

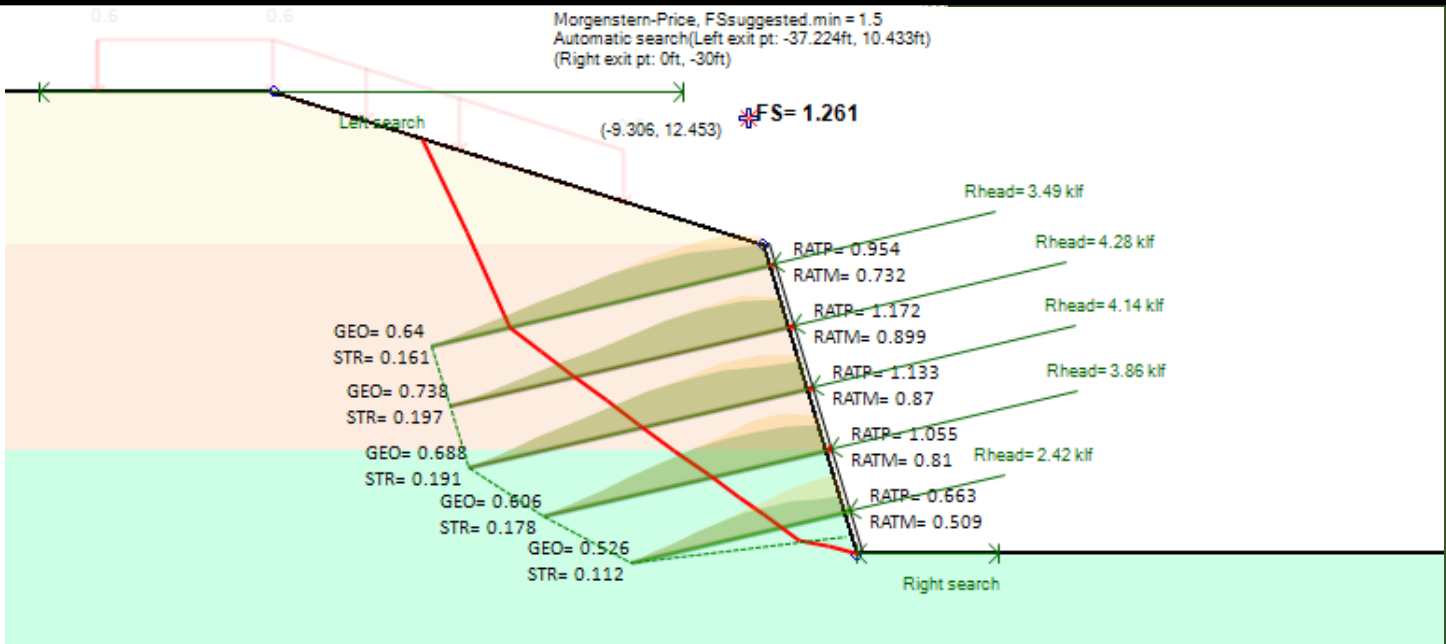


DEEP EXCAVATION

GEOTECHNICAL SOFTWARE & ENGINEERING

Soil Nail Wall Design Example - SnailPlus

Circular Failure Surface – Automatic Failure Surface Search Methods



SnailPlus
Soil Nail Wall Design
Software

Document Version: 1.0.2.5

Released: June 23, 2020

www.deepexcavation.com

www.deepex.com

Contact Information:

E: sales@deepexcavation.com

T: 1-206-279-3300



INTRODUCTION: SNAILPLUS – SOIL NAIL WALL DESIGN SOFTWARE

SnailPlus is a powerful software program for the slope stability analysis, and the design and evaluation of soil nail wall systems.

SnailPlus can be used for the calculation of the global stability safety factor, and it can also design all soil nail wall structural members (soil nails, shotcrete facing, head plates)

Slope Stability Methods: Bishop, Morgenstern-Price (General Limit Equilibrium), Spencer.

Shotcrete Facing: Temporary, Permanent, Two-Stage (Temporary and Permanent in different construction stages).

Design Conditions: Temporary Structure, Permanent Structure, Extreme Events (Seismic and High Water).

Seismic Pressures Methods: Semirigid, Mononobe-Okabe, Wood, User-Defined.

Water Pressures Methods: Hydrostatic, Simplified Flow, Full 2D Flownet Analysis.

Soil Properties: User-Defined, Estimation Tools (Test Data), SPT and CPT logs.

Structural Design: ACI, FHWA (ASD), FHWA (LRFD).

Analysis - Combinations: Allowable Design (ASD), LRFD GEC-7, EUROCODE 7 (ULS).

Printed Reports: Reports Exported in PDF and Word.

Model Creation: Graphical (Interactive Interface), Model Wizard.

SnailPlus – Software Capabilities and Examples

SnailPlus is a robust software for the design of soil nail wall systems. It can locate the most critical slope surfaces, the slope stability FS and it can fully design all structural items (soil nails, head plates, shotcrete facings).

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

Our Software Programs

The mission of our company is the creation and distribution of high quality software programs for engineering professionals.

Deep Excavation offers a variety of programs, dedicated to the design and analysis of deep excavation and pile foundation projects, the monitoring of inclinometer proceedings, the export of virtual reality deep excavation models and more.

[Click here to learn more: Our Software Products](#)

[CLICK HERE TO BOOK A FREE ONLINE PRESENTATION](#)
E: training@deepexcavation.com

A. PROJECT DESCRIPTION – MODEL DATA

In this example we will design a 75 deg slope surface, supported by a soil nail wall (5 rows of #9 bar soil nails, with a 6in permanent shotcrete facing).

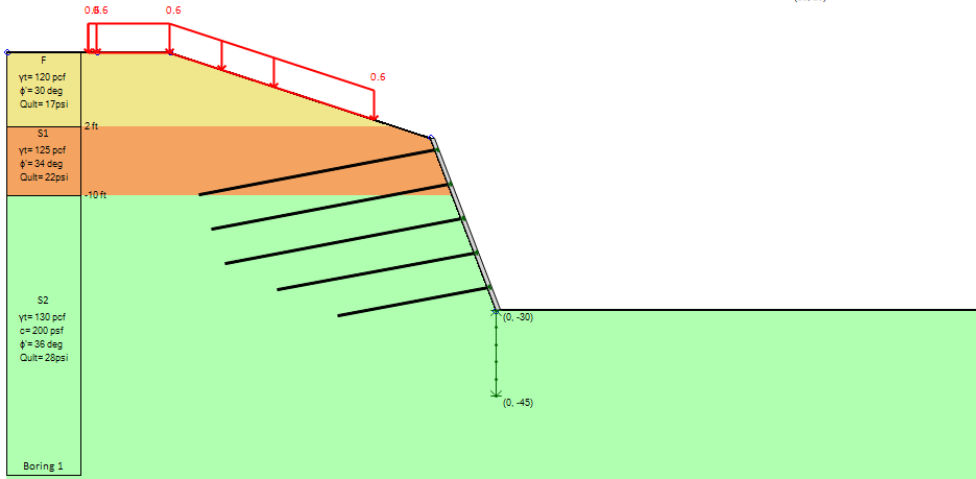


Figure: 2D Section Model

Table: Soil Properties and Soil Layer Elevations

Soil Layer Elev. (ft)	Soil (-)	Soil Type (-)	Friction Angle (deg)	Cohesion (psf)	Total Unit Weight (pcf)	Skin Friction (psi)
15	F	Sand (Fill)	30	10	120	17
0	S1	Medium Sand	34	20	125	22
-20	S2	Dense Sand	36	200	130	28

Table: Shotcrete Facing Properties

Wall Type	Shotcrete Wall
Wall Thickness	6 in
Reinforcement	2 rows / #6 Bars Horizontal And Vertical
Steel Grade	Grade 60
Concrete	3 ksi

Table: Soil Nails and Head Plates Properties

Elevation	Varies (5 rows)
Support Type	1#9 Rebar Soil Nails
Grout Diameter	4 in
Head Plate Section	Rectangular – 10in x 10in
Head Plate Thickness	1.5 in
Steel Grade	Grade 60
Concrete	5 ksi
Horizontal Spacing	6 ft
Vertical Spacing	6 ft

SnailPlus – Software Capabilities and Examples

SnailPlus is a robust software for the design of soil nail wall systems. It can locate the most critical slope surfaces, the slope stability FS and it can fully design all structural items (soil nails, head plates, shotcrete facings).

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

Our Software Programs

The mission of our company is the creation and distribution of high quality software programs for engineering professionals.

Deep Excavation offers a variety of programs, dedicated to the design and analysis of deep excavation and pile foundation projects, the monitoring of inclinometer proceedings, the export of virtual reality deep excavation models and more.

[Click here to learn more: Our Software Products](#)

[CLICK HERE TO BOOK A FREE ONLINE PRESENTATION](#)
E: training@deepexcavation.com

B. SNAILPLUS SOFTWARE – SOIL TYPES AND BORINGS

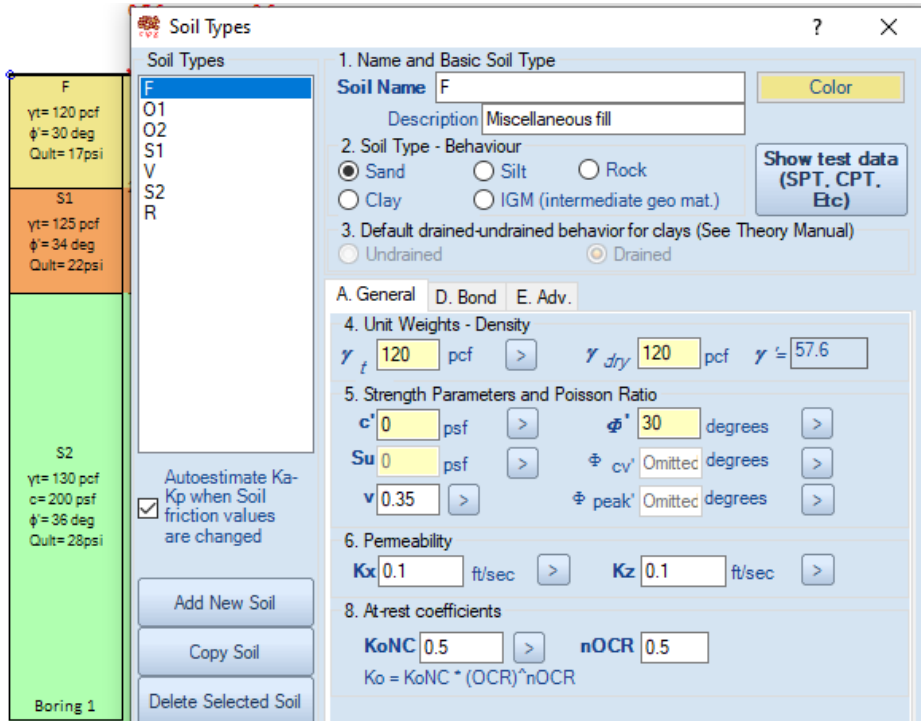


Figure: General soil properties – Fill Layer (Soil F)

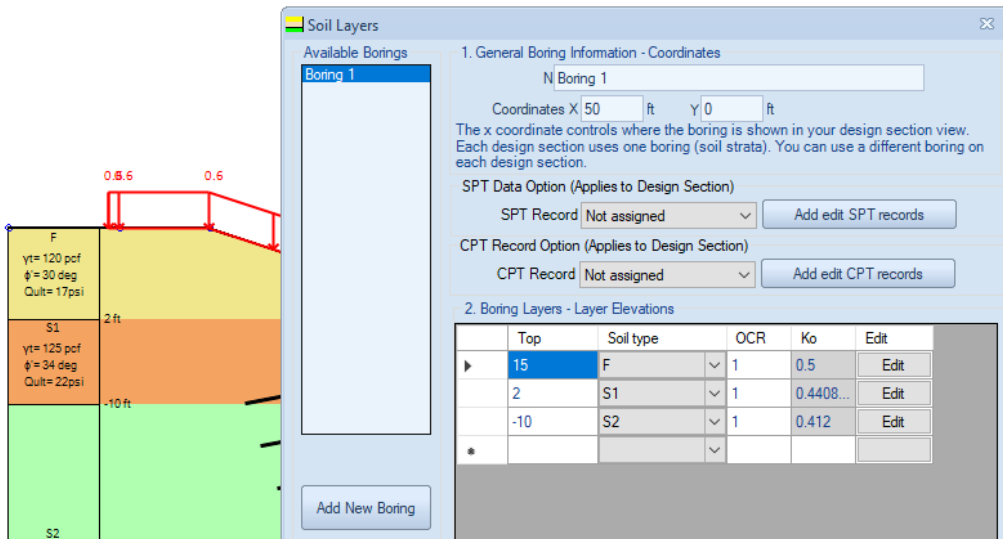


Figure: Soil Layers

SnailPlus – Software Capabilities and Examples

SnailPlus is a robust software for the design of soil nail wall systems. It can locate the most critical slope surfaces, the slope stability FS and it can fully design all structural items (soil nails, head plates, shotcrete facings).

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

Our Software Programs

The mission of our company is the creation and distribution of high quality software programs for engineering professionals.

Deep Excavation offers a variety of programs, dedicated to the design and analysis of deep excavation and pile foundation projects, the monitoring of inclinometer proceedings, the export of virtual reality deep excavation models and more.

[Click here to learn more: Our Software Products](#)

CLICK HERE TO BOOK A FREE ONLINE PRESENTATION
E: training@deepexcavation.com

C. SNAILPLUS SOFTWARE – SOIL NAILS AND FACING PROPERTIES

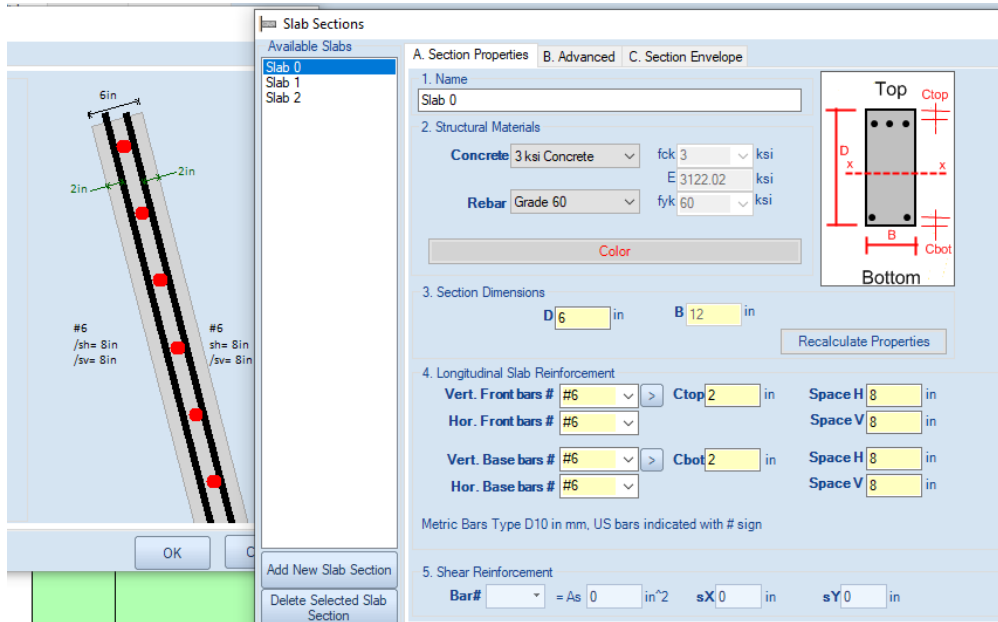


Figure: SnailPlus – Shotcrete Facing – Section Properties

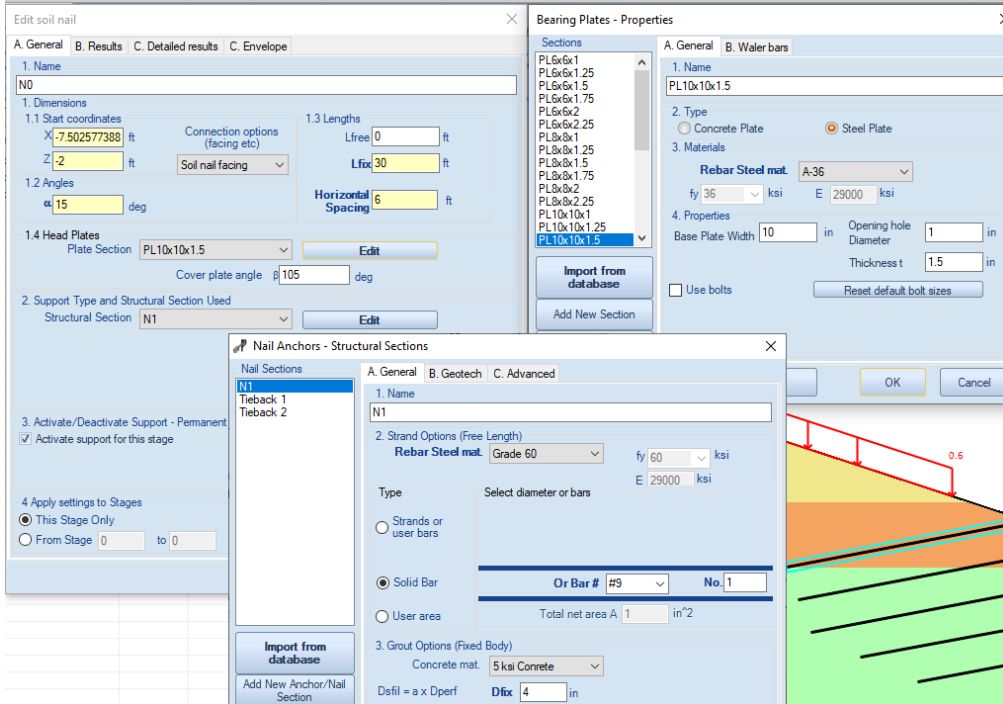


Figure: SnailPlus – Soil Nail and Head Plate Properties

SnailPlus – Software Capabilities and Examples

SnailPlus is a robust software for the design of soil nail wall systems. It can locate the most critical slope surfaces, the slope stability FS and it can fully design all structural items (soil nails, head plates, shotcrete facings).

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

Our Software Programs

The mission of our company is the creation and distribution of high quality software programs for engineering professionals.

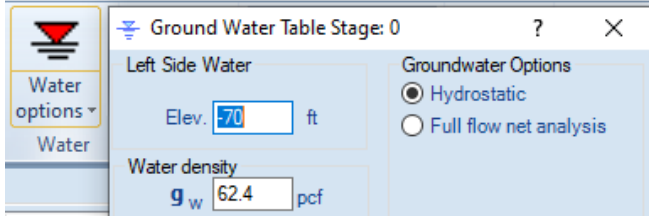
Deep Excavation offers a variety of programs, dedicated to the design and analysis of deep excavation and pile foundation projects, the monitoring of inclinometer proceedings, the export of virtual reality deep excavation models and more.

[Click here to learn more: Our Software Products](#)

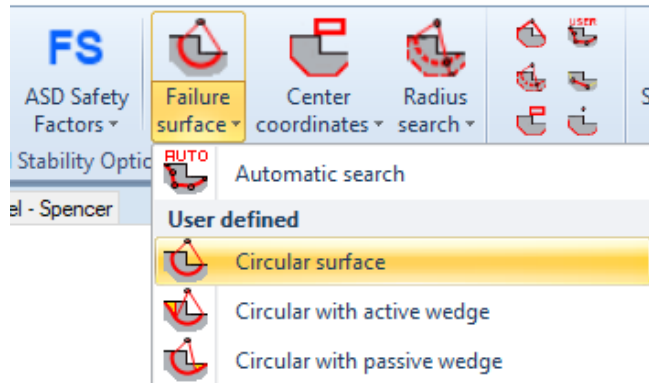
[CLICK HERE TO BOOK A FREE ONLINE PRESENTATION](#)
E: training@deepexcavation.com

D. SNAILPLUS – ANALYSIS SETTINGS

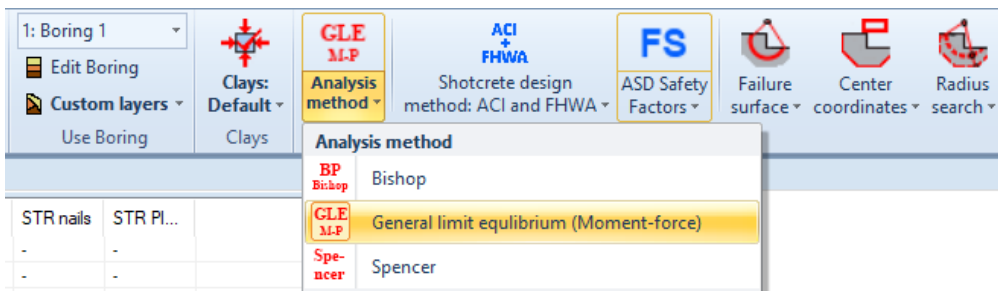
1. Water Pressures -> Hydrostatic



2. Failure Surface Type -> Circular



3. Slope Stability Analysis Method -> Morgenstern-Price (GLE Method)



SnailPlus – Software Capabilities and Examples

SnailPlus is a robust software for the design of soil nail wall systems. It can locate the most critical slope surfaces, the slope stability FS and it can fully design all structural items (soil nails, head plates, shotcrete facings).

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

Our Software Programs

The mission of our company is the creation and distribution of high quality software programs for engineering professionals. Deep Excavation offers a variety of programs, dedicated to the design and analysis of deep excavation and pile foundation projects, the monitoring of inclinometer proceedings, the export of virtual reality deep excavation models and more.

[Click here to learn more: Our Software Products](#)

[CLICK HERE TO BOOK A FREE ONLINE PRESENTATION](#)
E: training@deepexcavation.com

E. CRITICAL SLOPE SURFACE – CIRCULAR AND AUTOMATIC SEARCH

With the **Circular Surface** option selected, SnailPlus checks different possible circular surfaces, it calculates the slope stability FS for each examined surface and reports the most critical, as well as, the calculated FS.

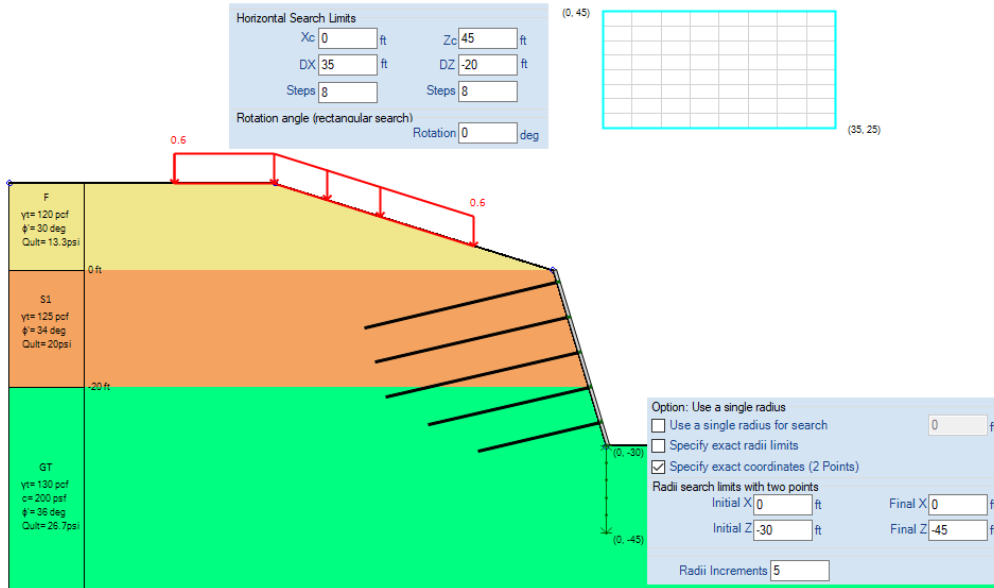


Figure: Circular Failure Surface Search Options – Rectangle of Centers and Radius Search Limits

The **Automatic Sliding Surface Search** solution uses a genetic evolution algorithm to examine several surfaces that pass from user-defined left and right search limits.

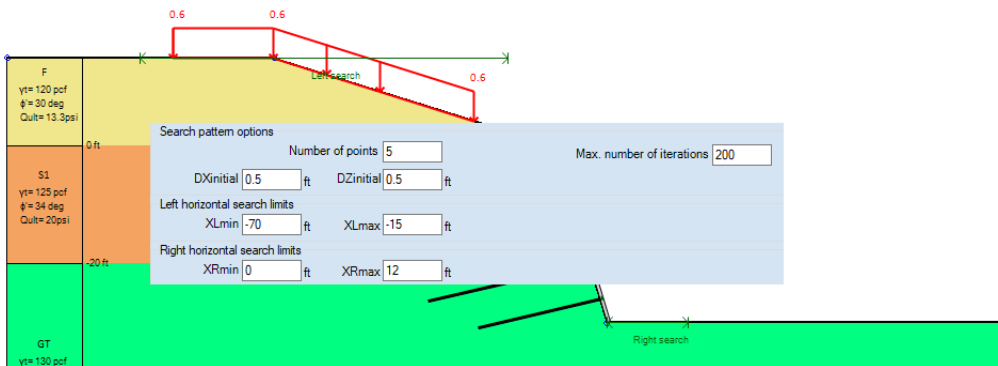


Figure: Automatic Failure Surface Search Options – Left and Right Search Limits, Steps (iterations) and Surface Points

SnailPlus – Software Capabilities and Examples

SnailPlus is a robust software for the design of soil nail wall systems. It can locate the most critical slope surfaces, the slope stability FS and it can fully design all structural items (soil nails, head plates, shotcrete facings).

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

Our Software Programs

The mission of our company is the creation and distribution of high quality software programs for engineering professionals.

Deep Excavation offers a variety of programs, dedicated to the design and analysis of deep excavation and pile foundation projects, the monitoring of inclinometer proceedings, the export of virtual reality deep excavation models and more.

[Click here to learn more: Our Software Products](#)

CLICK HERE TO BOOK A FREE ONLINE PRESENTATION
 E: training@deepexcavation.com

F.1. SNAIL PLUS ANALYSIS RESULTS – CIRCULAR FAILURE SURFACE

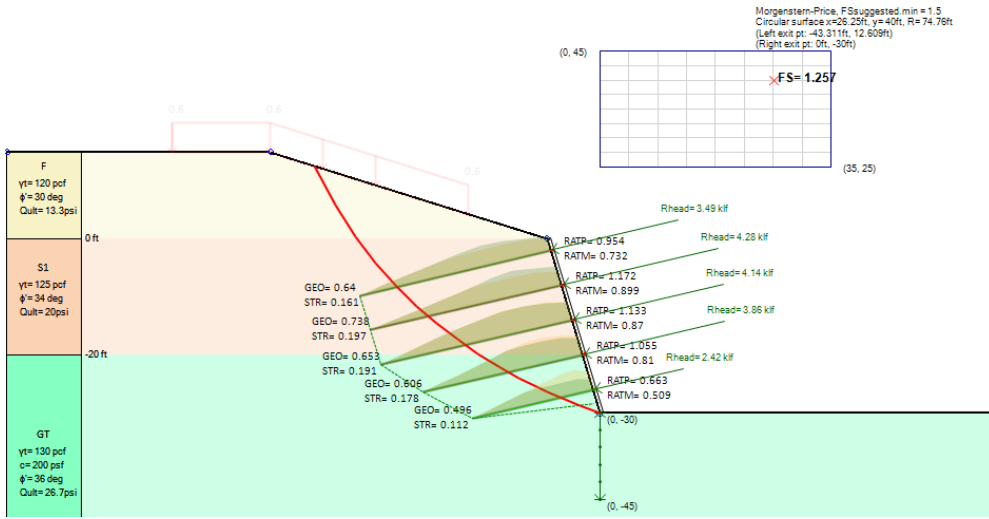


Figure: Slope Stability FS, Critical Slope Surface, Soil Nail and Head Plates Check Ratios (Circular Failure Surface)

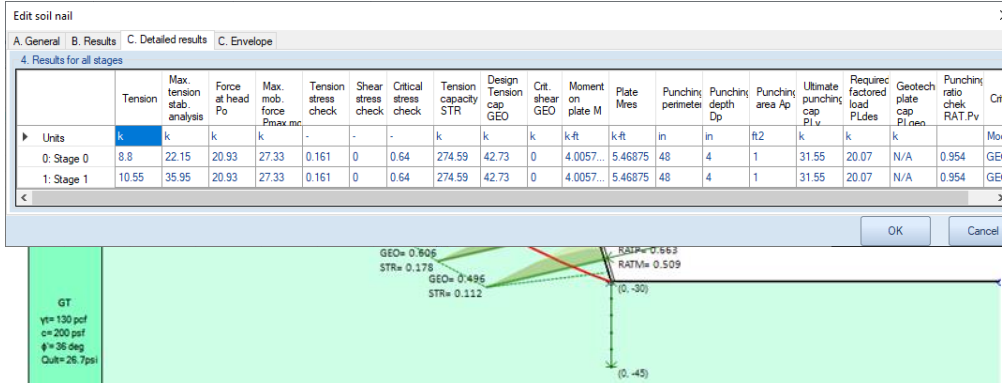


Figure: Soil Nail and Head Plates Results Table (Circular Surface: Stage 0)

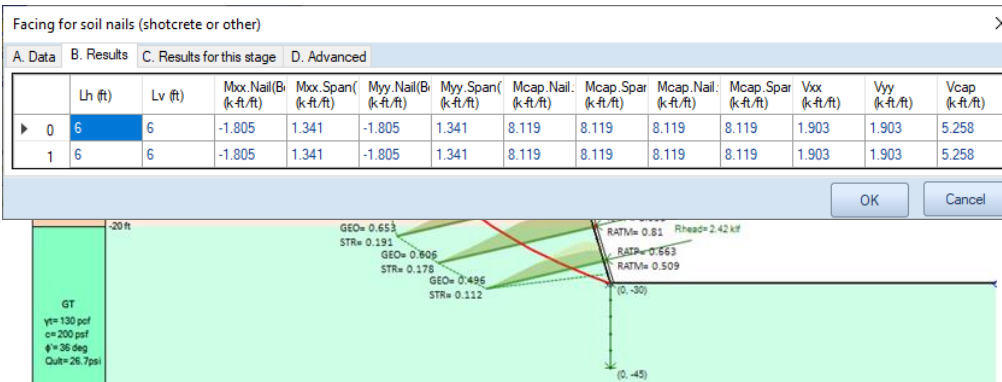


Figure: Shotcrete Facing Results Table (Circular Surface: Stage 0)

SnailPlus – Software Capabilities and Examples

SnailPlus is a robust software for the design of soil nail wall systems. It can locate the most critical slope surfaces, the slope stability FS and it can fully design all structural items (soil nails, head plates, shotcrete facings).

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

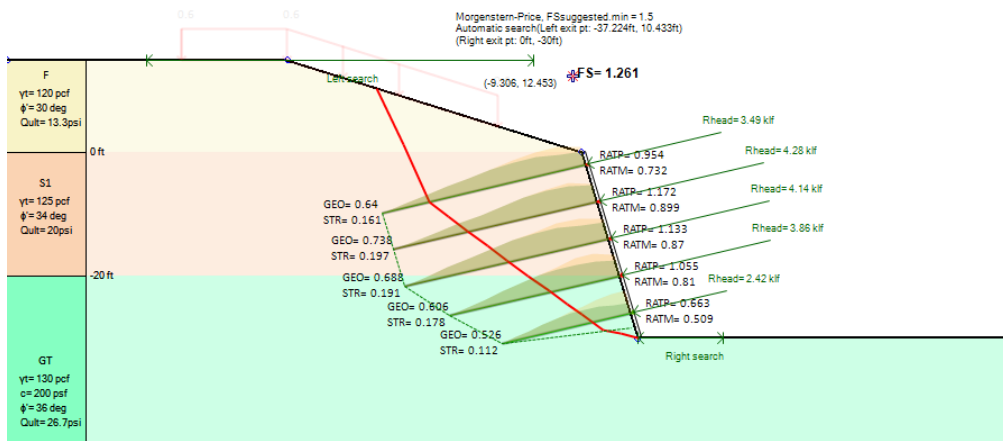
Our Software Programs

The mission of our company is the creation and distribution of high quality software programs for engineering professionals. Deep Excavation offers a variety of programs, dedicated to the design and analysis of deep excavation and pile foundation projects, the monitoring of inclinometer proceedings, the export of virtual reality deep excavation models and more.

[Click here to learn more: Our Software Products](#)

[CLICK HERE TO BOOK A FREE ONLINE PRESENTATION](#)
 E: training@deepexcavation.com

F.2. SNAIL PLUS ANALYSIS RESULTS – AUTOMATIC SLIDING SURFACE SEARCH



SnailPlus – Software Capabilities and Examples

SnailPlus is a robust software for the design of soil nail wall systems. It can locate the most critical slope surfaces, the slope stability FS and it can fully design all structural items (soil nails, head plates, shotcrete facings).

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

Our Software Programs

The mission of our company is the creation and distribution of high quality software programs for engineering professionals.

Deep Excavation offers a variety of programs, dedicated to the design and analysis of deep excavation and pile foundation projects, the monitoring of inclinometer proceedings, the export of virtual reality deep excavation models and more.

[Click here to learn more: Our Software Products](#)

[CLICK HERE TO BOOK A FREE ONLINE PRESENTATION](#)
E: training@deepexcavation.com

Figure: Slope Stability FS, Critical Slope Surface, Soil Nail and Head Plates Check Ratios (Automatic Search)

Edit soil nail																				
4. Results for all stages																				
Units	Tension	Max. tension stab. analysis	Force at head Po	Max. mob. force Pmax,mc	Tension stress check	Shear stress check	Critical stress check	Tension capacity STR	Design Tension cap GEO	Crit. shear GEO	Moment on plate M	Plate Mres	Punching perimeter	Punching depth Dp	Punching area Ap	Ultimate punching cap Pl v.	Required factored load PLdes	Geotech. plate cap Pl neo	Punching ratio check RAT.Pv	Critk
0: Stage 0	8.8	22.15	20.93	27.33	0.161	0	0.64	274.59	42.73	0	4.0057...	5.46875	48	4	1	31.55	20.07	N/A	0.954	GEO
1: Stage 1	10.55	35.95	20.93	27.33	0.161	0	0.64	274.59	42.73	0	4.0057...	5.46875	48	4	1	31.55	20.07	N/A	0.954	GEO

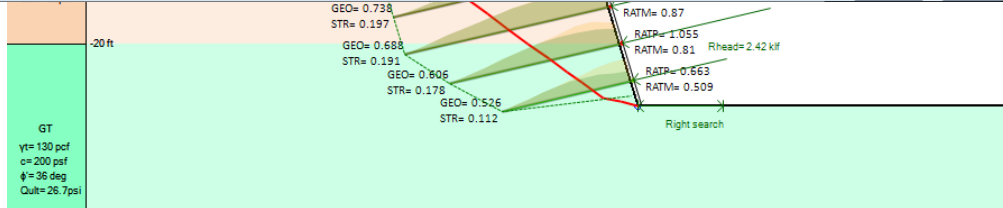


Figure: Soil Nail and Head Plates Results Table (Automatic Search: Stage 1)

Facing for soil nails (shotcrete or other)													
A. Data													
	Lh (ft)	Lv (ft)	Mox.Nail(B) (k-ft/ft)	Mox.Span (k-ft/ft)	Myy.Nail(B) (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)	Vox (k-ft/ft)	Vyy (k-ft/ft)	Vcap (k-ft/ft)
0	6	6	-1.805	1.341	-1.805	1.341	8.119	8.119	8.119	8.119	1.903	1.903	5.258
1	6	6	-1.805	1.341	-1.805	1.341	8.119	8.119	8.119	8.119	1.903	1.903	5.258

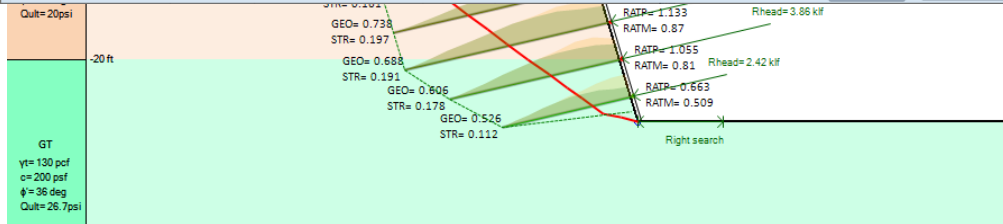


Figure: Shotcrete Facing Results Table (Automatic Search: Stage 1)

THANK YOU

DESIGN AND OPTIMIZE ANY DEEP EXCAVATION SYSTEM IN MINUTES AND GAIN A COMPETITIVE EDGE!

Learn tips and tricks of deep excavation design

CLICK HERE TO BOOK A FREE ONLINE
PRESENTATION
E: training@deepexcavation.com

Learn from examples, videos and case studies

CLICK HERE FOR EXAMPLES, VIDEOS
AND ARTICLES

Prices and Licensing Questions: sales@deepexcavation.com

Technical Support support@deepexcavation.com

TRUSTED BY

