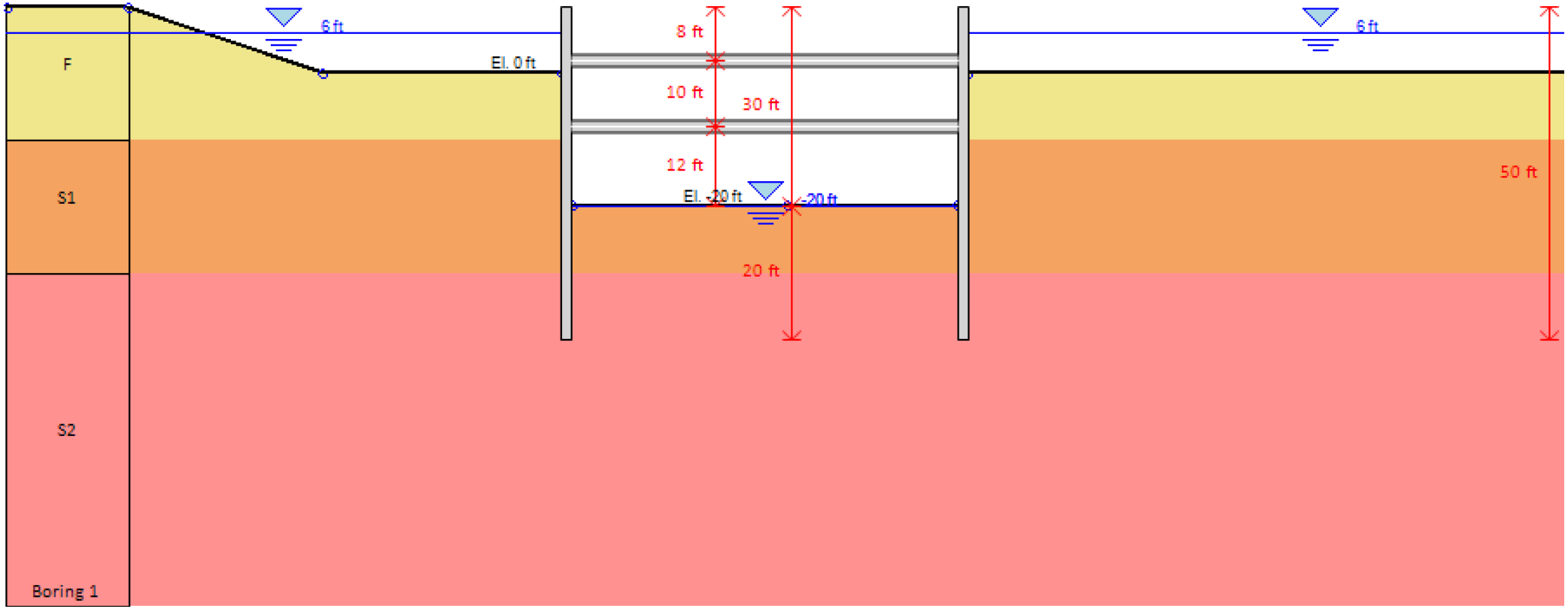
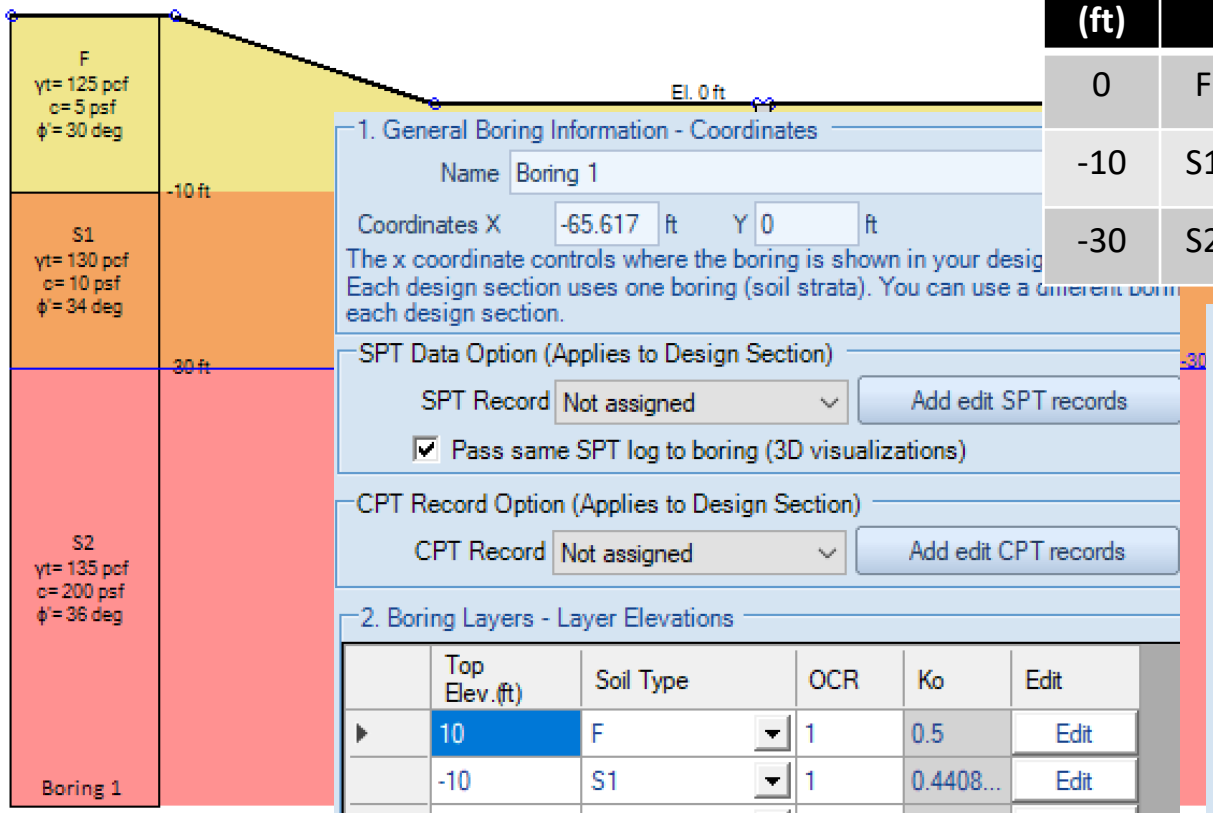
Example 4: Cofferdam - Sheet Pile Walls
Limit Equilibrium – Non-Linear – Finite Element Analysis



Example 4: Cofferdam - Sheet Pile Walls

A. Soil Properties and Stratigraphy (Soil Layers)

Elev. (ft)	Soil (-)	γt (pcf)	C' or Su (psf)	ϕ' (deg)	Eoed (ksf)	Eur (ksf)	m (-)
0	F - Sand	125	5	30	500	1500	0.5
-10	S1 - Sand	130	10	34	800	2400	0.4
-30	S2 - Sand	135	200	36	1200	3200	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 desig
Each design section uses one boring (soil strata). You can use a
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 γ' = 67.6

5. Strength Parameters and Poisson Ratio

Drained strength properties

c' 10 psf > ϕ' 34 degrees >

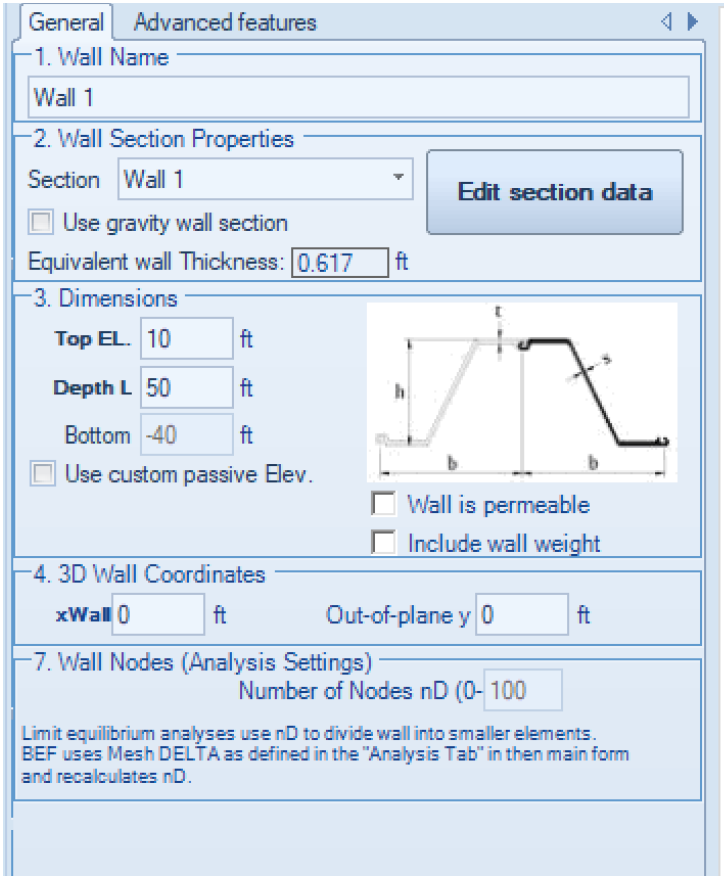
Peak - constant vol. (for estimation)

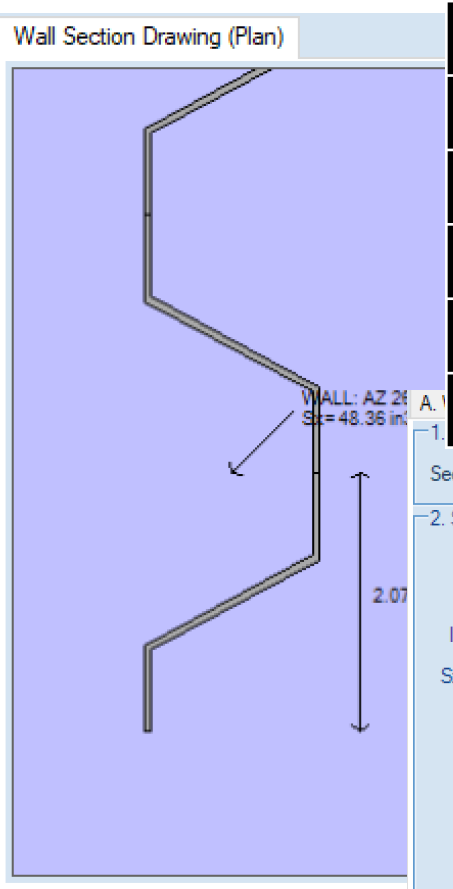
Φ cv' Omitted degrees >

Φ peak' Omitted degrees >

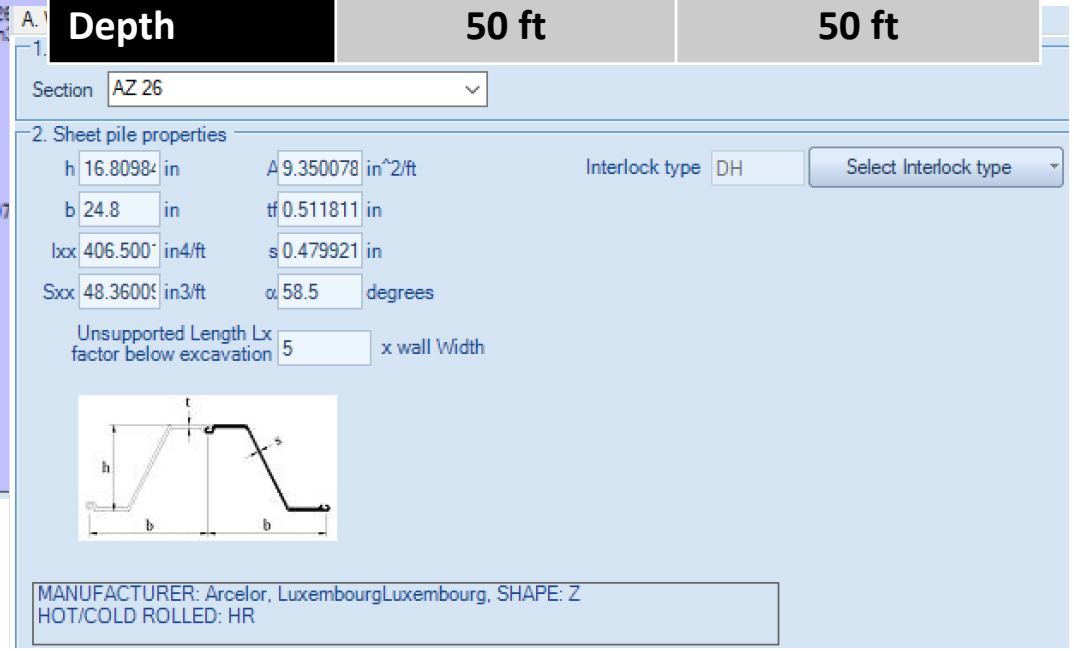
v 0.35 >

B. Wall Section Properties, Wall Position and Depth



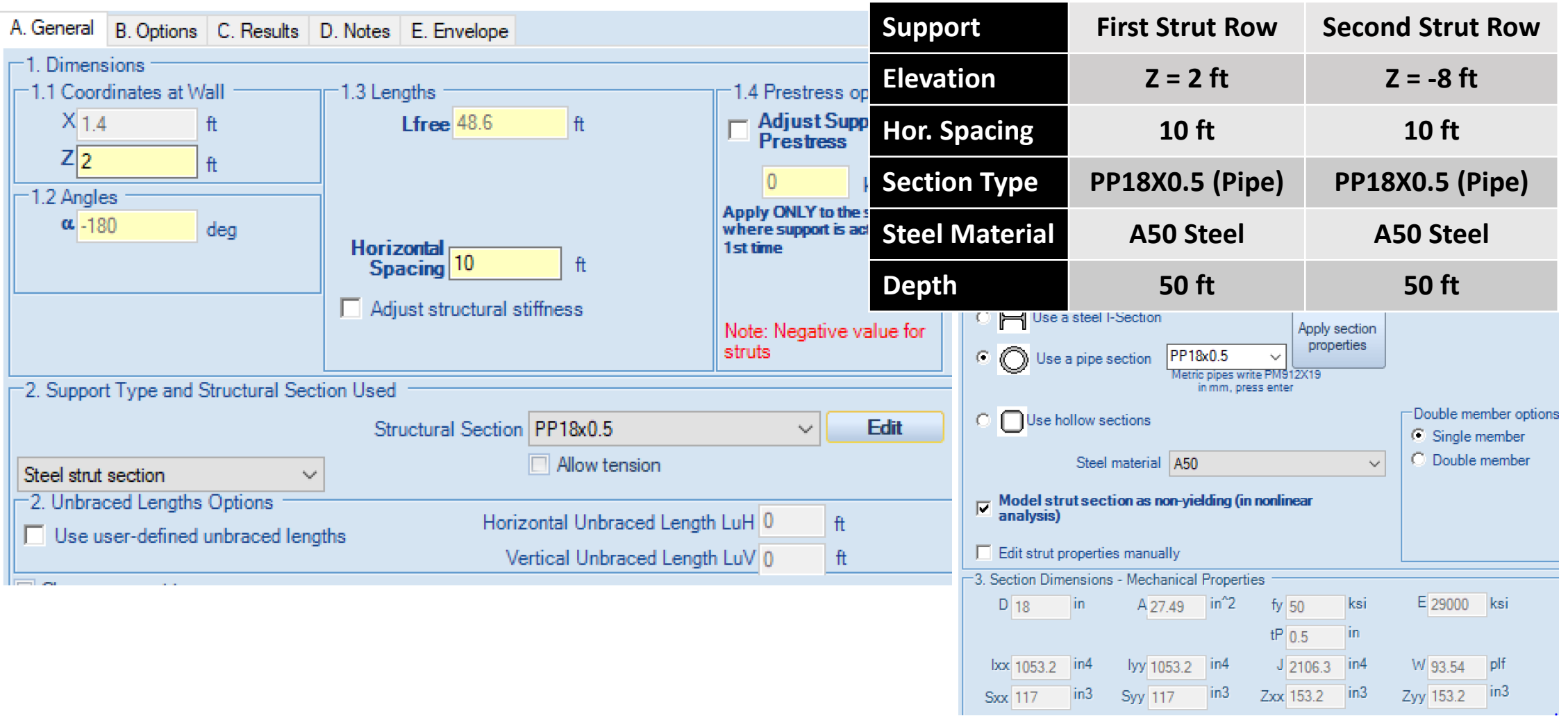


Wall	Left Wall	Right Wall
X-Coordinate	X = 0	X = 50 ft
Top Elevation	Z = 10 ft	Z = 10 ft
Section Type	AZ 26 Sheet Piles	AZ 26 Sheet Piles
Steel Material	A50 Steel	A50 Steel
Depth	50 ft	50 ft

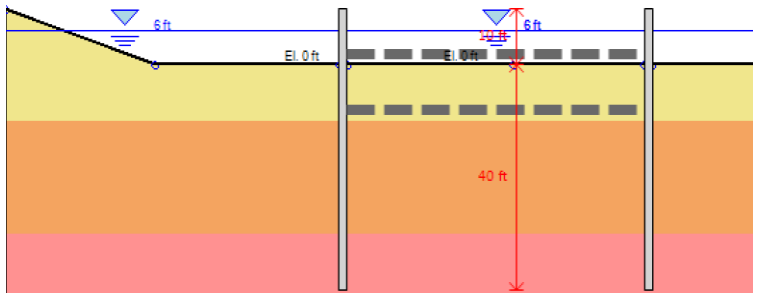


C. Support Section Properties and Elevations

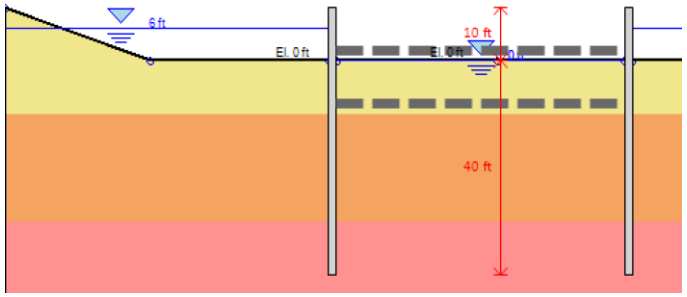
Support	First Strut Row	Second Strut Row
Elevation	Z = 2 ft	Z = -8 ft
Hor. Spacing	10 ft	10 ft
Section Type	PP18X0.5 (Pipe)	PP18X0.5 (Pipe)
Steel Material	A50 Steel	A50 Steel
Depth	50 ft	50 ft



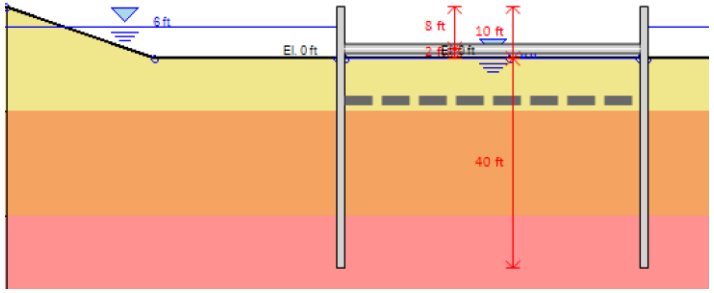
D. Model in Construction Stages



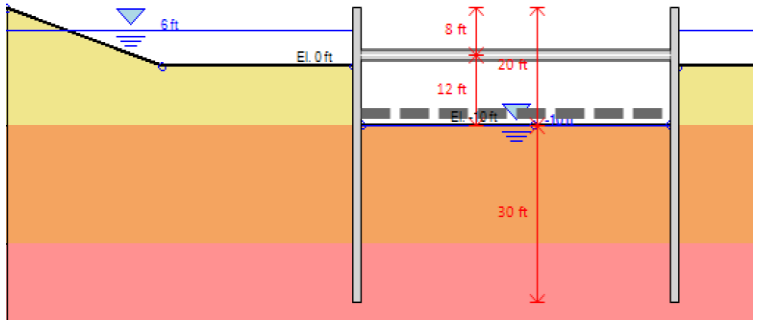
Stage 0: At-rest Conditions



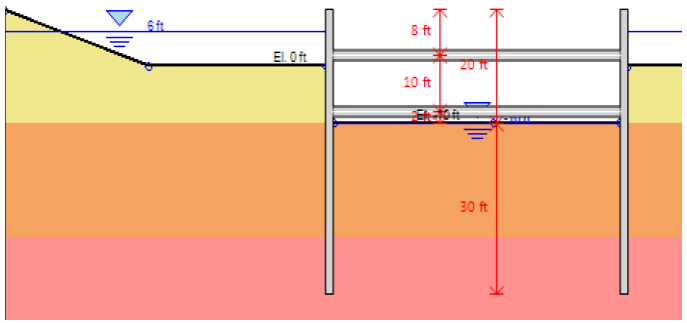
Stage 1: Dewatering



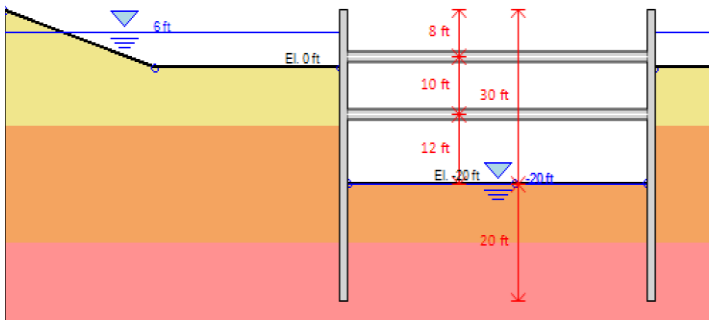
Stage 2: Support Installation



Stage 3: Excavation



Stage 4: Support Installation

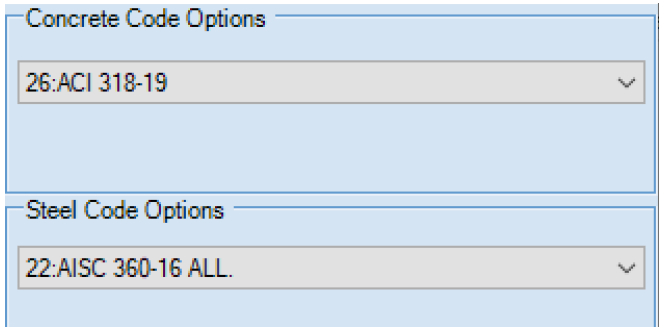


Stage 5: Final Excavation

E. Analysis Settings & Design Codes

- Wall Friction: 50% of the soil friction
- Water Pressures: Simplified Flow
- Cantilever Method (LEM): Free Earth Method
- Beam Analysis Method: Blum's
- Soil Pressures: Active & Passive (Stages 0 to 3), FHWA Apparent (Stages 4 to 5)

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

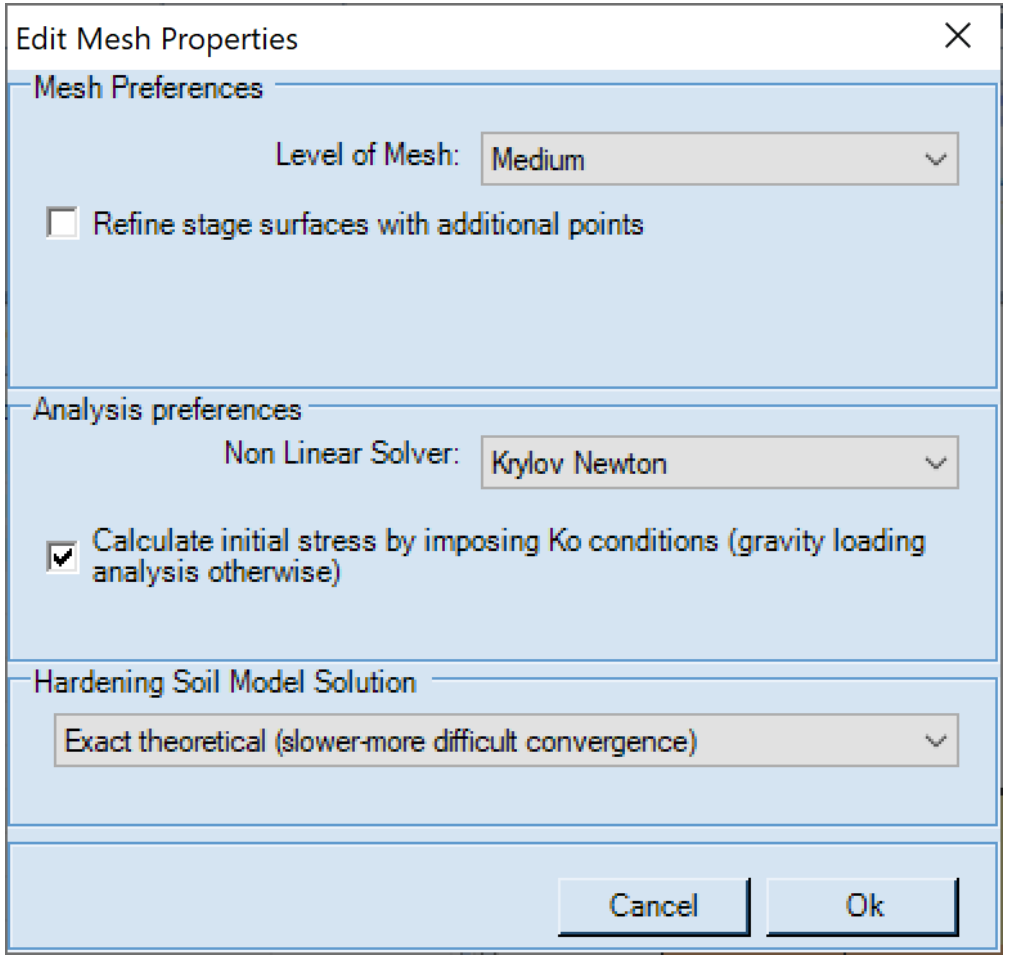


E2. Additional FEM Analysis Settings & Tips

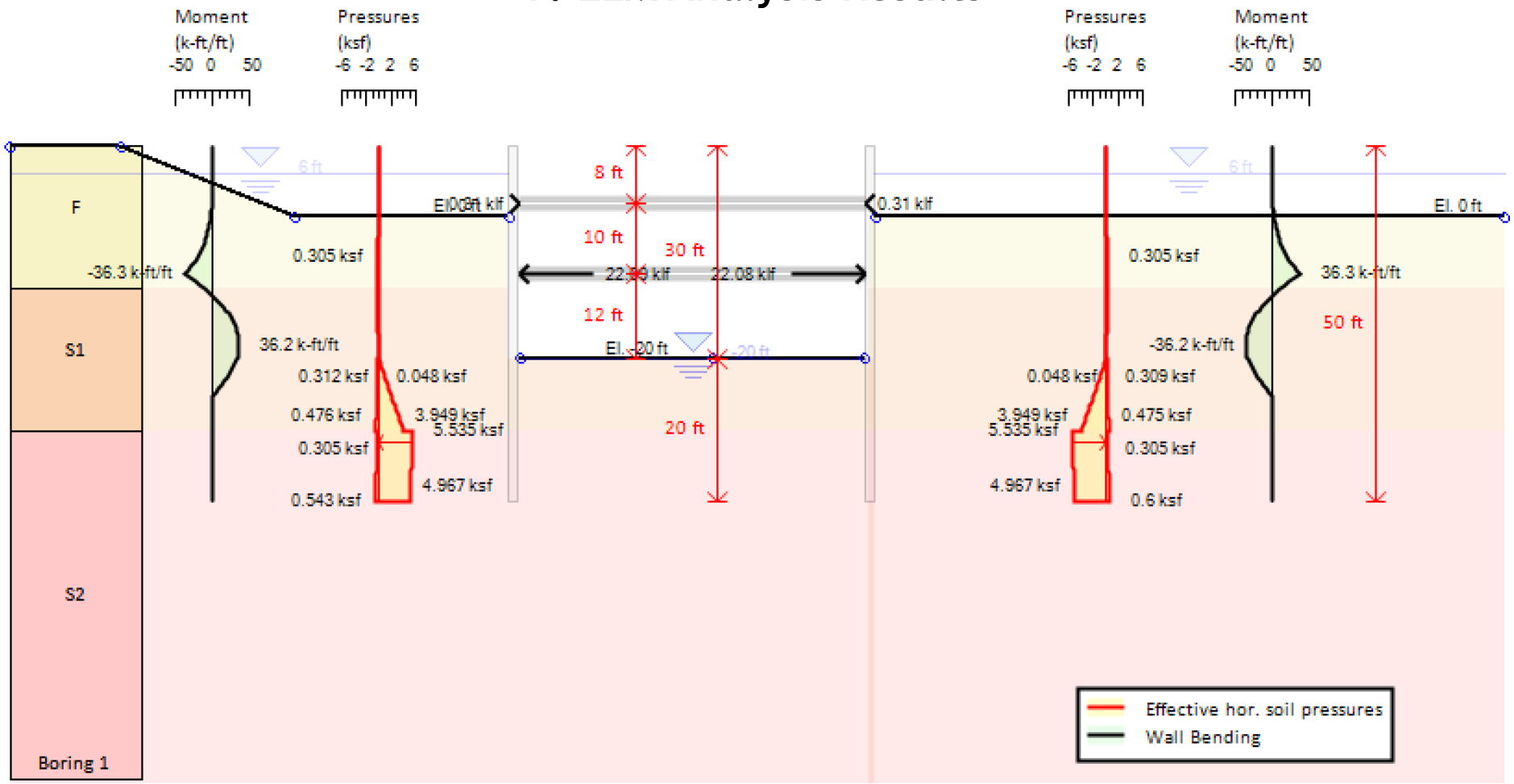
- Generated Mesh Density: Medium
- Non-Linear Solver: Krylov Newton Method
- Hardening Soil Model: Exact Theoretical

FEM Analysis - Model Convergence Tips:

- ✓ Always consider a small cohesion for frictional soils
- ✓ Always use wall friction for all your walls
- ✓ Create a strict staging
- ✓ Sometimes an initial stage with green field conditions (not activated walls) might be required
- ✓ Always assume realistic prestress values for the anchors (if used)

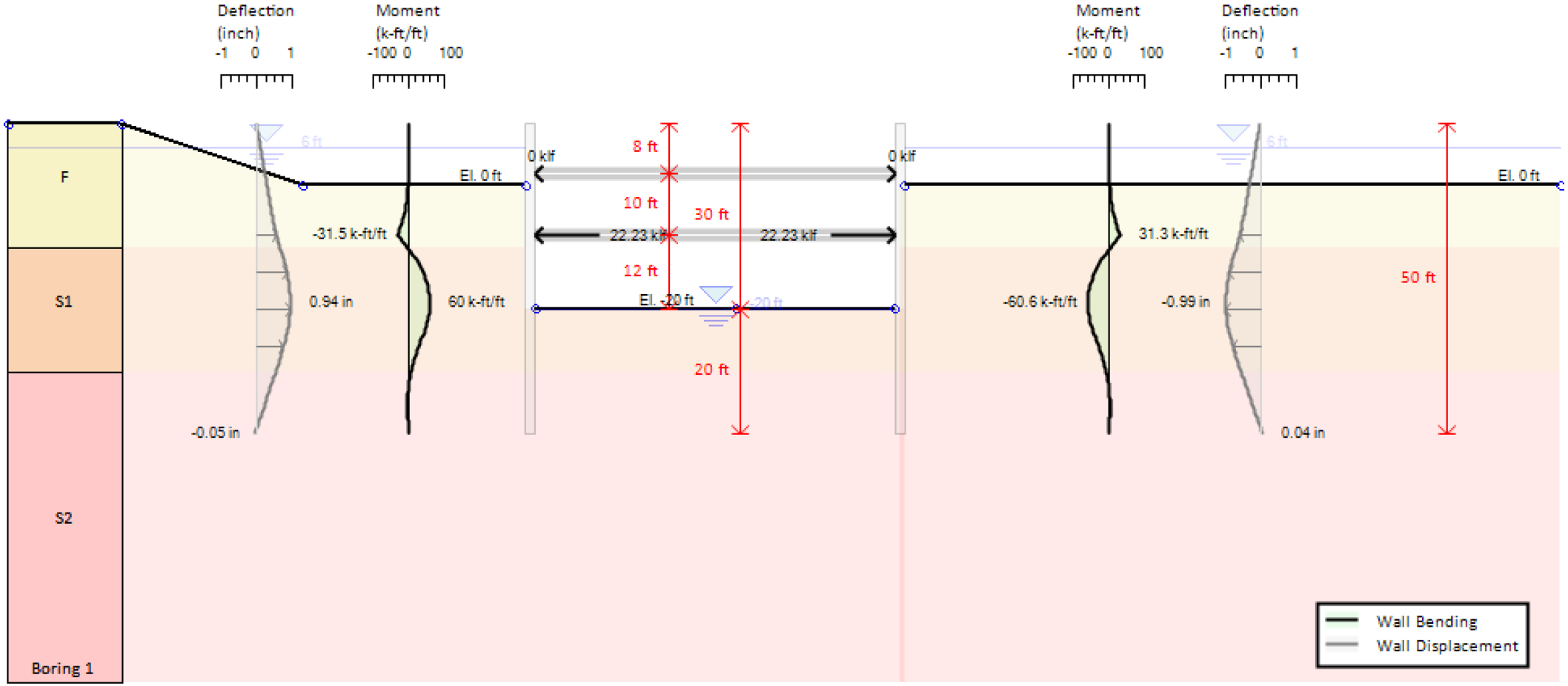


F. LEM Analysis Results



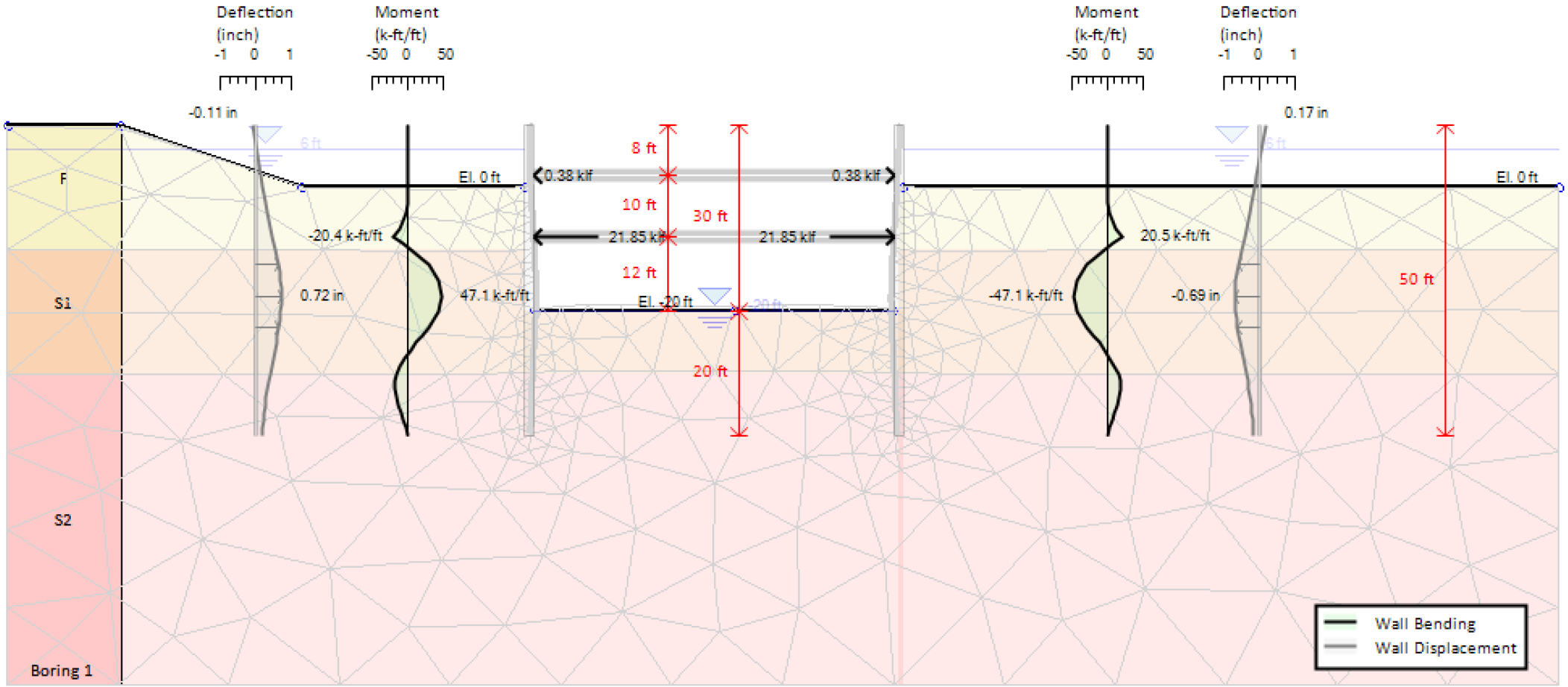
Wall Moments, Support Reactions & Soil Pressures - Stage 5

G. Non-Linear Analysis Results



Wall Moments, Displacements & Support Reactions - Stage 5

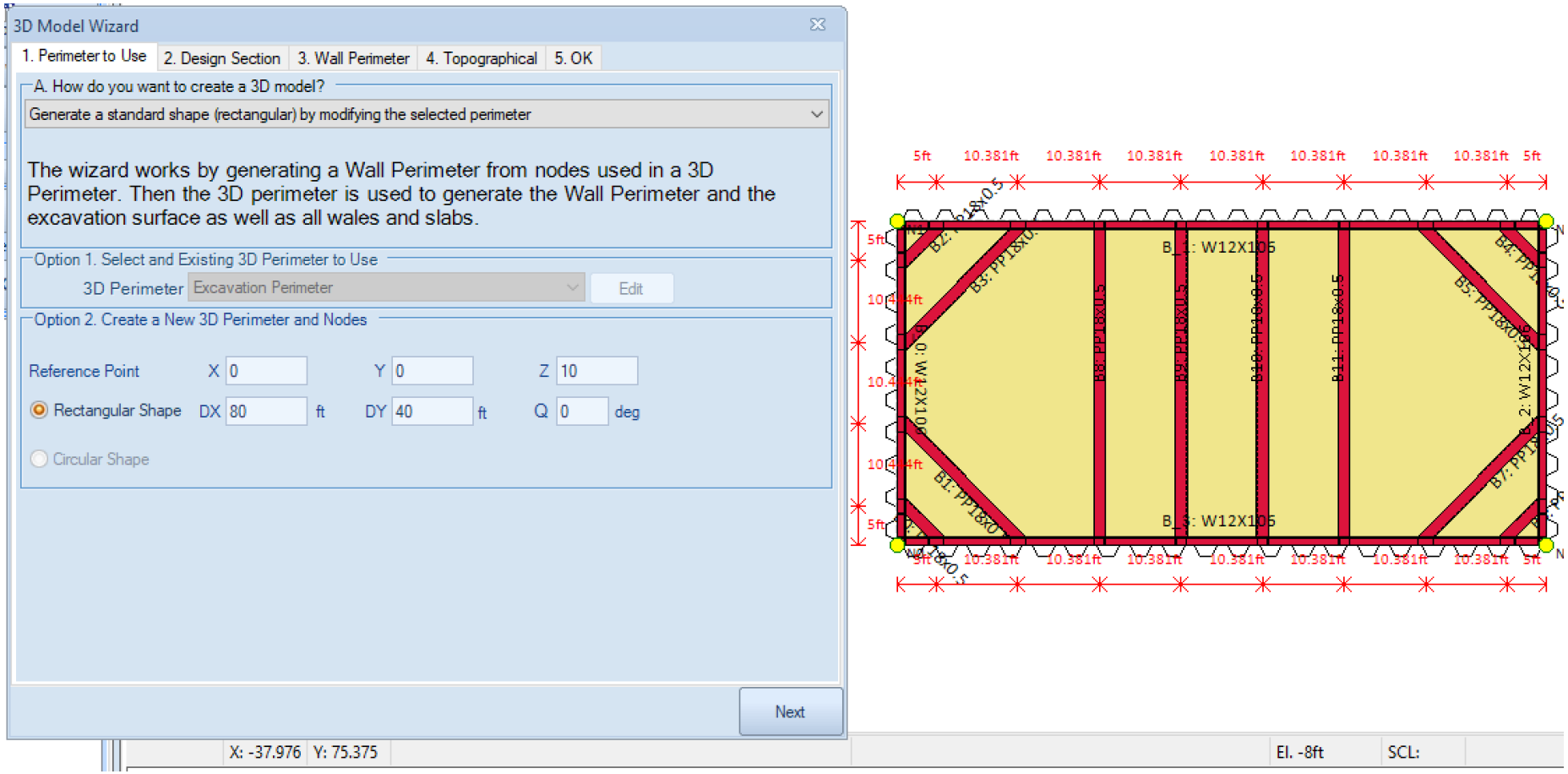
H. FEM Analysis Results



Wall Moments, Displacements & Support Reactions - Stage 5

I. 3D Frame Model Generation

- **3D model created with the 3D Model Wizard: 80ft x 40ft Excavation with Struts**



J. 3D Model Analysis Results

Results for walers (3D)

Name	Elev. (ft)	Moment (k-ft)	Shear (k)	Axial (k)	RAT -	RAT M -	RAT V -	Length (ft)	Weight (k)	Section
A_0	2	53.66	30.83	117.09	0.21	0.21	0.257	41.333	4.3912	W12X106
A_1	2	53.86	30.75	116.68	0.21	0.21	0.257	82.667	8.782	
A_2	2	53.66	30.83	117.09	0.21	0.21	0.257	41.333	4.39	
A_3	2	53.86	30.75	116.68	0.21	0.21	0.257	82.667	8.782	

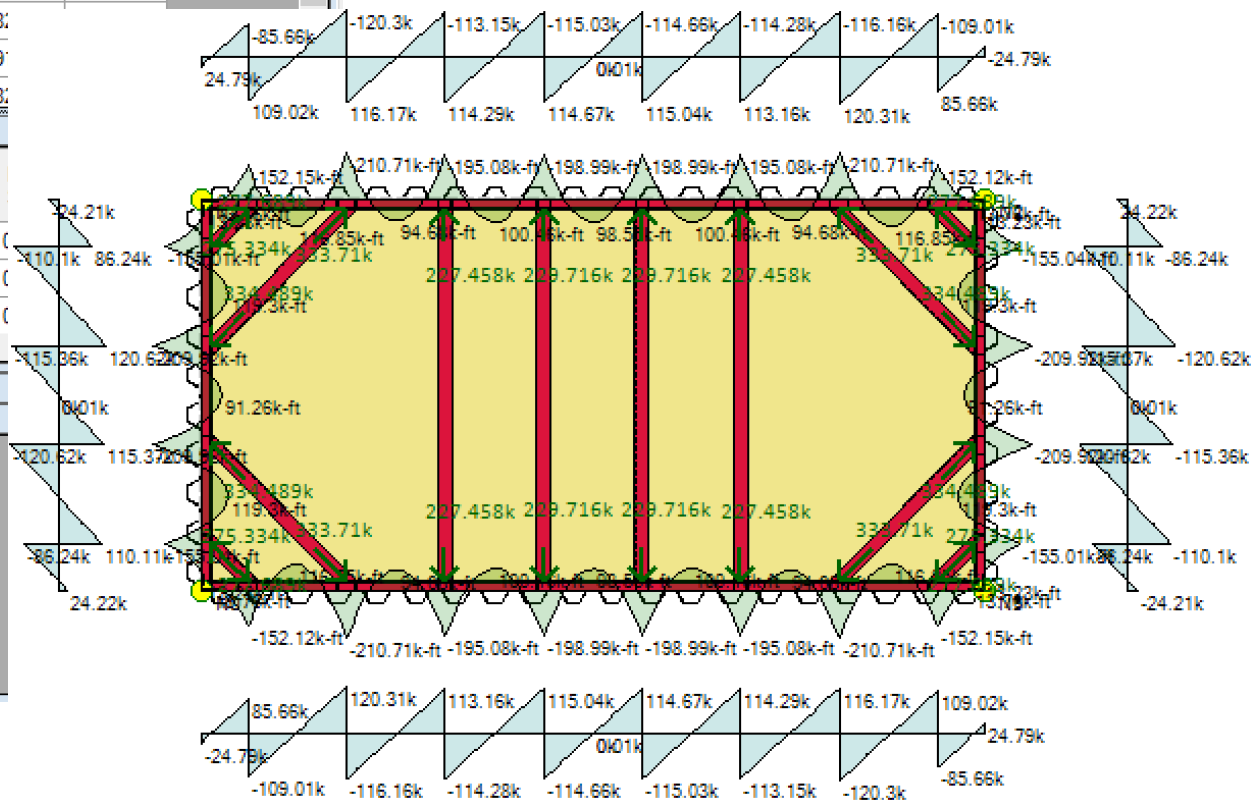
Results for steel connections (walers to struts)

	Waler	Strut	Weld size (in)	Weld Length (in)	Stiffeners	RAT Welds
WALE: A_0-STRUT: A0	A_0	A0	0.375	21.445	4x5.796 ...	0.42
WALE: A_3-STRUT: A0	A_3	A0	0.375	0	4x5.796 ...	0.42
WALE: A_0-STRUT: A1	A_0	A1	0.375	21.445	4x5.796 ...	0.507

Results for struts and anchors (3D)

Results for struts (3D)

Name	Length (ft)	Moment (k-ft)	Axial force (k)	RAT -	Weight (k)	Section Name
A0	5.549	0.36	70.96	0.044	0.5191	PP18x0....
A1	20.275	4.81	85.48	0.071	1.8965	PP18x0....
A2	5.549	0.36	70.96	0.044	0.5191	PP18x0....
A3	20.275	4.81	85.48	0.071	1.8965	PP18x0....



Waler - Strut - Steel Connections Checks, Wall Moment & Shear Diagrams

Thank You!

More Examples & Videos: Review Training Materials
www.deepexcavation.com

Licensing Information: Contact Us
E: sales@deepexcavation.com

Online Presentations & Training: Book a Meeting
Access Online Calendar