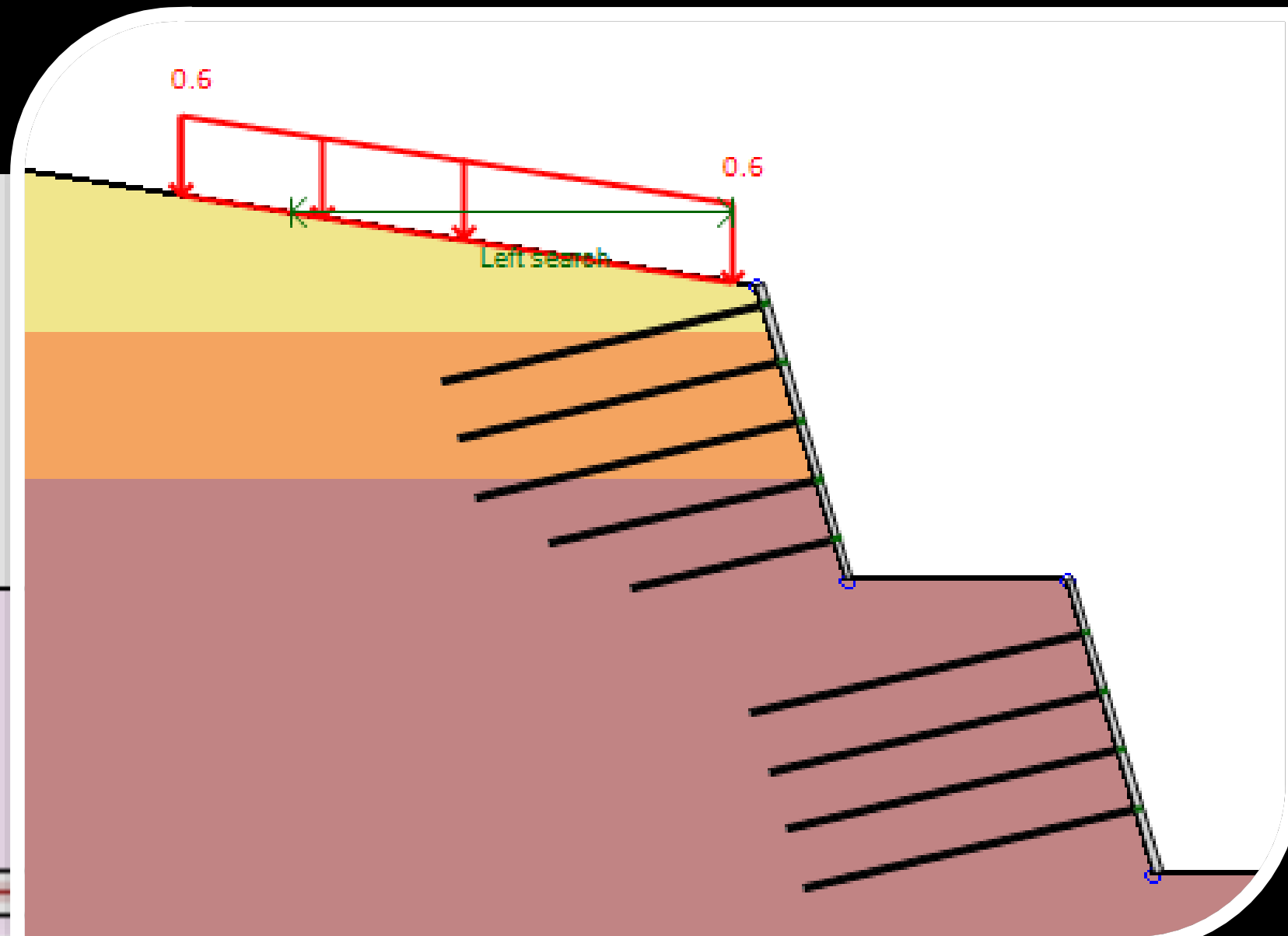
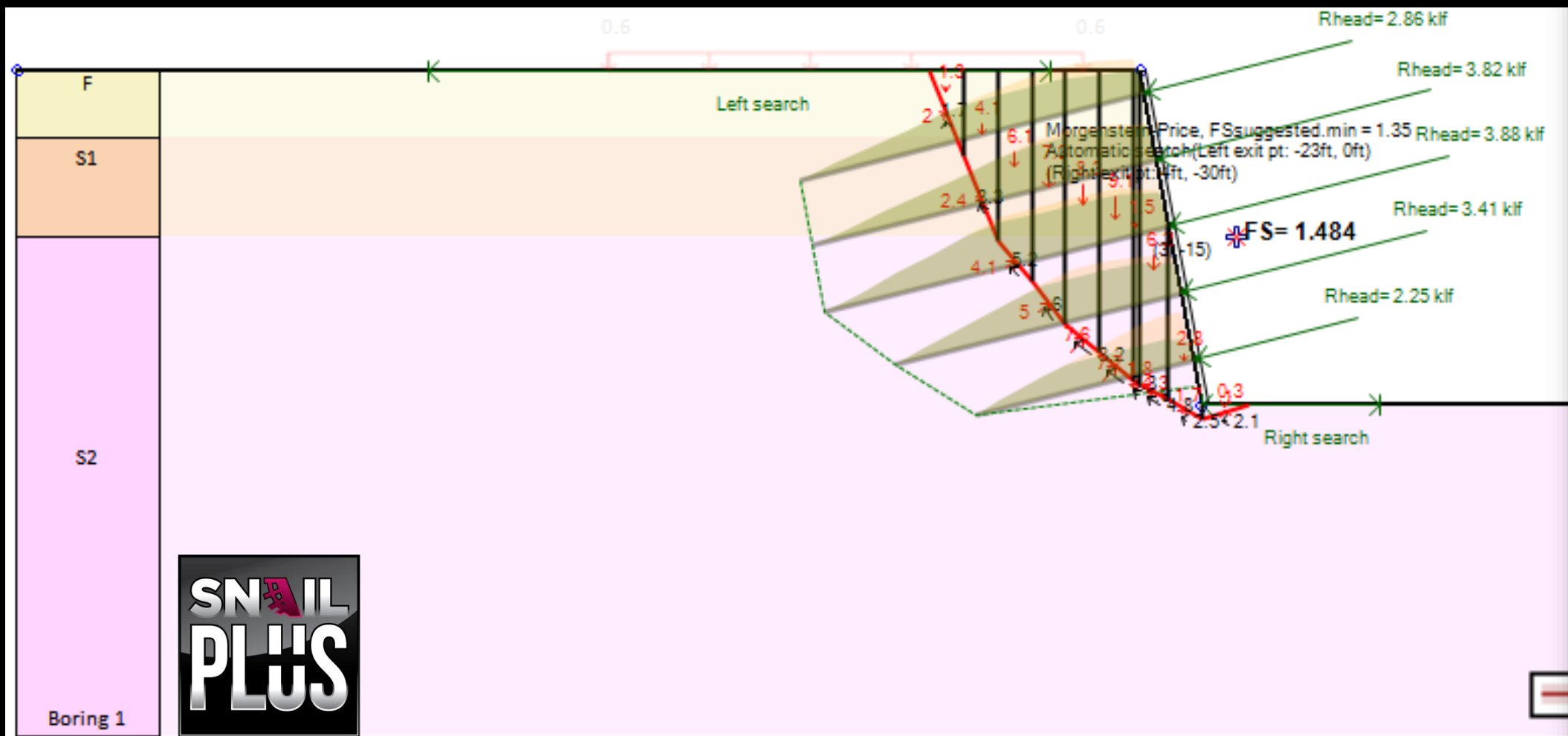


# Design of Soil Nail Walls - Methods and Software Application

Presentation: Dimitrios Mamoglou, Senior Engineer, Deep Excavation LLC  
[mamoglou@deepexcavation.com](mailto:mamoglou@deepexcavation.com) - T: +1-206-279-3300



Deep Excavation LLC  
240 W 35<sup>th</sup> Street, Suite 1004  
New York, NY, 10001  
USA

Websites:  
[www.deepexcavation.com](http://www.deepexcavation.com)  
[www.deepex.com](http://www.deepex.com)

Contact Information:  
[sales@deepexcavation.com](mailto:sales@deepexcavation.com)  
[training@deepexcavation.com](mailto:training@deepexcavation.com)

- Software solutions for excavation and foundation professionals
- Consulting Services - Design of deep excavations and pile foundations
- Virtual Reality applications for geotechnical engineers and contractors



DeepEX



HoloDeepEX



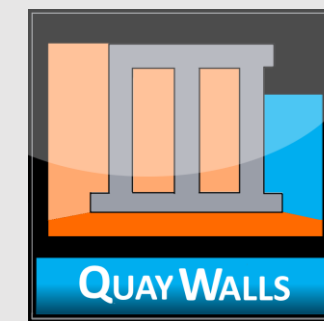
DeepFND



HelixPile



SnailPlus



QuayWalls



SiteMaster

## SnailPlus Software Features and Analysis Methods

More information:

Click here to learn more:  
[SnailPlus – Features and Capabilities  
Examples and Videos](#)



## Slope Stability Analysis and Design of any Soil Nail Wall System

### Slope Stability Analysis

#### Slope Stability Analysis Methods:

- ✓ Bishop Method
- ✓ General Limit Equilibrium (Morgenstern-Price Method)
- ✓ Spencer Method

#### Critical Slope Surface Search Methods:

- ✓ Circular Surface
- ✓ Circular Surface with Active/Passive Wedges
- ✓ Block Type Failure
- ✓ Automatic Slope Search
- ✓ Tri-linear Slope Search
- ✓ User-Defined Slope Surface

#### Stage Conditions:

- ✓ Temporary Structure (short term)
- ✓ Permanent Structure (long term)
- ✓ Extreme Event (Seismic/High Water)

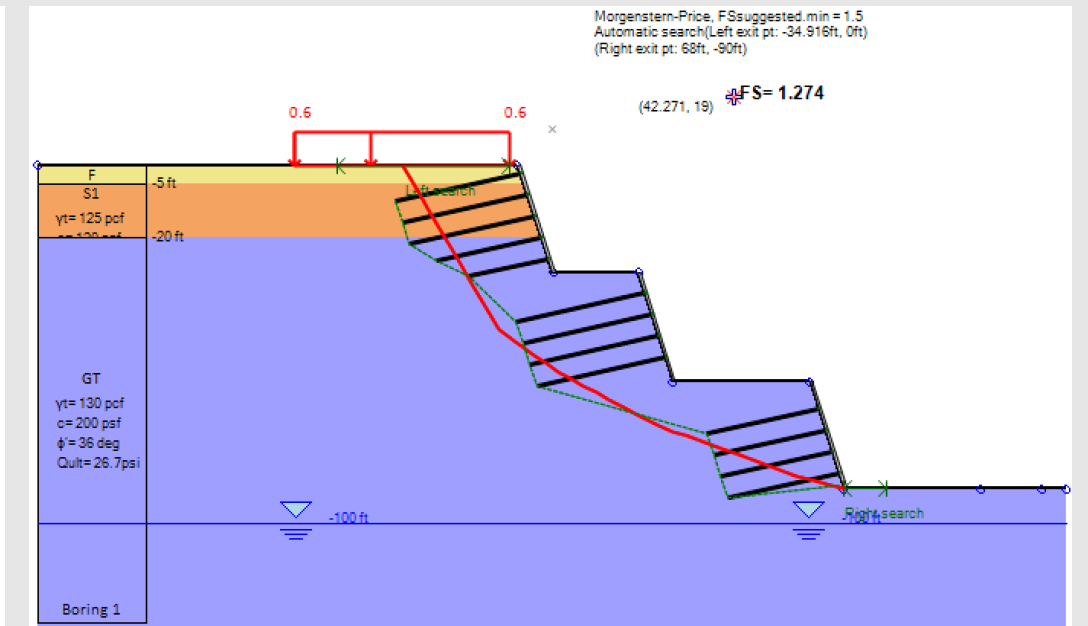
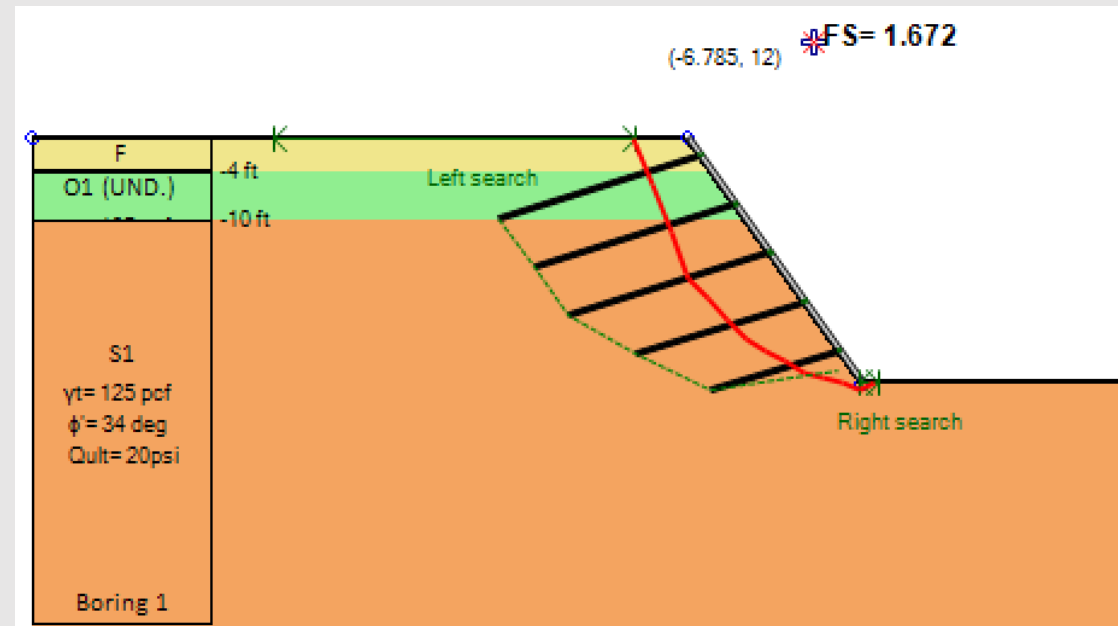
### Soil Nail Walls Design

#### Soil Nails:

- ✓ Structural and Geotechnical Design
- ✓ French Clouterre Recommendations

#### Shotcrete Facing and Head Plates:

- ✓ Full structural design
- ✓ ACI and FHWA Methods
- ✓ Two-Stage Facing (Permanent & Temporary)



- ✓ Create multiply soil types and define soil properties
- ✓ Soil properties estimation tools (NSPT values - test data)
- ✓ Create multiple borings and define the horizontal stratigraphy
- ✓ Add CPT logs and SPT Records - Estimate properties from records
- ✓ Custom Layer mode: Create inclined soil layers

**Soil Types**

Soil Types: F, O1, O2, S1, V, GT, R

1. Name and Basic Soil Type  
 Soil Name: F  
 Description: Miscellaneous fill

2. Soil Type - Behaviour  
 Sand  Silt  Rock  
 Clay  IGM (intermediate geo mat.)

3. Default drained-undrained behavior for clays (See Theory Manual)  
 Undrained  Drained

4. Unit Weights - Density  
 $\gamma_t$  120 pcf  $\gamma_{dry}$  120 pcf

5. Strength Parameters and Poisson Ratio  
 $c'$  0 psf  $\phi'$  30 degree  
 $S_u$  0 psf  $\phi_{cv}$  Omitted degree  
 $v$  0.35  $\phi_{peak}$  Omitted degree

6. Permeability  
 $K_x$  0.1 ft/sec  $K_z$  0.1 ft/sec

8. At-rest coefficients  
 $K_{oNC}$  0.5  $n_{OCR}$  0.5  
 $K_o = K_{oNC} * (OCR)^{n_{OCR}}$

Buttons: Add New Soil, Copy Soil, Delete Selected Soil, Paste Soil, OK

**Soil Layers**

Available Borings: Boring 1

1. General Boring Information - Coordinates  
 N Boring 1  
 Coordinates X 50 ft Y 0 ft  
 The x coordinate controls where the boring is shown in your design section view. Each design section uses one boring (soil strata). You can use a different boring on each design section.

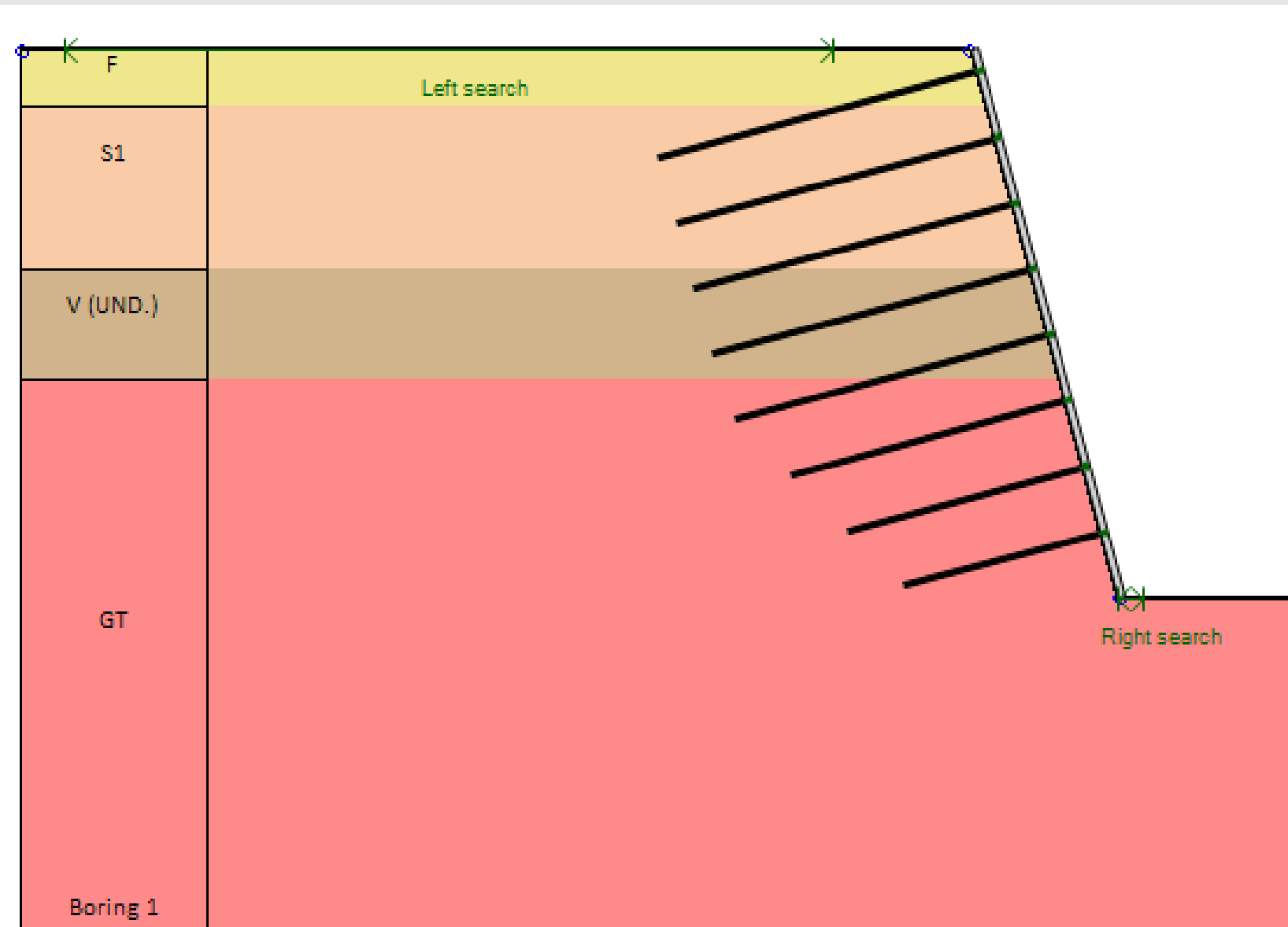
SPT Data Option (Applies to Design Section)  
 SPT Record: Not assigned [Add edit SPT records]

CPT Record Option (Applies to Design Section)  
 CPT Record: Not assigned [Add edit CPT records]

2. Boring Layers - Layer Elevations

Top	Soil type	OCR	Ko	Edit
20	F	1	0.5	Edit
15	S1	1	0.4408...	Edit
0	V	1	0.5305...	Edit
-10	GT	1	0.412	Edit
*				

Buttons: Add New Boring, Delete Selected Boring (Stratigraphy), Clone Boring, Insert Layer, Delete Layer, OK, Cancel



# SnailPlus - Shotcrete Facing and Head Plates

- ✓ Use two-stage facing through stages (temporary-permanent)
- ✓ Define facing structural section (thickness, materials, reinforcement)
- ✓ Define the structural section for the headplates
- ✓ Draw additional facing/soil nail row configurations
- ✓ Select Stud sections

Slab Sections

Available Slabs: Slab 0, Slab 1, Slab 2

**A. Section Properties** | B. Advanced | C. Section Envelope

1. Name: Slab 0

2. Structural Materials

Concrete: 3 ksi Concrete, fck 3 ksi, E 3122.02 ksi

Rebar: Grade 60, fyk 60 ksi

Color: [Color Selection]

3. Section Dimensions: D 8 in, B 12 in

4. Longitudinal Slab Reinforcement

Vert. Front bars #: #6, Ctop 2 in, Space H 8 in

Hor. Front bars #: #6, Space V 8 in

Vert. Base bars #: #6, Cbot 2 in, Space H 8 in

Hor. Base bars #: #6, Space V 8 in

5. Shear Reinforcement: Bar# = As 0 in<sup>2</sup>, sX 0 in, sY 0 in

Diagram: Top view showing dimensions D, B, Ctop, Cbot, and reinforcement layout.

Buttons: Add New Slab Section, Delete Selected Slab Section, OK, Cancel

Facing for soil nails (shotcrete or other)

A. Data | B. Results | C. Results for this stage | D. Advanced

1. Name: Soil nail facing

2. Facing type: Shotcrete (uses concrete slab sections)

Two stage facing (temporary and permanent)

Permanent facing this stage

Specify different temporary concrete

Front face is to the right side

3. Slab section used for facing: Slab 0

4. Activate/Deactivate

Activate facing for this stage

Facing is permanent

Include shear capacity in analysis

Use user defined CF (FHWA)

5. Edit facing points: Edit

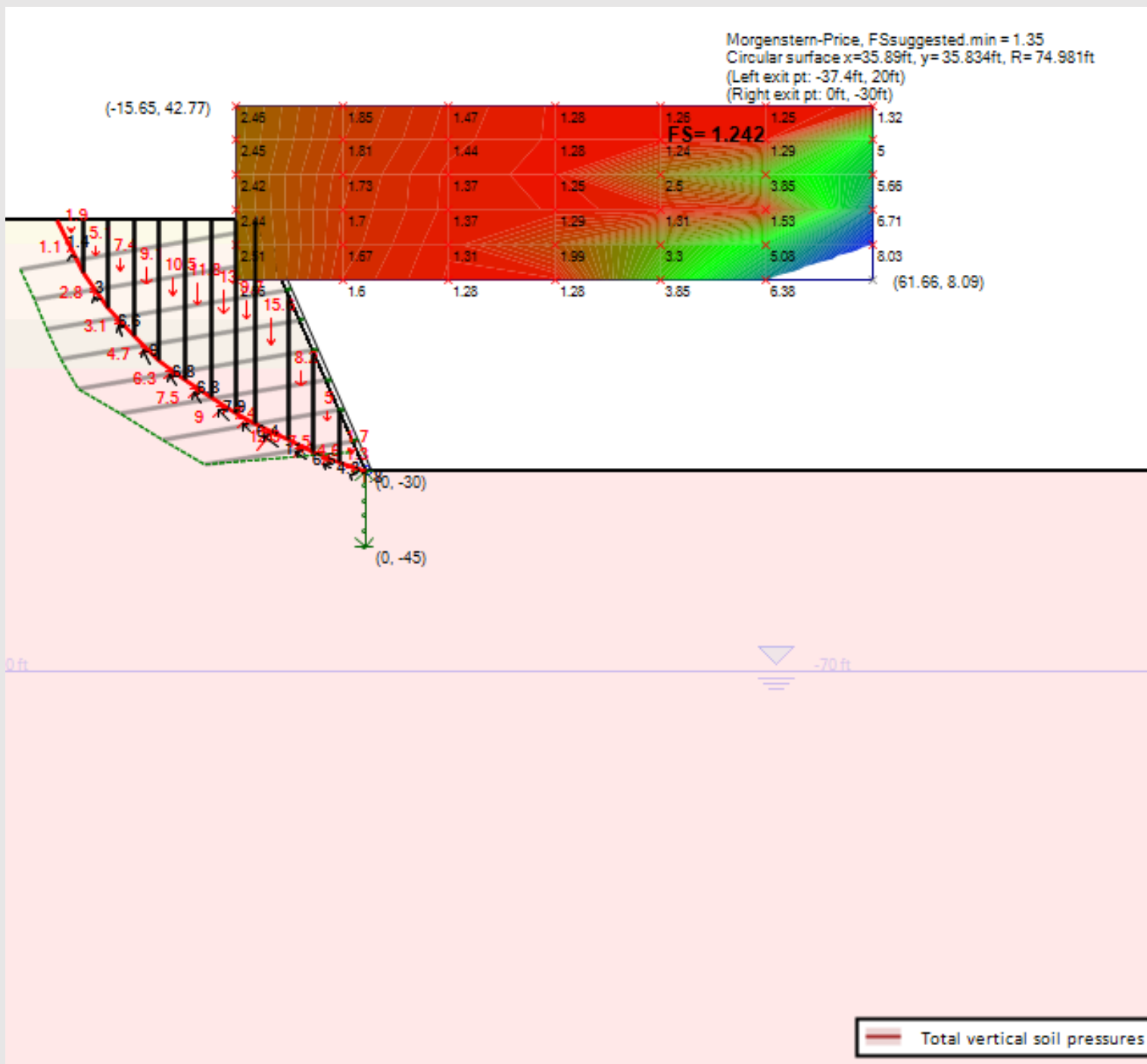
6. Options for staged excavation

Enable activation of individual stages

	Active	Bottom elevation
Stage 0	<input checked="" type="checkbox"/>	10
Stage 1	<input checked="" type="checkbox"/>	4
Stage 2	<input checked="" type="checkbox"/>	-2
Stage 3	<input checked="" type="checkbox"/>	-8
Stage 4	<input checked="" type="checkbox"/>	-14
Stage 5	<input checked="" type="checkbox"/>	-20
Stage 6	<input checked="" type="checkbox"/>	-26
Stage 7	<input checked="" type="checkbox"/>	-30
Stage 8	<input checked="" type="checkbox"/>	-30

Diagram: Cross-section showing soil nail spacing (sh=8in, sv=8in) and stage elevations.

Buttons: OK, Cancel



**Analysis method**

- BP** Bishop
- GLE M-P** General limit equilibrium (Moment-force)
- Spencer** Spencer

---

**AUTO** Automatic search

**User defined**

- Circular surface
- Circular with active wedge
- Circular with passive wedge
- Circular with active and passive wedge
- Block type failure
- User defined surface

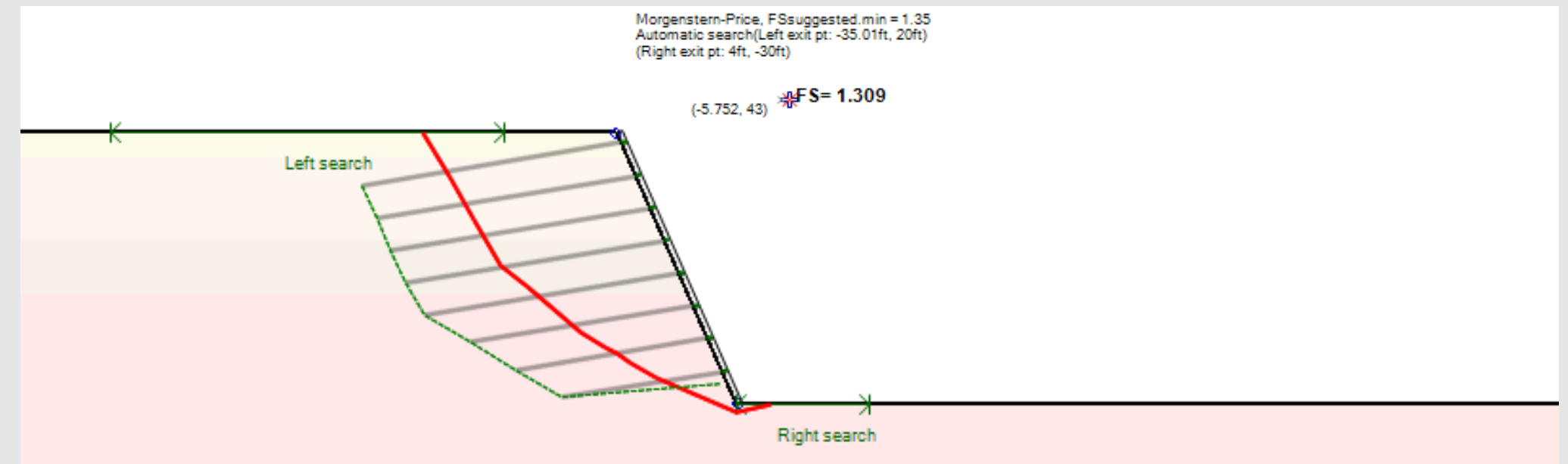
Pass critical surface to user surface

### Slope Stability Analysis Methods:

- ✓ Bishop Method
- ✓ General Limit Equilibrium (Morgenstern-Price Method)
- ✓ Spencer Method

### Critical Slope Surface Search Options:

- ✓ Circular Surface
- ✓ Circular Surface with Active/Passive Wedges
- ✓ Block Type Failure
- ✓ Automatic Slope Search
- ✓ Tri-linear Slope Search
- ✓ User-Defined Slope Surface



Facing for soil nails (shotcrete or other)

	Lh (ft)	Lv (ft)	Mxx.Nail(Bi (k-ft/ft)	Mxx.Span( (k-ft/ft)	Myy.Nail(Bi (k-ft/ft)	Myy.Span( (k-ft/ft)	Mcap.Nail. (k-ft/ft)	Mcap.Spar (k-ft/ft)	Mcap.Nail. (k-ft/ft)	Mcap.Spar (k-ft/ft)	Vxx (k-ft/ft)	Vyy (k-ft/ft)	Vcap (k-ft/ft)
0	6	10	-0.235	0.175	-0.721	0.536	12.678	12.678	12.678	12.678	0.327	0.187	7.887
1	6	8	-0.538	0.399	-1.016	0.755	12.678	12.678	12.678	12.678	0.587	0.427	7.887
2	6	8	-0.958	0.711	-1.464	1.088	12.678	12.678	12.678	12.678	0.845	0.76	7.887
3	6	8	-1.216	0.903	-1.765	1.311	12.678	12.678	12.678	12.678	1.019	0.965	7.887
4	6	8	-1.446	1.074	-1.932	1.435	12.678	12.678	12.678	12.678	1.148	1.148	7.887
5	6	8	-1.687	1.253	-2.145	1.594	12.678	12.678	12.678	12.678	1.339	1.339	7.887
6	6	8	-1.965	1.459	-2.357	1.751	12.678	12.678	12.678	12.678	1.559	1.559	7.887
7	6	6	-2.142	1.591	-2.142	1.591	12.678	12.678	12.678	12.678	1.7	1.7	7.887
8	6	6	-2.142	1.591	-2.142	1.591	12.678	12.678	12.678	12.678			

### Soil Nails:

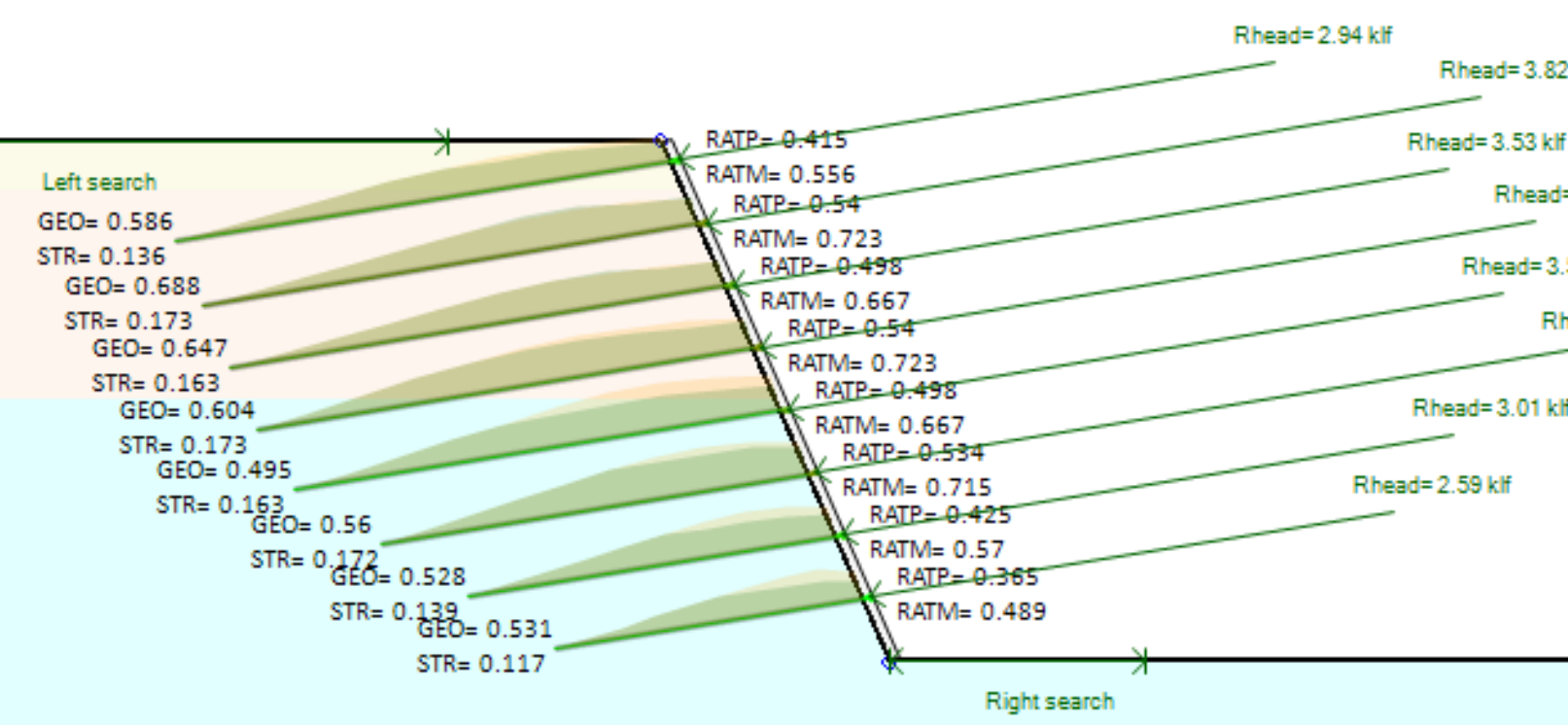
- ✓ Structural and geotechnical design
- ✓ French Clouterre recommendations
- ✓ Design of each soil nail row for the most critical load

### Shotcrete Facing and Head Plates:

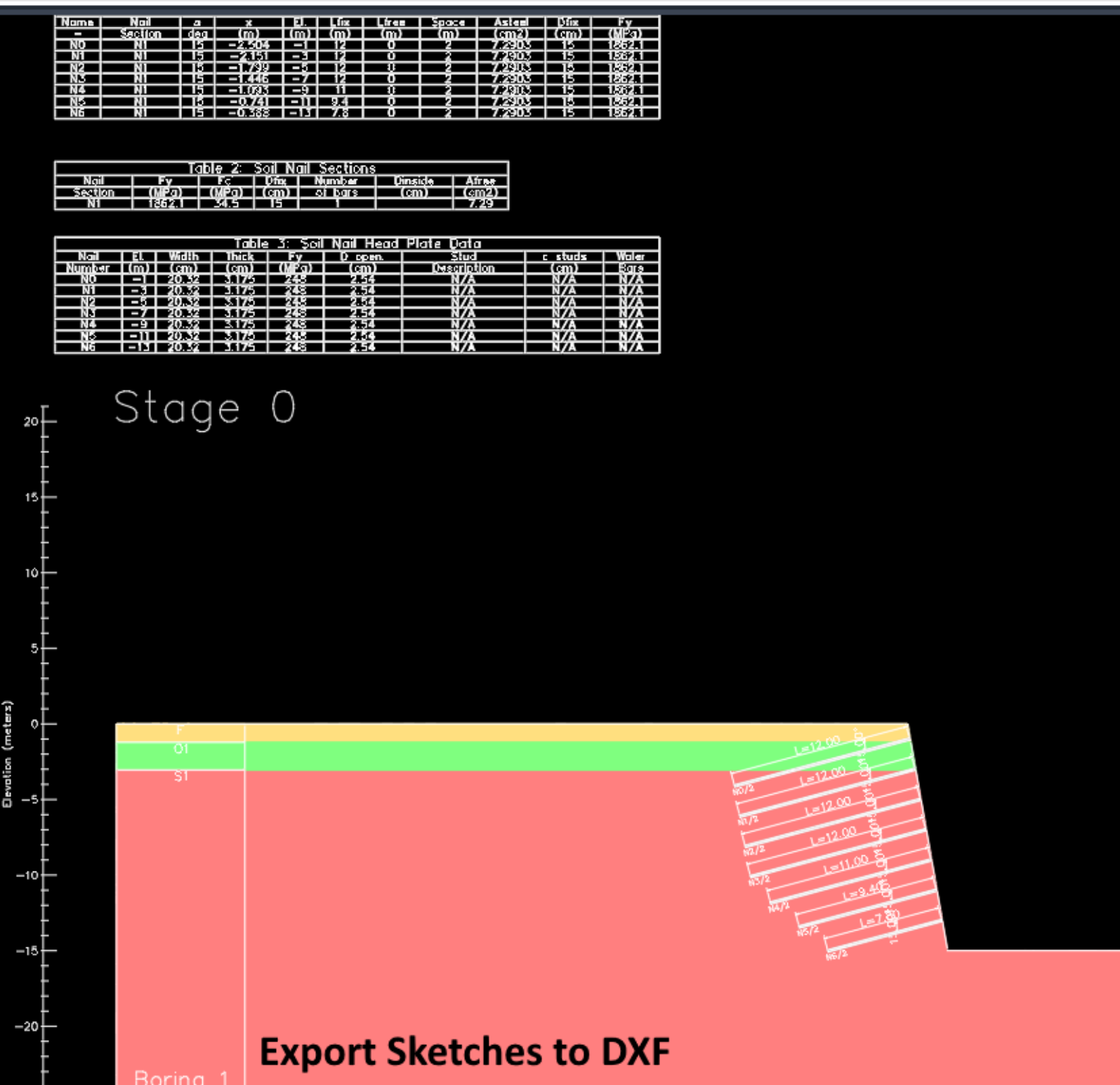
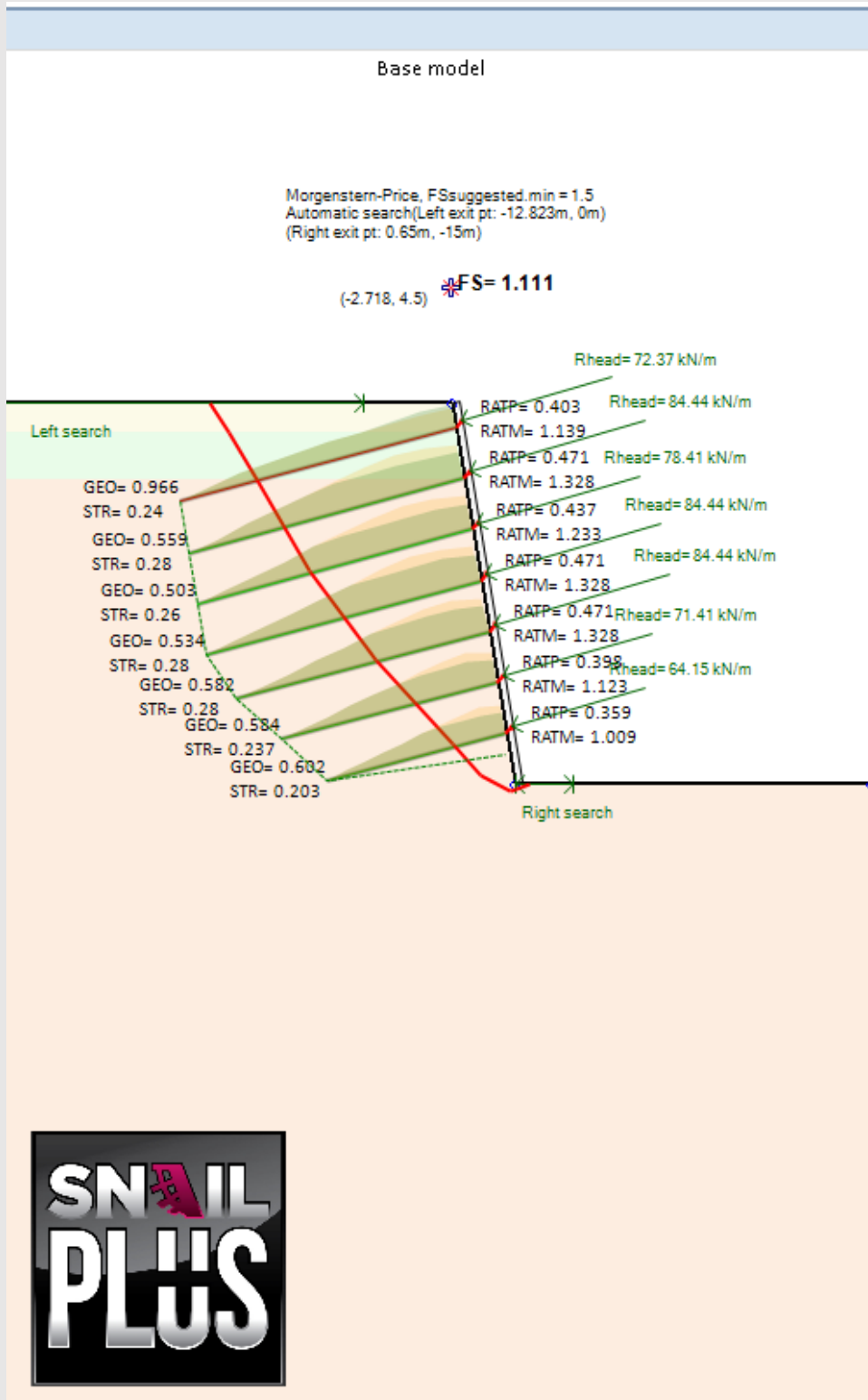
- ✓ Full structural design
- ✓ ACI and FHWA methods
- ✓ Moment and shear checks for the facings
- ✓ Moment and punching shear checks for the head plates

Edit soil nail

	Tension	Max. tension stab. analysis	Force at head Po	Max. mob. force Pmax	Tension stress check	Critical stress check	Tension capacity STR	Design Tension cap GEO	Crit. shear GEO	IxxCalc	SxxCalc	Thicknes loss	% STR loss	Moment on plate M	Plate Mres	Punching perimeter
Units	k	k	k	k	-	-	k	k	k	in4	in3	in	%	k-ft	k-ft	in
0: Exc.	34.37	36.48	4.2	5.38	0.032	0.143	274.59	37.67	0	0.08	0.14	N/A	N/A	0.7243...	5.46875	56
1: Exc.	30.69	35.89	5.19	6.78	0.04	0.172	274.59	39.35	0	0.08	0.14	N/A	N/A	0.8940...	5.46875	56
2: Exc.	26.39	33.99	7.89	10.31	0.061	0.274	274.59	37.67	0	0.08	0.14	N/A	N/A	1.35965	5.46875	56
3: Exc.	22.38	33	10.02	13.08	0.077	0.333	274.59	39.35	0	0.08	0.14	N/A	N/A	1.7259...	5.46875	56
4: Exc.	16.78	31.1	11.92	15.57	0.092	0.413	274.59	37.67	0	0.08	0.14	N/A	N/A	2.0535...	5.46875	56
5: Exc.	12.53	30.11	13.9	18.15	0.107	0.461	274.59	39.35	0	0.08	0.14	N/A	N/A	2.3945...	5.46875	56
6: Exc.	6.97	27.93	16.19	21.14	0.125	0.561	274.59	37.67	0	0.08	0.14	N/A	N/A	2.7892...	5.46875	56
7: Final	11.81	26.68	17.65	23.05	0.136	0.586	274.59	39.35	0	0.08	0.14	N/A	N/A	3.0409...	5.46875	56
8: Stage	4.79	39.09	17.65	23.05	0.136	0.586	274.59	39.35	0	0.08	0.14	N/A	N/A	3.0409...	5.46875	56







- Optional Module:
- ✓ Export model sketch to DXF files
  - ✓ Edit DXF exported sketches with any CAD software

## THANK YOU!

DESIGN AND OPTIMIZE ANY SOIL NAIL WALL SYSTEM IN MINUTES AND GAIN A COMPETITIVE EDGE!

Learn tips and tricks of deep excavation design

**BOOK HERE A FREE ONLINE PRESENTATION**  
E: [training@deepexcavation.com](mailto:training@deepexcavation.com)

or Call Us at: +1 - 206-279-3300

Learn from examples, videos and case studies

**CLICK HERE FOR EXAMPLES,  
VIDEOS AND ARTICLES**

Prices and Licensing Questions: [sales@deepexcavation.com](mailto:sales@deepexcavation.com)

Technical Support: [support@deepexcavation.com](mailto:support@deepexcavation.com)

## TRUSTED BY

