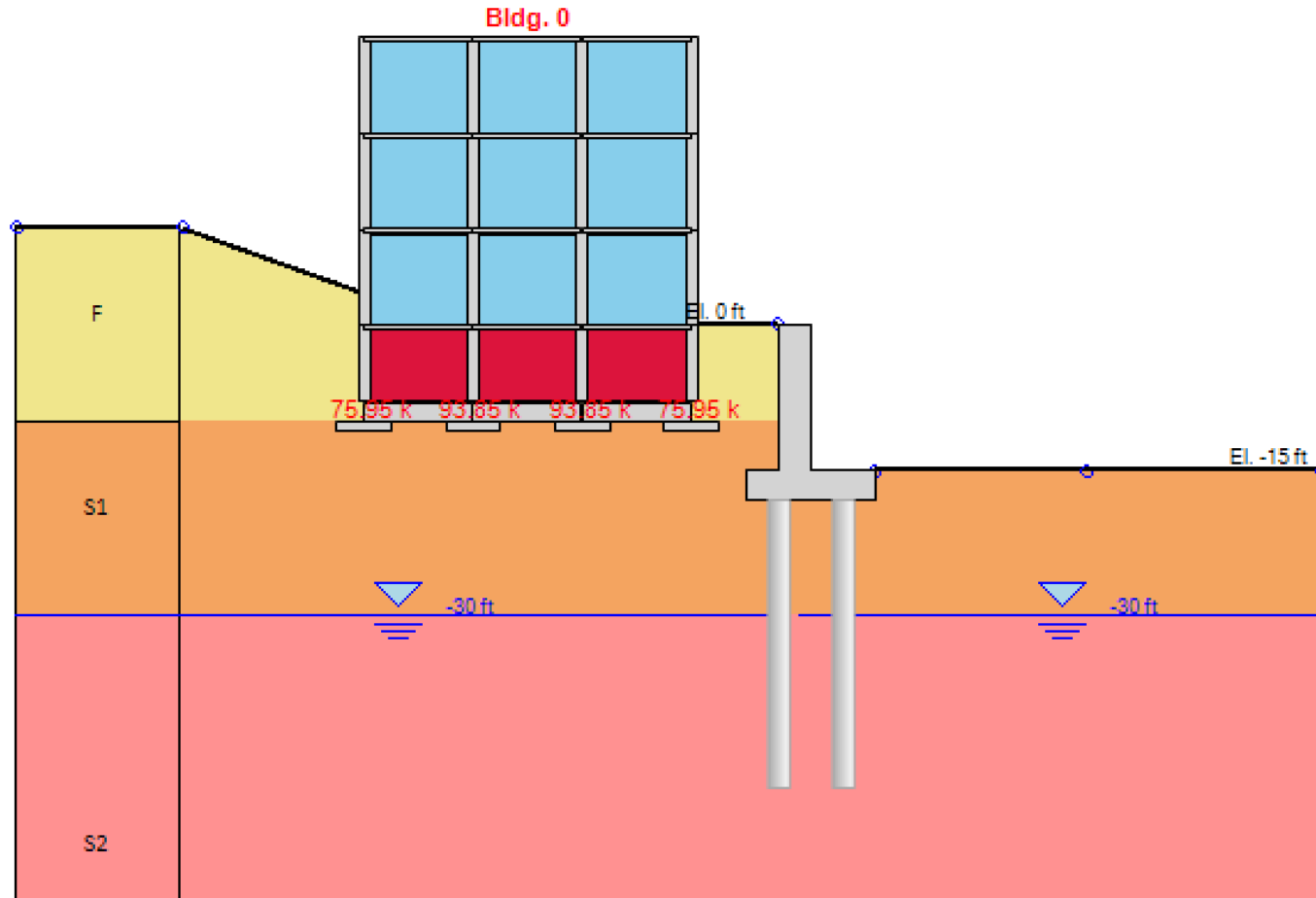
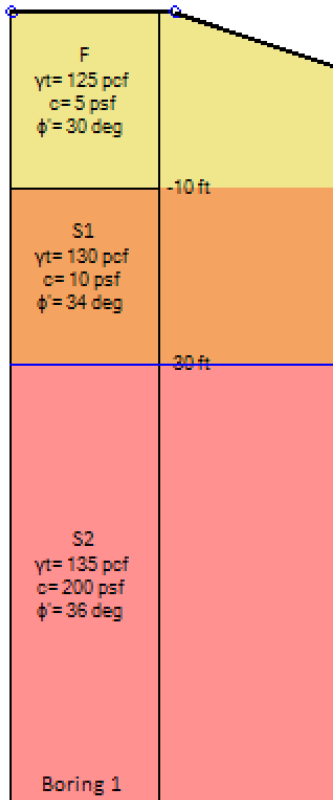


Example 9: Pile Supported Abutment Limit Equilibrium – Slope Stability Analysis



A. Soil Properties and Stratigraphy (Soil Layers)



Elev. (ft)	Soil (-)	γ_t (pcf)	C' (psf)	ϕ' (deg)	E (ksf)	exp (-)
0	F - Sand	125	5	30	500	0.5
-10	S1 - Sand	130	10	34	800	0.4
-30	S2 - Sand	135	200	36	1200	0.4

1. General Boring Information - Coordinates

Name: Boring 1

Coordinates X: -65.617 ft Y: 0 ft

The x coordinate controls where the boring is shown in your design. Each design section uses one boring (soil strata). You can use a different boring for each design section.

SPT Data Option (Applies to Design Section)

SPT Record: Not assigned [Add edit SPT records]

Pass same SPT log to boring (3D visualizations)

CPT Record Option (Applies to Design Section)

CPT Record: Not assigned [Add edit CPT records]

2. Boring Layers - Layer Elevations

	Top Elev. (ft)	Soil Type	OCR	Ko	Edit
	10	F	1	0.5	Edit
	-10	S1	1	0.4408...	Edit
	-30	S2	1	0.412	Edit
*					

A. General C. Elasto-plastic D. Bond E. Adv. F. Piles

4. Unit Weights - Density

γ_t : 130 pcf γ_{bulk} : 125 pcf $\gamma' = 67.6$

5. Strength Parameters and Poisson Ratio

Drained strength properties

c' : 10 psf ϕ' : 34 degrees

Peak - constant vol. (for estimation)

ϕ_{cv} : Omitted degrees ϕ_{peak} : Omitted degrees

ν : 0.35

B. Abutment Section Properties

Height ft

Base ft

Top Width ft

Distance to left Top corner ft

Heel Thick ft

Toe width ft

Toe Thick ft

Heel width ft

Use key

Drain back face

Use a rectangular cap at the top

Wall Name: Pile supported abutment

1. Reinforcement

Use	P1	P2	Rebar	S(in)	No.	Clear(in)	Ast(in2)
<input checked="" type="checkbox"/>	A	B	#4	6	1	3	0.2
<input checked="" type="checkbox"/>	B	C	#4	6	1	3	0.2
<input checked="" type="checkbox"/>	C	D	#4	6	1	3	0.2
<input checked="" type="checkbox"/>	D	E	#4	6	1	3	0.2
<input checked="" type="checkbox"/>	E	F	#4	6	1	3	0.2
<input checked="" type="checkbox"/>	F	G	#4	6	1	3	0.2
<input checked="" type="checkbox"/>	G	H	#4	6	1	3	0.2
<input checked="" type="checkbox"/>	H	A	#4	6	1	3	0.2

Abutment width ft

C. Foundation Piles Locations & Structural Section

Dimensions Piles (Abutments) Materials Results Descriptions

All coordinates are local to the abutment wall

	Pile Name	x	y	Length	Local Rotation	Angle from Horizontal	Lfree	Edit Pile
▶	P1	0	-12	30	0	90	0	Edit
	P2	0	-6	30	0	90	0	Edit
	P3	0	0	30	0	90	0	Edit
	P4	0	6	30	0	90	0	Edit
	P5	0	12	30	0	90	0	Edit
	P6	6	-12	30	0	90	0	Edit
	P7	6	-6	30	0	90	0	Edit
	P8	6	0	30	0	90	0	Edit
	P9	6	6	30	0	90	0	Edit
	P10	6	12	30	0	90	0	Edit

Circular

Non-prestressed section

Fc 3ksi fc' 3 ksi
Grade 60 fy 60 ksi

Use GFRP rebars

el sections - Hollow bars Advanced Prestress Options

Reinforcement

Rebars Bars # #5 N 10

Shear Reinforcement Bars # #3

sV 6 in

θ 21.8 deg α 90 deg
cot θ = 2.5

C 5 in

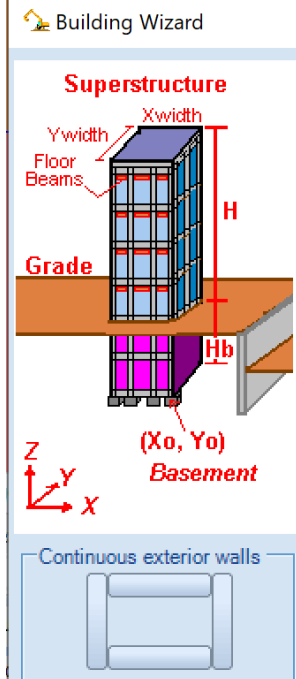
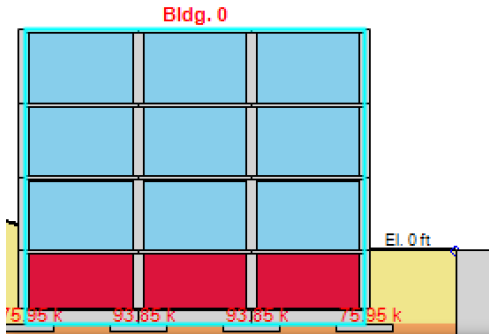
A 360 in²

Section Drawing Envelope

D=24 in

Options
x: y: Use user defined reinforcement

D. 3D Building Load



Building Wizard

1. Basic 2. Floors 3. Footings 4. Columns 5. Walls 6. Advanced

1. Building Name
Bldg. 0 Show name
Building type: Concrete frame building

2. Coordinates and Dimensions
Right Xo: -8 ft Grade Elevation: 0 ft
Start Yo (3D): 0 ft θ : 0 deg
Width along X axis: 30 ft Width along Y axis: 40 ft

3. Number of Floors
Superstructure floors nF: 3 Building Height H: 30 ft
Basement floors nB: 1 Basement depth Hb: 10 ft

4. Number of Columns
Number of columns in X axi: 4
Number of columns in Y axi: 5

Damage Assessment: Not performed

OK Cancel

1. Footing Dimensions
Width along X: 5 ft
Width along Y: 5 ft
Thickness: 1 ft

2. Grade Beam Dimensions and Options
Width along X Bx: 1 ft
Width along Y By: 1 ft
Section Area: 1 ft²

3. Use mat foundation for building
 Use mat foundation for building.

1. Basic 2. Floors 3. Footings 4. Columns 5. Walls 6. Advanced

1. Superstructure floor loads
Live Load: 0.05 ksf Thickness: 0.5 ft
Dead Load: 0.05 ksf Material:

2. Basement floors - Loads
Live Load: 0.05 ksf Thickness: 0.5 ft
Dead Load: 0.05 ksf Base Slab Thick: 2 ft

3. Floor Beam Dimensions and Options
Width along X Bx: 0 ft Use floor beams
Width along Y By: 0 ft Section Area: 0 ft²
Material: Density: 0.15 kcf

1. Basic 2. Floors 3. Footings 4. Columns 5. Walls 6. Advanced

Basement walls
 Building has exterior basement walls Color Critical strains and type: Select

2. Exterior Superstructure walls
 Building has exterior walls above ground Color Critical strains and type: Select

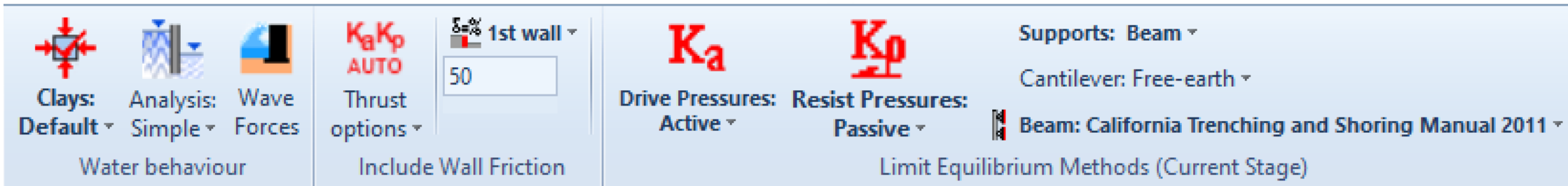
Wall function: Not defined
Wall thickness T: 1 ft Density: 0.15 kcf
Percent Open Space: 40
 Use material Select None

3. Interior Walls/Partitions
 Building has interior walls/partitions Color Critical strains and type: Select

Wall thickness T: 0.5 ft Density: 0.06 kcf
Percent Open Space: 25

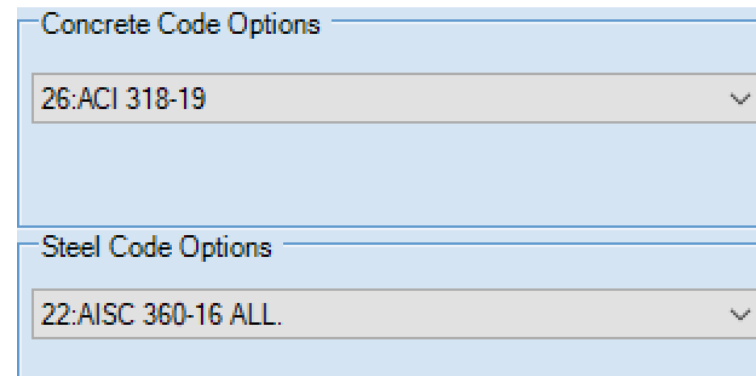
E1. Analysis Settings & Design Codes

- Wall Friction: 50% of the soil friction
- Water Pressures: Simplified Flow
- Cantilever Method (LEM): Free Earth Method
- Soil Pressures: Active & Passive (All Stages)



The screenshot shows a software interface for analysis settings. It includes several sections: 'Clays' with a 'Default' dropdown, 'Analysis' with a 'Simple' dropdown, and 'Wave Forces'. Below these is 'Water behaviour'. The 'Thrust options' section has 'KaKp AUTO' and 'Include Wall Friction' checked, with a value of '50' in a text box. The 'Drive Pressures' section has 'Active' selected. The 'Resist Pressures' section has 'Passive' selected. The 'Supports' section has 'Beam' selected. The 'Cantilever' section has 'Free-earth' selected. The 'Beam' section has 'California Trenching and Shoring Manual 2011' selected. The overall title for this section is 'Limit Equilibrium Methods (Current Stage)'.

- Steel Code: AISC 360-16 Allowable
- Concrete Code: ACI 318-19
- Analysis Code: None (Service Conditions)

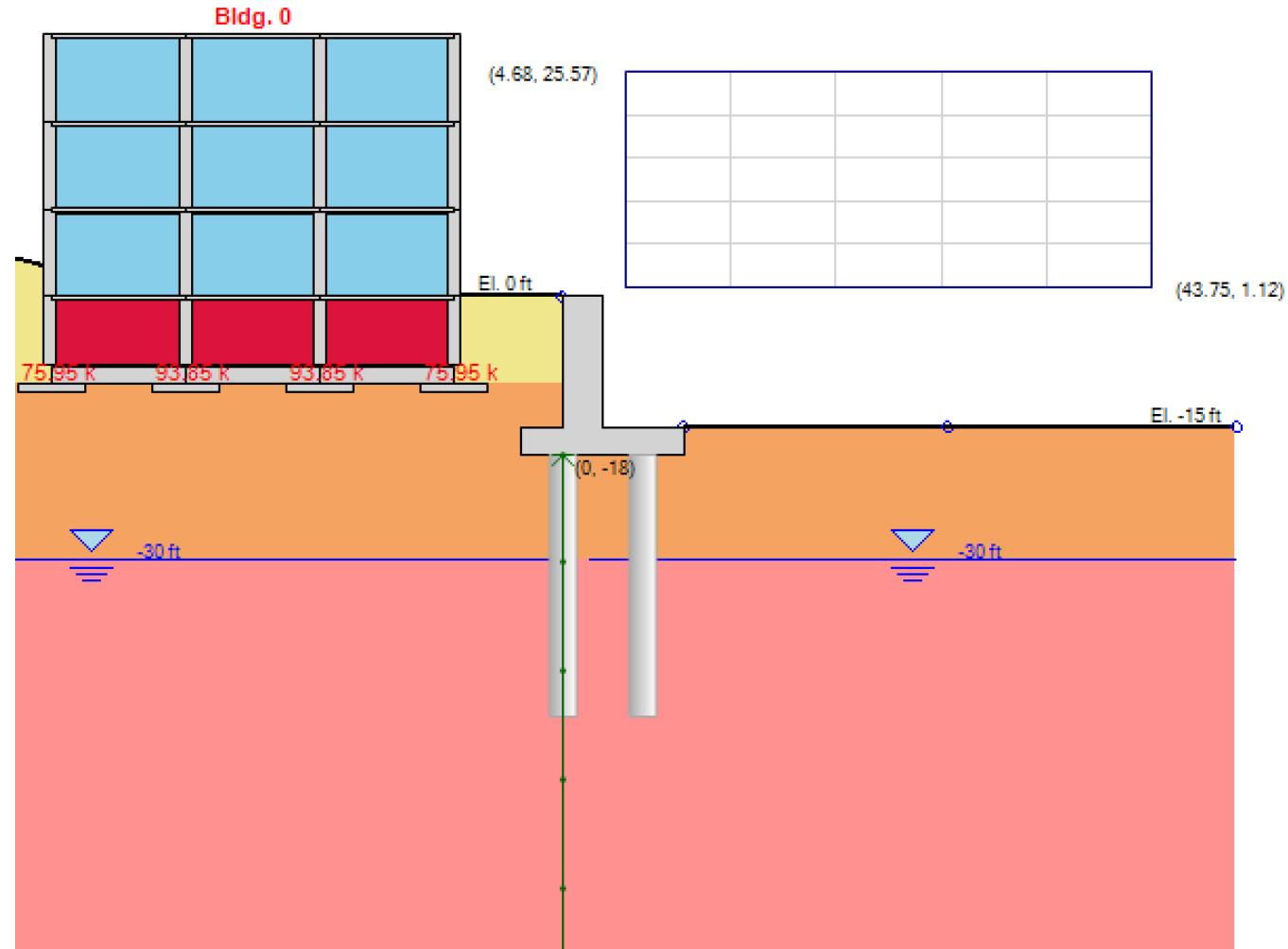
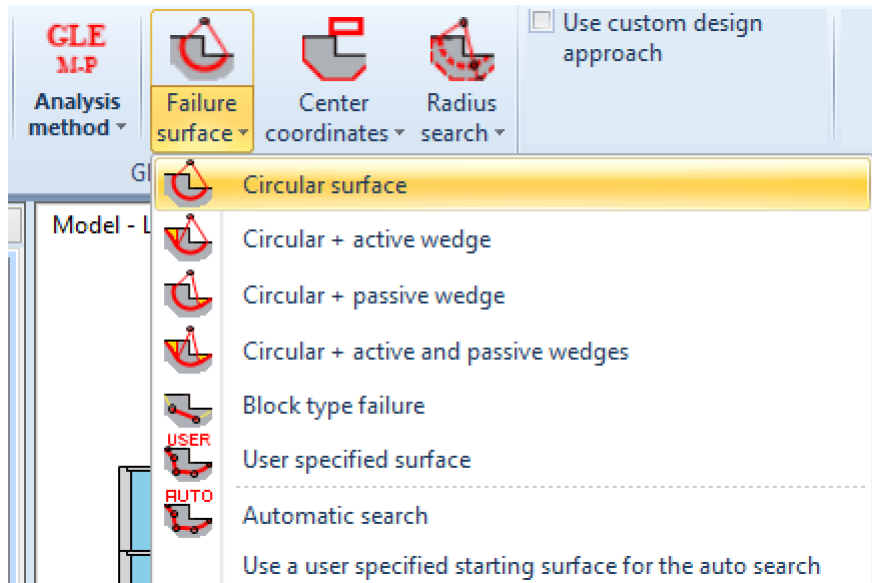


The screenshot shows two dropdown menus for code selection. The first is 'Concrete Code Options' with '26:ACI 318-19' selected. The second is 'Steel Code Options' with '22:AISC 360-16 ALL.' selected.

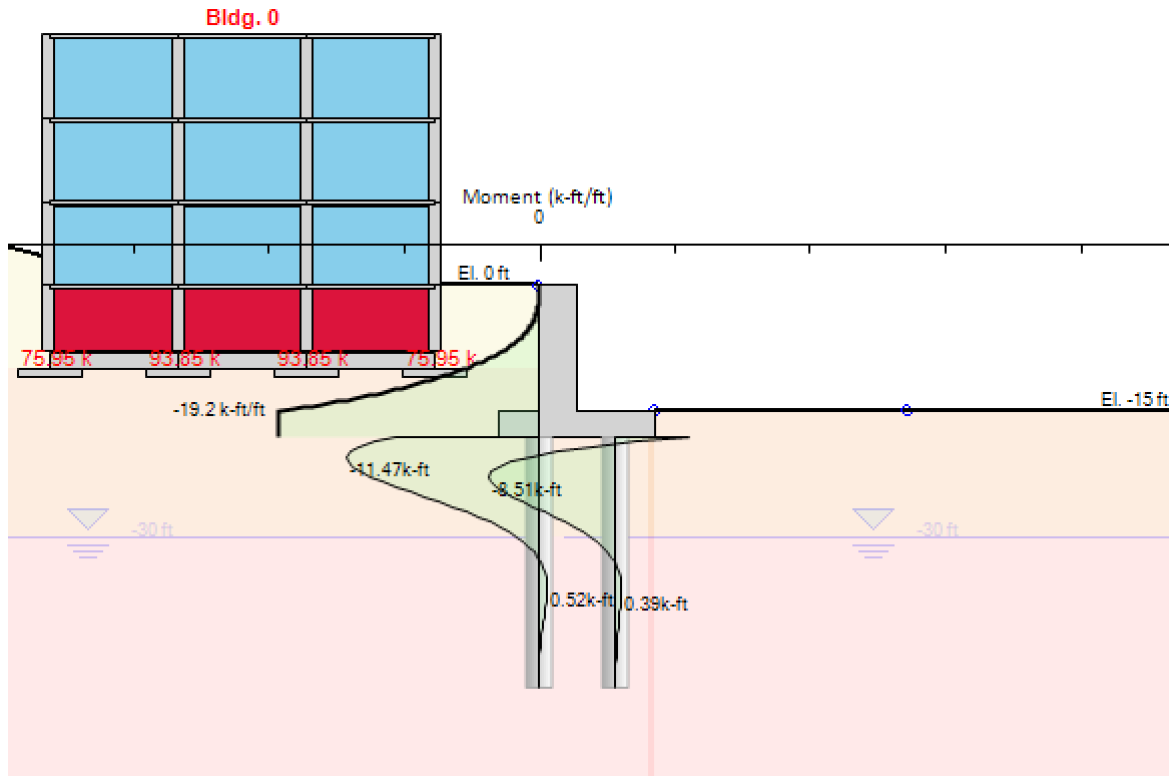
E2. Slope Stability Analysis Settings

- Slope Stability FS:
Mononobe - Okabe Method

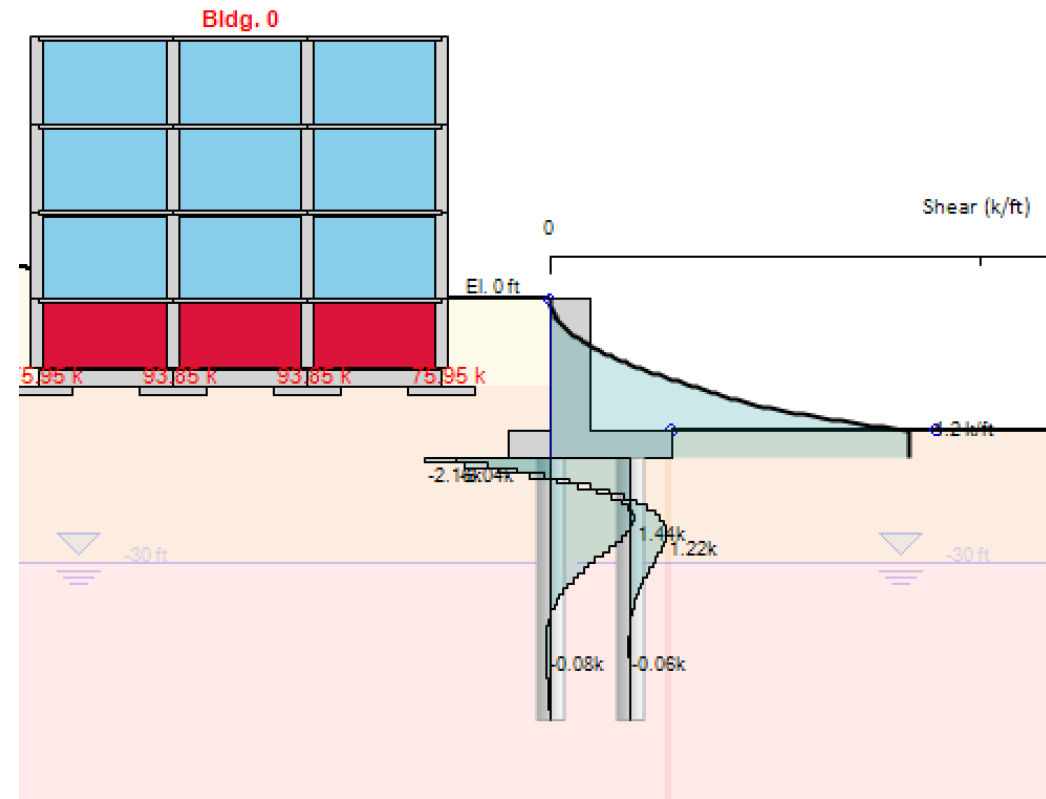
- Circular Slope Surface



F. LEM Analysis Results



Wall & Pile Moment Diagrams



Wall & Pile Shear Diagrams

Thank You!

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