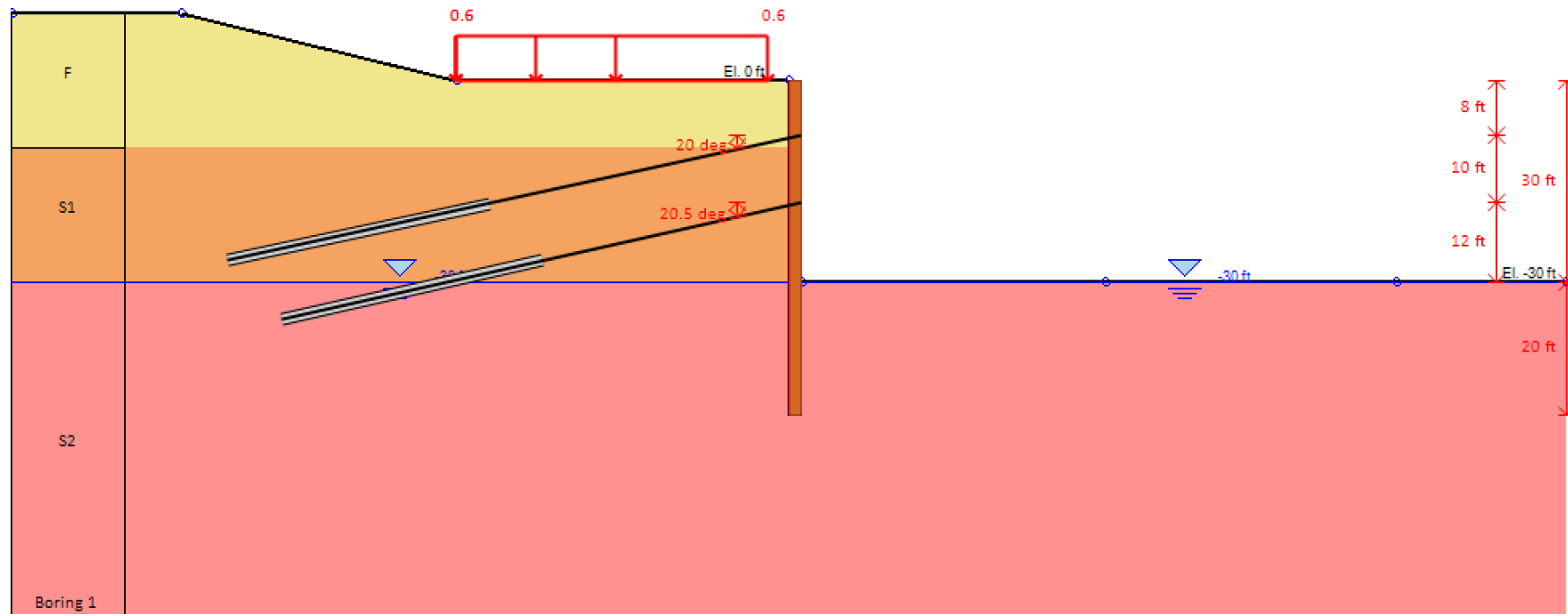


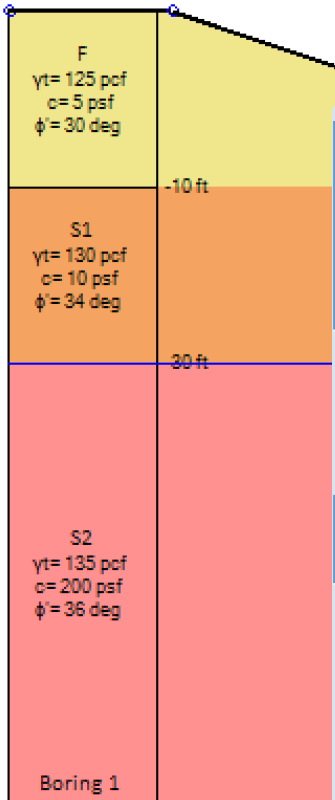
Example 3: Anchored Soldier Pile Wall Limit Equilibrium – Non-Linear – Finite Element Analysis





A. Soil Properties and Stratigraphy (Soil Layers)

Elev. (ft)	Soil (-)	γ_t (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 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. Wall Section Properties, Wall Position and Depth

X-Coordinate	X = 0
Top Elevation	Z = 10 ft
Wall Type	Soldier Piles
Pile Section	HP14X89 (H Beams)
Pile Spacing	8 ft
Lagging	2" Timber Lagging

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: 0.403 ft

3. Dimensions
Top EL: 0 ft
Depth L: 50 ft
Bottom: -50 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: 100

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.

Wall Section Drawing (Plan)

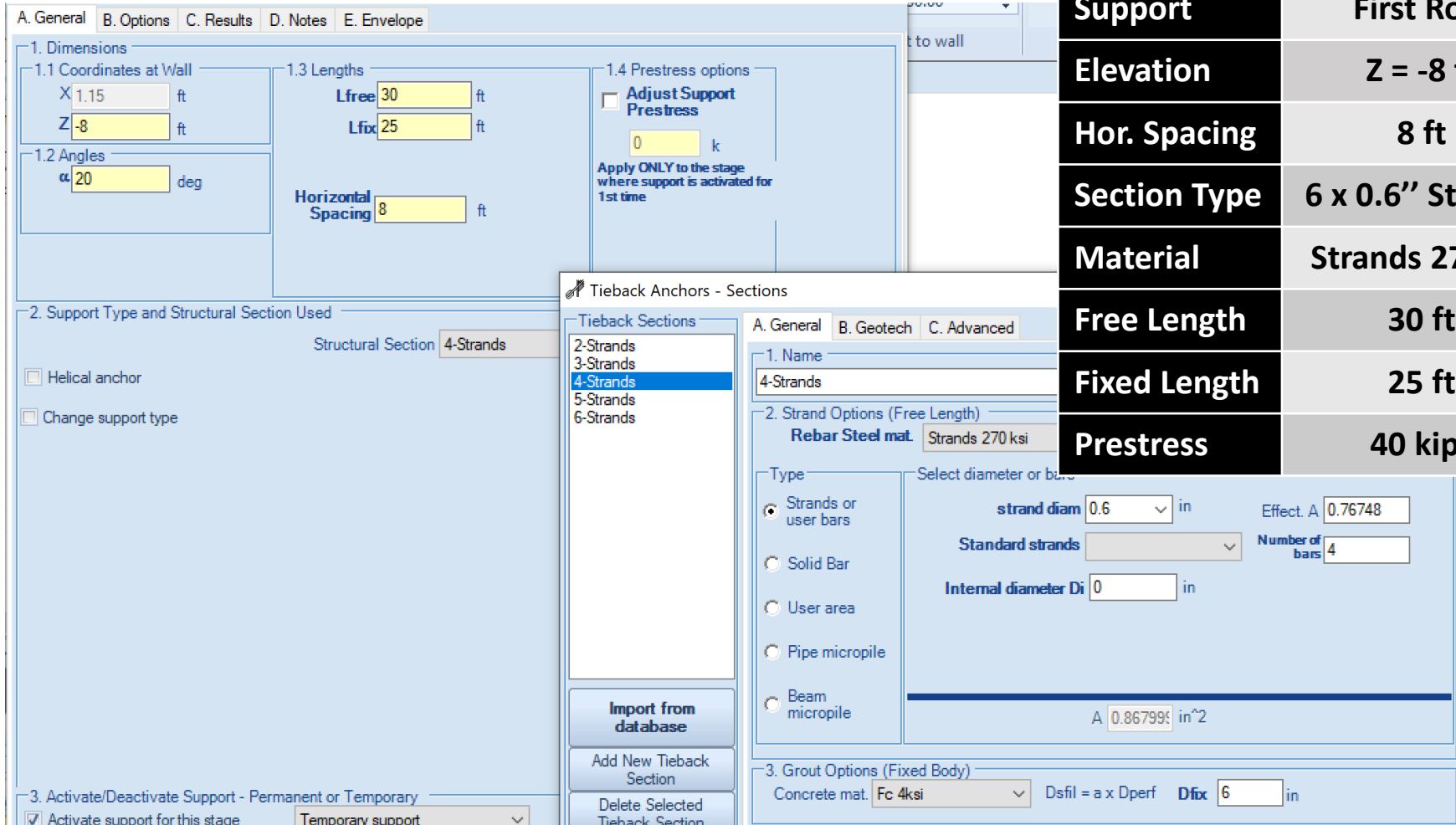
3. General Section Data
Soldier Piles
HP14x89

4. Dimensions
Width d: 1.15 ft
Hor. Space S: 8 ft
Passive width (below exc.): 3.675 ft
Active width (below exc.): 1.225 ft
Water width (below exc.): 1.225 ft

5. Structural Materials
Steel Beam Materials
A50 Edit

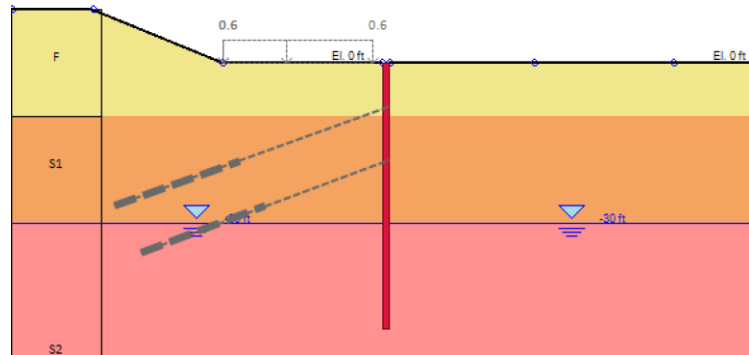
The "passive width and active width below exc." are used to multiply soil pressures on the wall element below the excavation grade (see manual).

C. Support Section Properties and Elevations

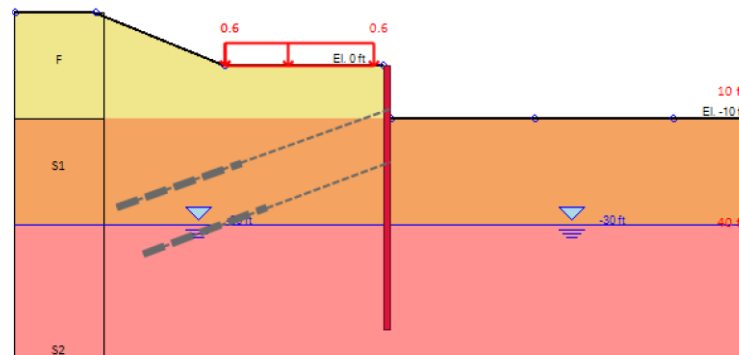


Support	First Row	Second Row
Elevation	Z = -8 ft	Z = -18 ft
Hor. Spacing	8 ft	8 ft
Section Type	6 x 0.6" Strands	6 x 0.6" Strands
Material	Strands 270 ksi	Strands 270 ksi
Free Length	30 ft	25 ft
Fixed Length	25 ft	25 ft
Prestress	40 kips	50 kips

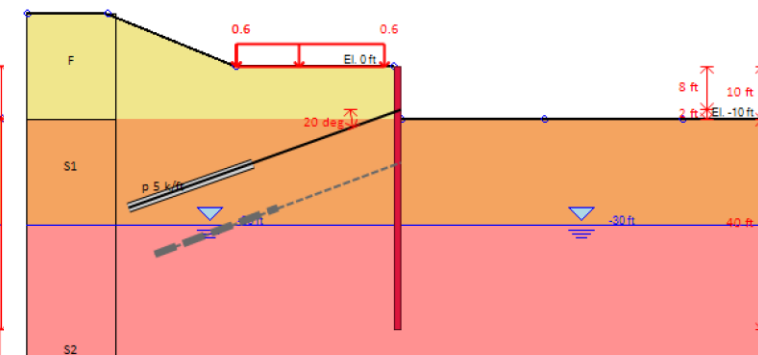
D. Model in Construction Stages



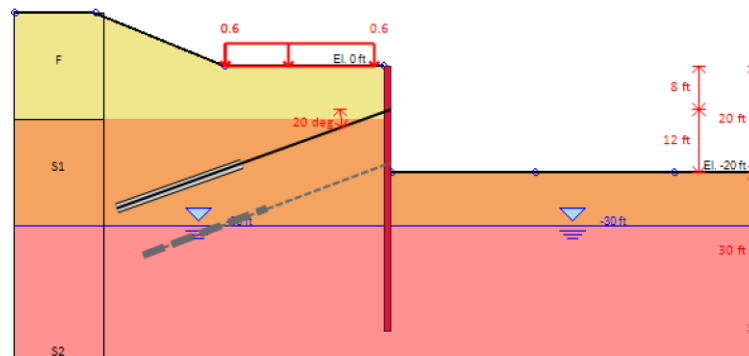
Stage 0: At-rest Conditions



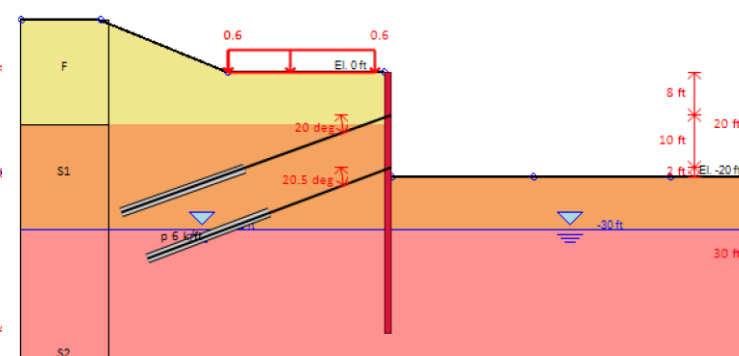
Stage 1: Excavation



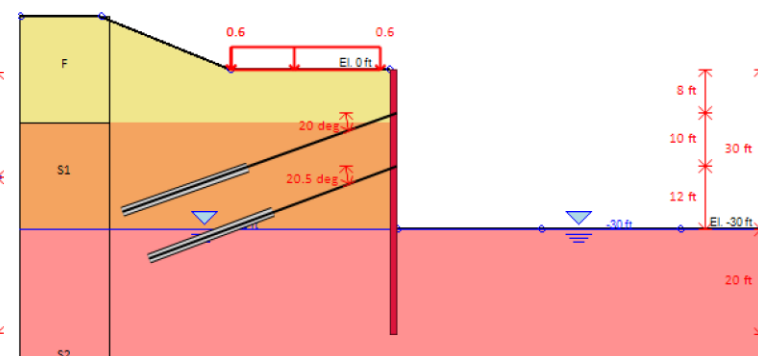
Stage 2: Support Installation



Stage 3: Excavation



Stage 4: Support Installation



Stage 5: Final Excavation

E1. 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)

The screenshot shows a software interface for analysis settings. It is divided into several sections:

- Water behaviour:** Clays: Default, Analysis: Simple, Wave Forces.
- Include Wall Friction:** Thrust options: $K_a K_p$ AUTO, a dropdown menu set to "1st wall", and a text input field containing "50".
- Limit Equilibrium Methods (Current Stage):** Drive Pressures: FHWA, Resist Pressures: Passive, and a checkbox for "Beam: Blum's method".
- Advanced Options:** Supports: Beam, Cantilever: Free-earth, and an icon for advanced options.

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

The screenshot shows two dropdown menus for design codes:

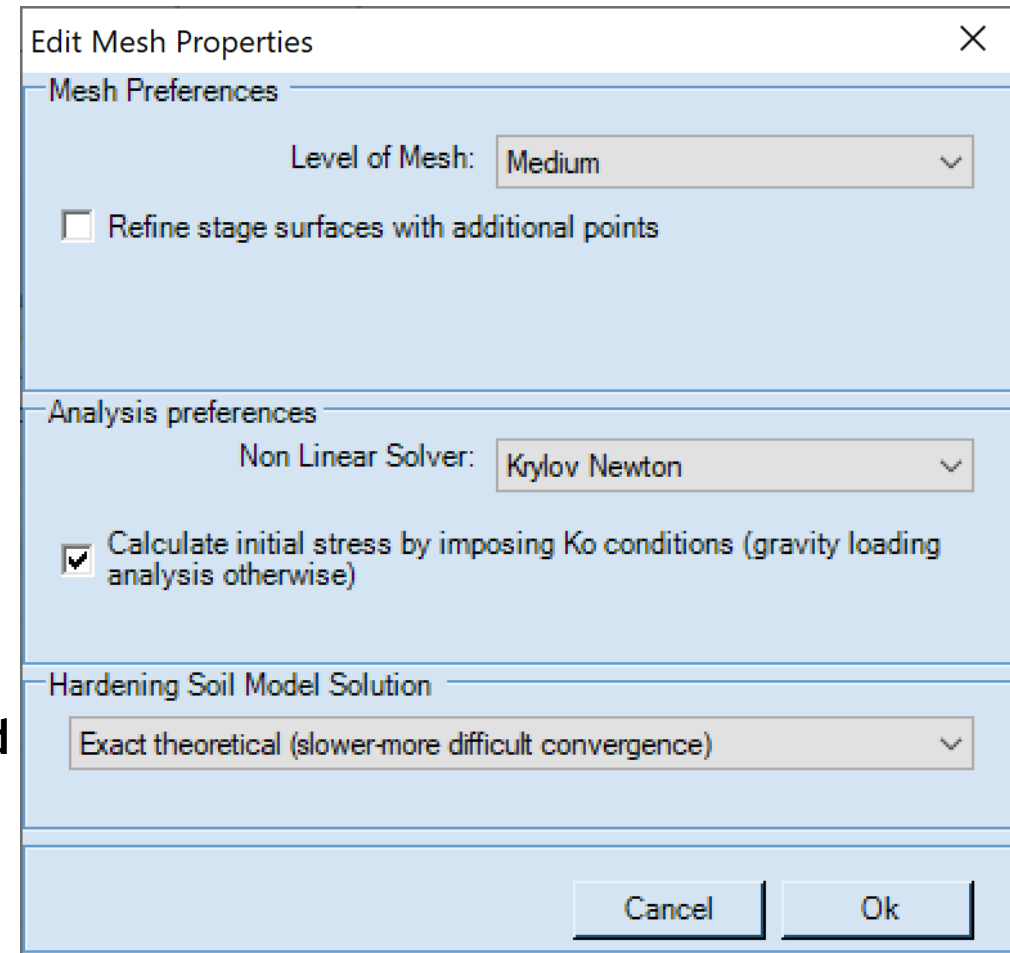
- Concrete Code Options:** 26:ACI 318-19
- Steel Code Options:** 22:AISC 360-16 ALL.

E2. Additional FEM Analysis Settings & Tips

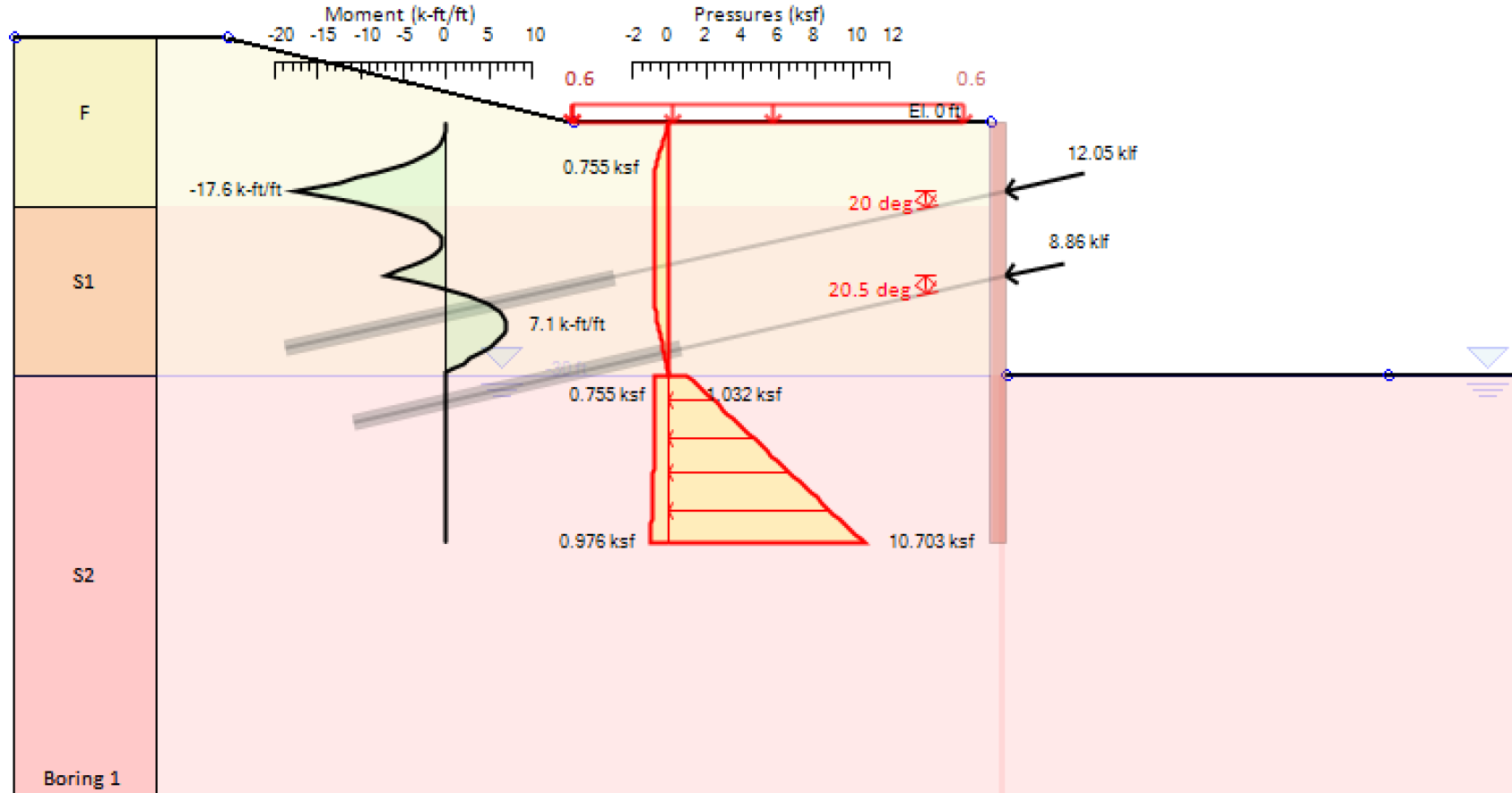
- **Generated Mesh Density: Medium**
- **Non-Linear Solver: Krylov Newton Method**
- **Hardening Soil Model: Exact Theoretical**

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)**

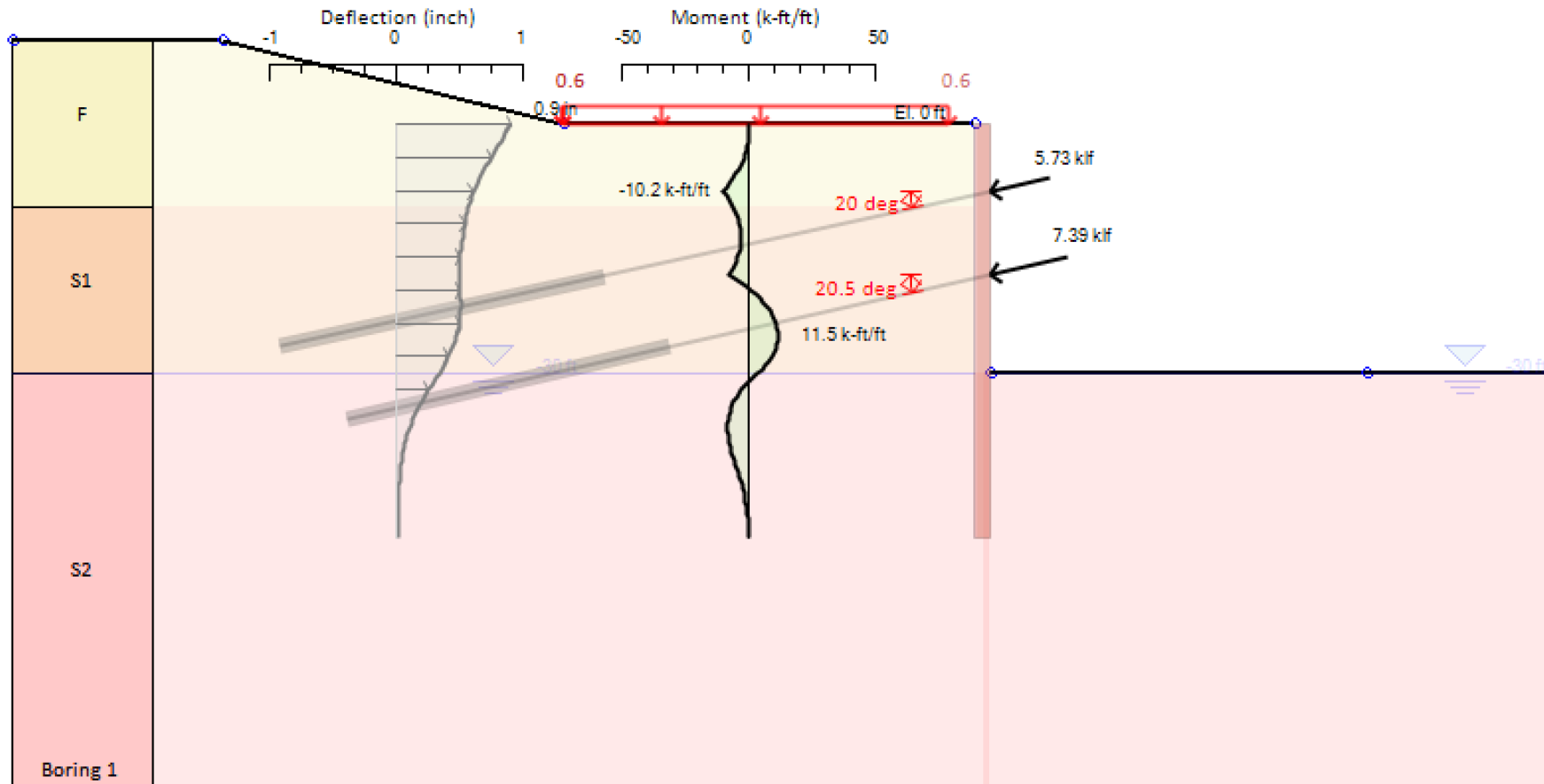


F. LEM Analysis Results



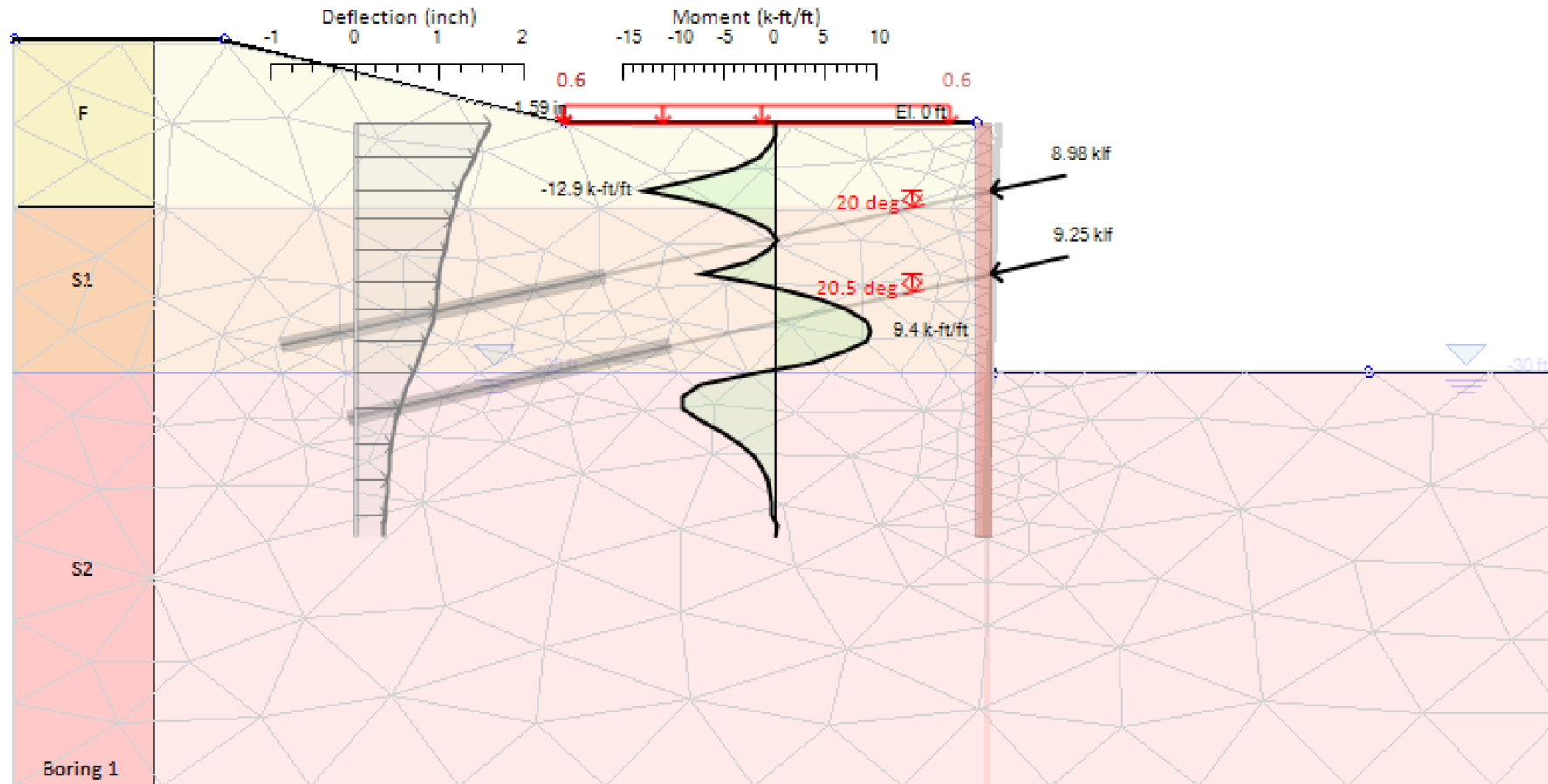
Wall Moments, Support Reactions & Soil Pressures - Stage 5

G. Non-Linear Analysis Results



Wall Moments, Displacements & Support Reactions - Stage 5

H. FEM Analysis Results



Wall Moments, Displacements & Support Reactions - Stage 5

Thank You!

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