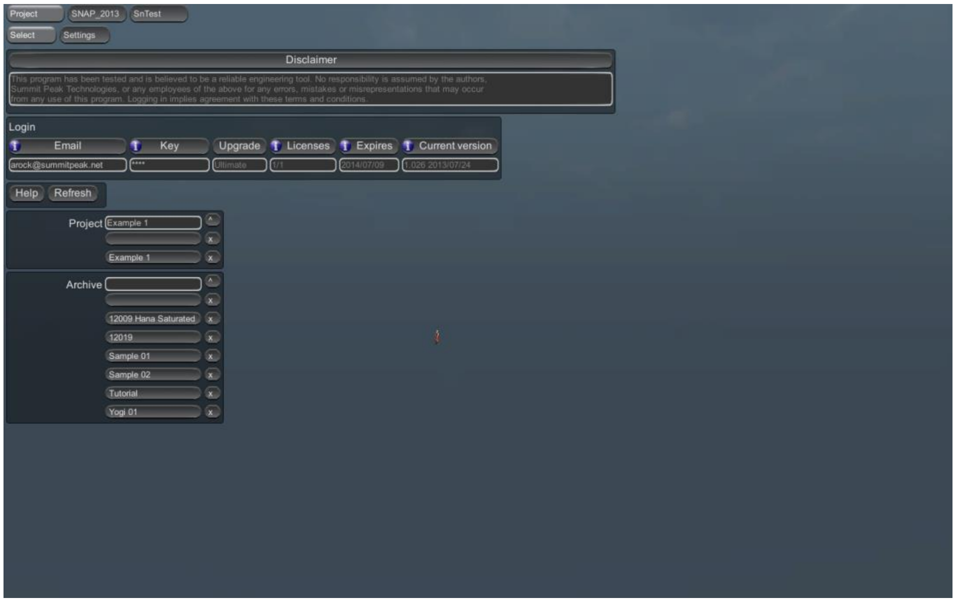
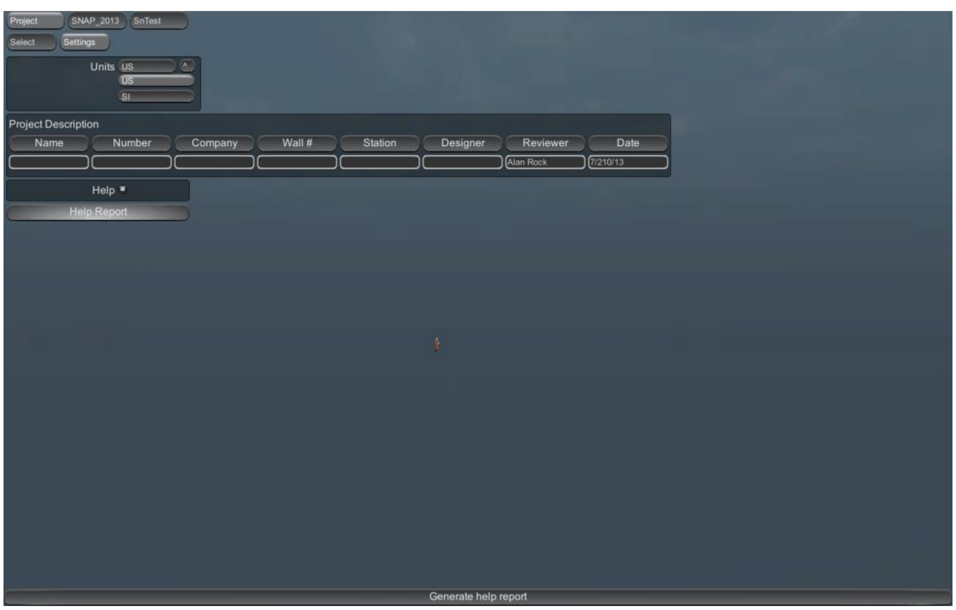
SNAP_2013 Help



- To copy a project, select the project and enter a new name in the Project edit box, then press enter.
- To create a new project, reopen the program and type in a new name.
- To archive a project, click the "x" next to the project name.
- To unarchive a project, select the project in the Archive box.
- To permanently delete a project folder, click the "x" next to the Archive name.



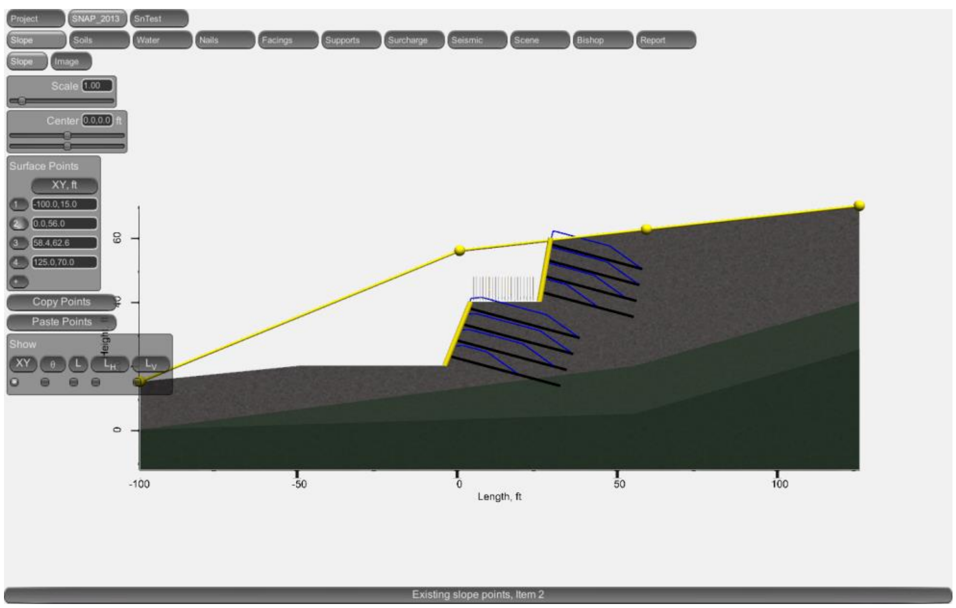
- Selecting US or SI units will convert all existing data in project to the corresponding units
- Project Description data will appear in the report

Reviewer	Date
Alan Rock	7/210/13

Reviewer: Name of person performing project review.
Date: Date of project

SNAP_2013 Help

<u>Existing Slope</u>



- Change Scale to resize image
- Change Center to move image
- To create point, click on image or click "+" on Surface Points grid
- To select point, click on point in image or click row number in grid
- Selected points are magenta, unselected points are yellow
- Ctrl-click to select or deselect a point
- Shift-click to select a string of points
- To move selected points, click on a selected point and drag mouse
- Press the delete key to delete selected points
- Select Copy Points to put points on clipboard, then paste into Excel
- Copy points in Excel, the press Paste Points to fill the Surface Points table
- View additional information for each point and point segment, for slope points, soil points, and water points
    - XY, Show Horizontal X and Y coordinates for each point
    - θ, Show angle of segment in degrees from horizontal
    - L, Show length of segment

- L_H, Show horizontal length, or width, of segment
- L_V, Show vertical length, or height, of segment

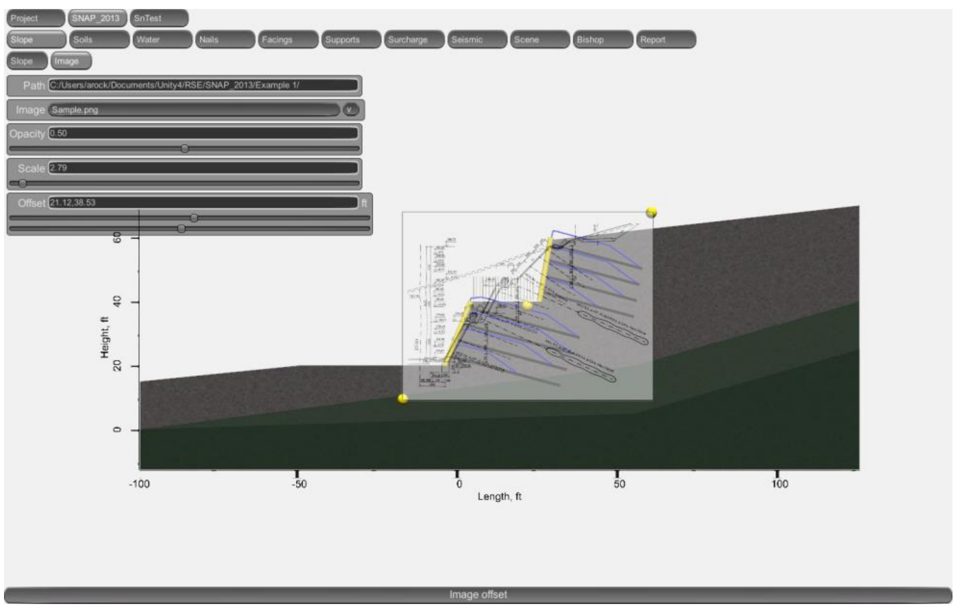
- Existing slope points will appear in the report as follows, based on selections in the point grid and report unit options:

Existing Slope Points

#	XY, ft
1	-100.0,15.0
2	0.0,56.0
3	58.4,62.6
4	125.0,70.0

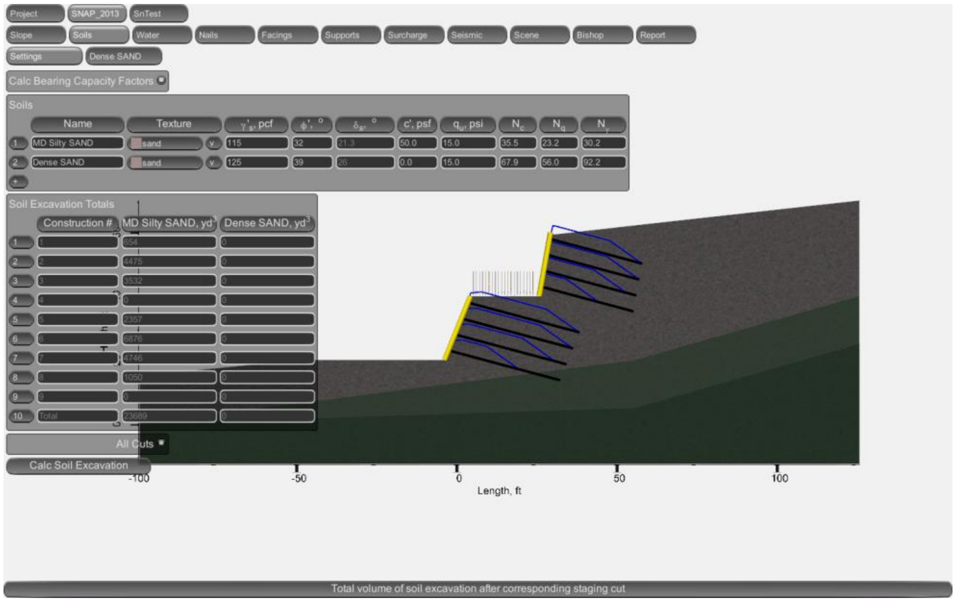
XY: Horizontal X and vertical Y coordinates

Slope Image Tab



- Import an image overlay to quickly digitize slope, soils, groundwater, walls, nails, and surcharge loads.
- Place desired png image in the Path folder.
- The image file name will appear in the list where it can be selected.
- Change Opacity to make image transparent.
- Image may appear behind plot when moved to edge.
- To more easily position the image, first enter two or more temporary reference points in the Slope tab, then return to the Image tab and position the image with the mouse to align the image to the reference points.
- When finished digitizing the image, set Opacity to zero or select a blank image.
- To add a company logo or watermark, place desired png image in the image folder, then set the image position and opacity.

Soils



- Click "+" to add new soil layers
- A new tab will be created for each additional soil layer to specify points for top of soil
- Bearing capacity factors can be automatically calculated for flat downslope
- Check "All Cuts" to include soil excavation volumes for all construction cuts
- First enter soil nail wall slope supports before calculating soil excavation volumes
  - Calculating soil excavation volumes may take several minutes
  - Please do not interact with the program until the calculation is complete

- Soil excavation volumes may be included in the report
  - Select the "Excavation" option in the Report Tab
  - This option may add several minutes to the report generation, so we suggest using this option only when generating the final report

Soil Excavation Volumes

#	Construction #	MD Silty SAND, yd^3	Dense SAND, yd^3
1	1	654	0
2	2	4475	0
3	3	3532	0
4	4	0	0
5	5	2357	0
6	6	6876	0
7	7	4746	0
8	8	1050	0

9	9	0	0
10	Total	23689	0

Construction #: Construction number (stage cut)
MD Silty SAND: Soil 0
Dense SAND: Soil 1

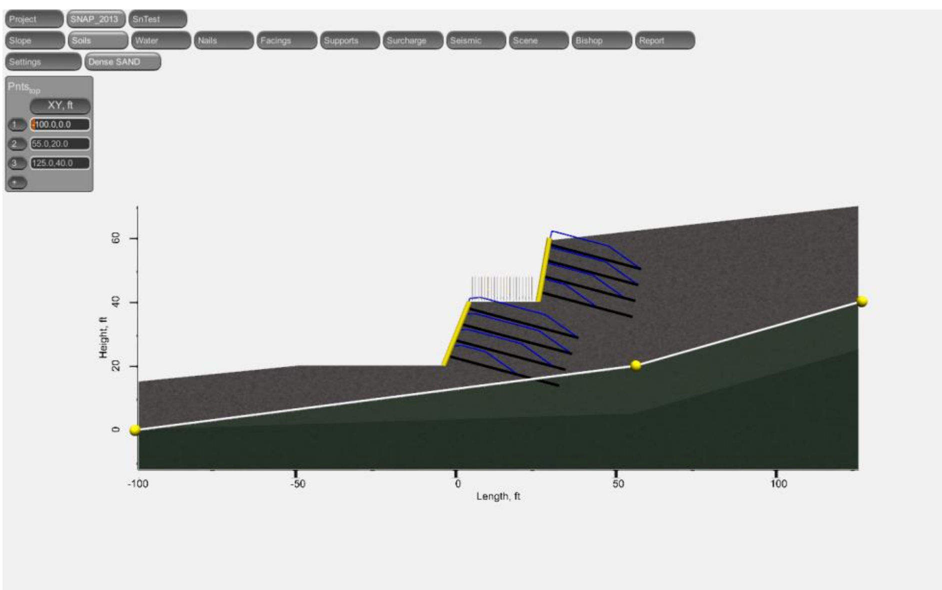
- Soil properties will be included in the report as follows:

Soil Properties

#	Name	Texture	γ'_s, pcf	ϕ', ^{o}	δ_s, ^{o}	c', psf	q_u, psi	N_c	N_q	N_γ
1	MD Silty SAND	sand	115	32	21.3	50.0	15.0	35.5	23.2	30.2
2	Dense SAND	sand	125	39	26	0.0	15.0	67.9	56.0	92.2

Name: Name of soil
Texture: Soil/rock Type
γ'_s: Effective unit weight of soil
ϕ': Effective soil friction angle / angle of internal friction
δ_s: Wall-soil interface friction angle, $\delta = 2/3\phi$
c': Effective cohesion of soil
q_u: Ultimate bond strength
N_c: N_c bearing capacity factor
N_q: N_q bearing capacity factor
N_γ: N_γ bearing capacity factor

<u>Dense SAND: Points at top of Dense SAND</u>



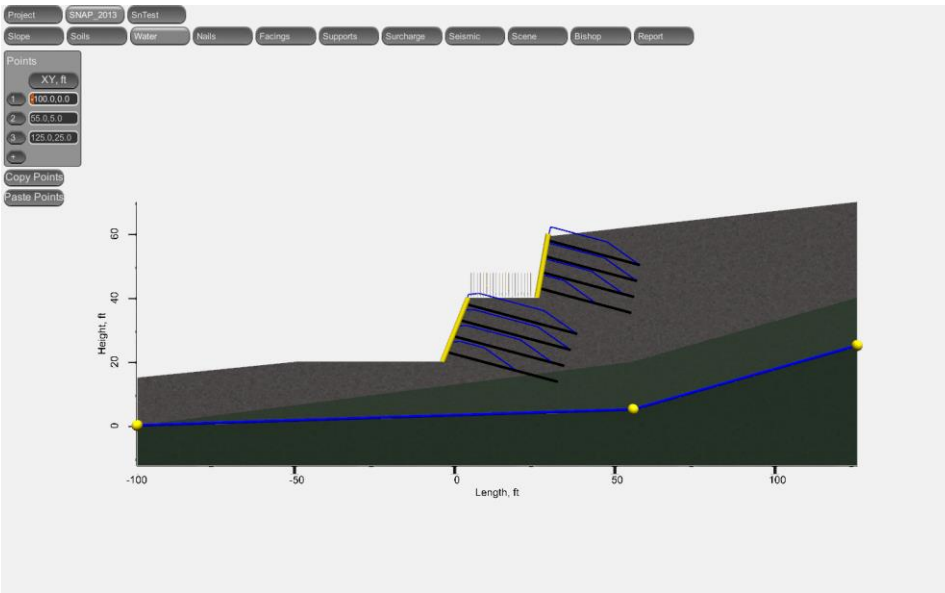
- Click soil tab to specify points for top of soil layer
- Points will be included in the report as follows:

Points at top of Dense SAND

#	XY, ft
1	-100.0,0.0
2	55.0,20.0
3	125.0,40.0

XY: Horizontal X and Y coordinates

Ground Water



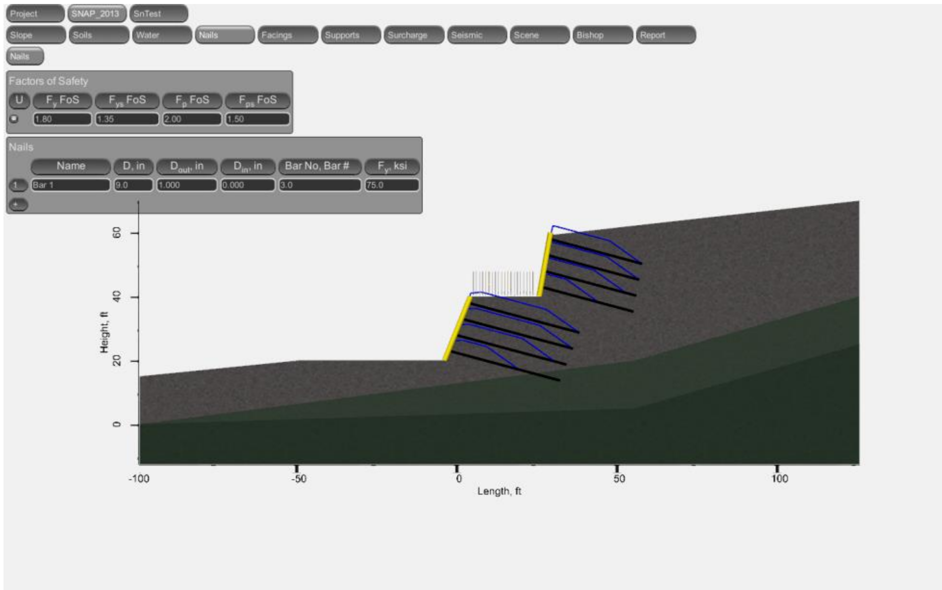
- Enter ground water points
- Ground water points will appear in the report as follows:

Points at top of water table

#	XY, ft
1	-100.0,0.0
2	55.0,5.0
3	125.0,25.0

XY: Horizontal X and Y coordinates

Nails



- Enter one or more bars for nails.
- Assign inside diameter for hollow bars.
- Deselect "U" to use different factors of safety for each bar

- Bar properties will appear in the report as follows:

Default Factors of Safety

U	F_y FoS	F_{ys} FoS	F_p FoS	F_{ps} FoS
true	1.80	1.35	2.00	1.50

U: Use same factors of safety for each bar
F_y FoS: Factor of safety for yield strength
F_{ys} FoS: Seismic factor of safety for yield strength
F_p FoS: Factor of safety for pullout
F_{ps} FoS: Seismic factor of safety for pullout

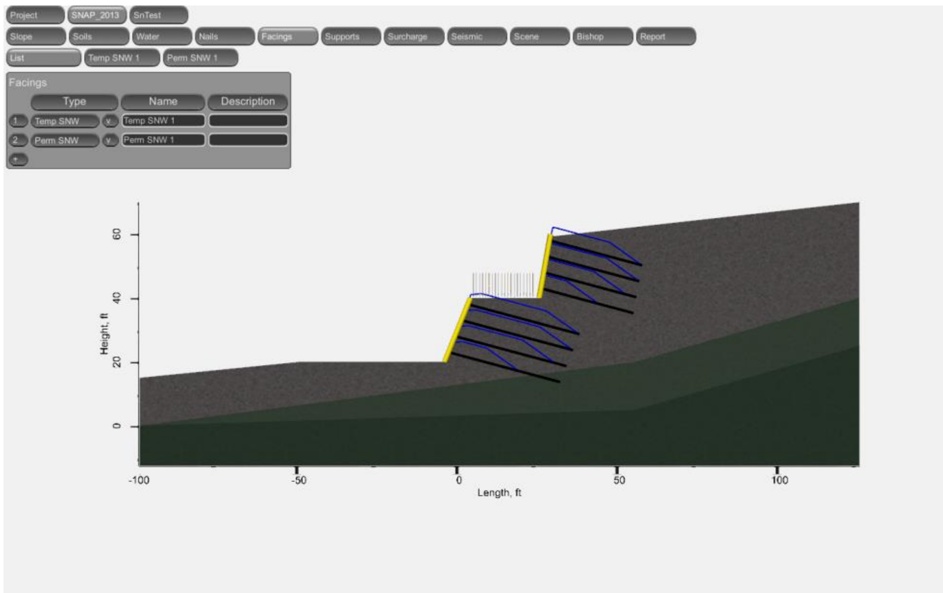
Bar Properties

Name	D, in	D_{out}, in	D_{in}, in	Bar No, Bar #	F_y, ksi
Bar 1	9.0	1.000	0.000	3.0	75.0

Name: Name of bar set
D: Drill hole diameter
D_{out}: Outside diameter of bar
D_{in}: Inside diameter of bar

Bar No: Nail size 3-18
F_y: Steel yield strength of bar

Facings



- Design multiple facings to use for project
- Each wall can have a different facing
- Facings may easily be reassigned to each wall
- When using a permanent facing, first create a temporary facing, then create permanent facing to be placed over temporary facing
- Select temporary facing in permanent facing tab.

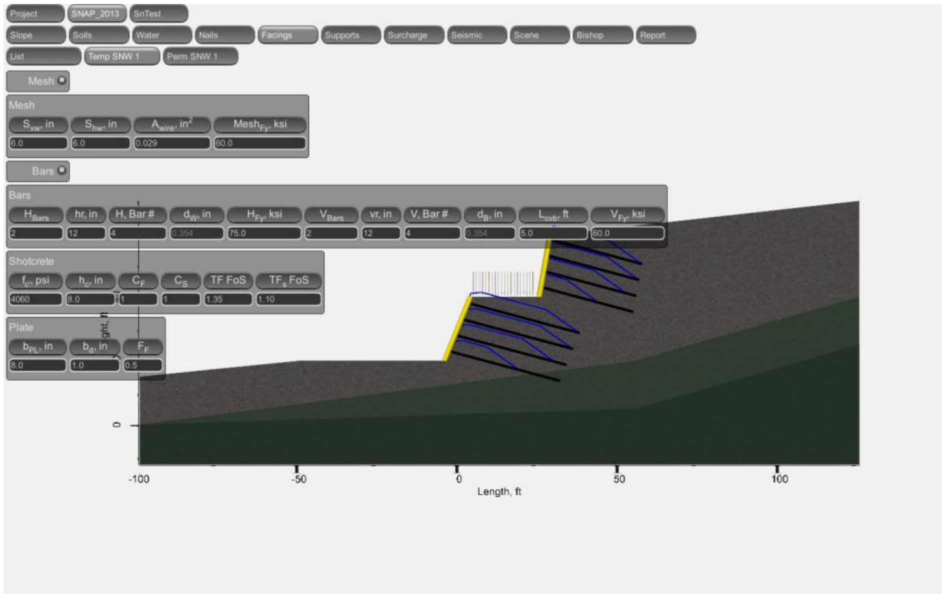
- Facing types will appear in the report as follows:

Facing Properties

#	Type	Name	Description
1	Temp SNW	Temp SNW 1	-
2	Perm SNW	Perm SNW 1	-

Type: Facing type
Name: Name of facing
Description: Facing description

Temp SNW 1:



- Mesh and bar reinforcements may be included or omitted with a click.
- Facing properties will appear in the report as follows:

Mesh	Bars
true	true

Mesh: true if temporary facing has mesh reinforcement
Bars: true if temporary facing has bar reinforcement

Mesh: Temporary facing mesh

S_{vw}, in	S_{hw}, in	A_{wire}, in^2	$Mesh_{Fy}$, ksi
6.0	6.0	0.029	60.0

S_{vw}: Vertical mesh spacing of wires
S_{hw}: Horizontal mesh spacing of wires
A_{wire}: Mesh area of wire
$Mesh_{Fy}$: Wire mesh yield strength

Bars: Temporary facing bars

H_{Bars}	hr, in	H, Bar #	d_W, in	H_{Fy}, ksi	V_{Bars}	vr, in	V, Bar #	d_B, in	L_{cvb}, ft	V_{Fy}, ksi
2	12	4	0.354	75.0	2	12	4	0.354	5.0	60.0

H_{Bars}: Number of horizontal waler bars
hr: Horizontal reinforcement spacing
H: Horizontal waler bar size, 3-10
d_W: Horizontal bar diameter

H_{Fy}: Horizontal bar yield strength
V_{Bars}: Number of vertical bearing bars
vr: Vertical reinforcement spacing
V: Vertical bearing bar size, 3-10
d_B: Vertical bearing bar diameter
L_{cvb}: Vertical bearing bar length
V_{Fy}: Bearing bar yield strength

Shotcrete: Temporary shotcrete facing

$f_{c'}$, psi	h_c, in	C_F	C_S	TF FoS	TF_s FoS
4060	8.0	1	1	1.35	1.10

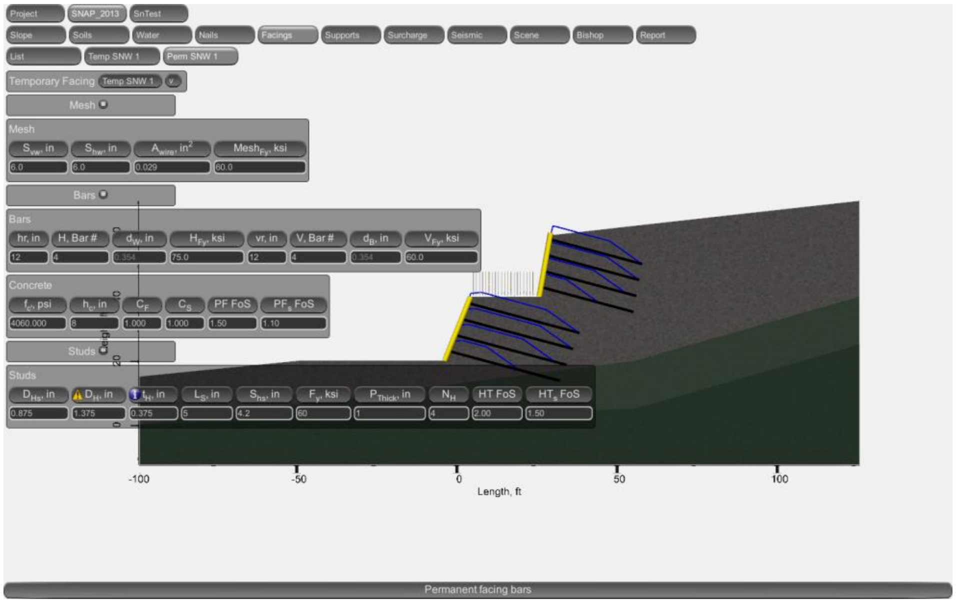
$f_{c'}$: Shotcrete facing compressive strength
h_c: Shotcrete facing thickness
C_F: Flexure pressure factor (Accounts for non-uniformity of pressure at back of facing)
C_S: Shear pressure factor
TF FoS: Factor of safety for flexure and punching
TF_s FoS: Seismic factor of safety for flexure and punching

Plate: Temporary facing plate

b_{PL}, in	b_d, in	F_F
8.0	1.0	0.5

b_{PL}: Bearing plate side length
b_d: Bearing plate thickness
F_F: Nail head service load factor

<u>Perm SNW 1:</u>



- Select Temporary Facing built under this permanent facing
- Select Mesh, Bars, or Studs to include in wall
- Deselect Mesh, Bars, or Studs to exclude from calculations
- Entered data will be restored when Mesh, Bars, or Studs are re-selected

- Facing properties will appear in the report as follows:

Temporary Facing	Mesh	Bars	Studs
Temp SNW 1	true	true	true

Temporary Facing: Temporary wall facing behind this permanent facing
Mesh: True if permanent facing has mesh reinforcement
Bars: true if permanent facing has bar reinforcement
Studs: true if permanent facing has studs

Mesh: Permanent facing mesh

S_{vw}, in	S_{hw}, in	A_{wire}, in^2	$Mesh_{Fy}$, ksi
6.0	6.0	0.029	60.0

S_{vw}: Vertical mesh spacing of wires
S_{hw}: Horizontal mesh spacing of wires
A_{wire}: Mesh area of wire
$Mesh_{Fy}$: Wire mesh yield strength

Bars: Permanent facing bars

hr, in	H, Bar #	d_W, in	H_{Fy}, ksi	vr, in	V, Bar #	d_B, in	V_{Fy}, ksi
12	4	0.354	75.0	12	4	0.354	60.0

hr: Horizontal reinforcement spacing
H: Horizontal waler bar size, 3-10
d_W: Horizontal bar diameter
H_{Fy}: Horizontal bar yield strength
vr: Vertical reinforcement spacing
V: Vertical bearing bar size, 3-10
d_B: Vertical bearing bar diameter
V_{Fy}: Bearing bar yield strength

Concrete: Permanent facing concrete

$f_{c'}$, psi	h_c, in	C_F	C_S	PF FoS	PF_s FoS
4060.000	8	1.000	1.000	1.50	1.10

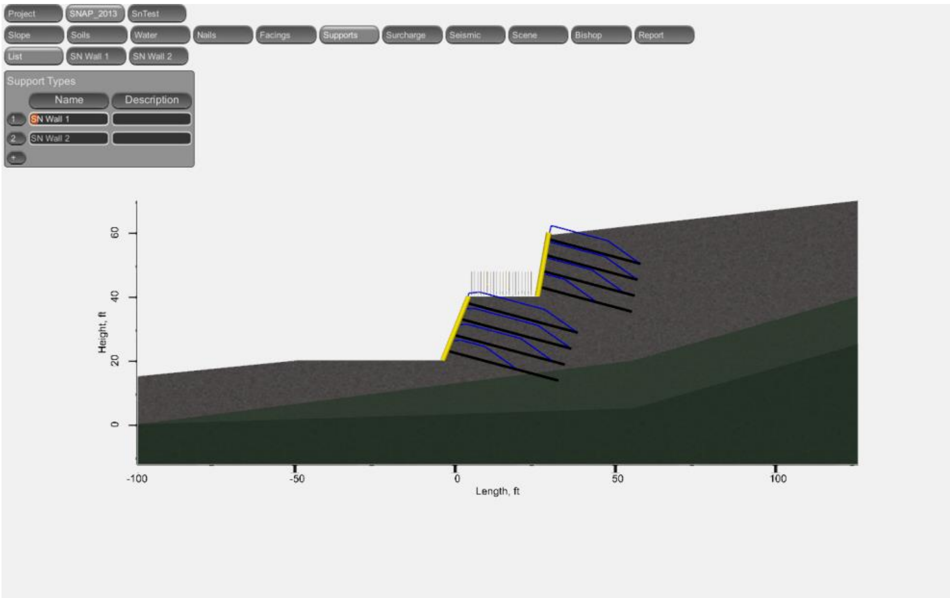
$f_{c'}$: Concrete compressive strength
h_c: Permanent facing thickness
C_F: Flexure Pressure Factor, Table 4.2 (Accounts for non-uniformity of pressure at back of facing)
C_S: Shear pressure factor
PF FoS: Factor of safety for flexure and punching
PF_s FoS: Seismic factor of safety for flexure and punching

Studs: Permanent facing studs

D_{Hs}, in	D_H, in	t_H, in	L_S, in	S_{hs}, in	F_y, ksi	P_{Thick}, in	N_H	HT FoS	HT_s FoS
0.875	1.375	0.375	5	4.2	60	1	4	2.00	1.50

D_{Hs}: Stud body diameter
D_H: Stud head diameter, d_h: WARNING, Stud head diameter not OK: $d_h < 1.58 * d_{hs}$, 1.375 < 1.58 * 0.875, 1.375 < 1.383
t_H: Stud head thickness, t_h: Stud head thickness Ok: $t_h >= (d_h - d_{hs}) / 2$, 0.375 >= (1.375 - 0.875) / 2, 0.375 >= 0.25
L_S: Stud overall length
S_{hs}: Stud spacing
F_y: Stud yield strength
P_{Thick}: Plate thickness
N_H: Number of headed-studs in the connection
HT FoS: Headed-stud tensile fracture factor (for ASTM A307, $?_{FHS}$ = 0.50; for ASTM A325 $?_{FHS}$ = 0.59)
HT_s FoS: Seismic headed-stud tensile fracture factor

Wall List



- Multiple walls may be specified for multi-tiered or stepped walls.
- Walls should be specified top-down, with the upper-most wall being specified first.
- Walls may be re-ordered by selecting one or more rows in the table, then pressing ctrl-x to cut, the selecting a row and pressing ctrl-v to insert the cut rows.

- Wall types will appear in the report as follows:

Wall types

#	Name	Description
1	SN Wall 1	-
2	SN Wall 2	-

Name: Name of wall
Description: Wall Description

SN Wall 1:

Static Case

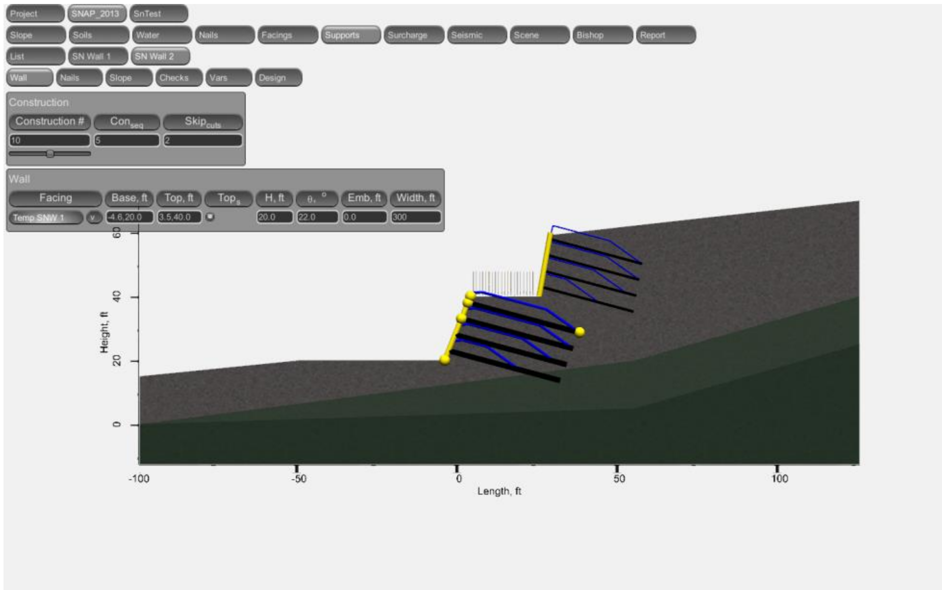
Cost: Wall cost

Breakdown: Wall breakdown

SN Wall 2:

Static Case

Wall: Soil nail wall geometry



- The wall top and base may be entered in the table or moved with the mouse.
- Remember to assign the wall facing.
- The construction sequence should be assigned for each wall. In this example, the construction sequence for the first wall is 1, the second wall is 5 (since the first wall has 4 cuts)

- Wall properties will appear in the report as follows:

Construction: Construction specification

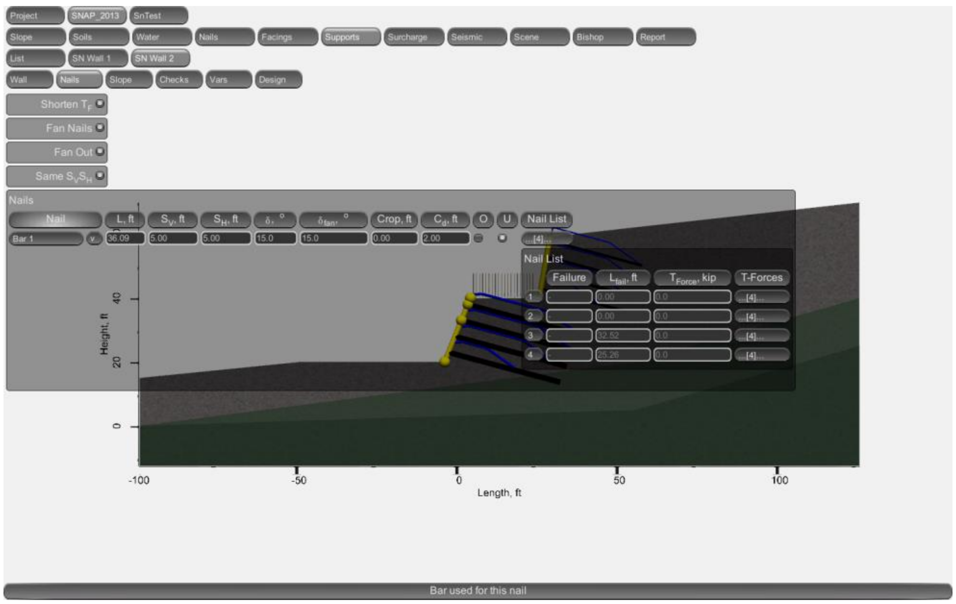
Construction #	Con_{seq}	$Skip_{cuts}$
10	5	2

Construction #: Construction number, adds stage cuts and nails according to assigned construction sequences
Con_{seq}: Construction (stage cut) sequence when wall construction begins ie. "1" or "2,4-6"
$Skip_{cuts}$: Skip staging cuts (allow for larger cuts), ie. "1-3"

Wall: Soil nail wall size and location

Facing	Base, ft	Top, ft	Top_s	H, ft	θ, °	Emb, ft	Width, ft
Temp SNW 1	-4.6,20.0	3.5,40.0	true	20.0	22.0	0.0	300

Facing: Wall facing
Base: Base of wall
Top: Top of wall
Top_s: True if wall top is immovable when changing H and θ, false if wall bottom is immovable
H: Wall height
θ: Wall batter angle, degrees from vertical
Emb: Embedment, depth below ground surface at toe
Width: Width of wall, extending along Z-Axis



- Shorten T_F, Shortens T-Forces on lower nails due to deformation during construction
  - Must be selected to crop nail lengths
  - Not necessary when supporting an existing slope with no excavation
- Fan Nails, Change nail δ inclination angles from top nail to bottom nail
  - Often can improve global stability factor of safety
- Fan Out, Nails should only fan out, bottom nail δ >= top nail δ
  - SNAP VE Design is occasionally better when nails fan in, but beware of group effects for this case
- Same $S_V S_H$, Use same horizontal and vertical spacing on nails
  - SNAP VE Design is usually better when different nail spacings are allowed
- L, Nail length
  - May be adjusted by dragging the point at the end of the nail
- S_V, Vertical nail spacing
  - May be adjusted by dragging the point at the head of the second nail
- S_H, Horizontal nail spacing
  - Unselect "Same $S_V S_H$" to allow different horizontal and vertical spacings
- δ, Nail inclination, degrees from horizontal
  - May be adjusted by dragging the point at the end of the nail
- δ_{fan}, Nail fan, inclination of last nail
  - Inclination angles of nails between top and bottom nail should be interpolated incrementally
  - Select "Fan Nails" option to allow this feature
  - Select "Fan Out" to allow this angle to be less than δ
- Crop, Crop nail length to T-force using this resolution
  - 0: do not crop
  - 1: crop to nearest unit length
  - 0.5: crop to nearest half unit length
  - "Shorten T_F" must be selected to show this parameter

- C_d, Cantilever distance, vertical distance from top of wall to top nail
    - May be adjusted by dragging the point at the head of the top nail
- O, Offset pattern, true if nails in even rows are offset to midspan, otherwise nails are in a square pattern
- U, Use uniform nails
    - If non-uniform nails are desired, set all uniform nail properties before changing to non-uniform nails, then set the non-uniform properties for each nail. Each nail may have a different bar size, height, length, and inclination angle.
- If the nail T-forces (the blue lines above each nail) are not showing, make sure the wall facing (in Walls Tab) and nail bar have been assigned.

- Nail properties will appear in the report as follows:

Shorten T_F	Fan Nails	Fan Out	Same $S_V S_H$
true	true	true	true

Shorten T_F: Shorten T-Forces on lower nails due to deformation during construction
Fan Nails: Change nail δ inclination angles from top nail to bottom nail
Fan Out: Nails should only fan out, bottom nail δ >= top nail δ
Same $S_V S_H$: Use same horizontal and vertical spacing on nails

Nails: Soil nail sizes and locations

Nail	L, ft	S_V, ft	S_H, ft	δ, º	δ_{fan}, º	Crop, ft	C_d, ft	O	U
Bar 1	36.09	5.00	5.00	15.0	15.0	0.00	2.00	false	true

Nail: Bar used for this nail
L: Nail length
S_V: Vertical nail spacing
S_H: Horizontal nail spacing
δ: Nail inclination, degrees from horizontal
δ_{fan}: Nail fan, inclination of last nail
Crop: Crop nail length to T-force using this resolution (0: no crop, 1: nearest unit length, 0.5: nearest half unit length)
C_d: Cantilever distance, vertical distance from top of wall to top nail
O: Offset pattern, true if nails in even rows are offset to midspan, otherwise nails are in a square pattern
U: Use uniform nails
Nail List: Nail properties

Nail[1]

Failure	L_{fail}, ft	T_{Force}, kip
-	0.00	0.0

Failure: Failure mode for wall slip surface
L_{fail}: Distance from nail head to failure surface
T_{Force}: Nail T-force

T-Forces: Nail T-forces

#	Dist, ft	T-Force, kip	Soil	Failure
1	0.00	23.8	MD Silty SAND	Punching/Flexure Failure
2	3.25	32.7	MD Silty SAND	Tendon Failure
3	24.18	32.7	MD Silty SAND	Tendon Failure
4	36.09	0.0	MD Silty SAND	Pullout

Dist: Horizontal distance of T-force from nail head
T-Force: Nail T-force
Soil: Soil layer at T-force location
Failure: Failure mode at T-force location

Nail[2]

Failure	L_{fail}, ft	T_{Force}, kip
-	0.00	0.0

Failure: Failure mode for wall slip surface
L_{fail}: Distance from nail head to failure surface
T_{Force}: Nail T-force

T-Forces: Nail T-forces

#	Dist, ft	T-Force, kip	Soil	Failure
1	0.00	23.8	MD Silty SAND	Punching/Flexure Failure
2	3.25	32.7	MD Silty SAND	Tendon Failure
3	24.18	32.7	MD Silty SAND	Tendon Failure
4	36.09	0.0	MD Silty SAND	Pullout

Dist: Horizontal distance of T-force from nail head
T-Force: Nail T-force
Soil: Soil layer at T-force location
Failure: Failure mode at T-force location

Nail[3]

Failure	L_{fail}, ft	T_{Force}, kip
-	32.52	0.0

Failure: Failure mode for wall slip surface
L_{fail}: Distance from nail head to failure surface
T_{Force}: Nail T-force

T-Forces: Nail T-forces

#	Dist, ft	T-Force, kip	Soil	Failure
1	0.00	23.7	MD Silty SAND	Punching/Flexure Failure
2	3.23	32.7	MD Silty SAND	Tendon Failure
3	20.66	32.7	MD Silty SAND	Tendon Failure
4	32.29	0.0	MD Silty SAND	Pullout

Dist: Horizontal distance of T-force from nail head
T-Force: Nail T-force
Soil: Soil layer at T-force location
Failure: Failure mode at T-force location

Nail[4]

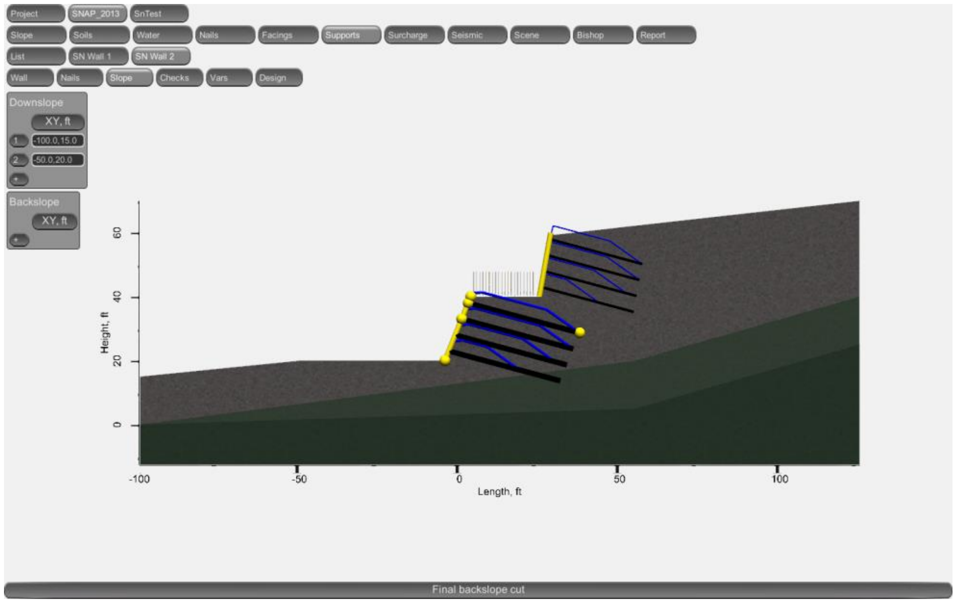
Failure	L_{fail}, ft	T_{Force}, kip
-	25.26	0.0

Failure: Failure mode for wall slip surface
L_{fail}: Distance from nail head to failure surface
T_{Force}: Nail T-force

T-Forces: Nail T-forces

#	Dist, ft	T-Force, kip	Soil	Failure
1	0.00	23.4	MD Silty SAND	Punching/Flexure Failure
2	3.42	32.7	MD Silty SAND	Tendon Failure
3	11.17	32.7	MD Silty SAND	Tendon Failure
4	22.79	0.0	MD Silty SAND	Pullout

Dist: Horizontal distance of T-force from nail head
T-Force: Nail T-force
Soil: Soil layer at T-force location
Failure: Failure mode at T-force location



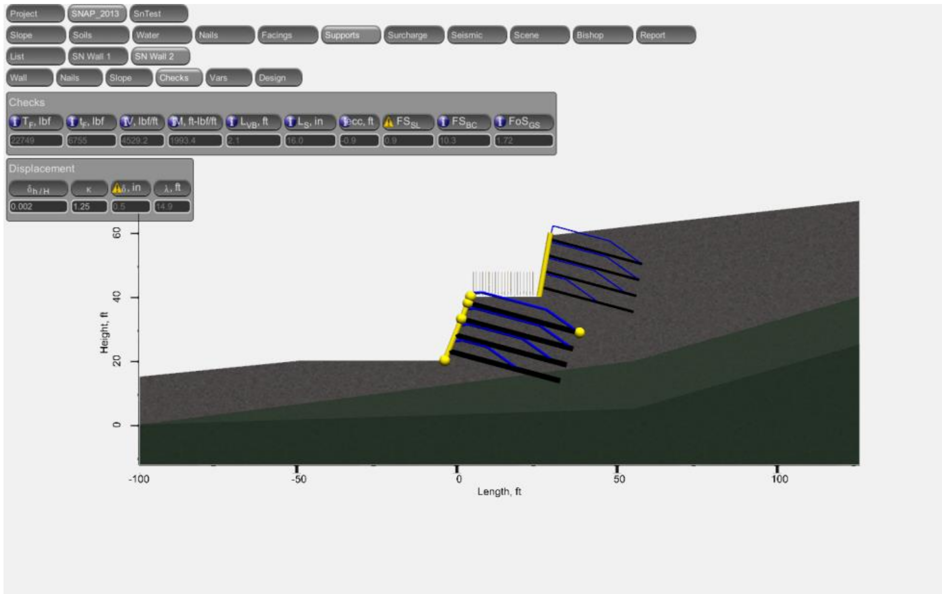
- Downslope and backslope cuts may be specified for each wall by selecting the wall and clicking points with the mouse above the wall for backslope points, and below the wall for downslope points.
- In this example, the lower wall has a downslope cut.

- Downslope and/or backslope points will appear in the report as follows:

Downslope: Final downslope cut

#	XY, ft
1	-100.0,15.0
2	-50.0,20.0

XY: Horizontal X and Y coordinates



- Design checks for the wall facing and external stability are displayed in this tab.
- A blue icon means the check passed, a yellow icon means the check failed or that there is a warning.
- Move the mouse over the icon to show additional information in the status bar at the bottom of the window.
- All checks and messages are displayed in the report with corresponding colors, so it may be easier to generate a report and view results of all checks at a glance.

- Wall checks will appear in the report as follows:

Checks: Facing design checks

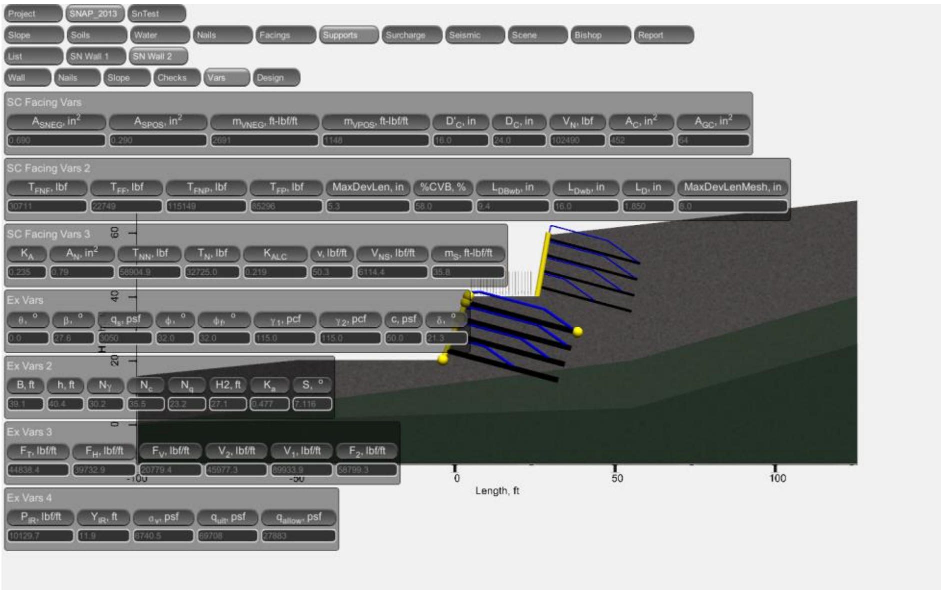
T_F, lbf	t_F, lbf	V, lbf/ft	M, ft-lbf/ft	L_{VB}, ft	L_S, in	ecc, ft	FS_{SL}	FS_{BC}	FoS_{GS}
22749	6755	4529.2	1993.4	2.1	16.0	-0.9	0.9	10.3	1.72

T_F: Allowable nail head strength - minimum of temporary facing T_{FF} and T_{FP}, T_F: Nail Head Load Ok: $t_F < T_F$: 6755 < 22749
t_F: Estimated nail head service load, Nail Head Load Ok: $t_F < T_F$: 6755 < 22749
V: Allowable one-way unit shear strength, One-way Unit Shear in Upper Cantilever OK: v < 0.67 V
M: Allowable one-way unit moment, Design for Flexure in Upper Cantilever OK: mS < 0.67 M
L_{VB}: Minimum total length of vertical bearing bars, Bearing bar embedment length OK
L_S: Minimum waler splice length, AASHTO 8.32, Waler splice length must be greater of 12 in. or LDwb, Ok
ecc: Eccentricity check for overturning, Ok: ecc < B / 4
FS_{SL}: Factor of safety with respect to base sliding, WARNING: $FS_{SL} < 1.3$
FS_{BC}: Factor of safety with respect to bearing capacity $FS_{BC} = q_{ult}/\sigma_v$, Ok: $FS_{BC} >= 2.5$
FoS_{GS}: Factor of safety of global stability slip surface, Ok: $FoS_{GS} >= 1.35$

Displacement: Long-term wall deformation and displacement parameters

$\delta_{h/H}$	κ	δ, in	λ, ft
0.002	1.25	0.5	14.9

$\delta_{h/H}$: Displacement ratio: (weathered rock/stiff soil: 0.001) (sandy soil: 0.002) (fine-grained soil: 0.003)
κ: Damping coefficient used to estimate wall displacement: (weathered rock/stiff soil: 0.8) (sandy soil: 1.25) (fine-grained soil: 1.5)
δ: Estimated displacement at the top of soil nail wall, L/H ratio outside 0.7 - 1.0, Estimation may not be accurate
λ: Horizontal distance behind soil nail wall where ground deformation can be significant



- Intermediate variables for facing design and external stability for each wall are accessible here.
- Intermediate variables will appear in the report as follows:

SC Facing Vars: Shotctrete facing design intermediate variables

A_{SNEG}, in^2	A_{SPOS}, in^2	m_{VNEG}, ft-lbf/ft	m_{VPOS}, ft-lbf/ft	D'_C, in	D_C, in	V_N, lbf	A_C, in^2	A_{GC}, in^2
0.690	0.290	2691	1148	16.0	24.0	102490	452	64

A_{SNEG}: Cross sectional area of steel near the nail head
A_{SPOS}: Cross sectional area of steel near the nail mid-point
m_{VNEG}: NEG average nominal unit moment resistance
m_{VPOS}: POS average nominal unit moment resistance
D'_C: Effective diameter of punching cone
D_C: Base diameter of punching cone
V_N: Nominal internal punching shear strength of the shotcrete facing
A_C: Cross-sectional area at base of punching cone
A_{GC}: Cross-sectional area of grout column

SC Facing Vars 2: More shotctrete facing design intermediate variables

T_{FNF}, lbf	T_{FF}, lbf	T_{FNP}, lbf	T_{FP}, lbf	MaxDevLen, in	%CVB, %	L_{DBwb}, in	L_{Dwb}, in	L_D, in	MaxDevLenMesh, in
30711	22749	115149	85296	5.3	58.0	9.4	16.0	1.850	8.0

T_{FNF}: Nominal nail head strength - flexure
T_{FF}: Allowable nail head strength - flexure
T_{FNP}: Nominal nail head strength - punching
T_{FP}: Allowable nail head strength - punching
MaxDevLen: Maximum of (L_{cvb}/20), (15*d_B), and (h_c/2)
%CVB: Percent coverage from vertical bars
L_{DBwb}: Basic development length of waler bars, AASHTO 8.25.1
L_{Dwb}: Development length of waler bars, AASHTO 8.25
L_D: Basic development length of wire mesh, AASHTO 8.30
MaxDevLenMesh: Minimum wire mesh splice length

SC Facing Vars 3: More shotctrete facing design intermediate variables

K_A	A_N, in^2	T_{NN}, lbf	T_N, lbf	K_{ALC}	v, lbf/ft	V_{NS}, lbf/ft	m_S, ft-lbf/ft
0.235	0.79	58904.9	32725.0	0.219	50.3	6114.4	35.8

K_A: Coulomb active earth pressure coefficient
A_N: Nail tendon area
T_{NN}: Nominal nail tendon tensile load
T_N: Allowable nail tendon tensile load
K_{ALC}: Active earth pressure coefficient for load component normal to wall
v: One-way unit service shear force
V_{NS}: Nominal one-way unit shear strength
m_S: One-way unit service moment

Ex Vars: External stability intermediate variables

θ, °	β, °	q_s, psf	ϕ, °	ϕ_f, °	γ_1, pcf	γ_2, pcf	c, psf	δ, °
0.0	27.6	3050	32.0	32.0	115.0	115.0	50.0	21.3

θ: Inclination of back wall measured CCW from vertical plane
β: Inclination of ground slope behind wall measured CCW from horiz. plane
q_s: Surcharge load behind wall
ϕ: Internal friction angle of weakest retained soil
ϕ_f: Internal friction angle of weakest foundation soil
γ_1: Unit weight of weakest retained soil
γ_2: Unit weight of weakest foundation soil
c: Cohesion - weakest foundation soil
δ: Wall/soil interface friction angle

Ex Vars 2: More external stability intermediate variables

B, ft	h, ft	$N\gamma$	N_c	N_q	H2, ft	K_a	S, °
39.1	40.4	30.2	35.5	23.2	27.1	0.477	7.116

B: Effective width of wall at the base
h: Effective total height of soil at back of reinforced soil mass
$N\gamma$: See Fig 4.4.7.1.1.4B and Table 4.4.7.1A AASHTO
N_c: Bearing capacity coefficient - weakest foundation soil
N_q: Bearing capacity coefficient - weakest foundation soil
H2: A height near the back of wall for calculating PIR and PAE
K_a: Active earth pressure coefficient - no seismic forces
S: Angle relating the horizontal and vertical seismic coefficients

Ex Vars 3: More external stability intermediate variables

F_T, lbf/ft	F_H, lbf/ft	F_V, lbf/ft	V_2, lbf/ft	V_1, lbf/ft	F_2, lbf/ft
44838.4	39732.9	20779.4	45977.3	89933.9	58799.3

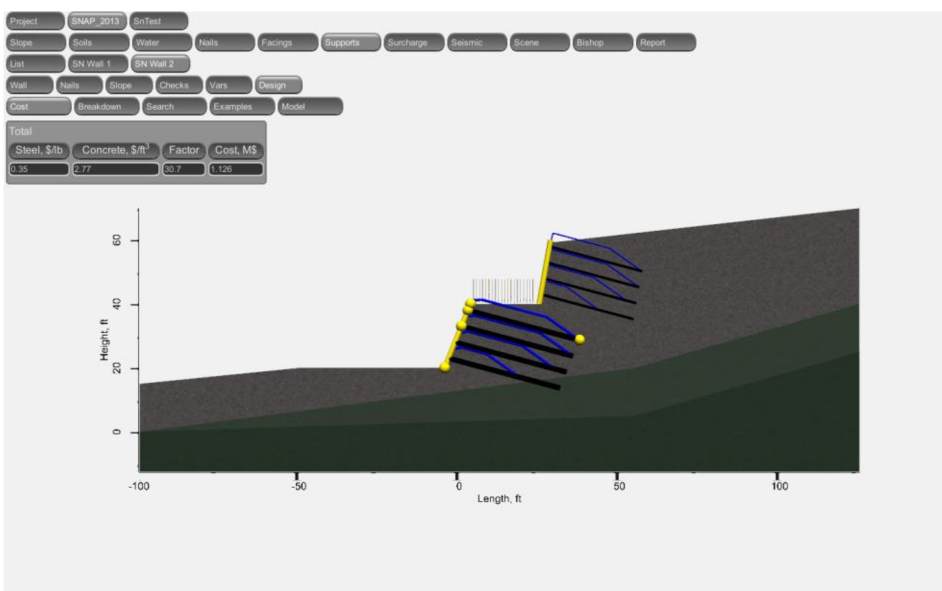
F_T: Lateral earth pressure
F_H: Horizontal lateral earth pressure
F_V: Vertical lateral earth pressure
V_2: Weight of soil above wall
V_1: Weight of soil above wall
F_2: Surcharge load

Ex Vars 4: More external stability intermediate variables

P_{IR}, lbf/ft	Y_{IR}, ft	σ_v, psf	q_{ult}, psf	q_{allow}, psf
10129.7	11.9	6740.5	69708	27883

P_{IR}: Horizontal inertial force
Y_{IR}: Y-coordinate of centroid of mass for inertial force
σ_v: Vertical effective stress at base of footing
q_{ult}: Terzaghi bearing capacity
q_{allow}: Terzaghi bearing capacity $q_{allow} = q_{ult}/FOS$

Cost: Wall cost



- Enter average cost of steel and concrete
  - Raw material costs may be entered, including any overhead, such as shipment costs
- Enter cost factor to estimate cost of wall

- The same cost factor is usually used for walls in a similar location
    - To determine the cost factor, enter the cost of steel and concrete, then enter the total cost of the wall. The cost factor will automatically be updated
- Enter total estimated cost of wall using current wall design to obtain cost factor
    - Enter cost factor, if known, to obtain estimated cost of wall

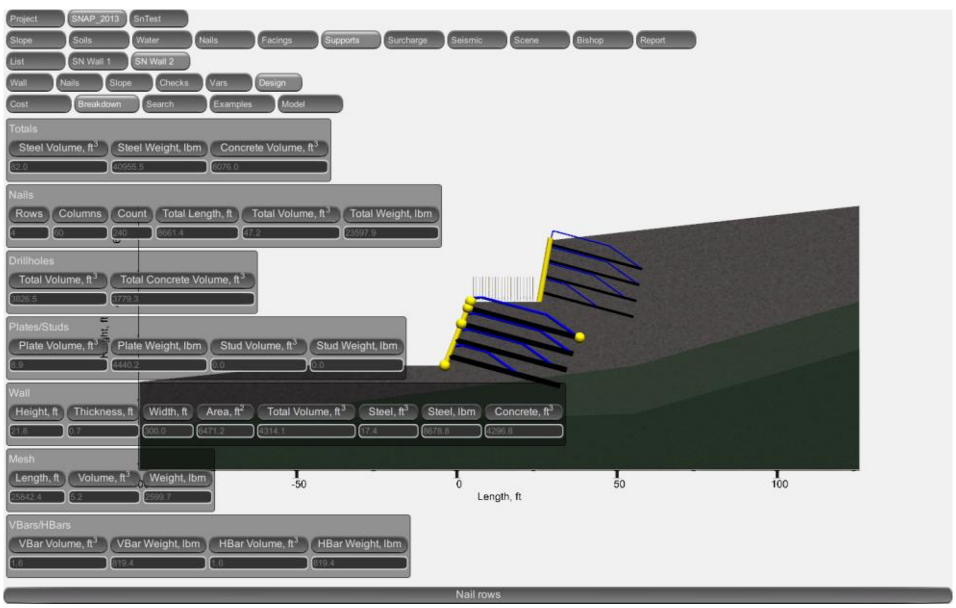
- Design costs will appear in the report as follows:

Total: Approximate total cost of wall

Steel, $/lb	Concrete, $/ft^3	Factor	Cost, M$
0.35	2.77	30.7	1.126

Steel: Average cost of steel per unit weight
Concrete: Average cost of concrete/shotcrete per unit volume
Factor: Cost factor, relates material quantities to wall cost
Cost: Total cost, in millions of $

Breakdown: Wall breakdown



- Displays steel and concrete quantities for each wall component.
- Intermediate variables used to compute wall cost.

- Design breakdown data will appear in the report as follows:

Totals: Breakdown total cost and time

Steel Volume, ft^3	Steel Weight, lbm	Concrete Volume, ft^3
82.0	40955.5	8076.0

Steel Volume: Steel volume
Steel Weight: Steel weight
Concrete Volume: Concrete volume

Nails: Breakdown for nails

Rows	Columns	Count	Total Length, ft	Total Volume, ft^3	Total Weight, lbm
4	60	240	8661.4	47.2	23597.9

Rows: Nail rows
Columns: Nail columns
Count: Nail count
Total Length: Total nail length
Total Volume: Total nail volume
Total Weight: Total nail weight

Drillholes: Breakdown for drillholes

Total Volume, ft^3	Total Concrete Volume, ft^3
3826.5	3779.3

Total Volume: Total drillhole volume
Total Concrete Volume: Total drillhole concrete volume

Plates/Studs: Breakdown for plates and studs

Plate Volume, ft^3	Plate Weight, lbm	Stud Volume, ft^3	Stud Weight, lbm
8.9	4440.2	0.0	0.0

Plate Volume: Total plate volume
Plate Weight: Total plate weight
Stud Volume: Total stud volume
Stud Weight: Total stud weight

Wall: Breakdown for wall

Height, ft	Thickness, ft	Width, ft	Area, ft^2	Total Volume, ft^3	Steel, ft^3	Steel, lbm	Concrete, ft^3
21.6	0.7	300.0	6471.2	4314.1	17.4	8678.8	4296.8

Height: Wall height
Thickness: Wall thickness
Width: Wall width
Area: Wall area
Total Volume: Total wall volume
Steel: Facing steel volume
Steel: Facing steel weight
Concrete: Facing concrete volume

Mesh: Breakdown for mesh

Length, ft	Volume, ft^3	Weight, lbm
25842.4	5.2	2599.7

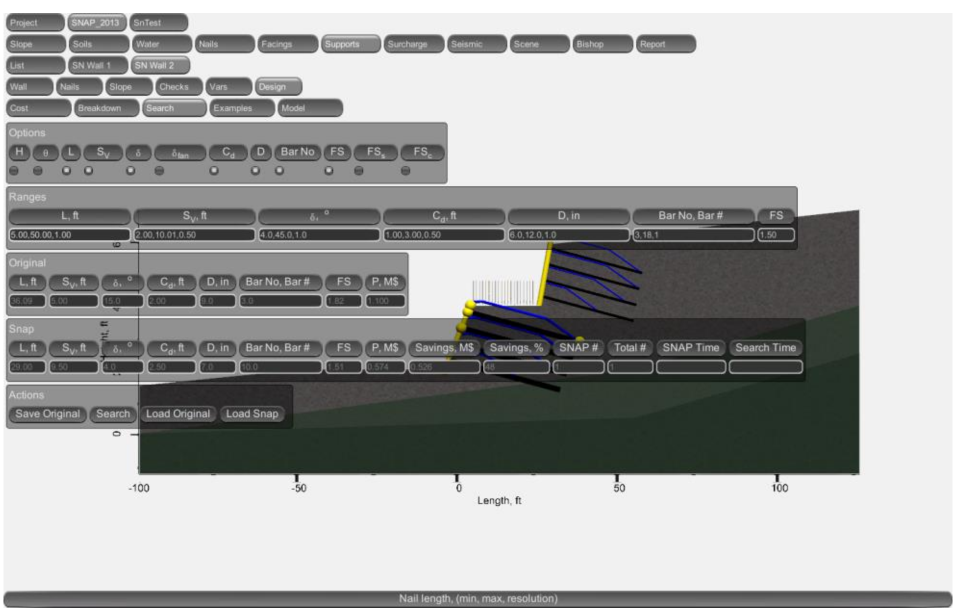
Length: Mesh wire length
Volume: Mesh wire volume
Weight: Mesh wire weight

VBars/HBars: Breakdown for vertical and horizontal bars

VBar Volume, ft^3	VBar Weight, lbm	HBar Volume, ft^3	HBar Weight, lbm
1.6	819.4	1.6	819.4

VBar Volume: Vertical bar volume
VBar Weight: Vertical bar weight
HBar Volume: Horizontal bar volume
HBar Weight: Horizontal bar weight

Search: Design search options



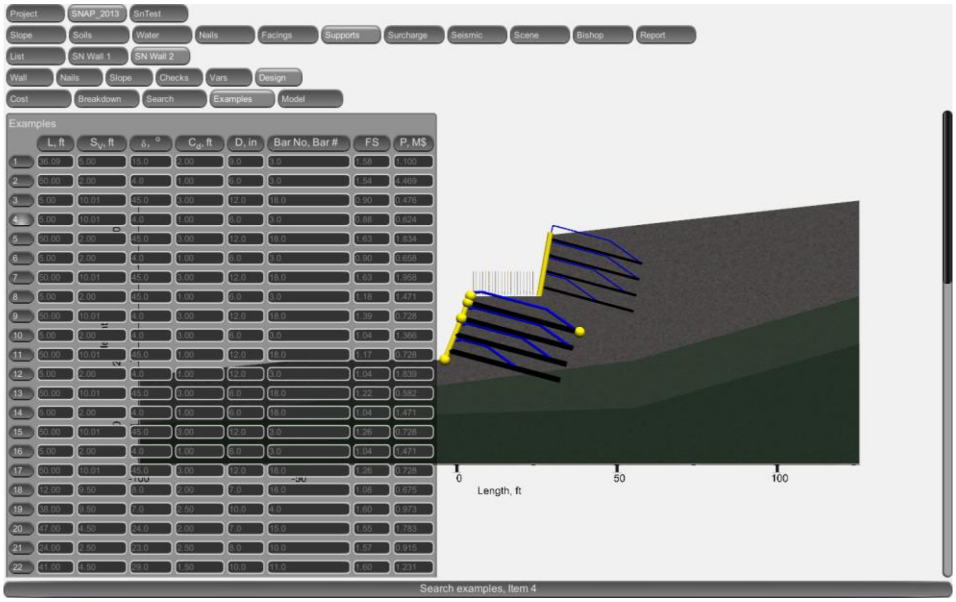
- Determines best Value Engineered (VE) SNAP design, based on valid parameter ranges and resolutions.
- Press "Save Original" design to view current parameter values, as it may help determining valid ranges and resolutions.
- SNAP design price and factor of safety are available in standard version. Premium version is required to access the actual SNAP design parameters.
- Several minutes may be required to obtain SNAP design, depending on the number of selected parameters. Checking factors of safety for staging cuts increases computation time.
- SNAP design determined using artificial intelligence and neural networks, based on the Scientific Method. The program:
    - Collects observations
    - Postulates causal relationships and theories
    - Generates hypotheses
    - Predicts results
    - Runs experiments
    - Re-evaluates theories, if necessary
    - Repeats until all experimental results are accurately predicted
- Savings of 30-40% common. Cost of Premium Version insignificant compared to cost savings.
    - SNAP design can be obtained with the Standard Version
        - Run a VE SNAP design
        - Email files in project folder (without report directories) to "arock@summitpeaktechnologies.com"
        - Mail check to Summit Peak Technologies for 25% of cost savings, as reported in the SNAP design box
        - You will receive your VE SNAP design project files by email

- SNAP can obtain optimal to near-optimal soil nail wall designs in minutes. The program can adjust:
    - Wall
        - height and batter angle
    - Nail
        - length
        - inclination angles
        - fan angles
        - horizontal and vertical spacing
        - cantilever distance
        - bar size
    - Drillhole diameter
    - Backslope cuts and downslope cuts
- Specify valid ranges and resolutions for each parameter, as well as minimum factors of safety for seismic loading and static loading at each staging cut.
- The VE design minimizes total cost while meeting all global stability safety factors
- VE designs are obtained using the scientific method. The program:
    - Collects observations
    - Postulates causal relationships and proposes theories
    - Generates a hypothesis
    - Predicts results
    - Runs an experiment to acquire measurements
    - Compares predictions to the measurements
    - Re-evaluates theories, if necessary
    - Generates a new hypothesis
- This process continues until proposed theories accurately predict any given design
- An artificial intelligence technique incorporating a specialized neural network is used to study observations, analyze parameters, propose theories, generate hypotheses, and predict results. The neural network simulates both the structure and function of the brain. It is trained on a set of observations (simulated wall designs) to predict results of future experiments (simulated wall designs) by analyzing causal relationships and interactions among parameters.

- The neural network goes through a process of logical reasoning and thought to make an educated guess, or hypothesis, of the optimal wall design. The neural network also predicts the price and minimum factor of safety of this wall design. The program then calculates a cost and a factor of safety for this wall design. If the neural network?s prediction is incorrect, the neural network re-analyzes parameter relationships to generate a new hypothesis for the best wall design. This process repeats until the neural network prediction of the hypothesis is correct.
- The neural network then goes through a sleep stage, where the synapsis connections release energy from the neurons. The neural network is then presented with a new random wall design, which the refreshed neural network uses in an attempt to think of a better wall design. The process concludes after no better design is discovered after several thought and sleep cycles.
- For example, a recent wall design from an existing project at a total cost of $35.4 M with a minimum factor of safety of 1.35 was analyzed by SNAP, varying 9 parameters. SNAP generated 127 wall designs out of a possible 672 billion to obtain a VE design at a total cost of $21.0 M with a minimum factor of safety of 1.35, in 34 minutes. This was a cost savings of $14.4 M, or 41%, at the same factor of safety. The time required for the neural network training, logical analysis, and sleep cycles was 15 minutes. The time required to exhaustively search all 672 billion possible designs would be 345,000 years.

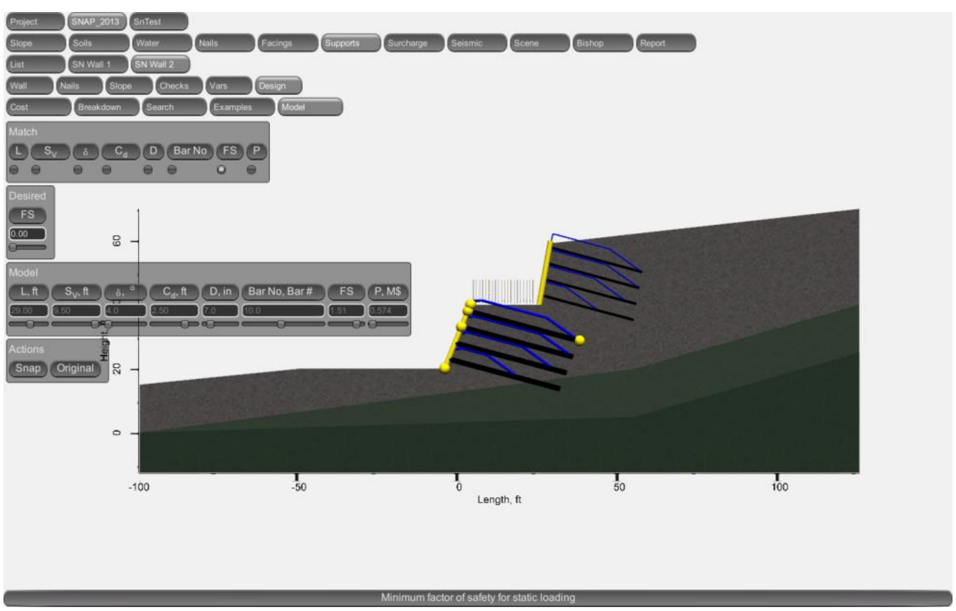
- Tips:
    - When adjusting H and/or θ
        - Remember to select correct value for Top_s in Walls Tab
        - Backslope points will move with top of wall, then connect with the next point to the right after the backslope cut on the existing slope
            - If no backslope points are entered, the top of the wall is considered to be a backslope point
        - Downslope points will move with the bottom of the wall, then connect with the previous point to the left after the downslope cut on the existing slope
            - If no downslope points are entered, the bottom of the wall is considered to be a downslope point
    - When adjusting nail spacing, remember to set corresponding options on the Nails Tab
    - When adjusting nail inclination and fan angles, remember to set corresponding options on the Nails Tab
    - Set ranges and resolutions to reasonable values
        - Do not set nail spacing ranges too small
            - The wall can't be built with very small nail spacings
            - It takes longer for the program to generate walls with very small nail spacings
        - Do not use a very small or negative nail inclination angle, or the nail will be difficult or impossible to install and grout
        - Do not set nail inclination angle resolutions too small. Avoid asking for a nail inclination angle δ of 12.32 degrees
        - Use valid bar sizes
        - Make sure drill hole diameter is large enough to install nail
    - Find critical global stability factor of safety, and only select that factor of safety for design
        - If the static factor of safety is 1.55 and the seismic factor of safety is 1.2, design using the static factor of safety
    - Selecting the factor of safety for staging cuts will significantly increase design time
        - First run a report and check staging cut factors of safety. Select this option if one or more cuts are critical
        - If desired, assign which cuts to skip in Walls tab before using this option. Significant savings in time and cost can be achieved by skipping staging cuts.
    - Determine VE SNAP designs for top walls first, then determine VE designs for lower walls
    - Try increasing range limits if VE design has a parameter matching a minimum or maximum range value
        - Since VE design parameters are not available in the Standard version, make sure the range limits are not too restrictive

Examples: Search examples



- Displays all hypotheses generated by VE SNAP design.
- Used to develop Design Model.

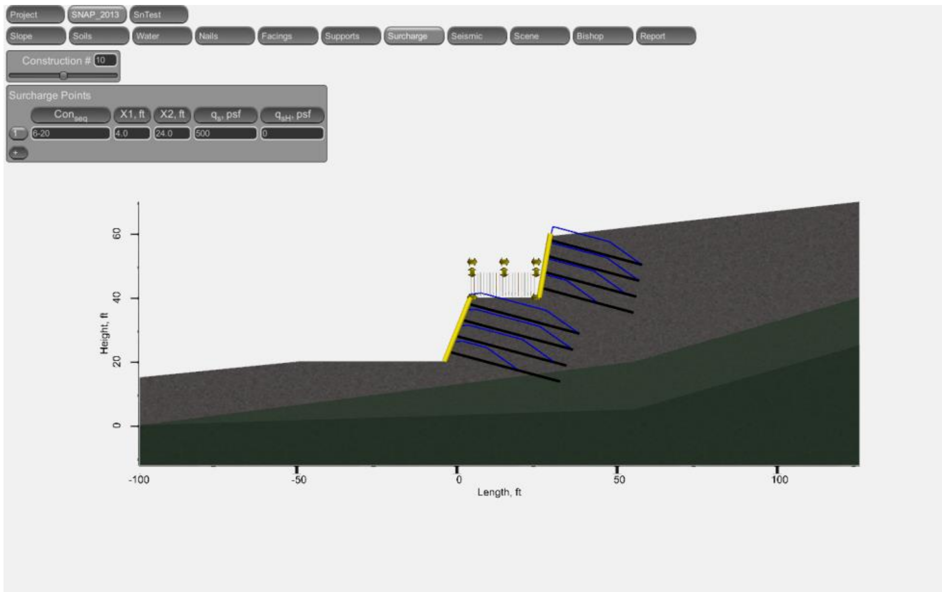
Model: Interactive model



- Select any number of inputs and outputs and immediately generate models matching design constraints.

- See effects of changing inputs on output results.
- Determine most critical design parameters.

Surcharge



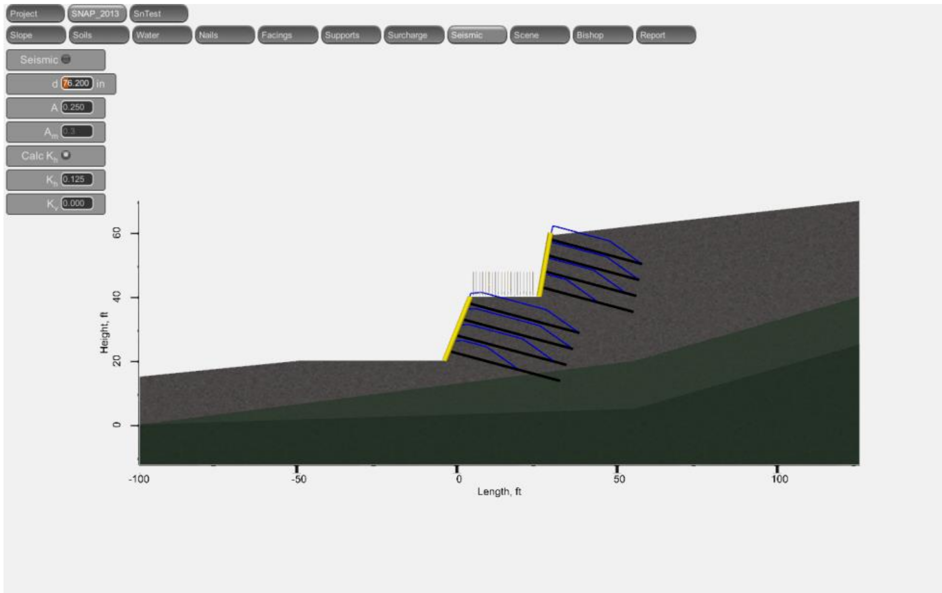
- Multiple surcharge loads may be specified for any construction sequence range.
- Complex surcharge loads can be specified as a range.
- Horizontal surcharge loads may be specified in the same manner.

- Surcharge data will appear in the report as follows:

Con_{seq}	X1, ft	X2, ft	q_s, psf	q_{sH}, psf
6-20	4.0	24.0	500	0

Con_{seq}: Construction sequence for applying surcharge, ie. "1-5" or "2,4-6"
X1: Surcharge X range start
X2: Surcharge X range end
q_s: Vertical surcharge load on slope segment as a number (250) or a linearly interpolated range (100~250)
q_{sH}: Horizontal surcharge load on slope segment as a number (250) or a linearly interpolated range (100~250)

Seismic



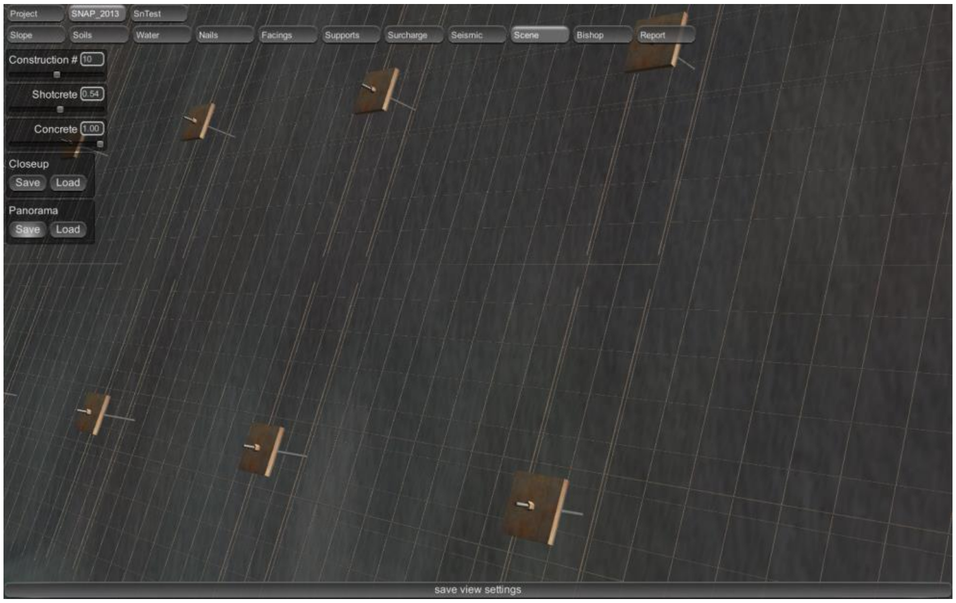
- The use of seismic loading may be turned on or off by selecting the radio button at the top.
- Seismic loading may also be turned on or off in the Bishop tab

- Seismic data will appear in the report as follows:

Seismic	d, in	A	A_m	Calc K_h	K_h	K_v
false	76.200	0.250	0.3	true	0.125	0.000

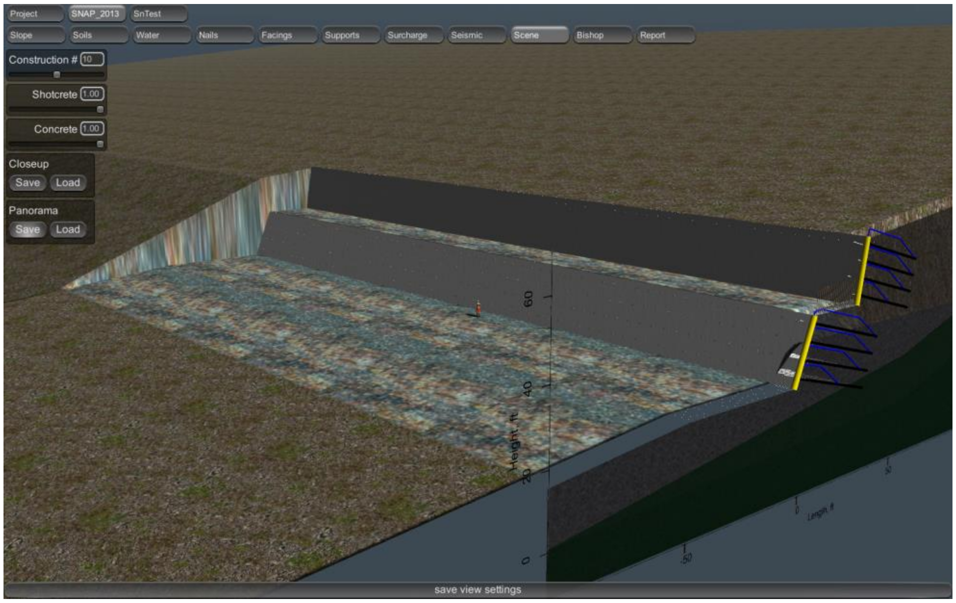
Seismic: Use seismic loading for external and global stability analysis
d: Tolerable seismically induced wall lateral movement
A: Peak ground acceleration coefficient as a fraction of gravity
A_m: Normalized horizontal acceleration, $A_m = A\ (1.45 - A)$
Calc K_h: Automatically calculate K_h from A, if d is between 25 and 203, $K_h = 0.74\ A_m\ (A_m/d)^{0.25}$, else $K_h = A/2$
K_h: Horizontal seismic coefficient
K_v: Vertical seismic coefficient

Scene Closeup



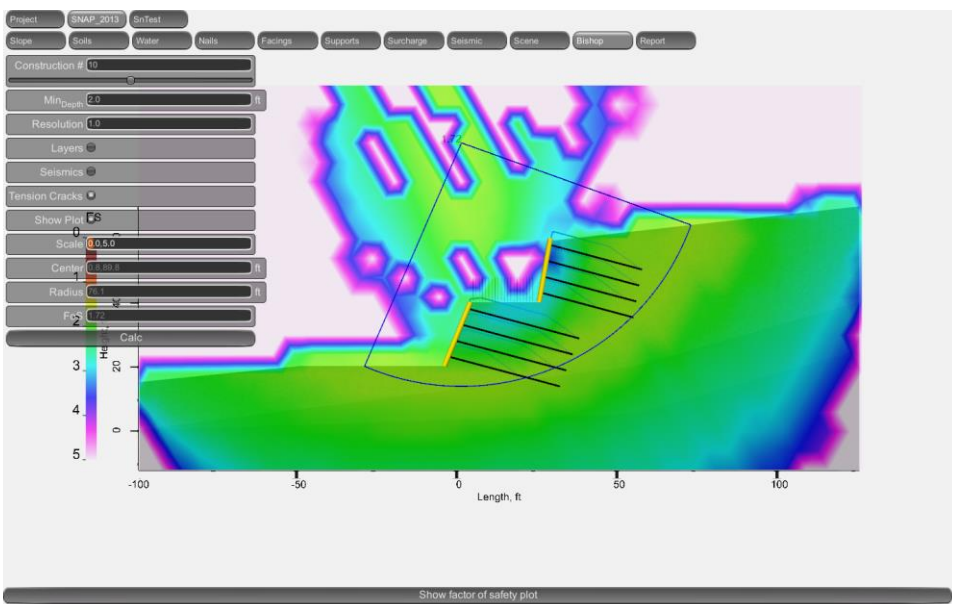
- The project may be explored in 3D. Left-click and drag mouse to rotate view. Hold down the left mouse button while pressing the following keys:
  - <Home><End> - move view toward or away from character
  - <A><S><D><W> - move character left, back, right, and forward
  - <shift> - move faster
  - <ctrl+shift> - move even faster
  - <space> - jump
  - <Page up><Page down> - move view above or below character
  - <ctrl+shift+W+space> - make character fly at high speed
- Move to desired close-up view, the press "Save" in Close-up box
  - Close-up view should be assigned before including Scene in report
  - After saving the close-up view, click "Load" to show the close-up view at any time

Scene Panorama



- The transparency of the concrete and shotcrete can be adjusted to view facing and nail components inside of the wall.
- Move to desired view, the save close-up and panorama views by clicking save buttons
- This provides 3D visual verification of facing and wall parameters
- Move to desired panorama view, the press "Save" in panorama box
    - The panorama view should be assigned before including Scene in report
    - After saving the panorama view, click "Load" to show the panorama view at any time

Global Stability



- This tab displays failure circles for global stability using the Modified Bishop method.

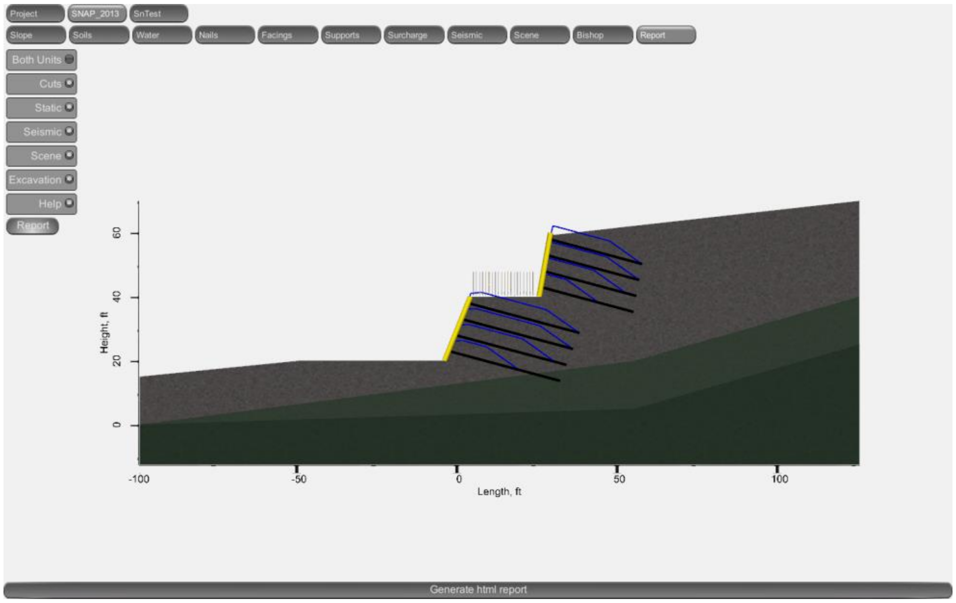
- The minimum failure depth may be specified to eliminate undesired failure checks at the top corner of walls.
- A minimum failure circle is displayed for the entire slope and for each wall (failure circle intersecting points above and below the top of the wall). These minimum failure circles may overlap. In this example, the minimum failure circles for the entire slope and each wall overlap, so only one failure circle is displayed. It may be possible to see 3 failure circles for this example.
- Turn on "Seismics" to see seismic loading failure circles and factors of safety.
- Higher Resolution values result in higher speed, lower values result in higher accuracy. A value of 1 is set to give the best balance between accuracy and performance
- The Layers option searches for failure surfaces between soil layers.
  - If plot does not change when this option is selected and de-selected, then unselect this option. Slightly more time is required to check for these failures.
- Tension cracks allows vertical failure surfaces.
  - This option can become unstable when the the wall is completely saturated or the water table is too high. Beware of constructing a soil nail wall in saturated conditions or in sand.
- When Show Plot is selected, the colors above the slope correspond to the minimum factor of safety for all failure surfaces with centers at the corresponding point. The colors below the slope correspond to the minimum factor of safety for all failure surfaces intersecting the corresponding point.

- Global stability data will appear in the report as follows:

Construction #	**$\text{Min}_{\text{Depth}}$, ft**	**Resolution**	**Layers**	**Seismics**	**Tension Cracks**	**Show Plot**	**Scale**	**Center, ft**	**Radius, ft**	**FoS**
10	2.0	1.0	false	false	true	true	0.0,5.0	0.8,89.8	76.1	1.72

Construction #: Construction number, adds stage cuts and nails according to assigned construction sequences
$\text{Min}_{\text{Depth}}$: Minimum height of failure circle arc. Use this to remove small failure circles.
Resolution: Resolution, higher value for higher speed, lower value for higher accuracy
Layers: Check failures along soil layer boundaries
Seismics: Select to use seismic case, unselect for static case
Tension Cracks: Select to include vertical tension cracks in soil
Show Plot: Show factor of safety plot
Scale: Range for factor of safety color scale
Center: Center of minimum factor of safety failure circle
Radius: Radius of minimum factor of safety failure circle
FoS: Minimum factor of safety

Report



- Specify report options, the click "Report".
- Generate report with figures, tables, and design checks with global stability for each staging cut, if desired.
- After clicking "Report", wait for the report to show in your web browser. Do not click or interact with the program until the report is complete.
- The program will automatically move to different tabs to collect images for the report.
- The report will show up in your browser when complete.
- To copy to MS-Word, click in the report browser window, type <ctrl-a> to select all, then paste into Word.

- A description of report options are as follows:

Both Units	Cuts	Static	Seismic	Scene	Excavation	Help
false	true	true	true	true	true	true

Both Units: Include both US and SI units in report
Cuts: Include each construction cut in report
Static: Include static results in report
Seismic: Include seismic results in report
Scene: Include 3D scene views in report
Excavation: Include soil excavation volumes in report
Help: Generate help

SnapTest Help

Test Types

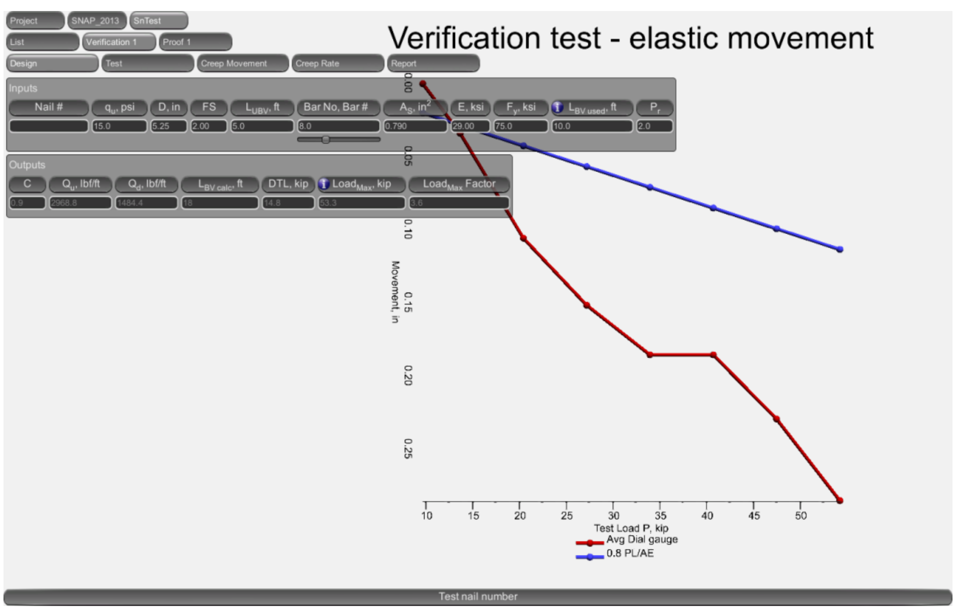
- Enter any number of proof or verification tests
- Test types will appear in the report as follows:

Test: Soil nail wall tests

#	Type	Name	Description
1	Verification	Verification 1	Verification Test 1
2	Proof	Proof 1	Proof Test 1

Type: Test type
Name: Name of test module
Description: Description of test

Design



- Input design data
- Design data will appear in the report as follows:

Inputs: Inputs

Nail #	q_u, psi	D, in	FS	L_{UBV}, ft	Bar No, Bar #	A_S, in^2	E, ksi	F_y, ksi	$L_{BV\ used}$, ft	P_r
-	15.0	5.25	2.00	5.0	8.0	0.790	29.00	75.0	10.0	2.0

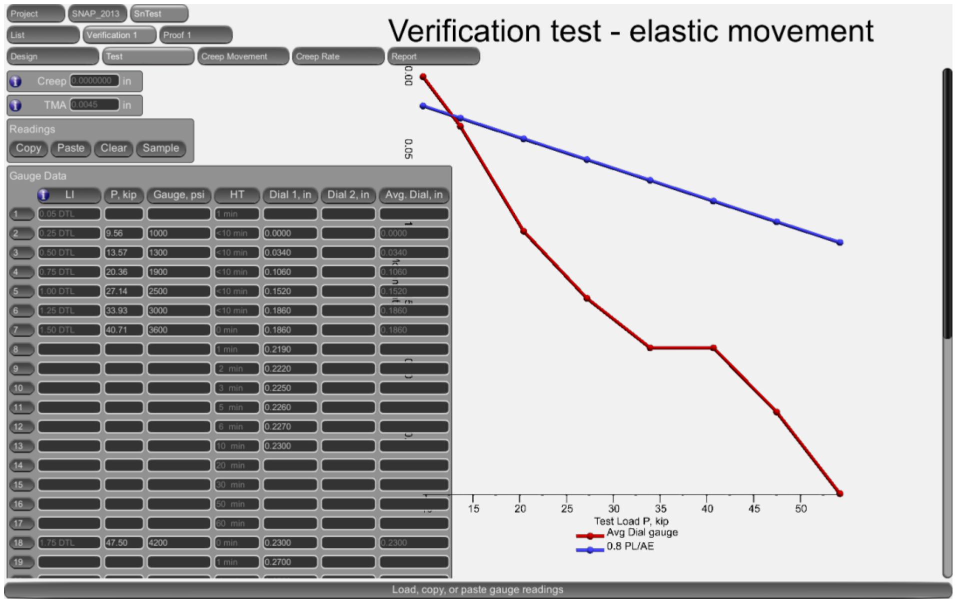
Nail #: Test nail number
q_u: Ultimate bond strength
D: Drill hole diameter
FS: Bond factor of safety
L_{UBV}: Unbonded length of nail
Bar No: Nail size 3-18
A_S: Cross-sectional area of nail
E: Elastic modulus of nail steel
F_y: Steel yield strength of bar
$L_{BV\ used}$: Actual nail bond length, $L_{BV\ used}$ must be a minimum of 10 ft - OK
P_r: Pullout resistance factor

Outputs: Outputs

C	Q_u, lbf/ft	Q_d, lbf/ft	$L_{BV\ calc}$, ft	DTL, kip	$Load_{Max}$, kip	$Load_{Max}$ Factor
0.9	2968.8	1484.4	18	14.8	53.3	3.6

C: Nail yield strength constant, 90% when F_y <= 75, 80% otherwise
Q_u: Ultimate pullout resistance
Q_d: Allowable pullout resistance
$L_{BV\ calc}$: Calculated maximum bond length
DTL: Design test load
$Load_{Max}$: Not-to-exceed load on the bar, 90%, ok
$Load_{Max}$ Factor: Maximum factor for allowable design load before exceeding ultimate tensile strength

Test



- Input test data
- Test data will appear in the report as follows:

Creep, in	TMA, in
0.0000000	0.0045

Creep: Creep acceptance, 60 min - 10 min reading, Creep Acceptance must be less than 0.08 inches - OK
TMA: Total movement acceptance, TMA OK - Final dial gauge value is greater than TMA result

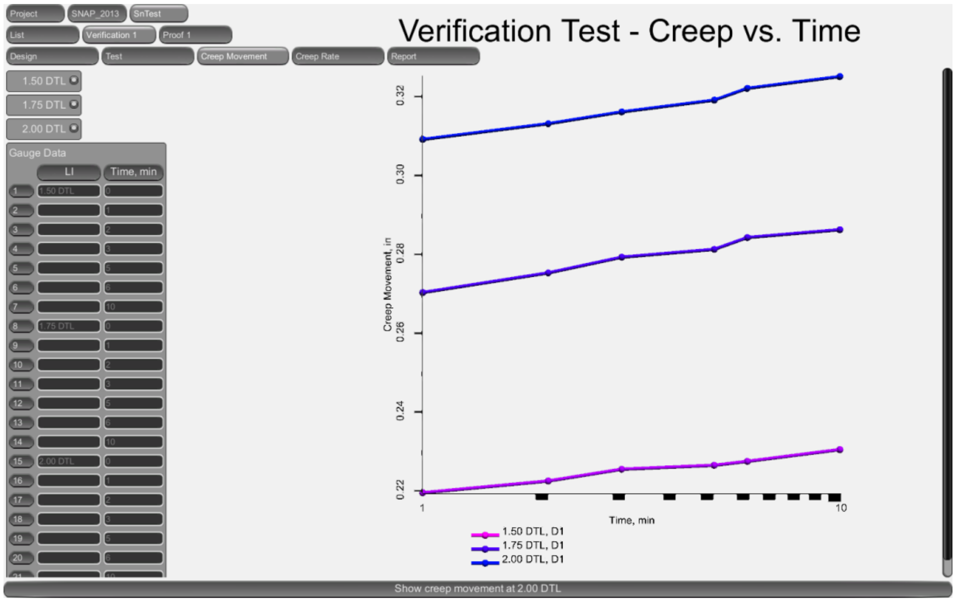
Gauge Data: Gauge readings for load tests

#	LI	P, kip	Gauge, psi	HT	Dial 1, in	Dial 2, in	Avg. Dial, in
1	0.05 DTL	-	-	1 min	-	-	-
2	0.25 DTL	9.56	1000	<10 min	0.0000	-	0.0000
3	0.50 DTL	13.57	1300	<10 min	0.0340	-	0.0340
4	0.75 DTL	20.36	1900	<10 min	0.1060	-	0.1060
5	1.00 DTL	27.14	2500	<10 min	0.1520	-	0.1520
6	1.25 DTL	33.93	3000	<10 min	0.1860	-	0.1860
7	1.50 DTL	40.71	3600	0 min	0.1860	-	0.1860
8	-	-	-	1 min	0.2190	-	-
9	-	-	-	2 min	0.2220	-	-
10	-	-	-	3 min	0.2250	-	-
11	-	-	-	5 min	0.2260	-	-
12	-	-	-	6 min	0.2270	-	-

13	-	-	-	10 min	0.2300	-	-
14	-	-	-	20 min	-	-	-
15	-	-	-	30 min	-	-	-
16	-	-	-	50 min	-	-	-
17	-	-	-	60 min	-	-	-
18	1.75 DTL	47.50	4200	0 min	0.2300	-	0.2300
19	-	-	-	1 min	0.2700	-	-
20	-	-	-	2 min	0.2750	-	-
21	-	-	-	3 min	0.2790	-	-
22	-	-	-	5 min	0.2810	-	-
23	-	-	-	6 min	0.2840	-	-
24	-	-	-	10 min	0.2860	-	-
25	-	-	-	20 min	-	-	-
26	-	-	-	30 min	-	-	-
27	-	-	-	50 min	-	-	-
28	-	-	-	60 min	-	-	-
29	2.00 DTL	54.28	4800	0 min	0.2860	-	0.2860
30	-	-	-	1 min	0.3090	-	-
31	-	-	-	2 min	0.3130	-	-
32	-	-	-	3 min	0.3160	-	-
33	-	-	-	5 min	0.3190	-	-
34	-	-	-	6 min	0.3220	-	-
35	-	-	-	10 min	0.3250	-	-
36	-	-	-	20 min	-	-	-
37	-	-	-	30 min	-	-	-
38	-	-	-	50 min	-	-	-
39	-	-	-	60 min	-	-	-
40	2.25 DTL	-	-	0 min	-	-	-
41	2.50 DTL	-	-	0 min	-	-	-
42	2.75 DTL	-	-	0 min	-	-	-
43	3.00 DTL	-	-	0 min	-	-	-

LI: Load increment (%DTL), Creep test - hold for 60-minute minimum
P: Actual Test Load
Gauge: Hydraulic jack pressure
HT: Hold time at each load increment (minutes)
Dial 1: Average dial gauge 1 at end of hold time, or for creep test, at specific hold times
Dial 2: Average dial gauge 2 at end of hold time, or for creep test, at specific hold times
Avg. Dial: Average of Dial 1 and Dial 2

<u>**Creep Movement**</u>



- View creep movement
- creep movement data will appear in the report as follows:

1.50 DTL	1.75 DTL	2.00 DTL
true	true	true

1.50 DTL: Show creep movement at 1.50 DTL
1.75 DTL: Show creep movement at 1.75 DTL
2.00 DTL: Show creep movement at 2.00 DTL

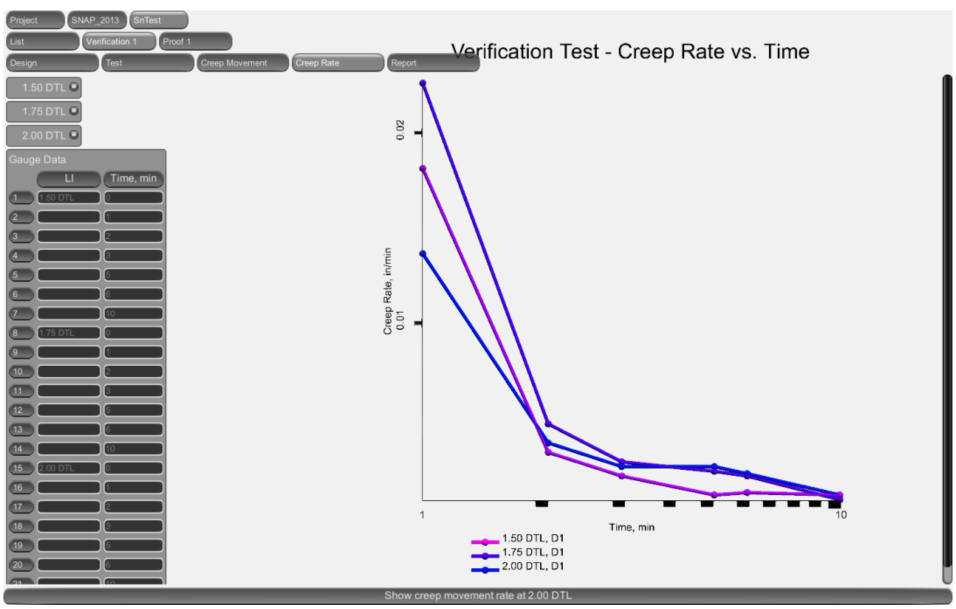
Gauge Data: Gauge readings for load tests

#	LI	Time, min
1	1.50 DTL	0
2	-	1
3	-	2
4	-	3
5	-	5
6	-	6
7	-	10
8	1.75 DTL	0

9	-	1
10	-	2
11	-	3
12	-	5
13	-	6
14	-	10
15	2.00 DTL	0
16	-	1
17	-	2
18	-	3
19	-	5
20	-	6
21	-	10

LI: Load increment (%DTL)
Time: Time from load increment

Creep Rate



- View creep rate
- creep rate data will appear in the report as follows:

1.50 DTL	1.75 DTL	2.00 DTL
true	true	true

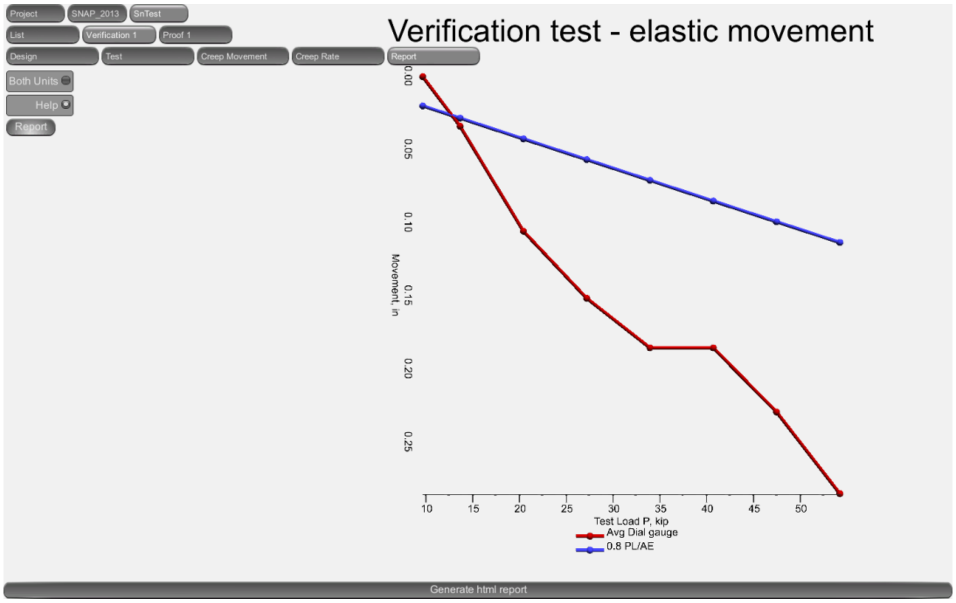
1.50 DTL: Show creep movement rate at 1.50 DTL
1.75 DTL: Show creep movement rate at 1.75 DTL
2.00 DTL: Show creep movement rate at 2.00 DTL

Gauge Data: Gauge readings for load tests

#	LI	Time, min
1	1.50 DTL	0
2	-	1
3	-	2
4	-	3
5	-	5
6	-	6
7	-	10
8	1.75 DTL	0
9	-	1
10	-	2
11	-	3
12	-	5
13	-	6
14	-	10
15	2.00 DTL	0
16	-	1
17	-	2
18	-	3
19	-	5
20	-	6
21	-	10

LI: Load increment (%DTL)
Time: Time from load increment

<u>Report</u>



- Specify report options, the click "Report".
- Generate report with figures, tables, and design checks for each proof or verification check, if desired.
- After clicking "Report", wait for the report to show in your web browser. Do not click or interact with the program until the report is complete.
- The program will automatically move to different tabs to collect images for the report.
- The report will show up in your browser when complete.
- To copy to MS-Word, click in the report browser window, type <ctrl-a> to select all, then paste into Word.

- A description of report options are as follows:

Both Units	Help
false	true

Both Units: Include both US and SI units in report
Help: Generate help