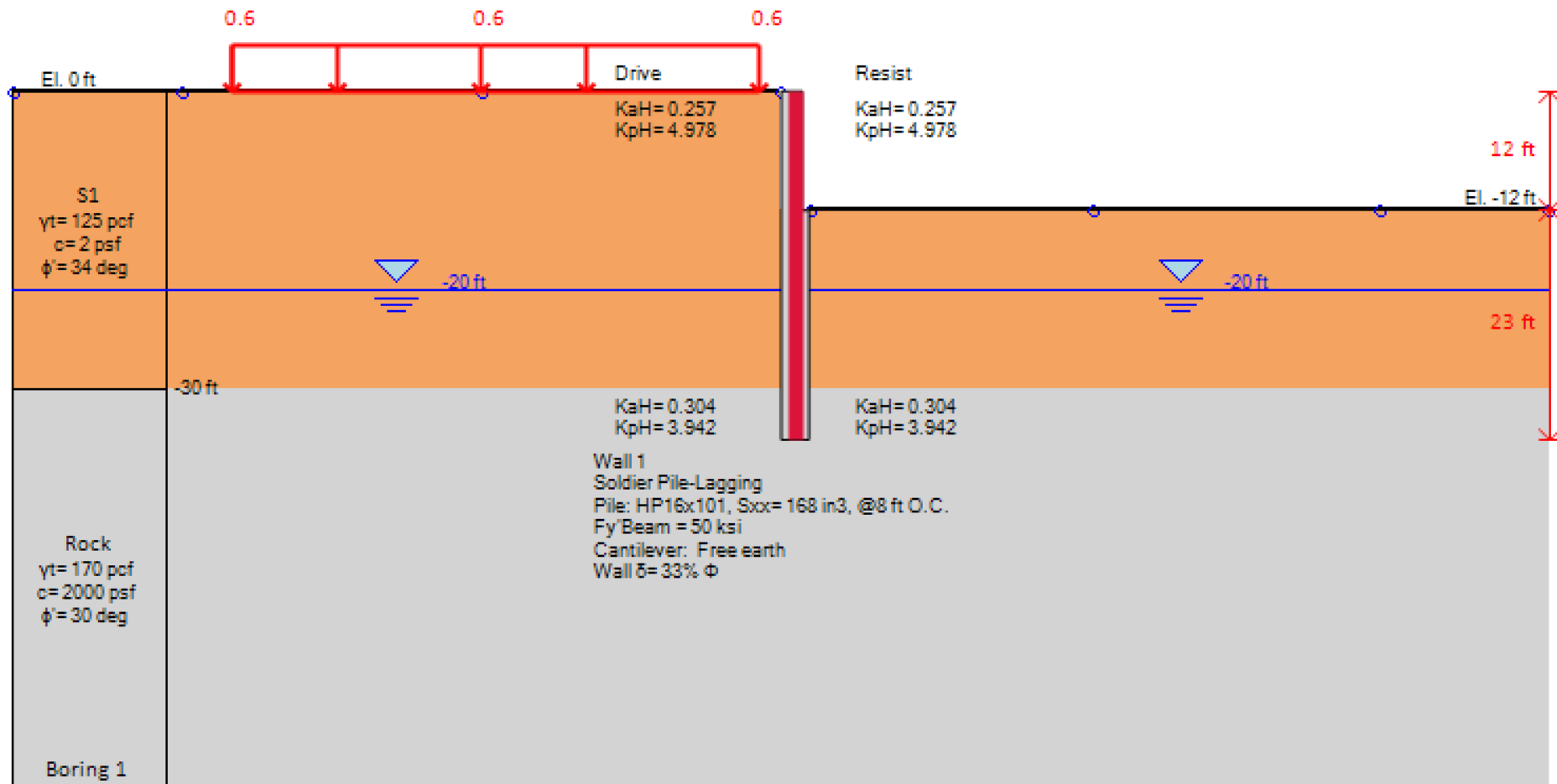


Example 2: Cantilever Soldier Pile Wall

**Example 2: Cantilever Soldier Pile Wall
 Limit Equilibrium – Non-Linear – Finite Element Analysis**



A. Soil Properties and Stratigraphy (Soil Layers)

Soil Properties and Stratigraphy Table:

Elev. (ft)	Soil (-)	γ_t (pcf)	C' or S_u (psf)	ϕ' (deg)	E_{oed} (ksf)	E_{ur} (ksf)	m (-)
0	S1 - Sand	125	2	34	550	1650	0.4
-30	R - Rock	170	2000	30	10000	30000	-

Soil Layer Properties:

- S1:** $\gamma_t = 125$ pcf, $c = 2$ psf, $\phi' = 34$ deg
- Rock:** $\gamma_t = 170$ pcf, $c = 2000$ psf, $\phi' = 30$ deg

Drive Parameters: $K_a H = 0.257$, $K_p H = 4.978$

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	K_o	Edit
	0	S1	1	0.4408...	Edit
	-30	Rock	1	0.5	Edit
Boring 1	*				

Property Configuration Windows:

- 4. Unit Weights - Density:** $\gamma_t = 170$ pcf, $\gamma_{bulk} = 160$ pcf, $\gamma' = 107.6$
- 5. Strength Parameters and Poisson Ratio:**
 - Drained strength properties: $c' = 2000$ psf, $\phi' = 30$ degrees
 - Peak - constant vol. (for estimation): $\phi_{cv}' =$ Omitted, $\phi_{peak}' =$ Omitted
 - $\nu = 0.45$
- 6. Permeability:** $K_x = 0.000328$ ft/sec, $K_z = 0.000328$ ft/sec
- 8. At-rest coefficients:** $K_{oNC} = 0.5$, $n_{OCR} = 0.5$, $K_o = K_{oNC} \cdot (OCR)^{n_{OCR}}$

B. Wall Section Properties, Wall Position and Depth

General | Advanced features

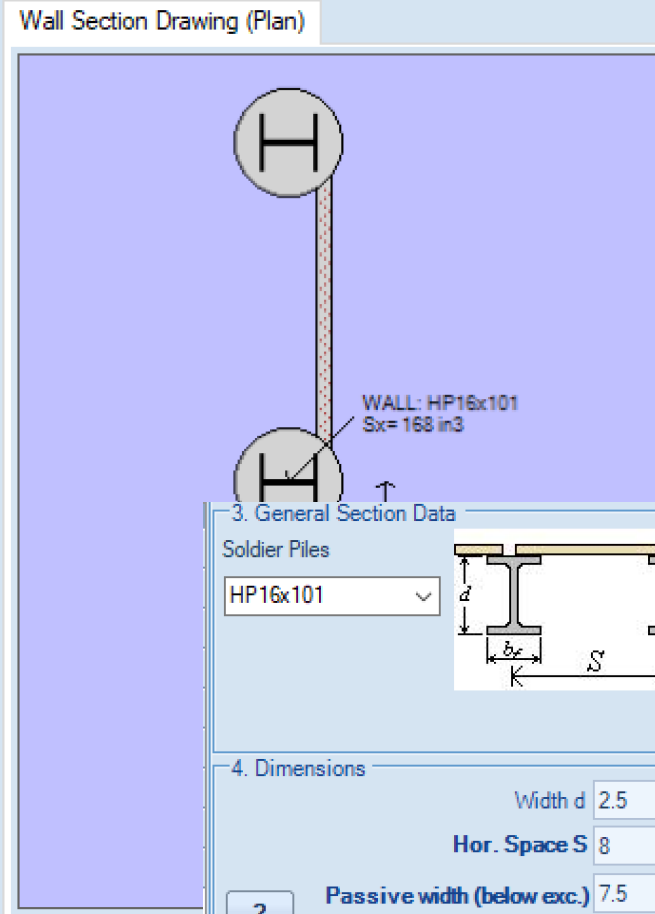
1. Wall Name
Wall 1

2. Wall Section Properties
Section: Wall 1 | Edit section data
 Use gravity wall section
Equivalent wall Thickness: 0.455 ft

3. Dimensions
Top EL: 0 ft
Depth L: 35 ft
Bottom: -35 ft
 Use custom passive Elev.
 Wall is permeable
 Include wall weight

4. 3D Wall Coordinates
xWall: 0 ft | Out-of-plane y: 0 ft

7. Wall Nodes (Analysis Settings)
Number of Nodes nD (0-200): []
Limit equilibrium analyses use nD to divide wall into smaller elements. BEF uses Mesh DELTA as defined in the "Analysis Tab" in then main form and recalculates nD.

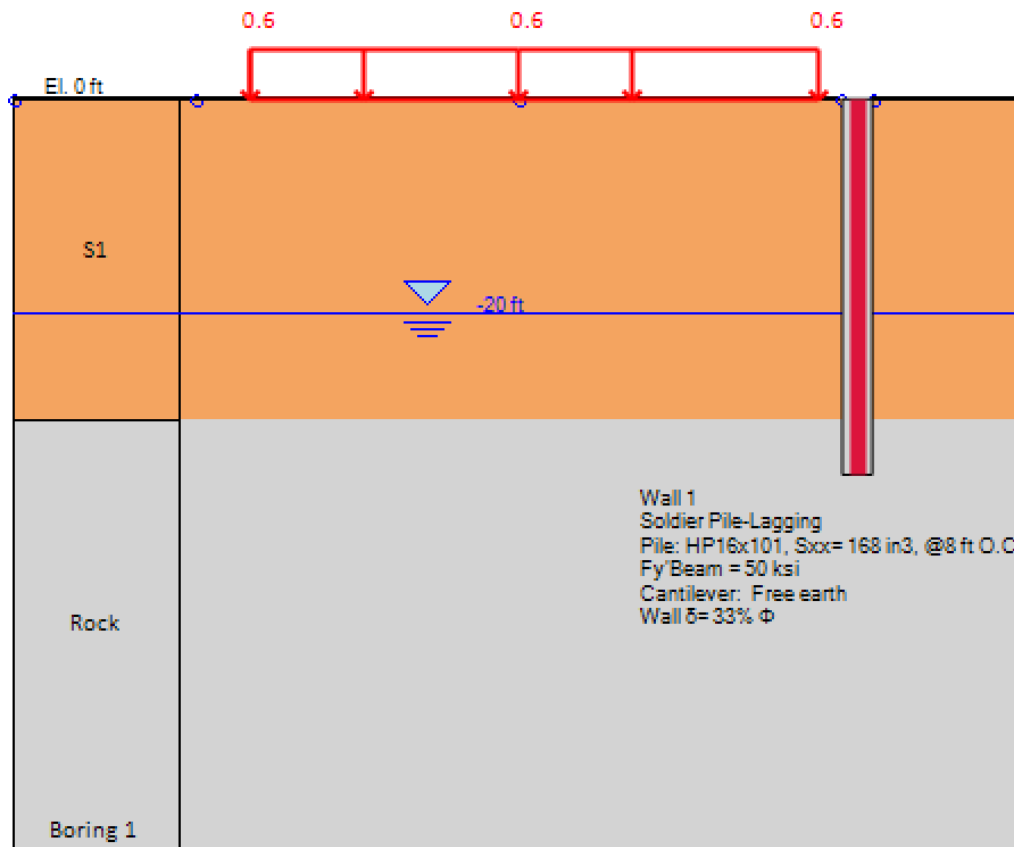


X-Coordinate	0
Section Type	Bored Soldier Piles
Wall Width	2ft diam. Piles
Wall Spacing	8ft
Reinforcement	HP16x101 (H Beams)
Lagging	4" Concrete Lagging
Concrete Material	3ksi Concrete
Steel Material	A50 Steel
Depth	35ft

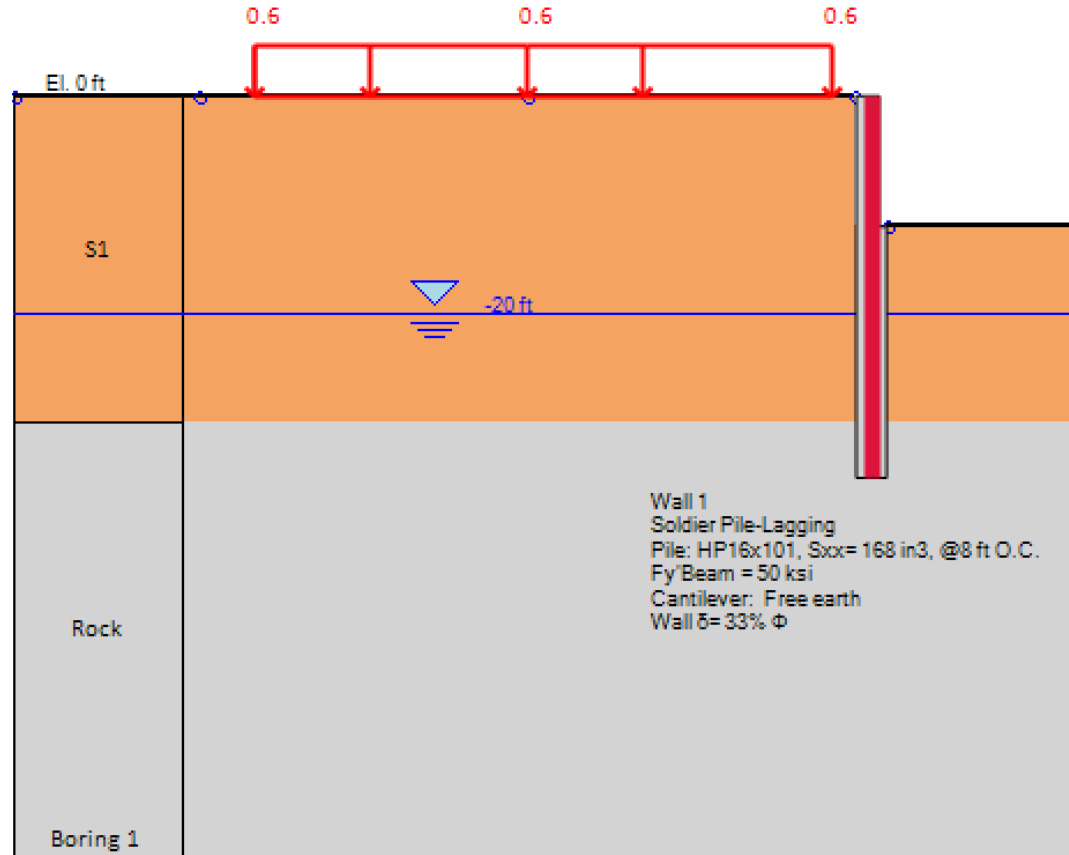
4. Dimensions
Width d: 2.5 ft
Hor. Space S: 8 ft
Passive width (below exc.): 7.5 ft >
Active width (below exc.): 2.5 ft >
Water width (below exc.): 2.5 ft >

5. Structural Materials
Steel Beam Materials: A50 | Edit

C. Model in Construction Stages



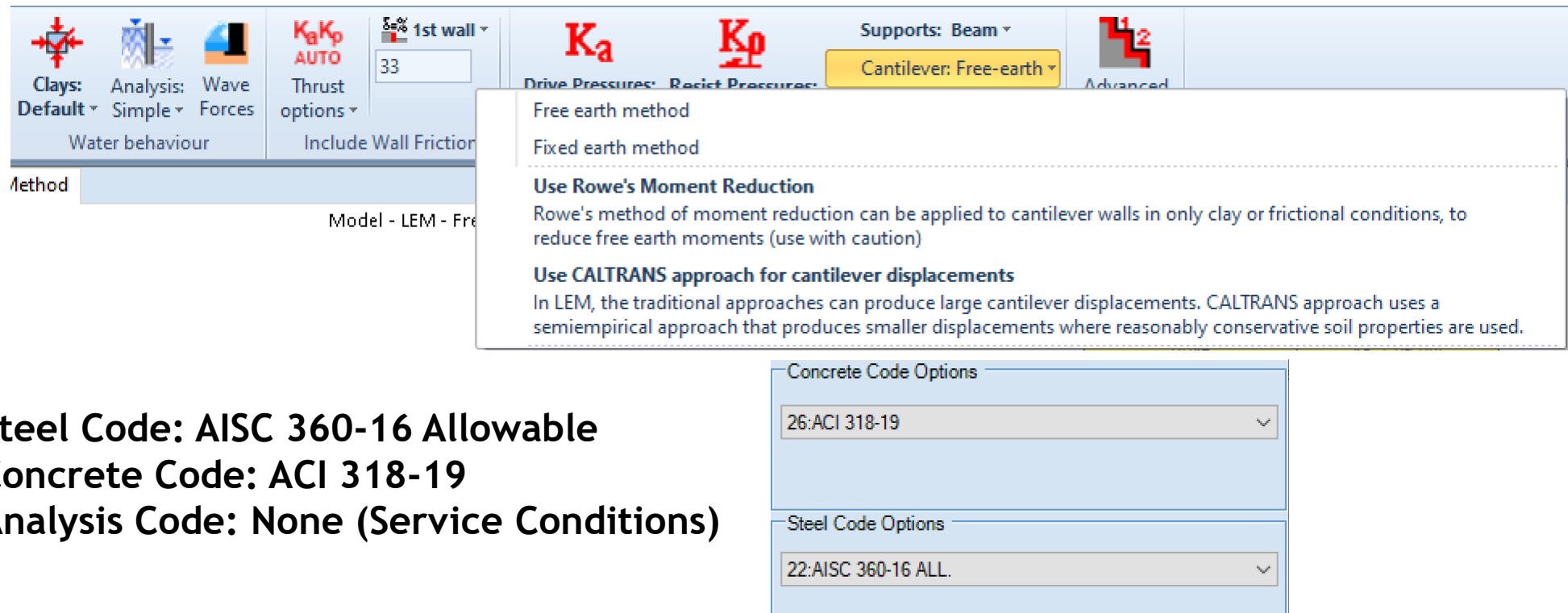
Stage 0: At-rest Conditions



Stage 1: Cantilever Excavation

D. Analysis Settings & Design Codes

- Wall Friction: 33% of the soil friction
- Water Pressures: Simplified Flow
- Cantilever Method (LEM): Examine Free Earth Method & Fixed Earth Method
- Soil Pressures: Active & Passive (All Stages)



Method

Model - LEM - Free

Concrete Code Options

26:ACI 318-19

Steel Code Options

22:AISC 360-16 ALL.

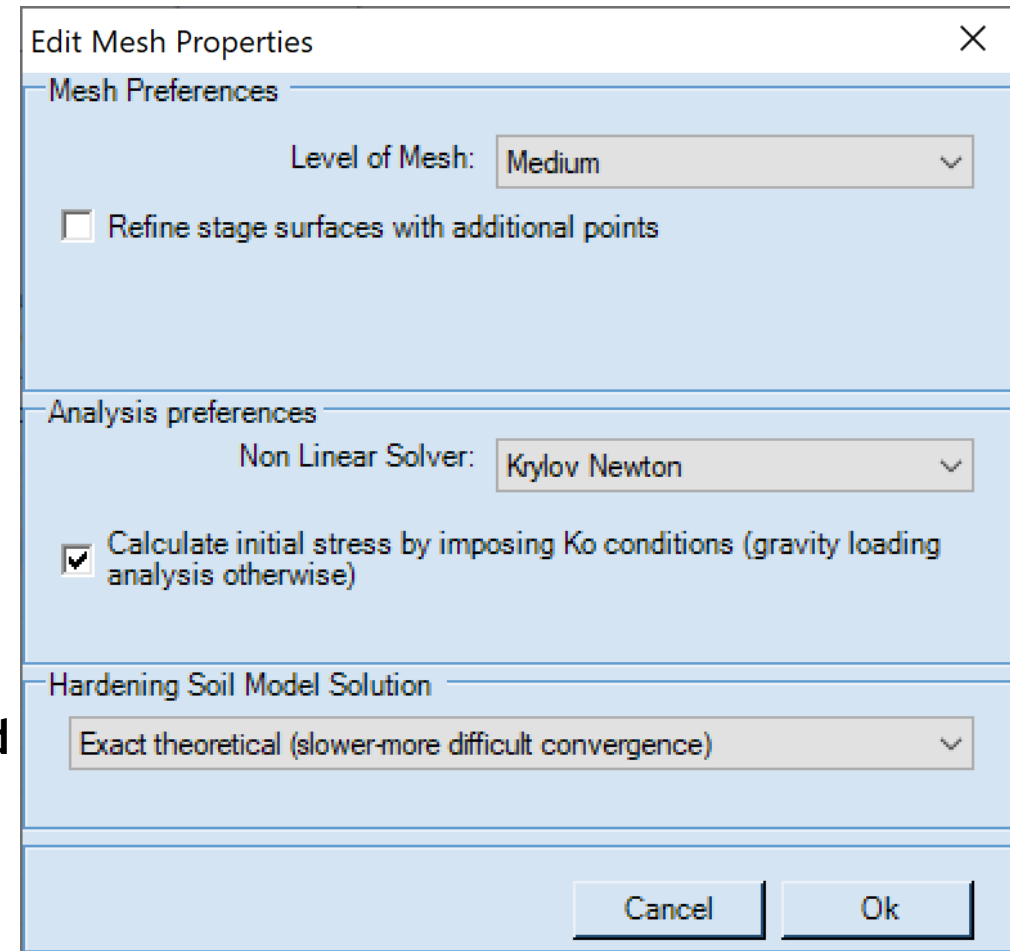
- Steel Code: AISC 360-16 Allowable
- Concrete Code: ACI 318-19
- Analysis Code: None (Service Conditions)

D2. Additional FEM Analysis Settings & Tips

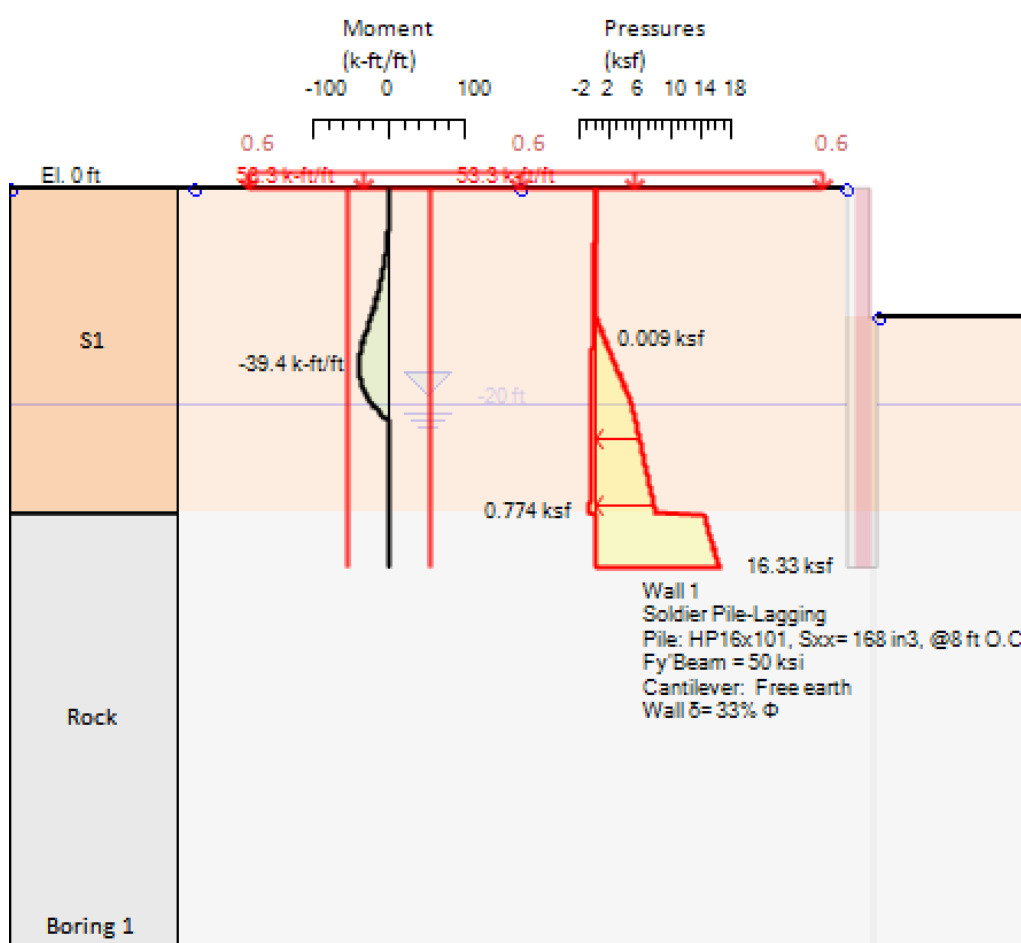
- **Generated Mesh Density: Medium**
- **Non-Linear Solver: Krylov Newton Method**
- **Hardening Soil Model: Exact Theoretical**

FEM Analysis - Model Convergence Tips:

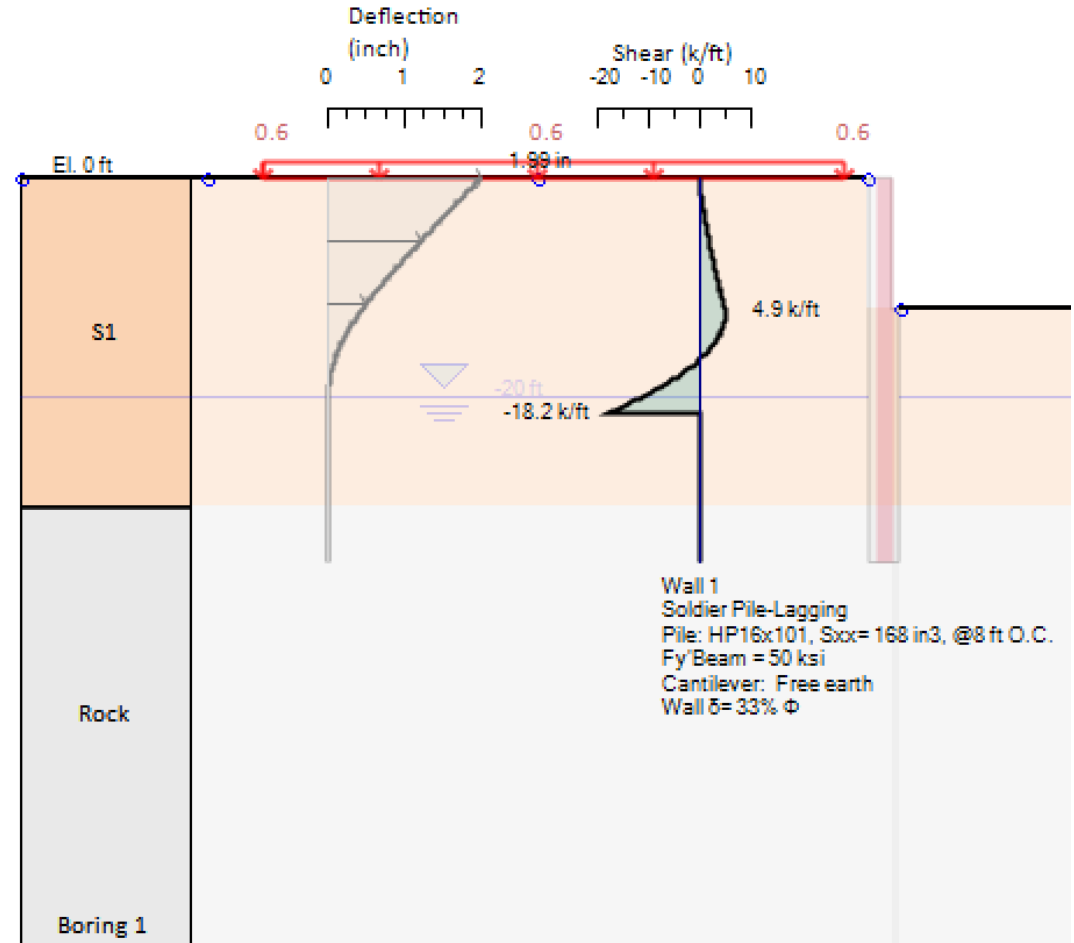
- ✓ **Always consider a small cohesion for frictional soils**
- ✓ **Always use wall friction for all your walls**
- ✓ **Create a strict staging**
- ✓ **Sometimes an initial stage with green field conditions (not activated walls) might be required**
- ✓ **Always assume realistic prestress values for the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



E1. LEM Analysis Results - Free Earth Method

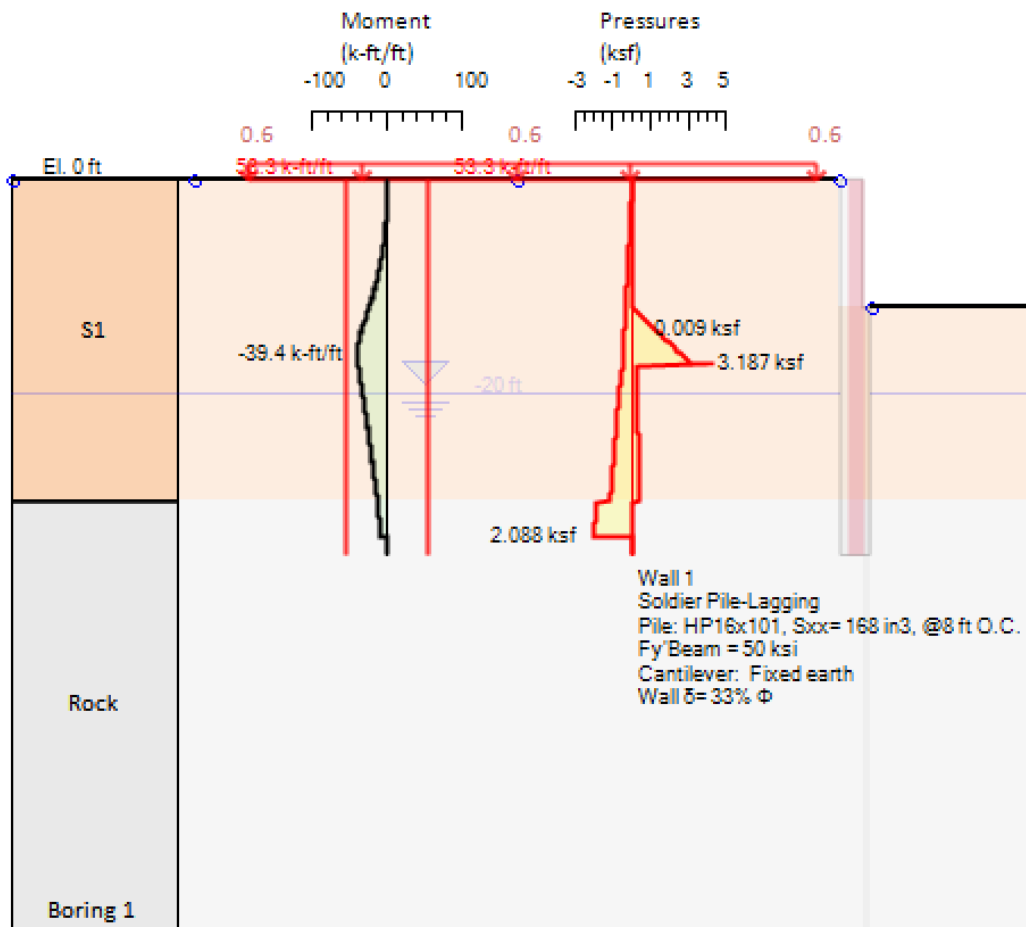


Wall Moments & Soil Pressures - Stage 1

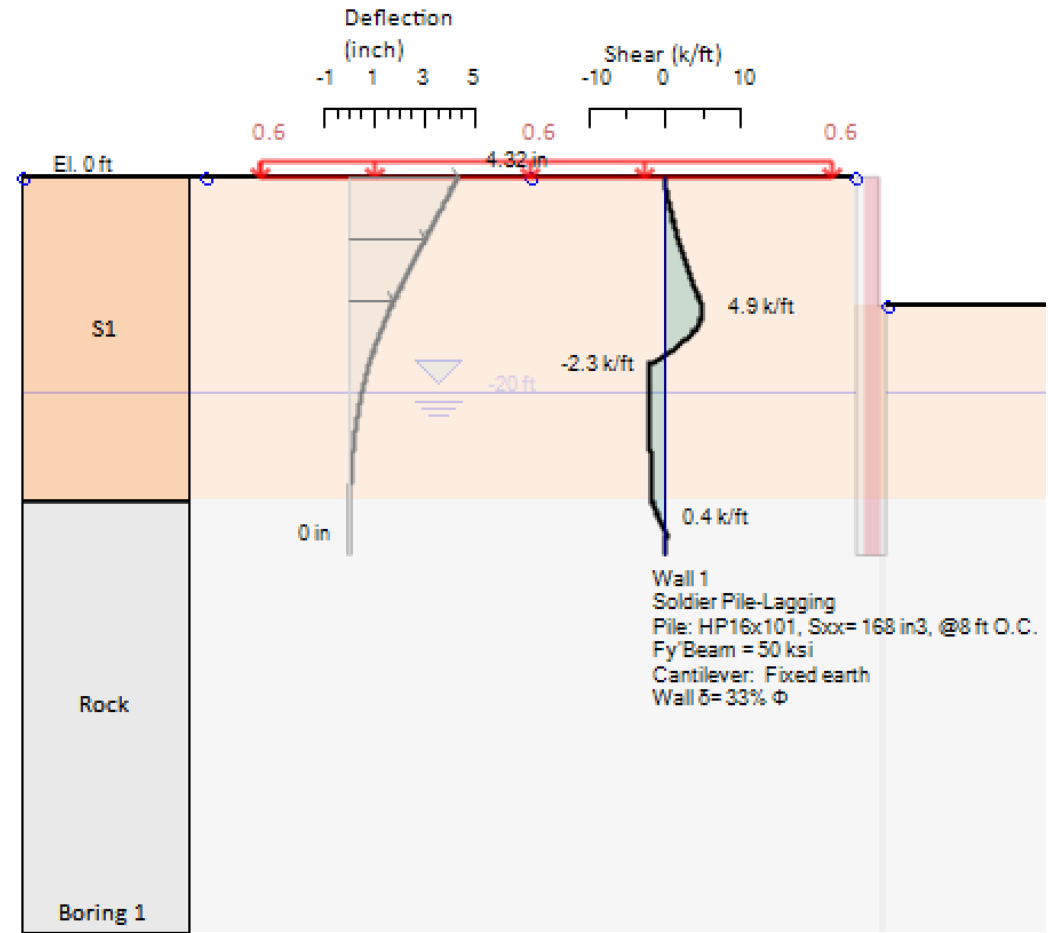


Est. Displacements & Wall Shear - Stage 1

E2. LEM Analysis Results - Fixed Earth Method

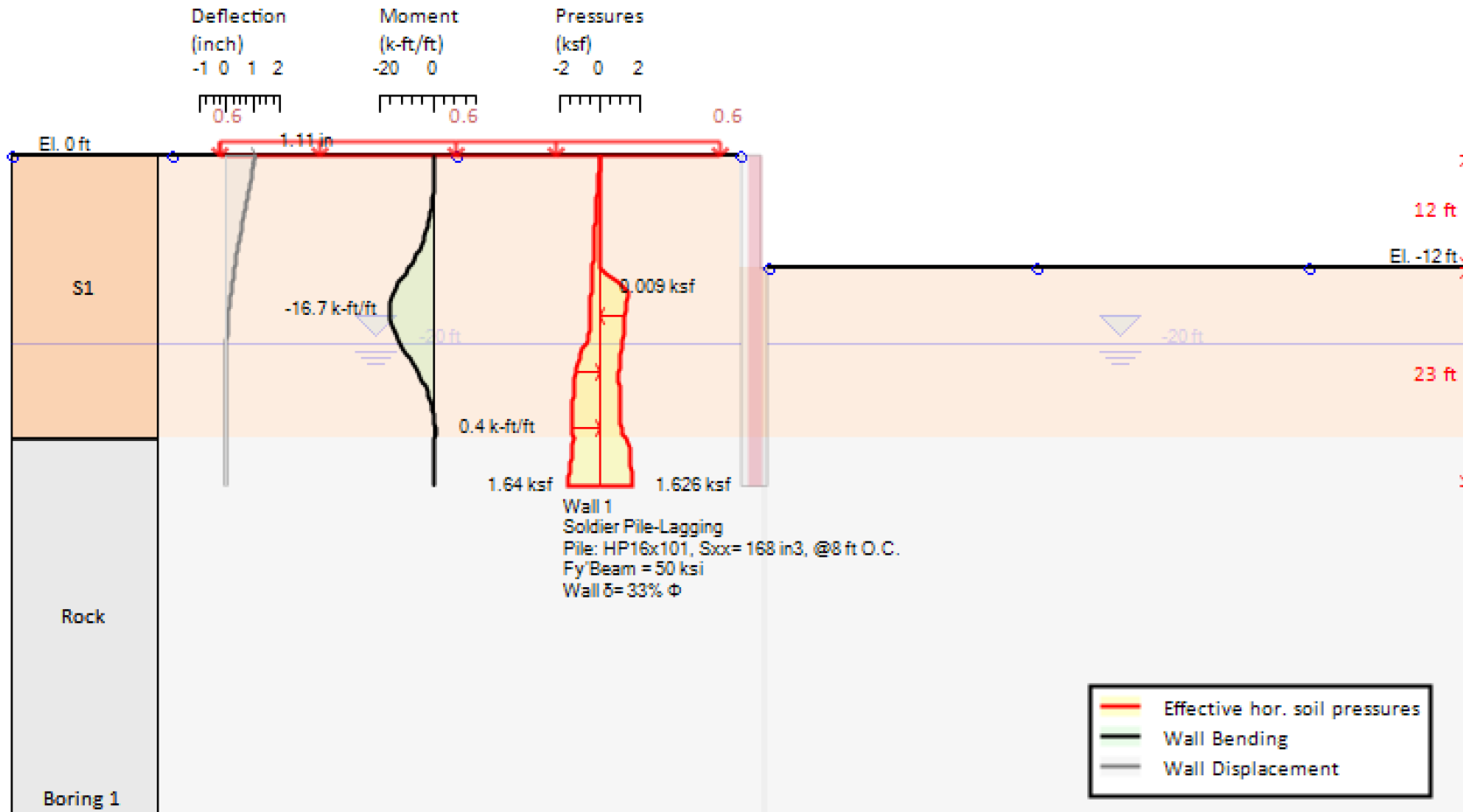


Wall Moments & Soil Pressures - Stage 1



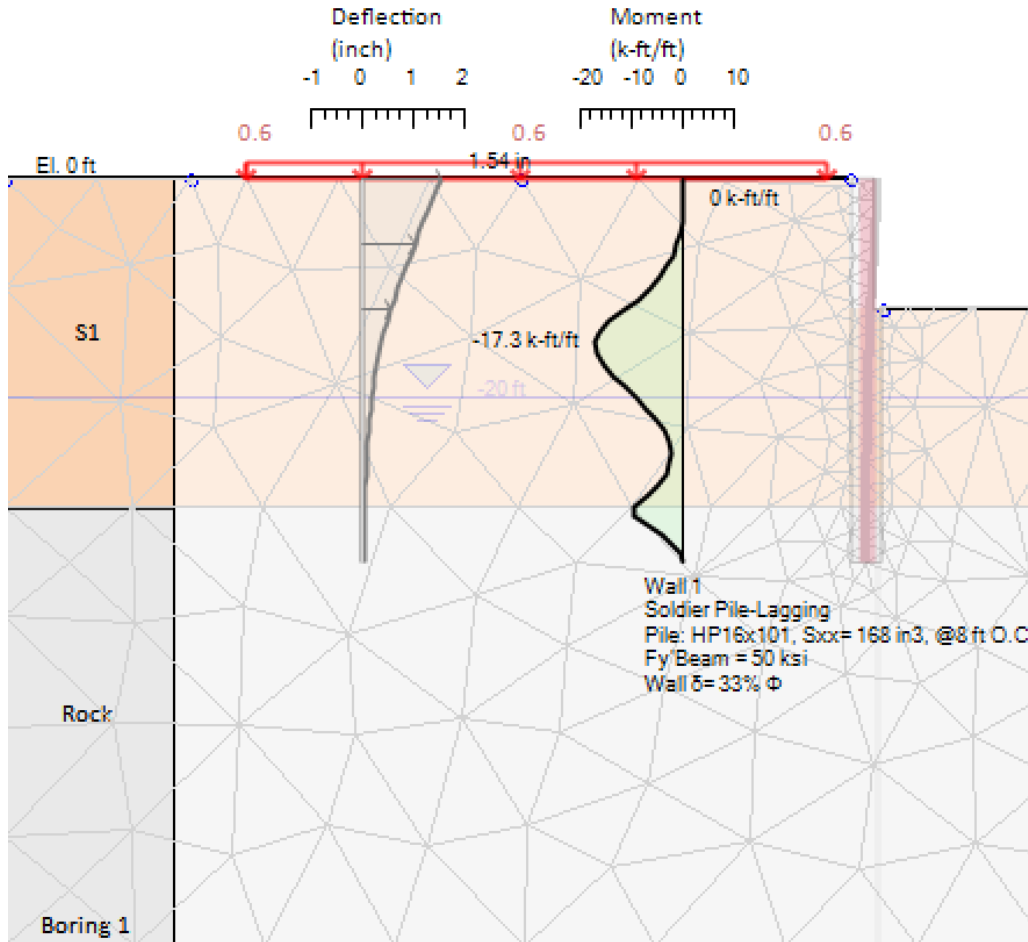
Est. Displacements & Wall Shear - Stage 1

F. Non-Linear Analysis Results

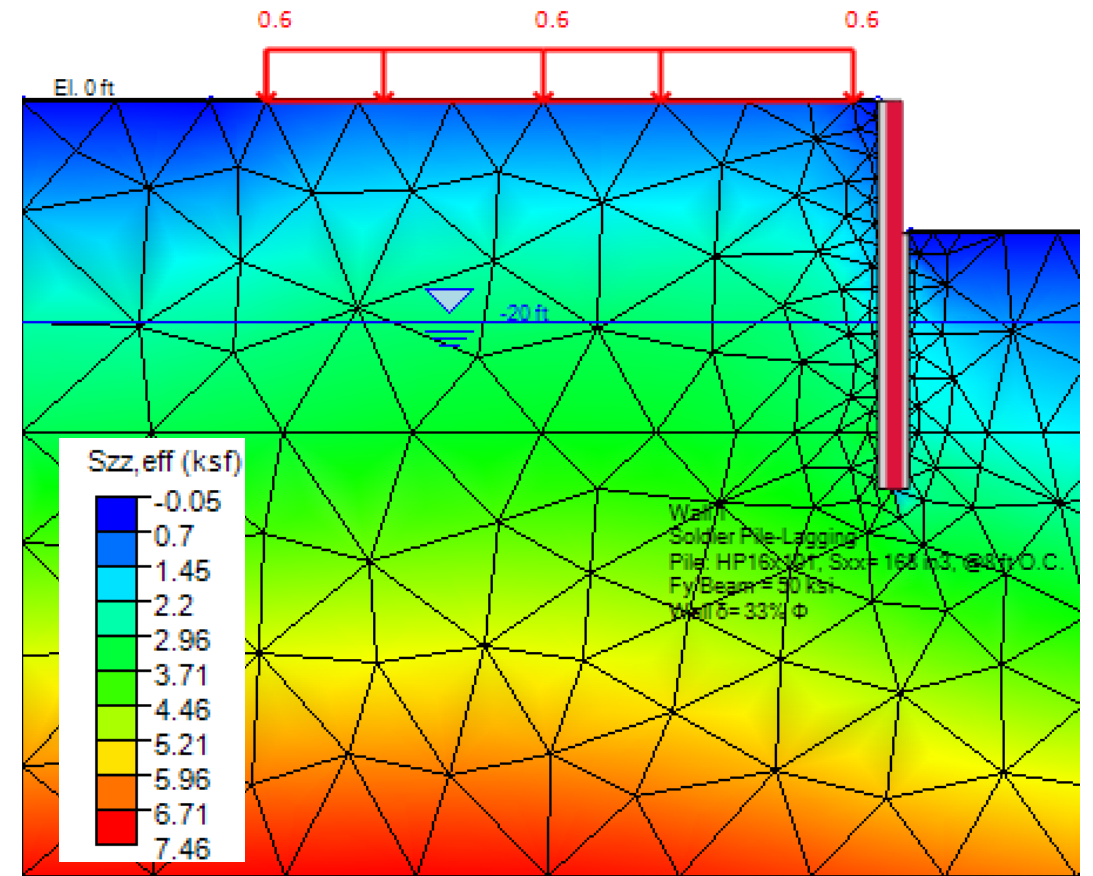


Wall Moments, Displacements & Soil Pressures - Stage 1

G. FEM Analysis Results



Wall Moments & Displacements - Stage 1



FEM Mesh & Effective Vertical Pressures - Stage 1

Thank You!

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