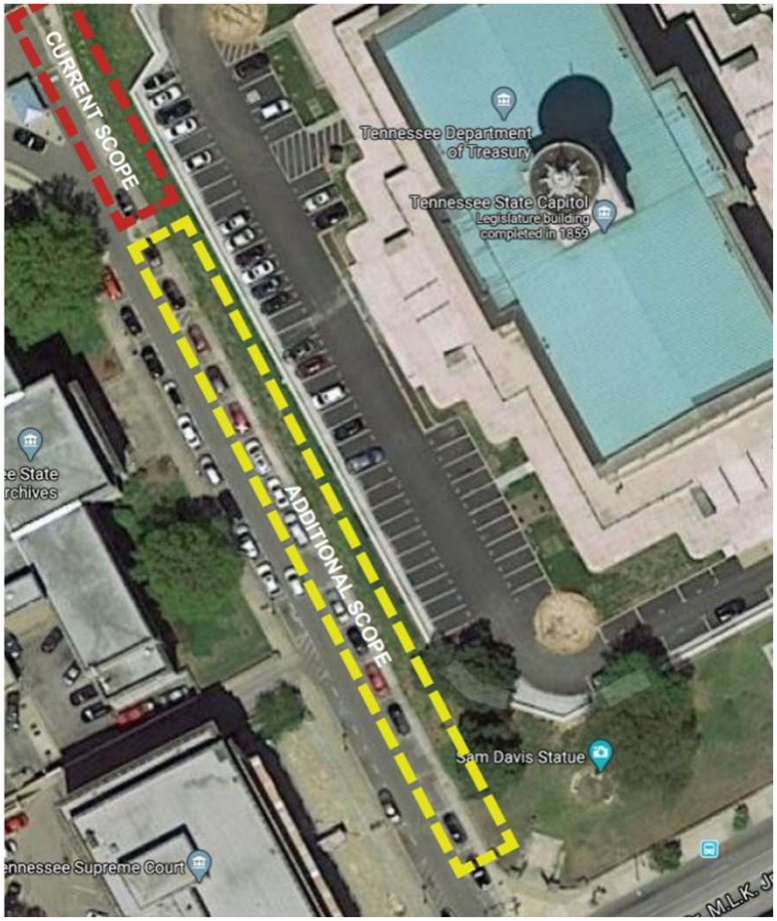
SOIL NAIL DESIGN – FAST FORWARD TO FEBRUARY 2020

- ECS contacted in February 2020 by Hodgson Douglas (HDLA) to provide a proposal to increase the wall design length from 88 feet to 440 feet due to additional slope and block wall movement. New maximum wall height 20 feet.

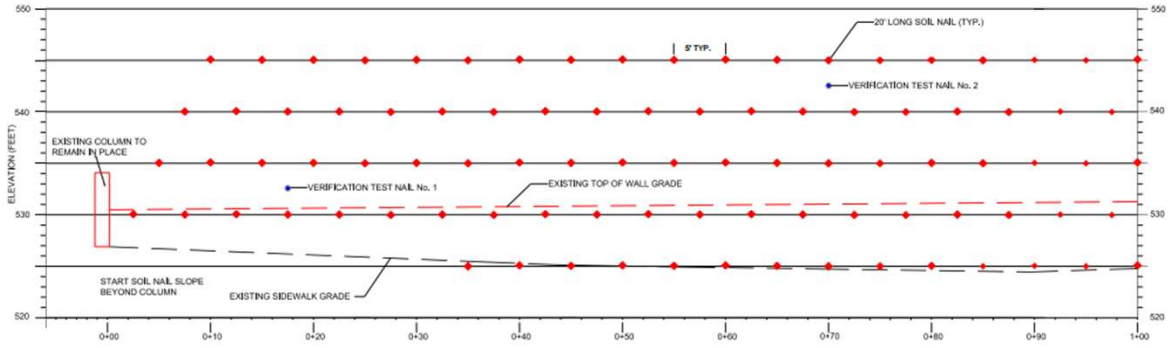
- A new plan of the extended wall and area of soil nail stabilization was provided for ECS to complete the new design.



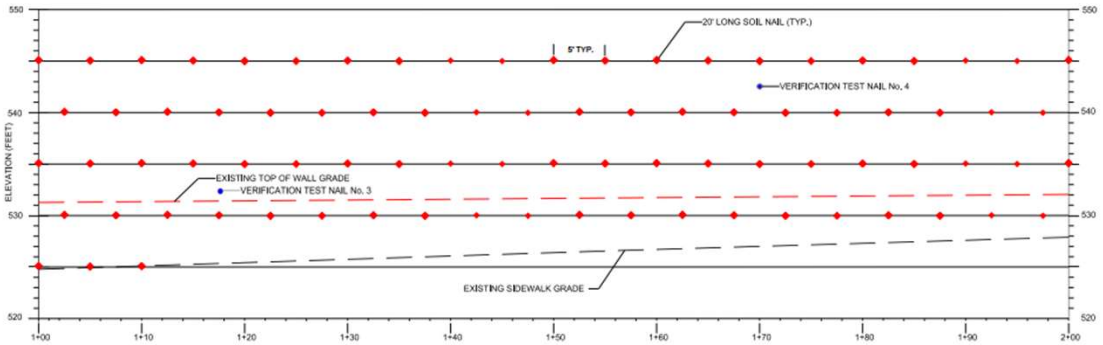
SOIL NAIL DESIGN – FAST FORWARD TO FEBRUARY 2020



SOIL NAIL DESIGN – JULY 2020

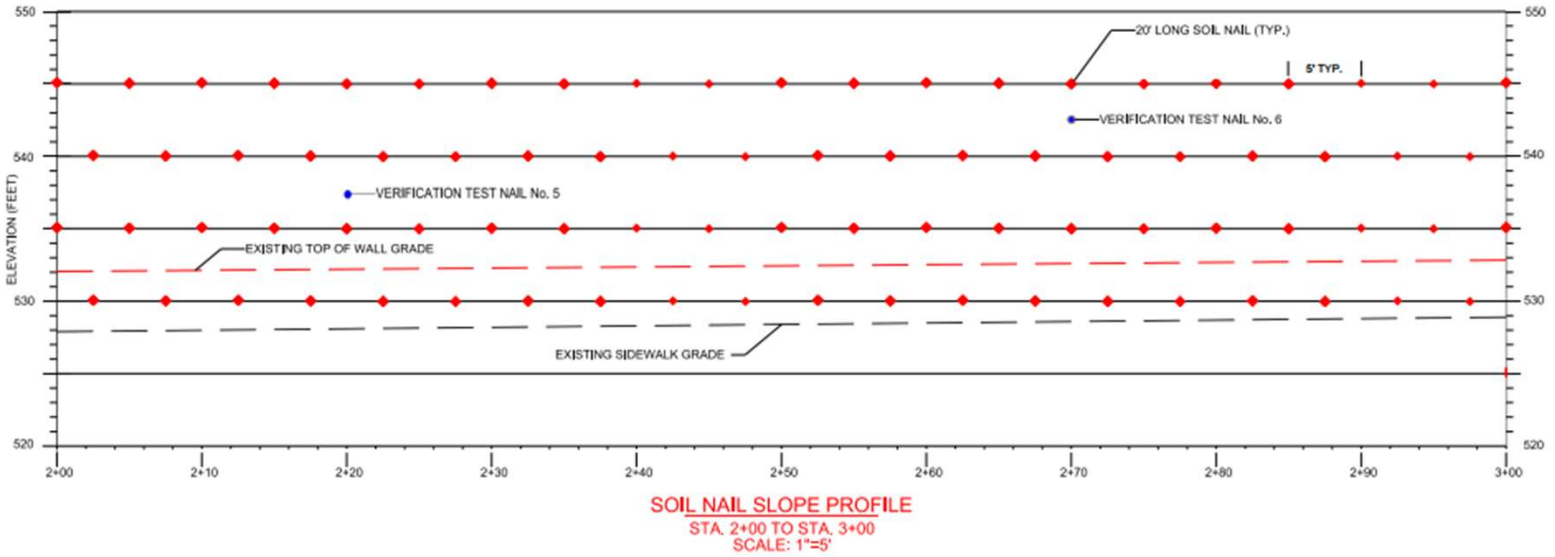


SOIL NAIL SLOPE PROFILE
STA. 0+00 TO STA. 1+00
SCALE: 1"=5'



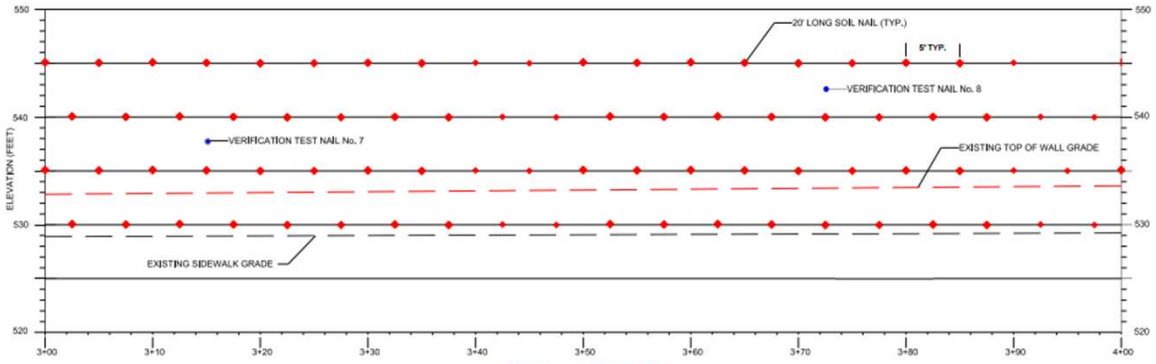
SOIL NAIL SLOPE PROFILE
STA. 1+00 TO STA. 2+00
SCALE: 1"=5'

SOIL NAIL DESIGN – JULY 2020

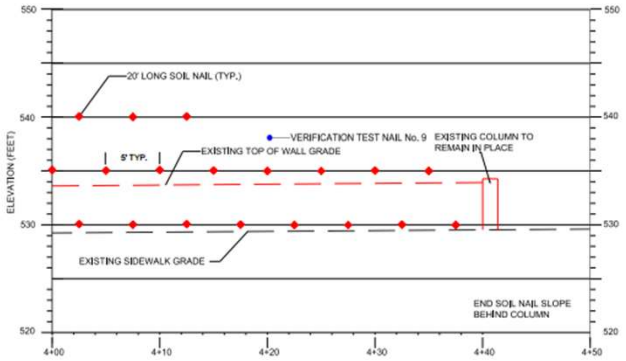


SOIL NAIL SLOPE PROFILE
STA. 2+00 TO STA. 3+00
SCALE: 1"=5'

SOIL NAIL DESIGN – JULY 2020



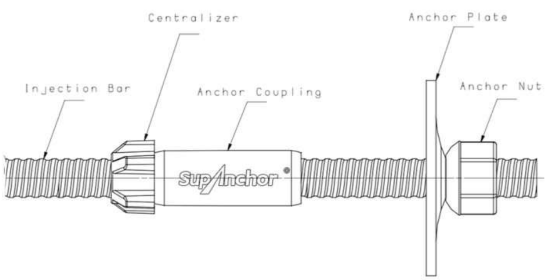
SOIL NAIL SLOPE PROFILE
STA. 3+00 TO STA. 4+00
SCALE: 1"=5'

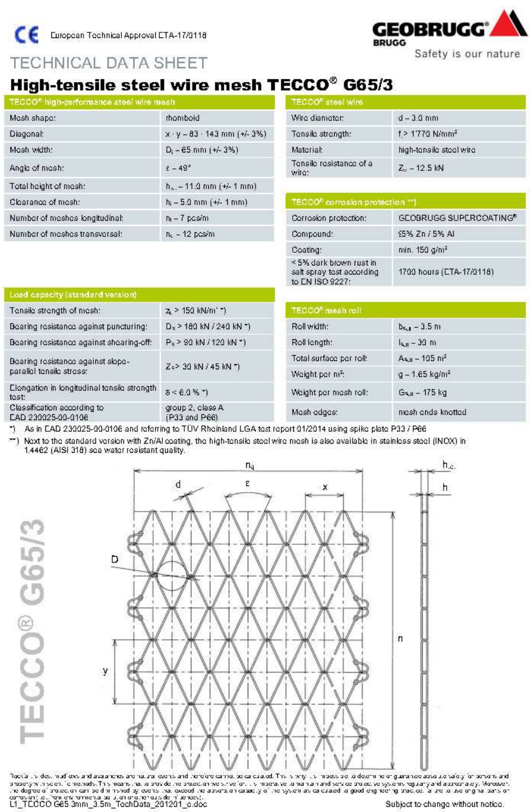


SOIL NAIL SLOPE PROFILE
STA. 4+00 TO STA. 4+50
SCALE: 1"=5'

SOIL NAIL DESIGN – JULY 2020 SUBMITTALS

SupAnchor® T40 Self Drilling Injection Anchor Systems





CE European Technical Approval ETA-17/0118

GEOBRUGG BRUGG
Safety is our nature

TECHNICAL DATA SHEET

High-tensile steel wire mesh TECCO® G65/3

TECCO® high-performance steel wire mesh	
Mesh shape:	rhomboid
Diagonal:	x · y – 83 · 143 mm (+/- 3%)
Mesh width:	D_i – 65 mm (+/- 3%)
Angle of mesh:	ε – 49°
Total height of mesh:	h_{tot} – 11.0 mm (+/- 1 mm)
Clearance of mesh:	h_i – 5.0 mm (+/- 1 mm)
Number of meshes longitudinal:	n_l – 7 pcs/m
Number of meshes transversal:	n_q – 12 pcs/m

Load capacity (standard version)	
Tensile strength of mesh:	z_k > 150 kN/m' *)
Bearing resistance against puncturing:	D_R > 180 kN / 240 kN *)
Bearing resistance against shearing-off:	P_R > 90 kN / 120 kN *)
Bearing resistance against slope-parallel tensile stress:	Z_R > 30 kN / 45 kN *)
Elongation in longitudinal tensile strength test:	δ < 6.0 % *)
Classification according to EAD 230025-00-0106	group 2, class A (P33 and P66)

TECCO® steel wire	
Wire diameter:	d – 3.0 mm
Tensile strength:	f_t > 1'770 N/mm²
Material:	high-tensile steel wire
Tensile resistance of a wire:	Z_w – 12.5 kN

TECCO® corrosion protection **)	
Corrosion protection:	GEOBRUGG SUPERCOATING®
Compound:	95% Zn / 5% Al
Coating:	min. 150 g/m²
< 5% dark brown rust in salt spray test according to EN ISO 9227:	1700 hours (ETA-17/0118)

TECCO® mesh roll	
Roll width:	$b_{R,II}$ – 3.5 m
Roll length:	$l_{R,II}$ – 30 m
Total surface per roll:	$A_{R,II}$ – 105 m²
Weight per m²:	g – 1.65 kg/m²
Weight per mesh roll:	$G_{R,II}$ – 175 kg
Mesh edges:	mesh ends knotted

*) As in EAD 230025-00-0106 and referring to TÜV Rheinland LGA test report 01/2014 using spike plate P33 / P66

**) Next to the standard version with Zn/Al coating, the high-tensile steel wire mesh is also available in stainless steel (INOX) in 1.4462 (AISI 318) sea water resistant quality.

L1_TECCO G65 3mm_3.5m_TechData_201201_c.doc

Subject to change without notice.

ROLLMAX™ ROLLED EROSION CONTROL

Specification Sheet – EroNet™ SC150® Erosion Control Blanket

DESCRIPTION

The extended-term double net erosion control blanket shall be a machine-produced mat of 70% agricultural straw and 30% coconut fiber with a functional longevity of up to 24 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw and coconut evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a heavyweight photodegradable polypropylene netting having ultraviolet additives to delay breakdown and an approximate 0.63 x 0.63 in (1.59 x 1.59 cm) mesh, and on the bottom side with a lightweight photodegradable polypropylene netting with an approximate 0.50 x 0.50 (1.27 x 1.27 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The SC150 shall meet Type 3.B specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.17

Material Content		
Matrix	70% Straw Fiber 30% Coconut Fiber	0.35 lbs/sq yd (0.19 kg/sm) 0.15 lbs/sq yd (0.08 kg/sm)
Netting	Top: Heavyweight photodegradable with UV additives Bottom: lighweight photodegradable	3 lbs/1000 sq ft (1.47 kg/100 sm) 1.5 lb/1000 sq ft (0.73 kg/100 sm)
Thread	Degradable	

Standard Roll Sizes			
Width	6.67 ft (2.03 m)	8 ft (2.4 m)	16.0 ft (4.87 m)
Length	108 ft (32.92 m)	112 ft (34.14 m)	108 ft (32.92 m)
Weight ± 10%	44 lbs (19.95 kg)	55 lbs (24.95 kg)	105.6 lbs (47.9 kg)
Area	80 sq yd (66.9 sm)	100 sq yd (83.61 sm)	192 sq yd (165.6 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.35 in. (8.89 mm)
Resiliency	ECTC Guidelines	75%
Water Absorbency	ASTM D1117	342%
Mass/Unit Area	ASTM D6475	7.87 oz/sy (267.6 g/sm)
Swell	ECTC Guidelines	30%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	1.11 oz-in
Light Penetration	ASTM D6567	6.2%
Tensile Strength - MD	ASTM D6818	362.4 lbs/ft (5.37 kN/m)
Elongation - MD	ASTM D6818	29.4%
Tensile Strength - TD	ASTM D6818	136.8 lbs/ft (2.03 kN/m)
Elongation - TD	ASTM D6818	27.6%
Biomass Improvement	ASTM D7322	481%

Design Permissible Shear Stress	
Unvegetated Shear Stress	2.00 psf (96 Pa)
Unvegetated Velocity	8.0 fps (2.44 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 - 2:1	≥ 2:1
≤ 20 ft (6 m)	0.001	0.048	0.100
20-50 ft	0.051	0.079	0.145
≥ 50 ft (15.2 m)	0.10	0.110	0.190

NTPEP Large-Scale Slope ASTM D6459 - C-factor = 0.031

Roughness Coefficients - Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.050
0.50 - 2.0 ft	[illegible]
≥ 2.0 ft (0.60 m)	[illegible]

NORTH AMERICAN GREEN

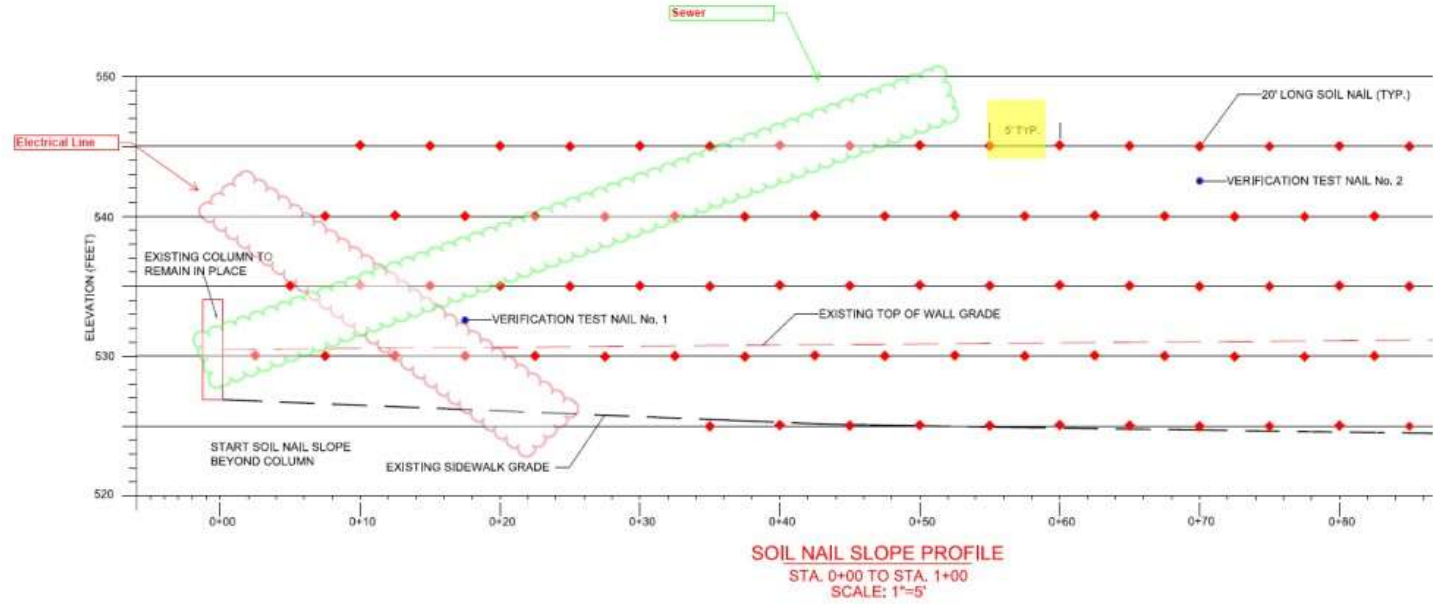
North American Green
5401 St. Wendel-Cynthiana Road
Poseyville, Indiana 47633

nagreen.com
800-772-2040

SITE – BEGIN CONSTRUCTION MAY 2021

RFI'S TO NAIL LAYOUT PRIOR TO CONSTRUCTION

- Review existing utility conflicts with design nail locations per drawing.
- Storm line identified behind stacked stone wall section may be damaged and leaking.
- ECS Response: Adjust nail spacing as necessary to clear utilities.

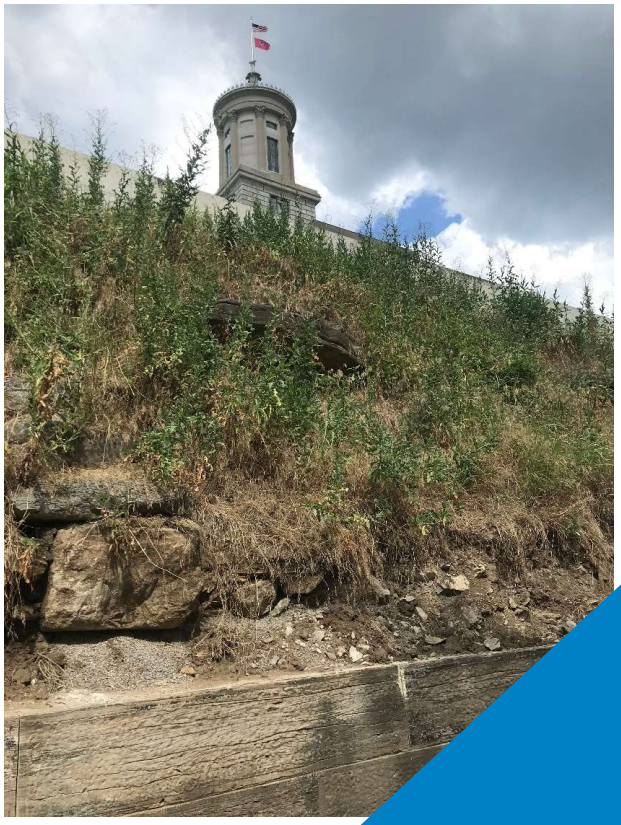


RFI'S TO NAIL LAYOUT PRIOR TO CONSTRUCTION

- Stack Stone Wall discovered between approximate Stations 0+00 to 1+80.
- Stacked Stone Wall should be stabilized prior to removing additional rows of milled stone wall.
- ECS approved adjustment of nails to move vertical as needed to clear bottom limestone wall section.
- Remove overhanging rock outcroppings.
- Change 6-inch tolerance of nail spacing to 2 feet tolerance due to boulder spacing.
- Verification and proof test locations can be moved.

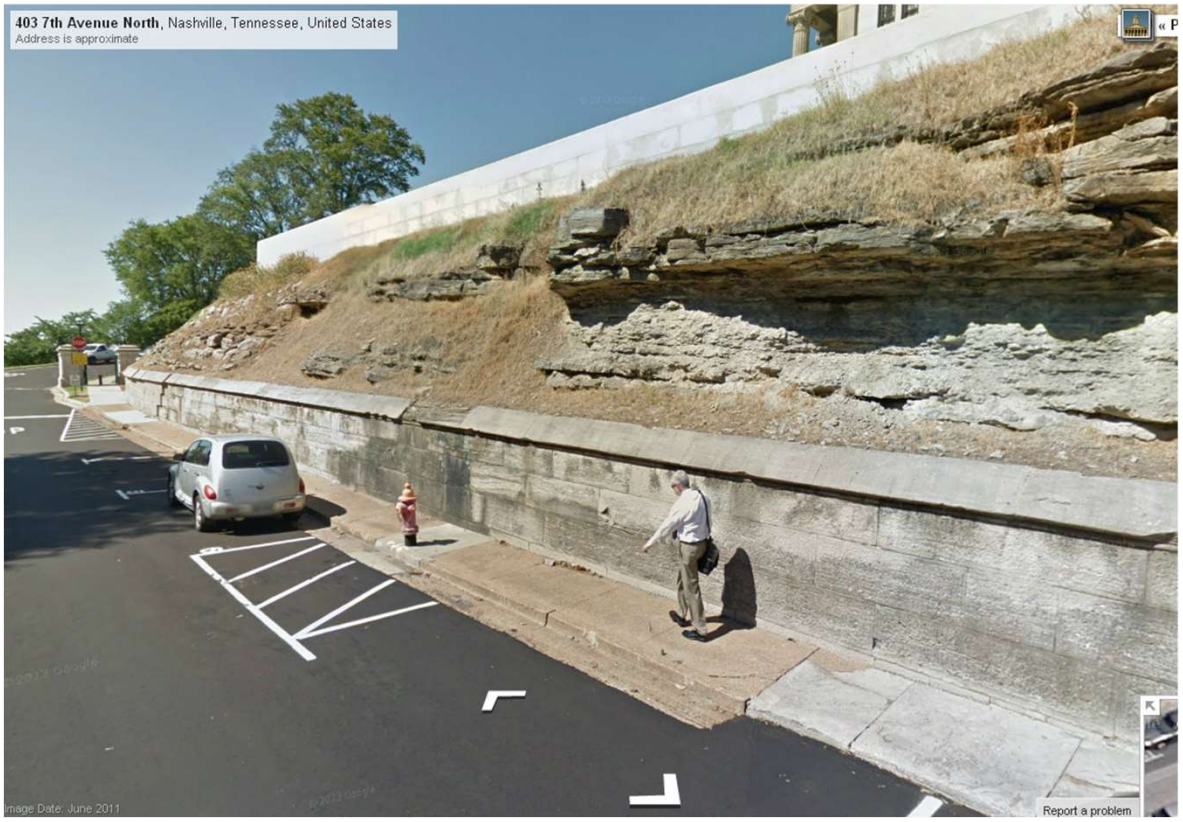
RFI'S TO NAIL LAYOUT PRIOR TO CONSTRUCTION

STACKED STONE WALL



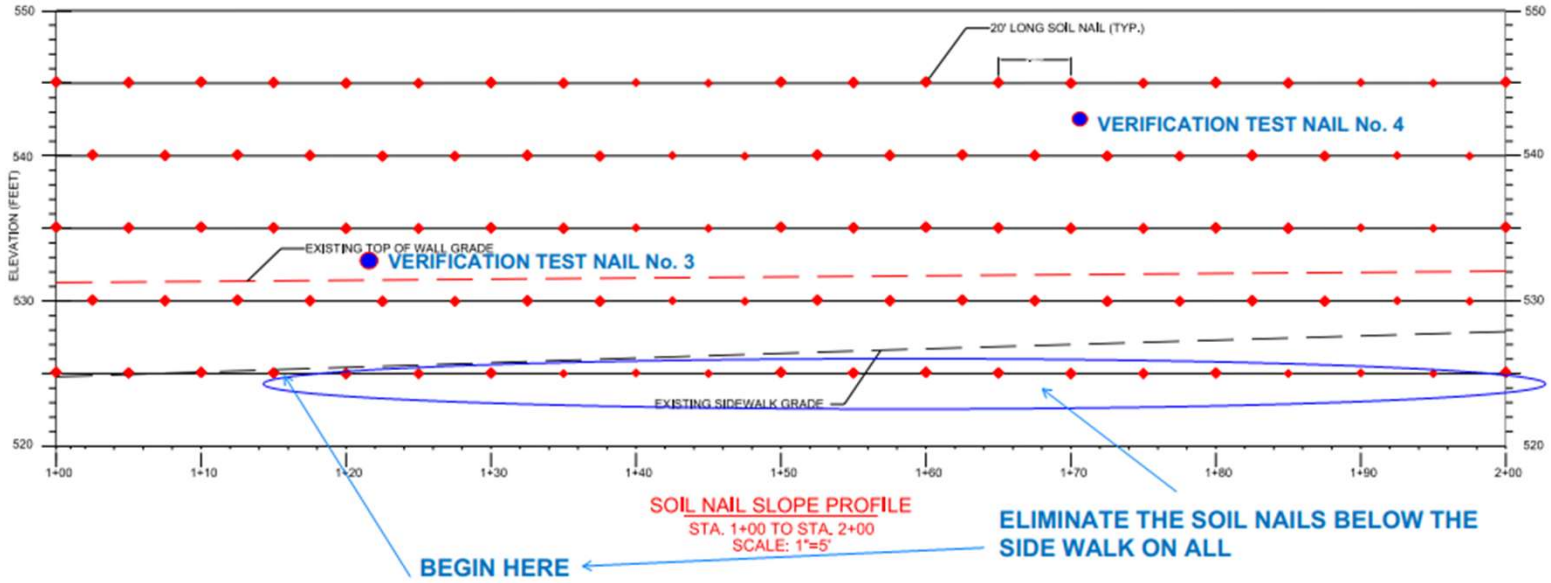
RFI'S TO NAIL LAYOUT PRIOR TO CONSTRUCTION

ROCK OVERHANG



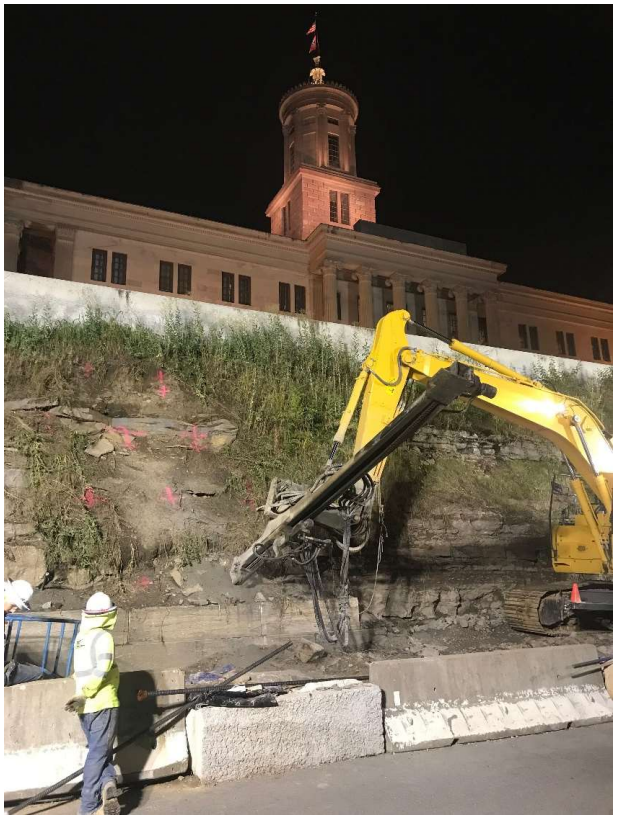
RFI'S TO NAIL LAYOUT PRIOR TO CONSTRUCTION

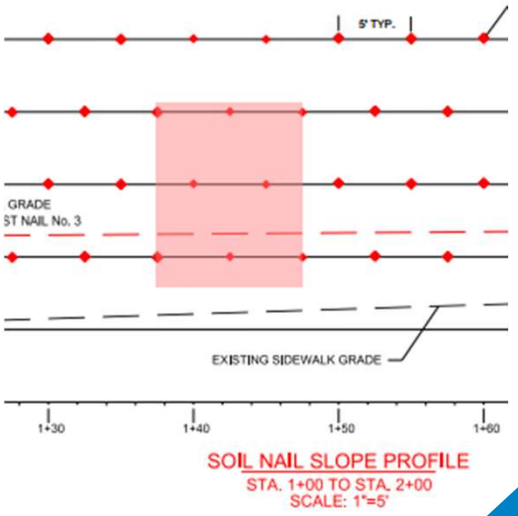
- Eliminate soil nails indicated below side wall along entire length.



SOIL NAIL WALL CONSTRUCTION

Soil nail wall construction begins July 7, 2021.





SOIL NAIL SLOPE PROFILE
STA. 1+00 TO STA. 2+00
SCALE: 1"=5'

SOIL NAIL WALL CONSTRUCTION

SOIL NAIL WALL CONSTRUCTION

SOIL NAIL WALL CONSTRUCTION

SOIL NAIL WALL CONSTRUCTION

SLOPE FAILURE 8-1-2021

During the Sunday night work (8-1), it was observed that an area of the stacked boulder wall had failed, possibly the result of the heavy rainfall on Saturday night (7-31). Some of the boulders had dropped behind the netting and a few of the nails showed evidence of bending as a result of boulder(s) dropping on the exposed nail length. Also noticed was that the contractor had removed most of the bottom rows of stacked, milled stone last week (7-25 thru 7-30) to provide access for installation of the bottom row of nails. There was evidence behind the netting that runoff was coming down the slope or possibly out from between the boulders and washing away support soils.

SOIL NAIL WALL CONSTRUCTION

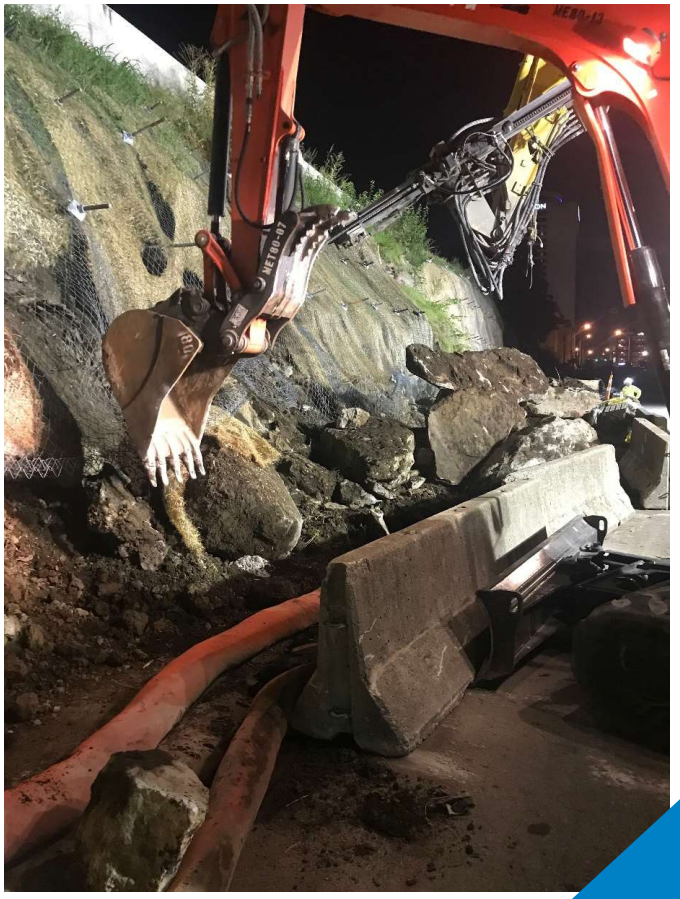
SLOPE FAILURE

SOIL NAIL WALL CONSTRUCTION

SLOPE FAILURE

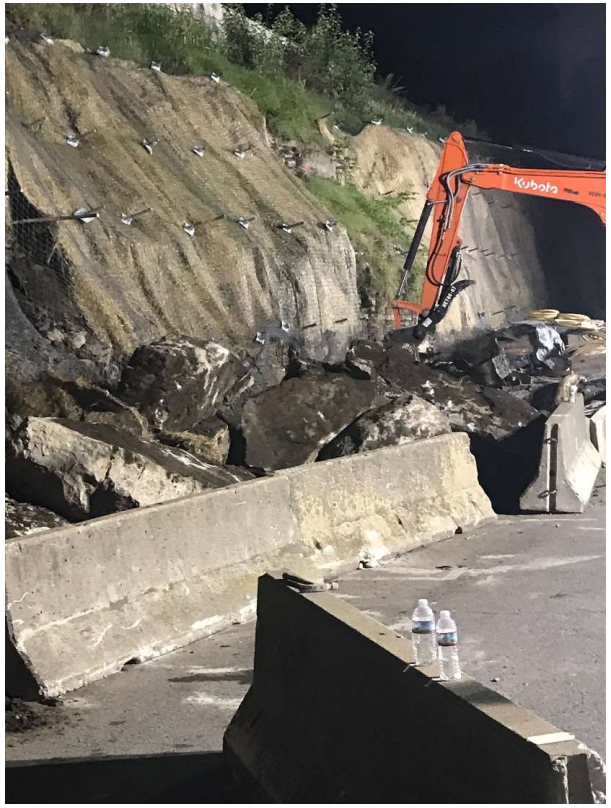
SOIL NAIL WALL CONSTRUCTION

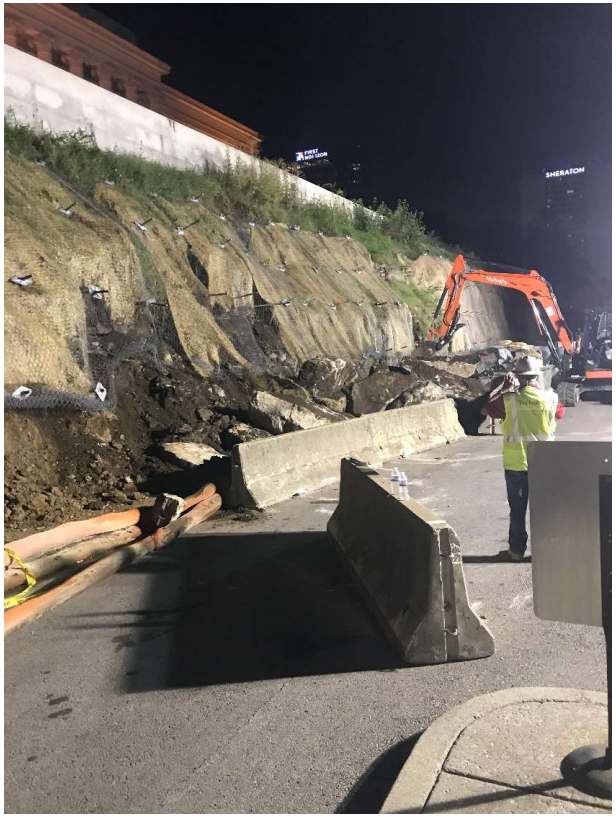
SLOPE FAILURE



SOIL NAIL WALL CONSTRUCTION

SLOPE FAILURE – BOULDER FIELD





SOIL NAIL WALL CONSTRUCTION

SLOPE FAILURE – AFTER BOULDER REMOVAL

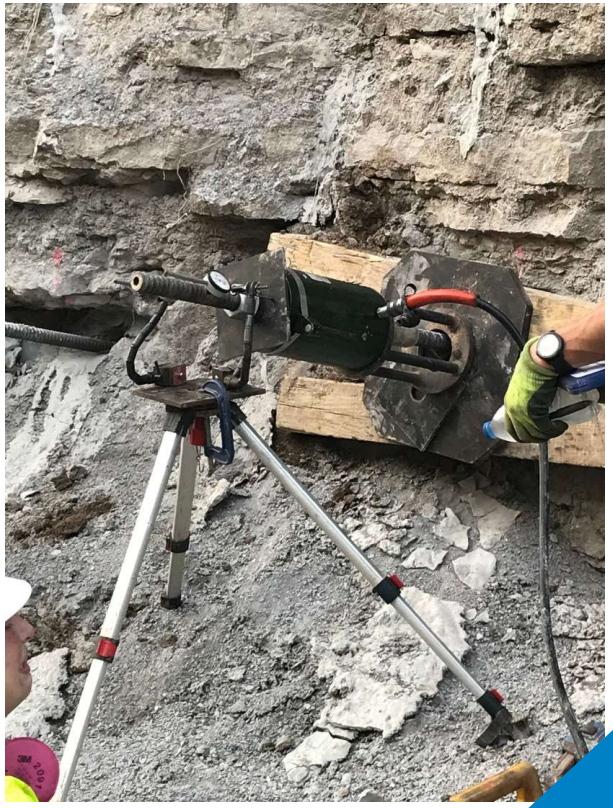
SOIL NAIL WALL CONSTRUCTION

SLOPE FAILURE – REPAIRED

SOIL NAIL WALL CONSTRUCTION

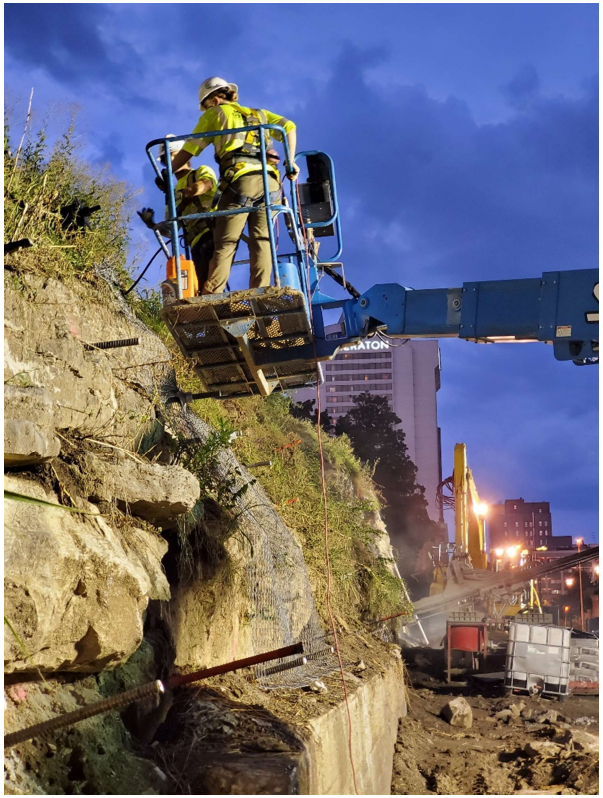
VERIFICATION AND PROOF TESTING

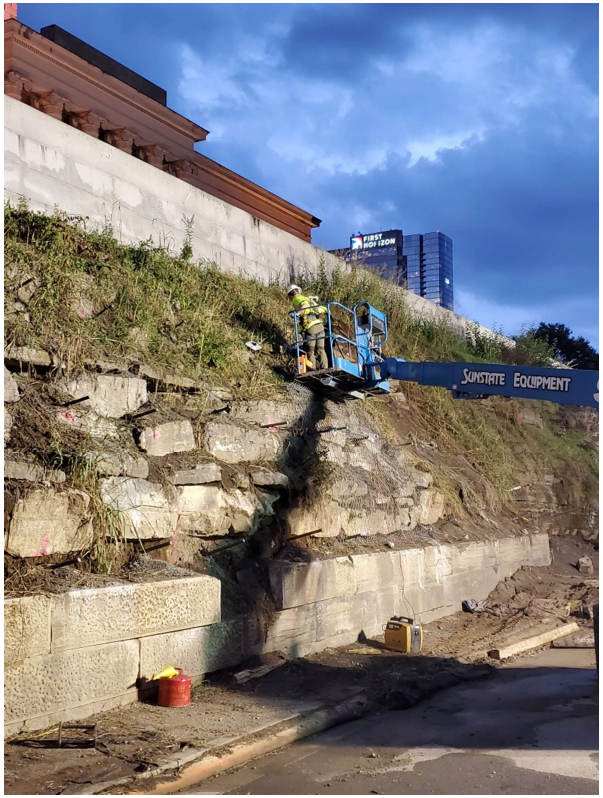
15 Proof Tests
8 Verification Tests



SOIL NAIL WALL CONSTRUCTION

VERIFICATION AND PROOF TESTING





SOIL NAIL WALL CONSTRUCTION

VERIFICATION AND PROOF TESTING

Proof Test Load – 17.1 kips

Verification Test Load – 22.8 kips

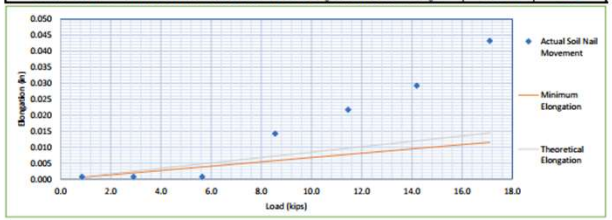
All Acceptance Criteria **PASS**

Project Information		Soil Nail Proof Test		Soil Nail Information	
Project Name:	TN State Capitol	GeoStabilization International		Test Nail Number:	261
GSI Project #:	210207TN01	Testing Performed Per:	(FHWA-GRC-007)	Soil Nail Type:	Titan Bar 40/20
Location:	Davidson County	Loading Information		Design Bond Strength:	1425 lbs/ft
Test Date:	July 27, 2021	Proof Test Load (PTL):	17.1 kips	Hole Diameter:	4 inches
Performed By:	PAB	Design Stress:	9.4 psi	Bond Length:	8 feet
Client:	The Tradesman Group, Inc.	Ultimate Load:	96.7 kips	Unbonded Length:	2 feet
Test Equipment		Maximum Allowed Load:	82.2 kips	Jack Length:	0 inches
Test Box & Gauge:	NC Test Box 1, 10000 psi			Cross Sectional Area:	1 in^2
Calibration Date:	April 1, 2021			Modulus of Elasticity:	28500000 psi

Loading Information					Actual Anchor Movement (in.)				Design Anchor Elongation (in.)	
Load Increment		Load (% of PTL)	Load (kips)	Pressure Gauge (psi)	Dial Gauge 1	Dial Gauge 2	Average	Corrected Average	Minimum	Theoretical
1 (AL)		5%	0.9	86	0.000	0.000	0.000	0.001	0.001	0.001
2		17%	2.9	250	0.000	0.000	0.000	0.001	0.002	0.002
3		33%	5.6	469	0.000	0.000	0.000	0.001	0.004	0.005
4		50%	8.6	701	0.013	0.014	0.014	0.014	0.006	0.007
5		67%	11.5	933	0.021	0.021	0.021	0.022	0.008	0.010
6		83%	14.2	1152	0.033	0.024	0.029	0.029	0.010	0.012
Creep Period	1 min	100%	17.1	1384	0.058	0.027	0.043	0.043	0.012	0.014
	2 min	100%	17.1	1384	0.059	0.027	0.043	0.044	0.012	0.014
	4 min	100%	17.1	1384	0.061	0.027	0.044	0.045	0.012	0.014
	5 min	100%	17.1	1384	0.061	0.027	0.044	0.045	0.012	0.014
	6 min	100%	17.1	1384	0.061	0.027	0.044	0.045	0.012	0.014
	10 min	100%	17.1	1384	0.062	0.027	0.045	0.045	0.012	0.014
Extended Creep (If Needed)	20 min	100%	17.1	1384			#N/A	#N/A	0.012	0.014
	30 min	100%	17.1	1384			#N/A	#N/A	0.012	0.014
	50 min	100%	17.1	1384			#N/A	#N/A	0.012	0.014
	60 min	100%	17.1	1384			#N/A	#N/A	0.012	0.014
8 (AL)		5%	0.9	86	0.026	-0.012	0.007	0.008	0.001	0.001

Comments

Results		
Acceptance Criteria	Movement	Pass/Fail
1 (a): Movement during creep test does not exceed 0.04 in. -OR-	0.002 in.	Pass
1 (b): Movement during extended creep test does not exceed 0.08 in.	N/A in.	N/A
2: Movement at Maximum Test Load exceeds 80% of theoretical elastic elongation of the unbonded length	0.043 in.	Pass



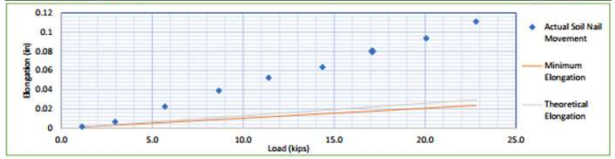
Project Information		Soil Nail Verification Test		Soil Nail Information	
Project Name:	TN State Capitol	GeoStabilization International		Test Nail Number:	V4
GSI Project #:	210207TN01	Testing Performed Per:	(FHWA-GRC-007)	Soil Nail Type:	Titan Bar 40/20
Location:	Davidson County	Loading Information		Design Bond Strength:	1425 lbs/ft
Test Date:	7/27/2021	Verification Test Load (VTL):	22.8 kips	Hole Diameter:	4 inches
Performed By:	PAB	Design Stress:	9.4 psi	Bond Length:	8 feet
Client:	The Tradesman Group, Inc.	Ultimate Load:	96.7 kips	Unbonded Length:	2 feet
Test Equipment		Maximum Allowed Load:	82.2 kips	Jack Length:	13 inches
Test Box & Gauge:	NC Test Box 1, 10000 psi			Cross Sectional Area:	1 in^2
Calibration Date:	April 1, 2021			Modulus of Elasticity:	28500000 psi

Loading Information					Actual Anchor Movement (in.)				Design Anchor Elongation (in.)	
Load Increment		Load (% of VTL)	Load (kips)	Pressure Gauge (psi)	Dial Gauge 1	Dial Gauge 2	Average	Corrected Average	Minimum	Theoretical
1 (AL)	1 min	5%	1.1	109	0.000	0.000	0.000	0.001	0.001	0.001
2	10 min	13%	3.0	254	0.003	0.007	0.005	0.006	0.003	0.004
3	10 min	25%	5.7	473	0.017	0.025	0.021	0.022	0.006	0.007
4	10 min	38%	8.7	710	0.033	0.042	0.038	0.039	0.009	0.011
5	10 min	50%	11.4	929	0.046	0.056	0.051	0.052	0.012	0.015
6	10 min	63%	14.4	1166	0.057	0.067	0.062	0.063	0.015	0.019
Creep Period	1 min	75%	17.1	1384	0.074	0.082	0.078	0.079	0.018	0.022
	2 min	75%	17.1	1384	0.074	0.082	0.078	0.079	0.018	0.022
	4 min	75%	17.1	1384	0.074	0.082	0.078	0.079	0.018	0.022
	5 min	75%	17.1	1384	0.074	0.082	0.078	0.079	0.018	0.022
	6 min	75%	17.1	1384	0.074	0.082	0.078	0.079	0.018	0.022
	10 min	75%	17.1	1384	0.074	0.082	0.078	0.079	0.018	0.022
	20 min	75%	17.1	1384	0.074	0.084	0.079	0.080	0.018	0.022
	30 min	75%	17.1	1384	0.074	0.084	0.079	0.080	0.018	0.022
	50 min	75%	17.1	1384	0.074	0.084	0.079	0.080	0.018	0.022
	60 min	75%	17.1	1384	0.074	0.084	0.079	0.080	0.018	0.022
8	10 min	88%	20.1	1621	0.087	0.097	0.092	0.093	0.021	0.026
9	10 min	100%	22.8	1840	0.103	0.116	0.110	0.111	0.024	0.030
(Optional)		113%	25.7	2068	0.112	0.124	0.118	0.119	0.027	0.033
(Optional)		125%	28.5	2296	0.122	0.133	0.128	0.129	0.030	0.037
(Optional)		138%	31.4	2523	0.136	0.149	0.143	0.144	0.033	0.041
10 (AL)		5%	1.1	109					0.001	0.001

Comments

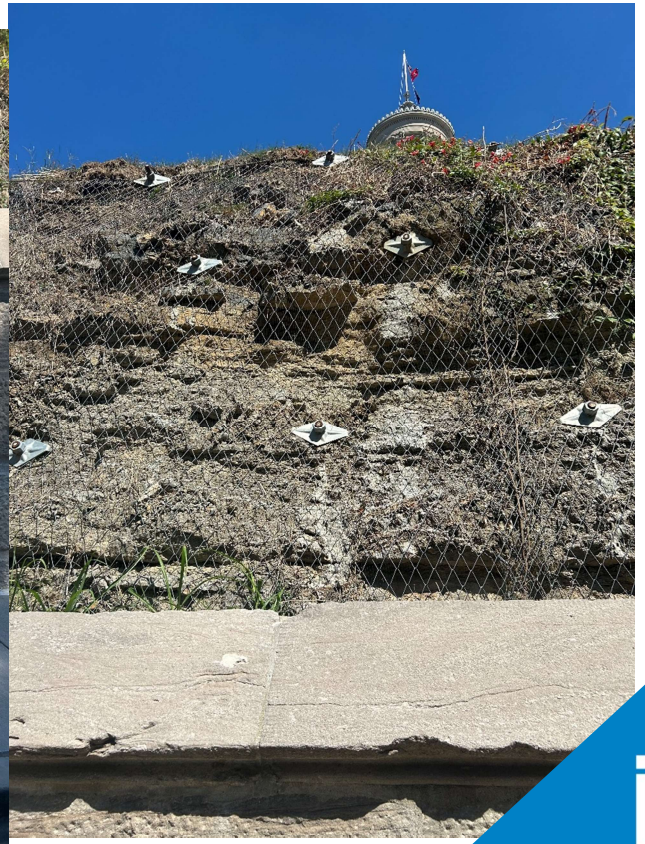
Got up to 6000 PSI, No Sign of excess Movement

Results		
Acceptance Criteria	Movement	Pass/Fail
1 (a): Movement during creep test does not exceed 0.04 in.	0.000 in.	Pass
2: Movement during extended creep test does not exceed 0.08 in.	0.001 in.	Pass
3: Movement at Maximum Test Load exceeds 80% of theoretical elastic elongation of the unbonded length	0.111 in.	Pass
4: Nail does not pull out at VTL.		Pass



WALL PHOTOS 2025

WALL PHOTOS 2025



QUESTIONS