One Dalton Hotel & Residences:
Implementation of ground movement control measure for a deep excavation in Boston blue clay

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HALEY ALDRICH

Outline

1. One Dalton Hotel & Residences
2. Challenges
3. Subsurface conditions
4. Excavation and Support of Excavation
5. Lateral and vertical movements
6. Conclusions

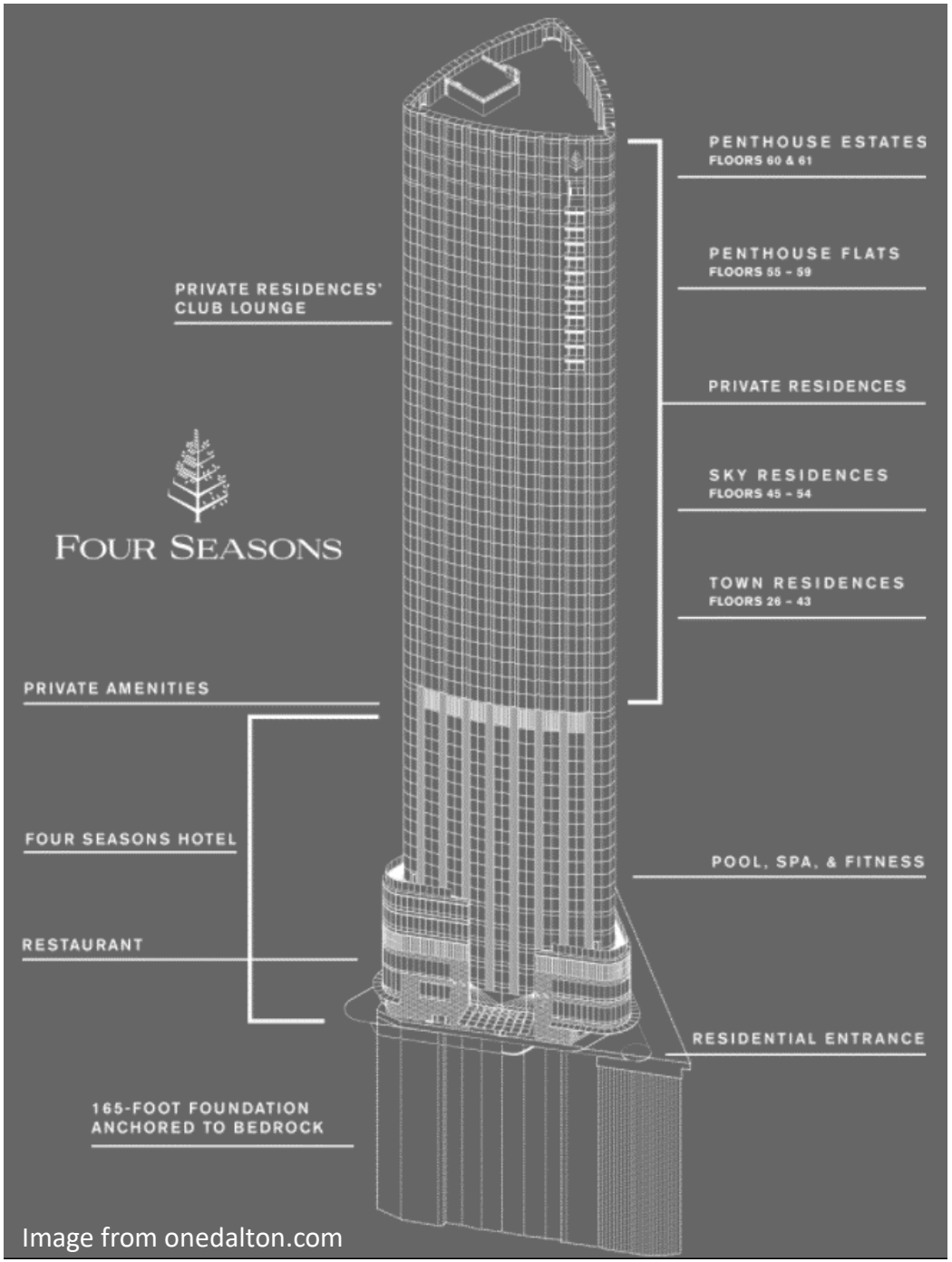
One Dalton Hotel & Residences

- Five-star hotel (Four Seasons) and luxury condos
- Back Bay Area of Boston, MA, USA
- Developer:
  One Dalton Owner LLC/Carpenter & Company
- Architect:
  Pei Cobb Freed & Partners, and Cambridge Seven Associates
- Structural:
  WSP New York
- Geotechnical:
  Haley & Aldrich, Inc.

Rendered image from onedalton.com

One Dalton Hotel & Residences

- Estimated completion: 2019
- 61-story tower, 742 ft tall (3rd tallest in Boston when finished)
- 3 levels below grade



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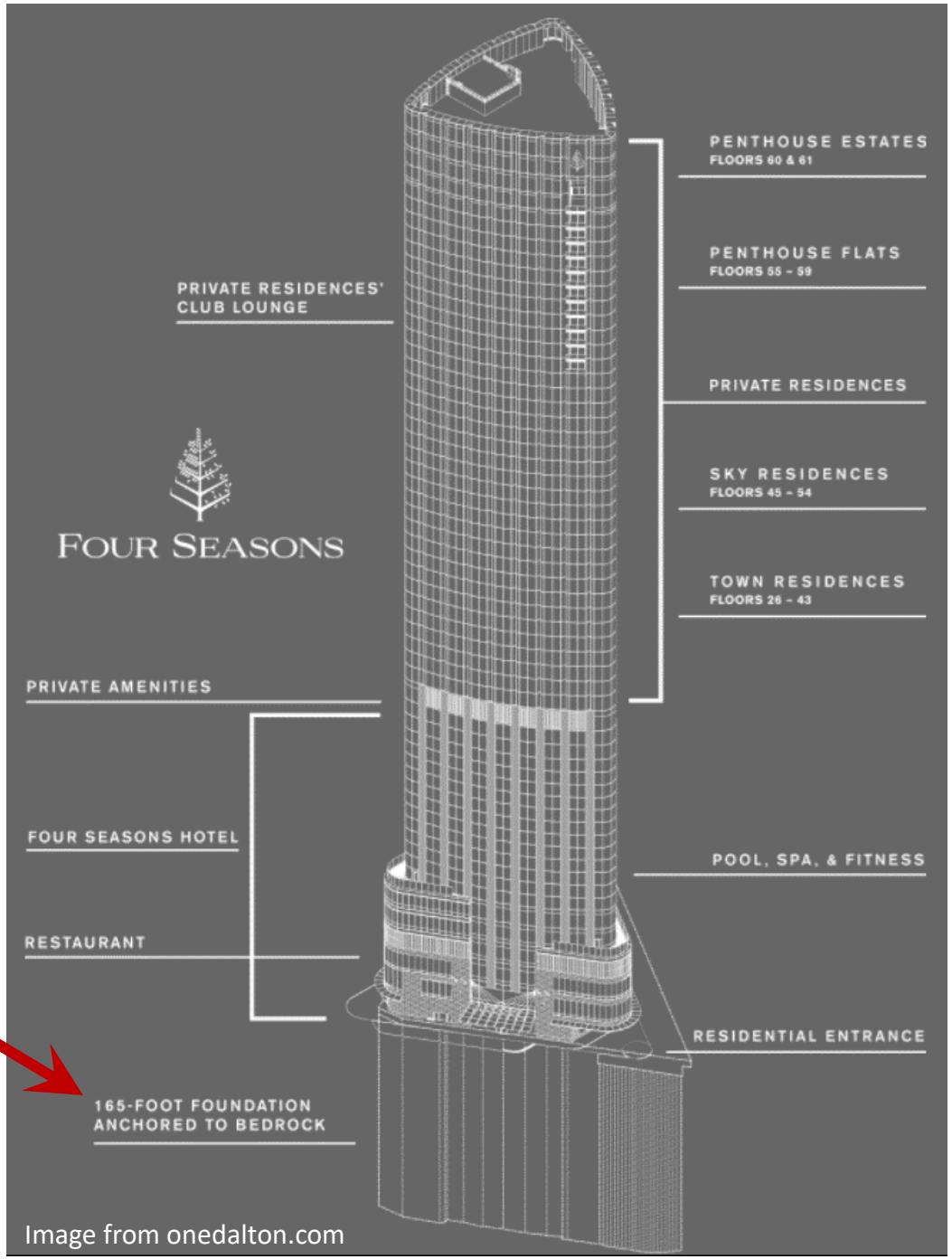
- 61-story tower, 742 ft tall (3rd tallest in Boston when finished)
- 3 levels below grade
- Rock-socketed deep foundations



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Challenges

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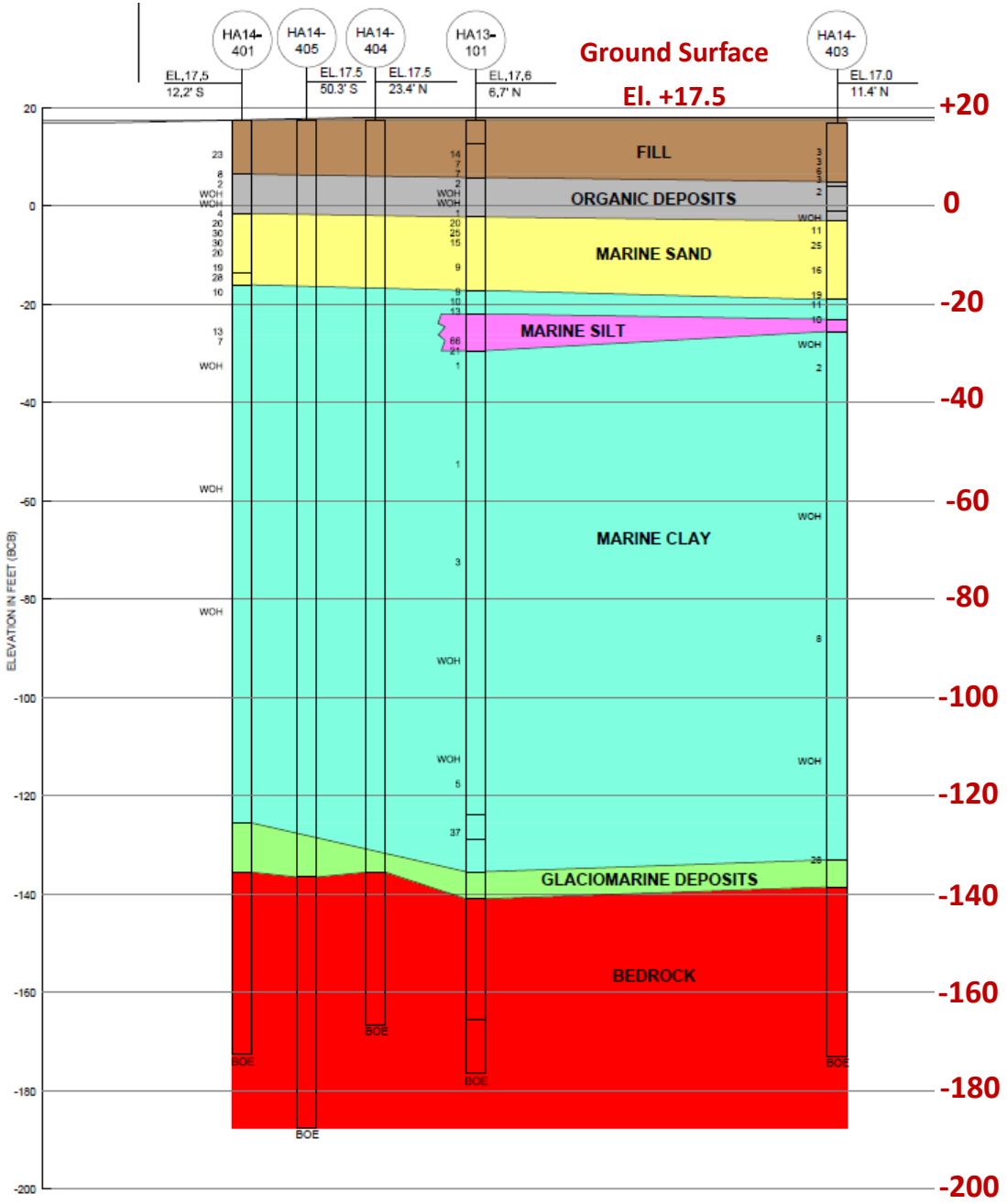
- Urban construction
- Deep excavation in soft soil
- Protection of adjacent structures on shallow foundations

Subsurface conditions

- Fill
- Organic deposits
- Marine sand
- Marine silt
- Marine clay (Boston blue clay)
- Glaciomarine deposits
- Bedrock (argillite)



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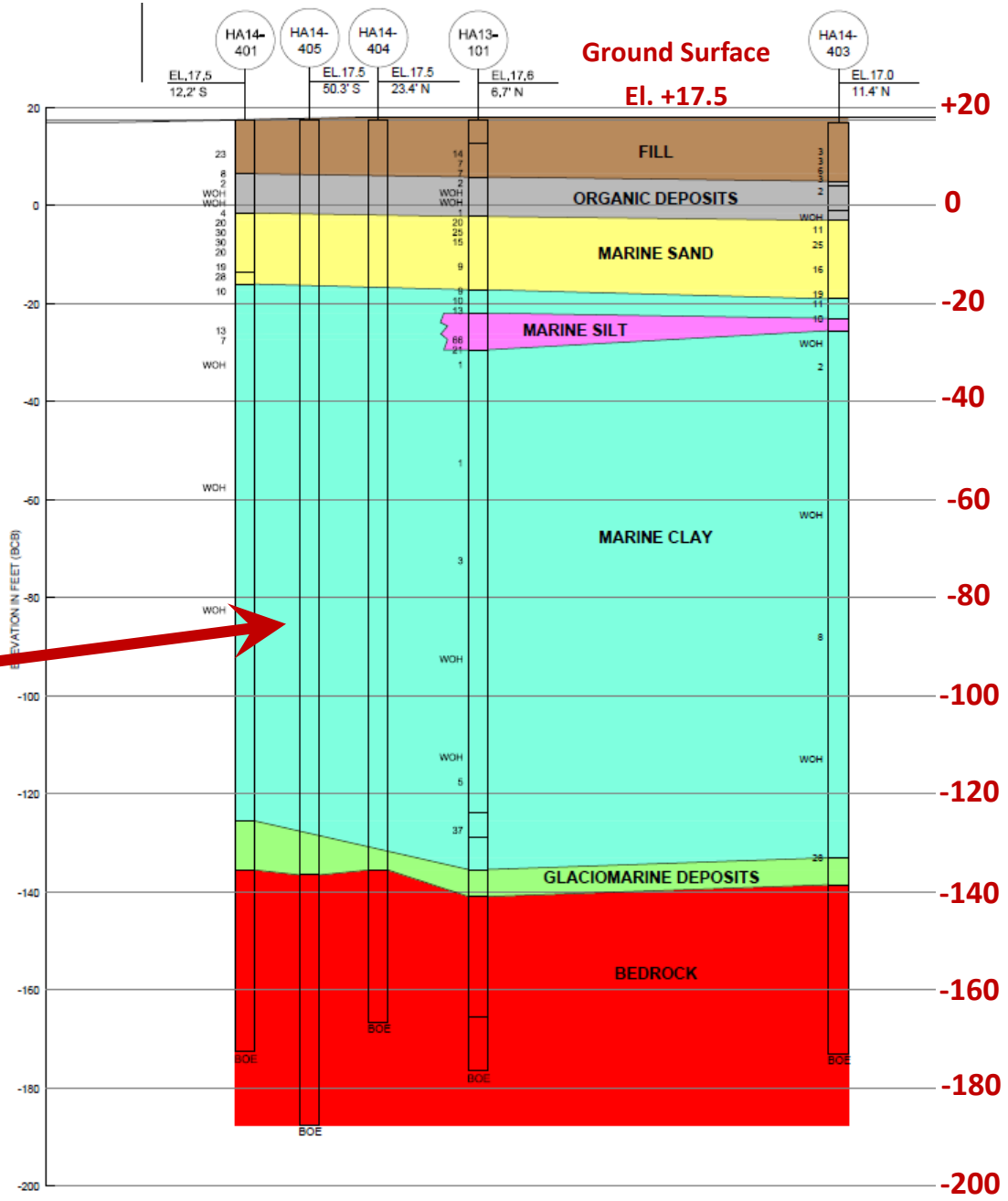

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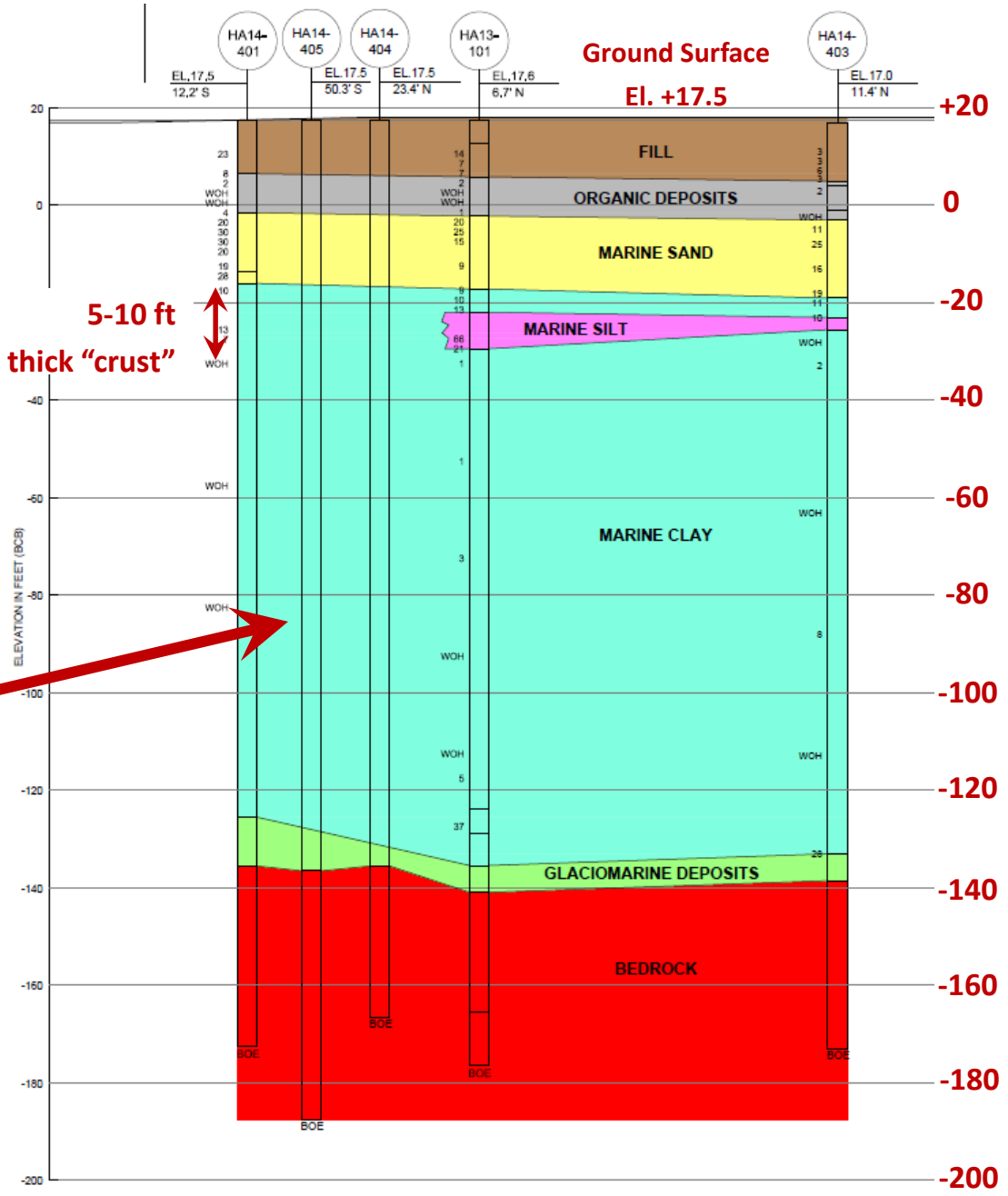

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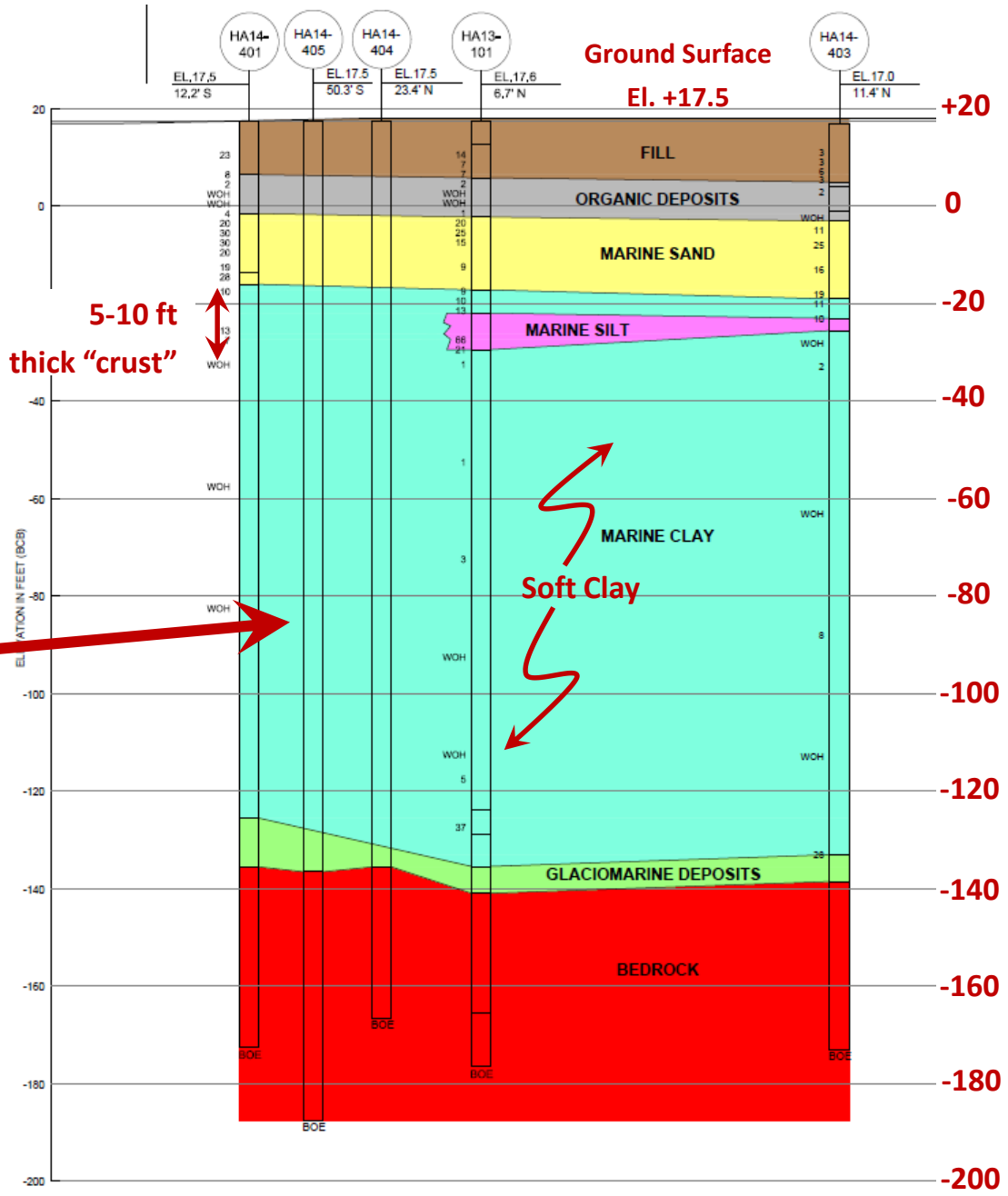
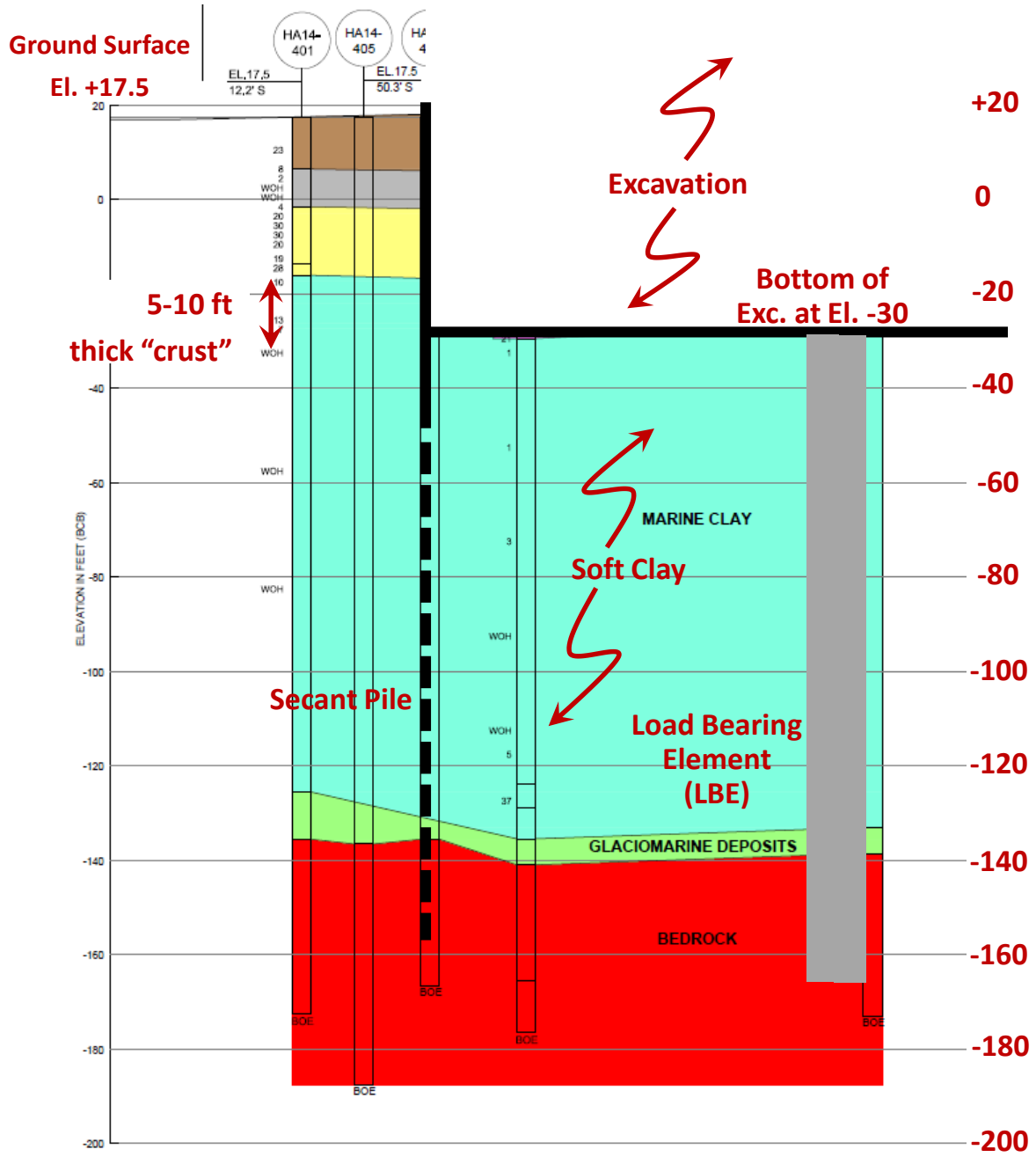


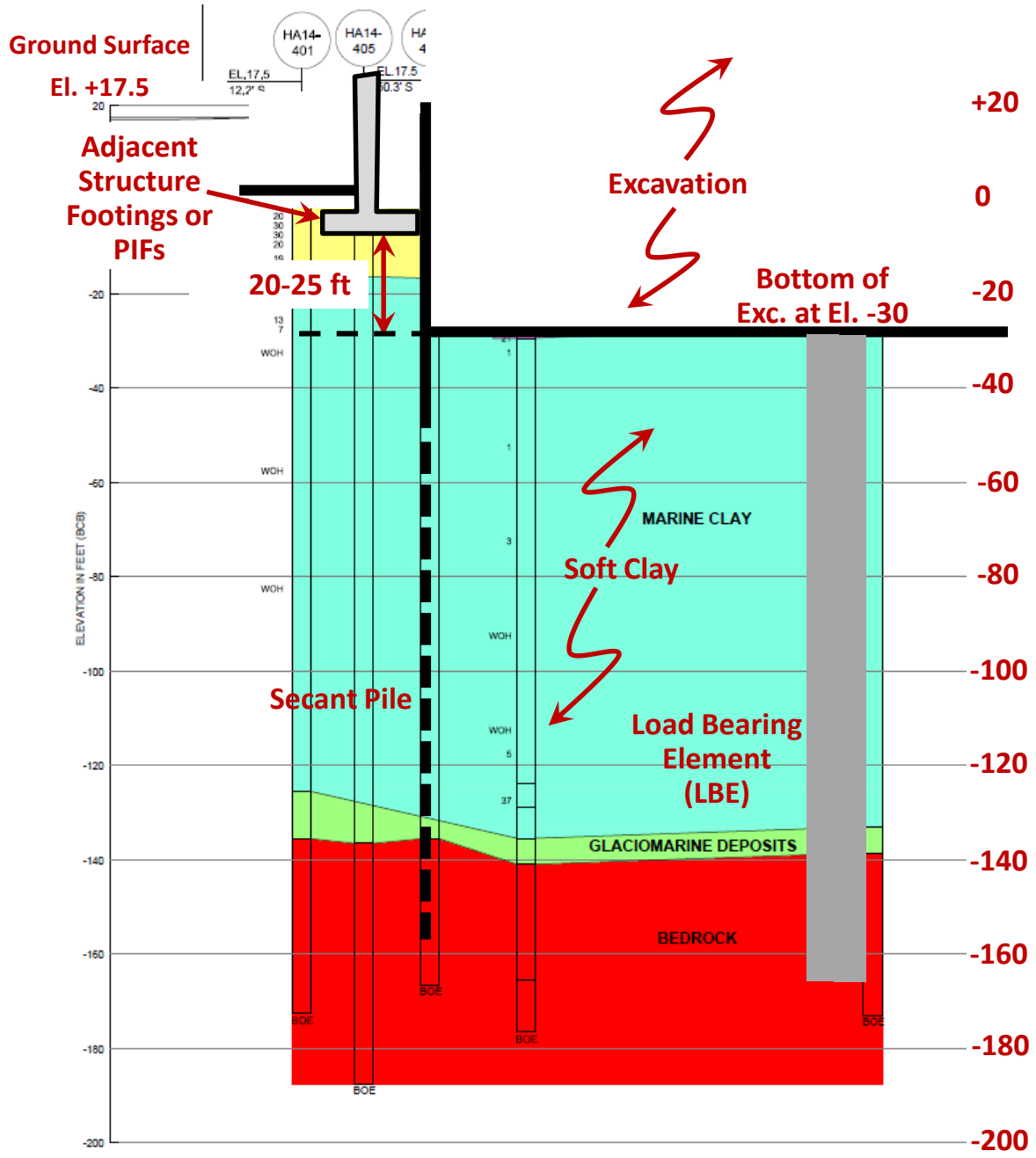
Excavation

- As deep as 48 ft below ground surface
- Bottom of excavation in soft clay

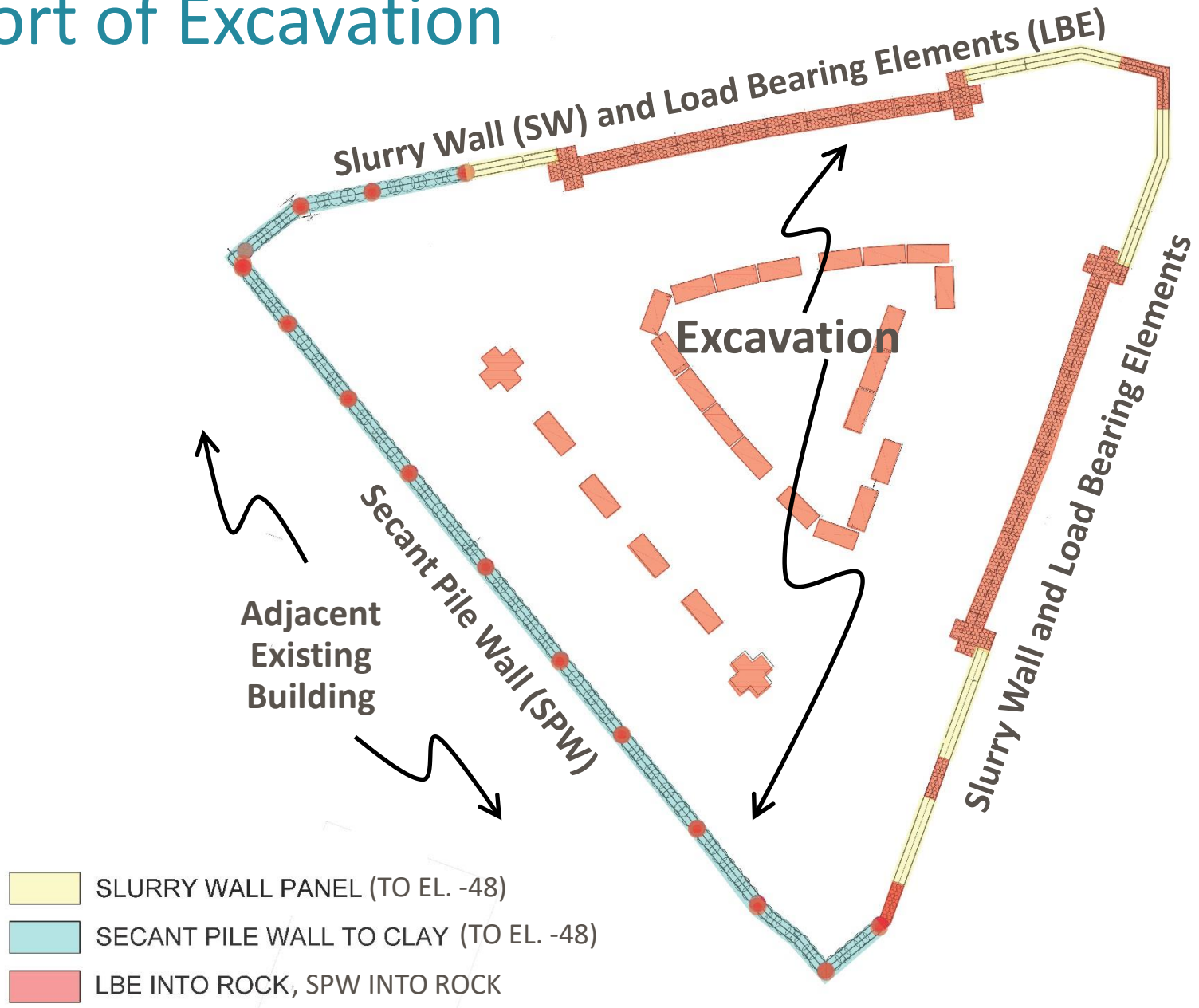


Excavation

- As deep as 48 ft below ground surface
- Bottom of excavation in soft clay
- 20 to 25 ft below adjacent structure foundations



Support of Excavation



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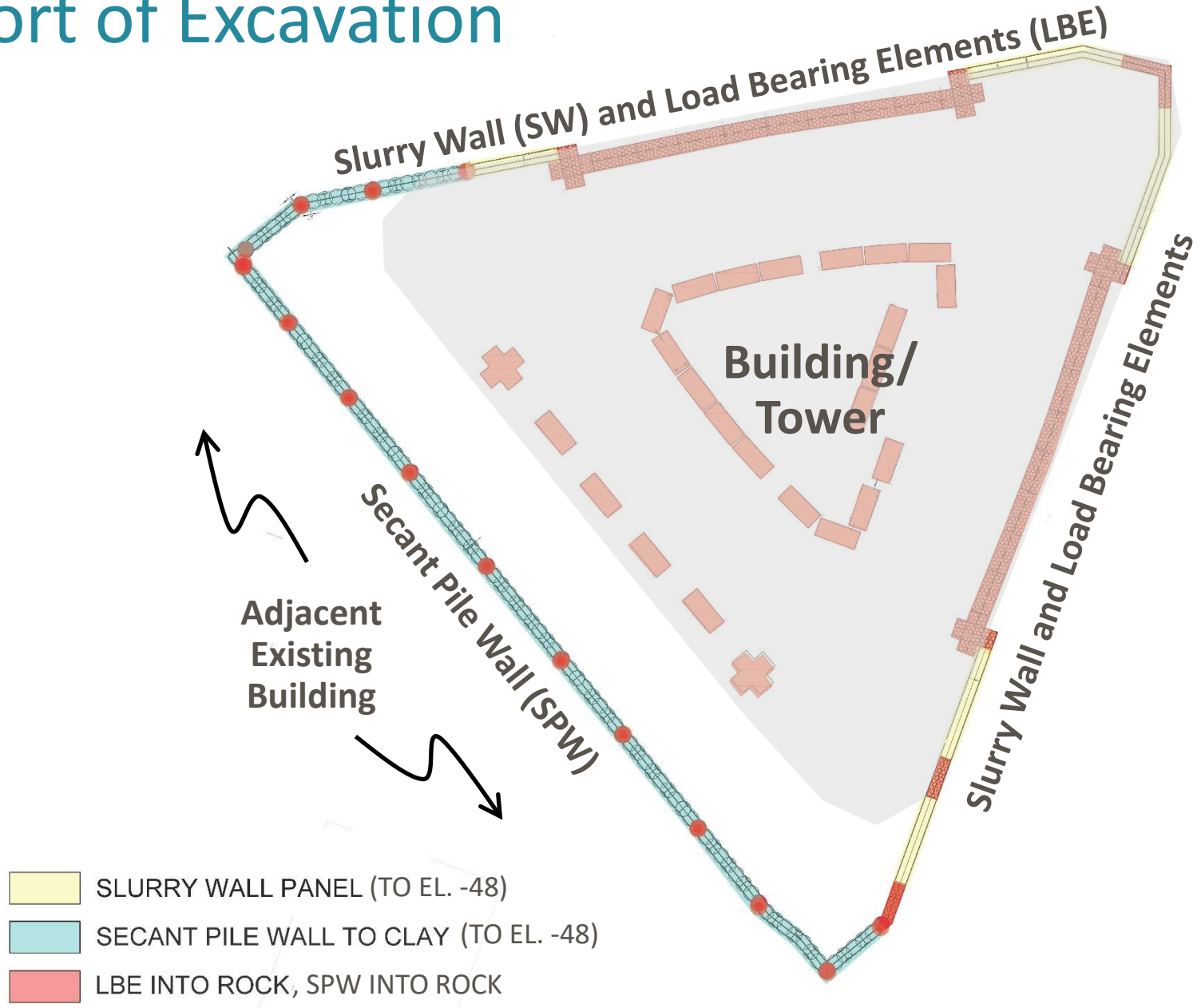
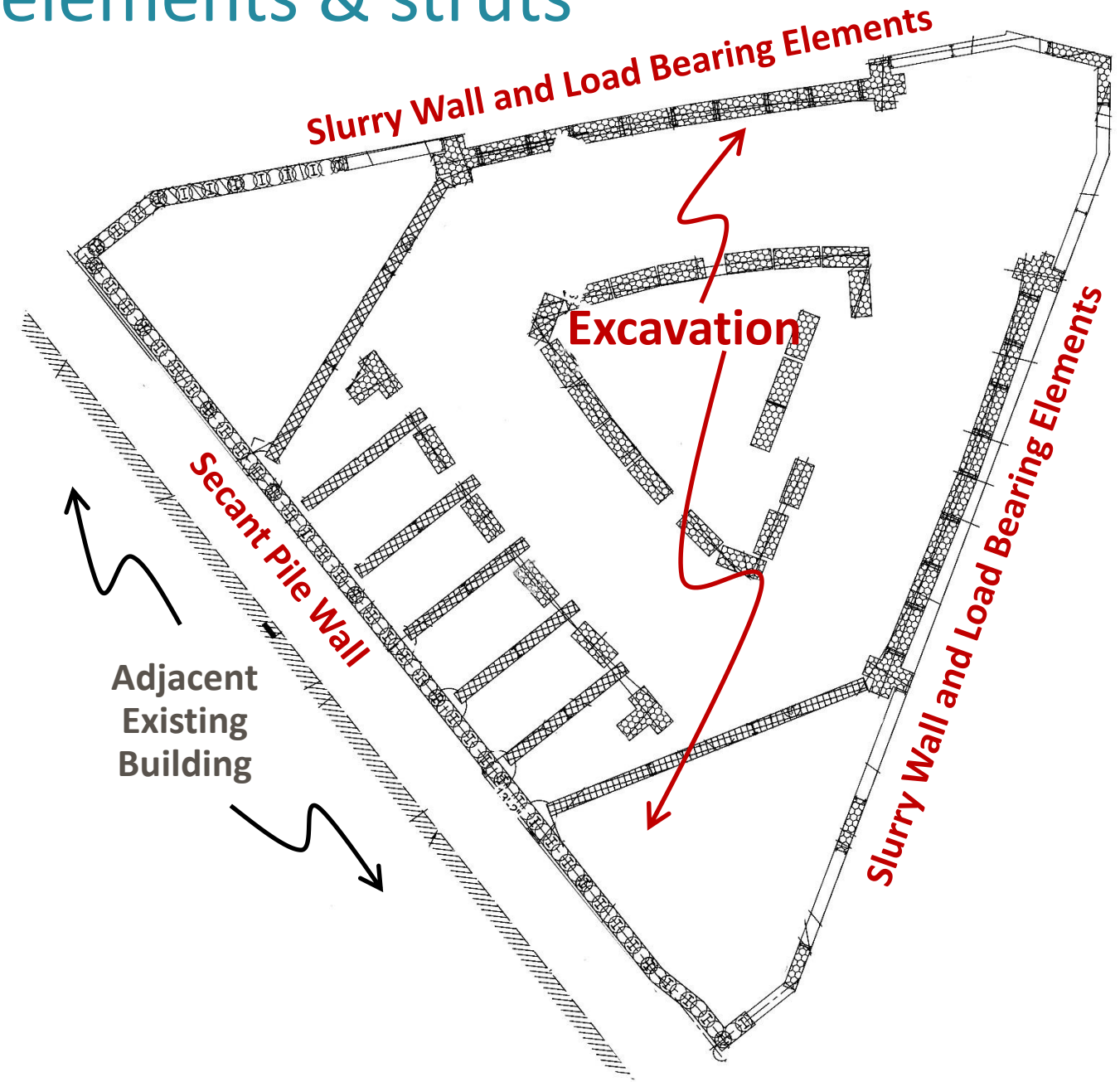


Support of Excavation

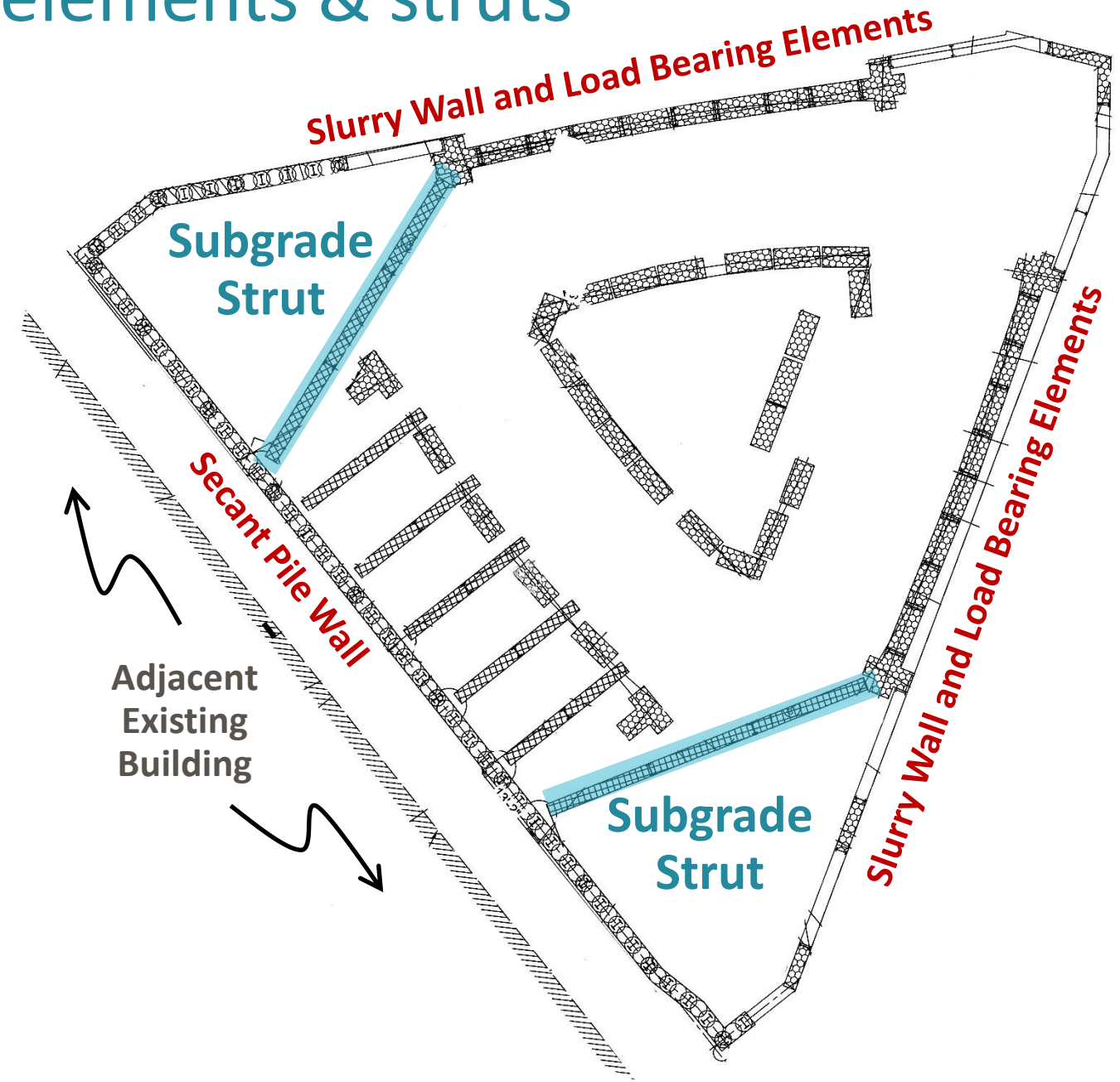
- The analysis for 3 bracing levels predicted ~1.7 in. lateral deflection along SPW (adjacent to 5-story building)
- Analysis indicated that to control movements, bottom lateral support would be required before excavation
- Solution: subgrade elements and struts

Subgrade elements & struts



Subgrade elements & struts

- Two subgrade struts span from wall to LBE



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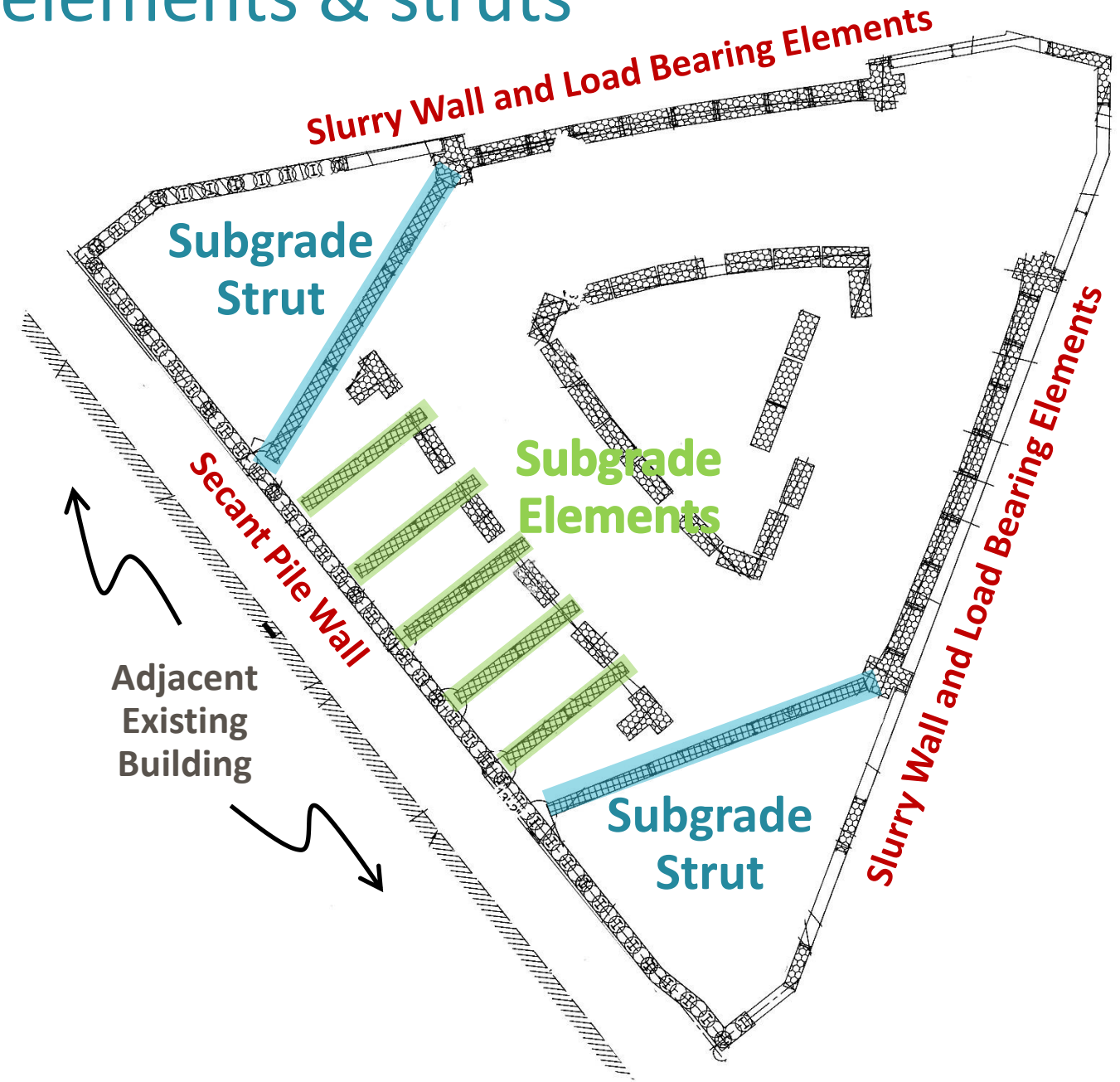

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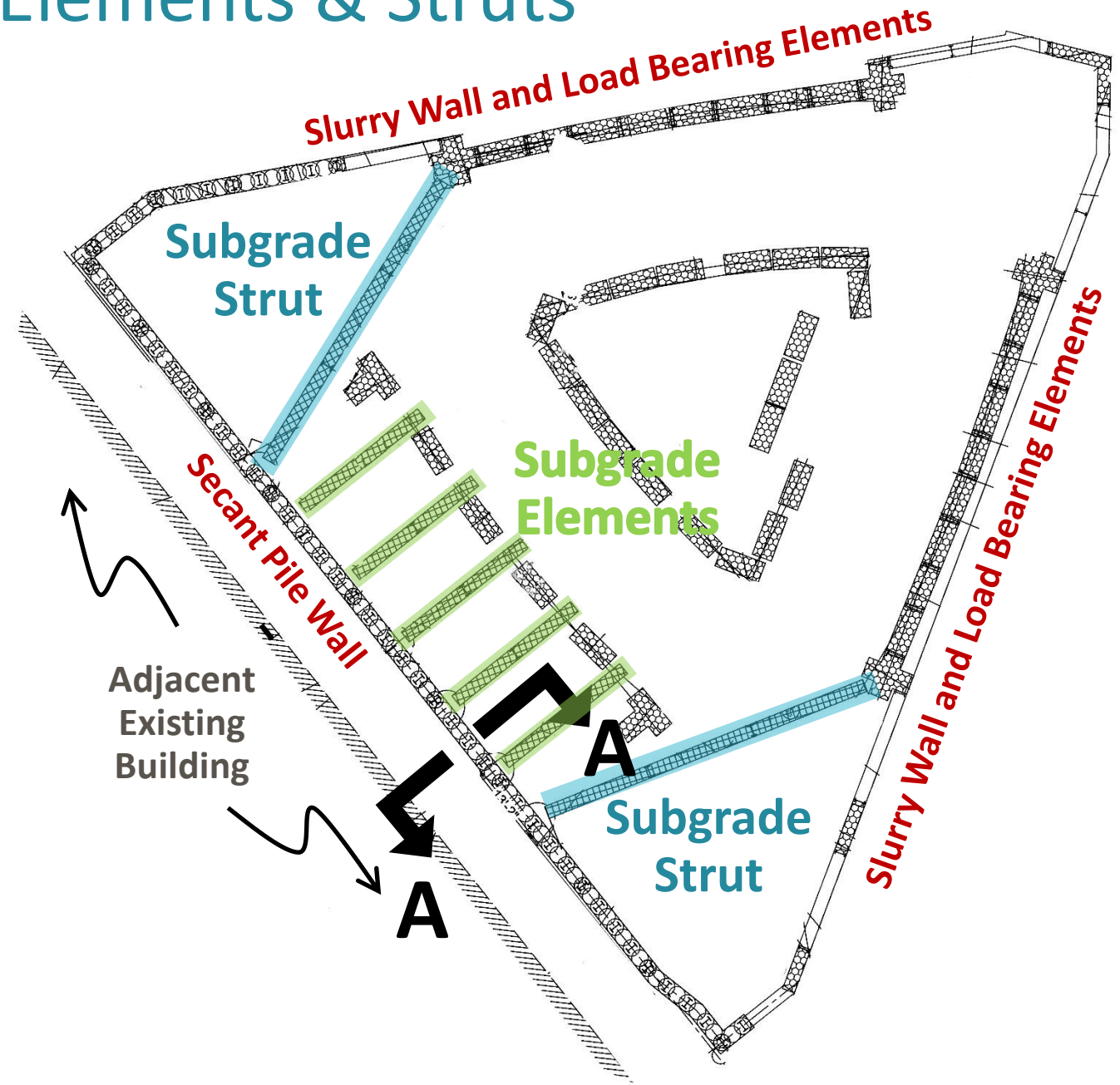
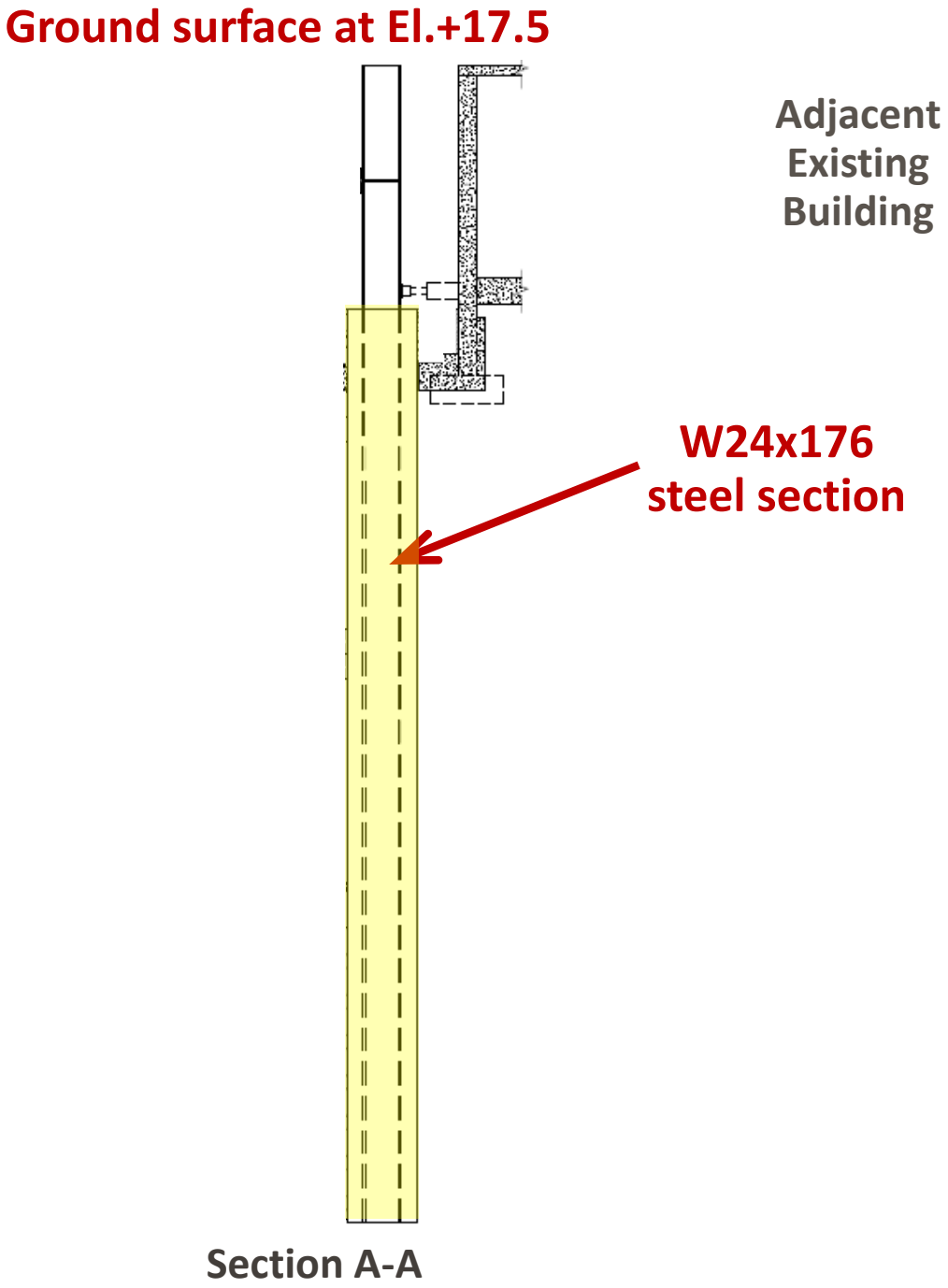


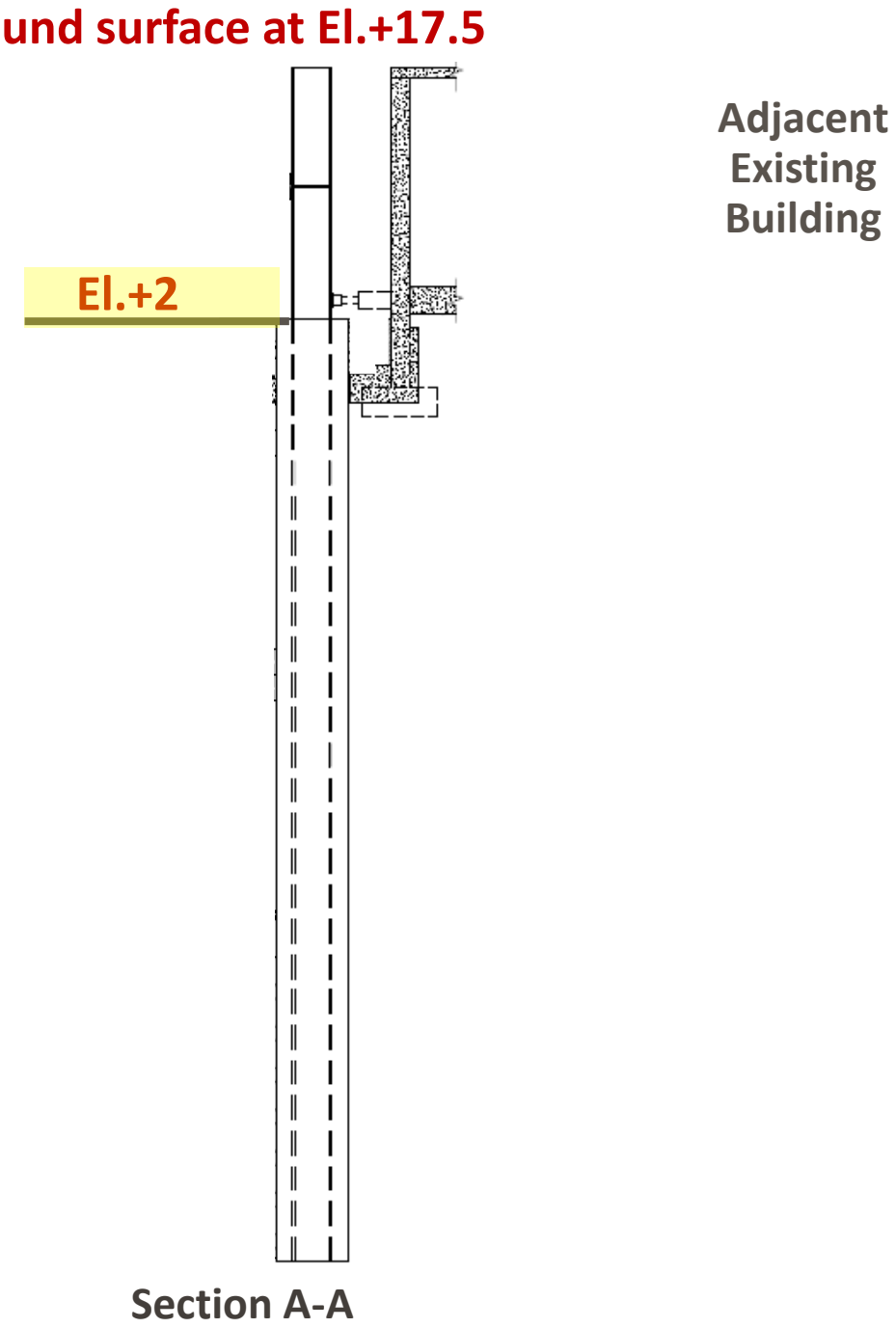
Subgrade elements & struts

- Secant pile wall (SPW) installed



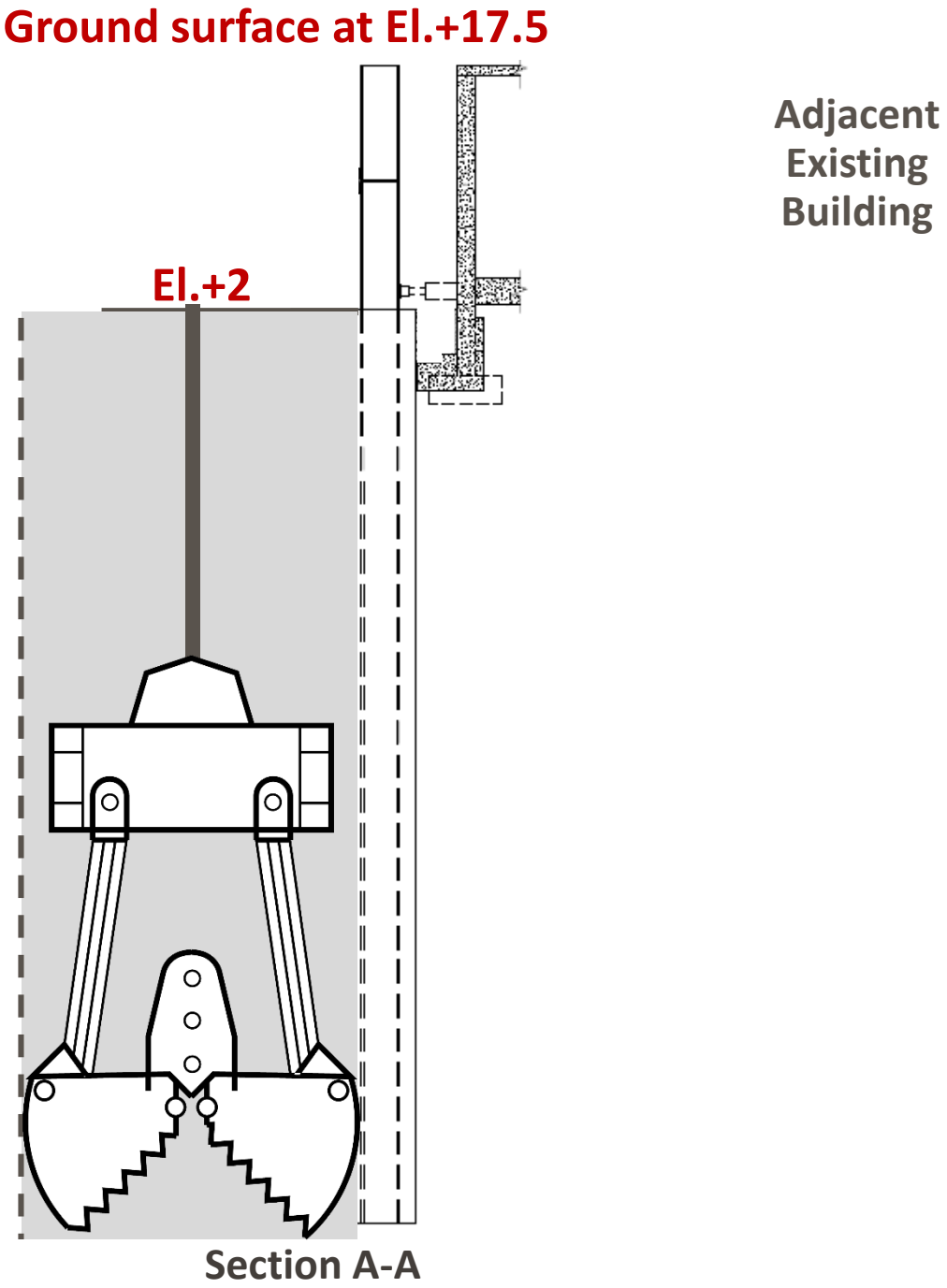
Subgrade elements & struts

- Excavated to ~El.+2



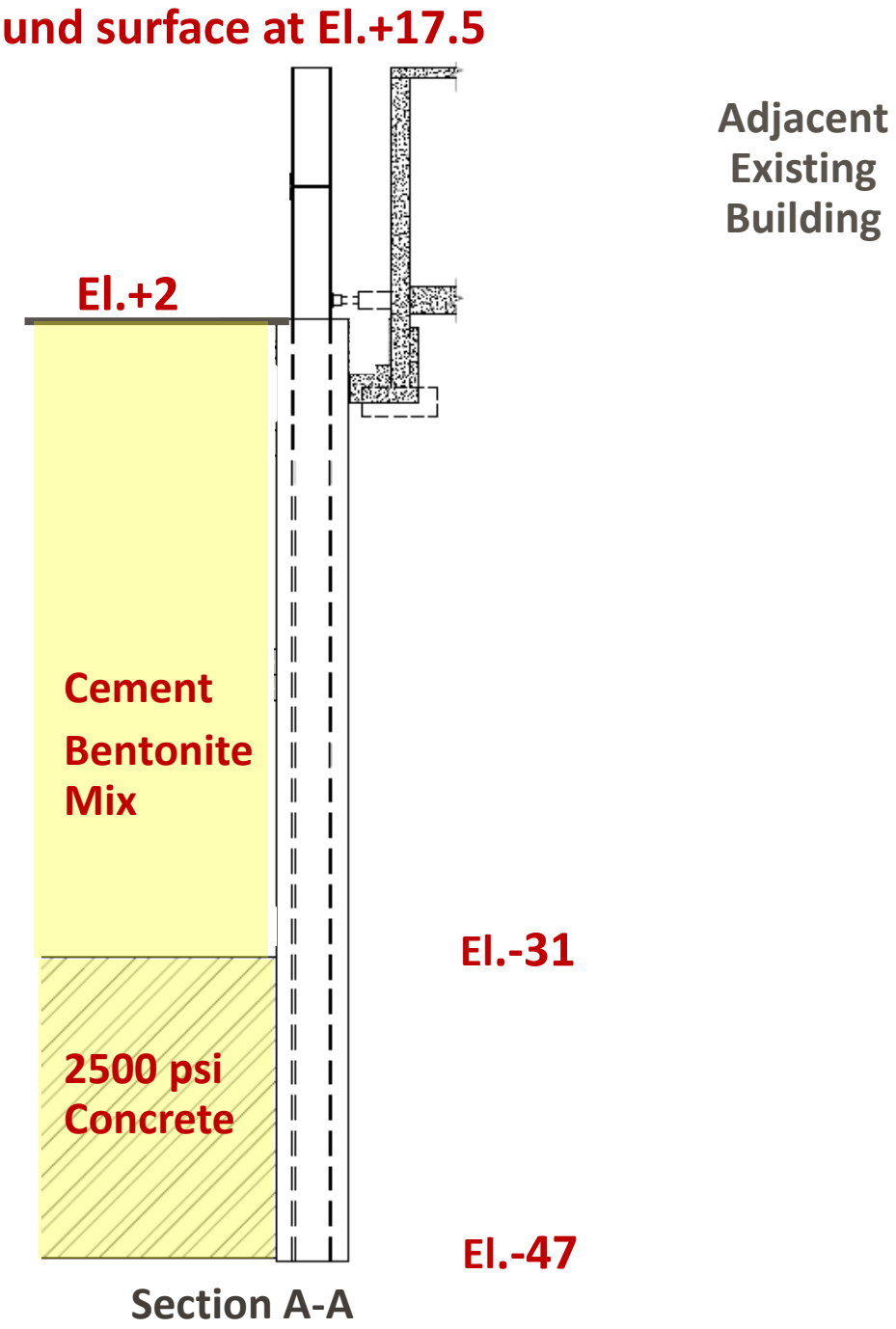
Subgrade elements & struts

- From El.+2, excavate trenches for subgrade elements using clamshell bucket



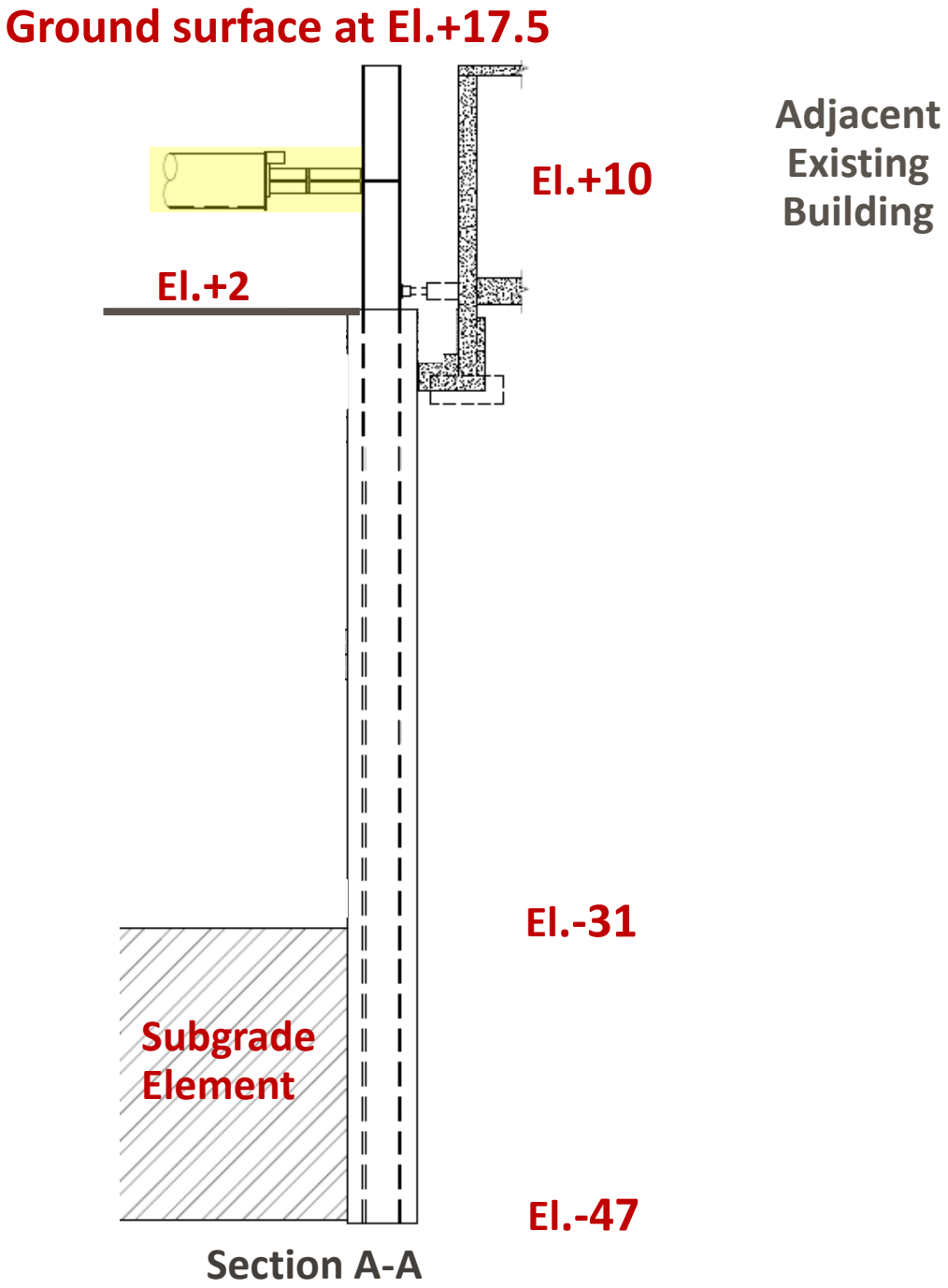
Subgrade elements & struts

- Subgrade elements & struts installed from El.+2
- 2.5 ft wide, top at El.-31, bottom at El.-47 (16 ft high), 2500 psi concrete
- Cement bentonite above El. -31



Subgrade elements & struts

- Excavation sequence with installation of internal bracing



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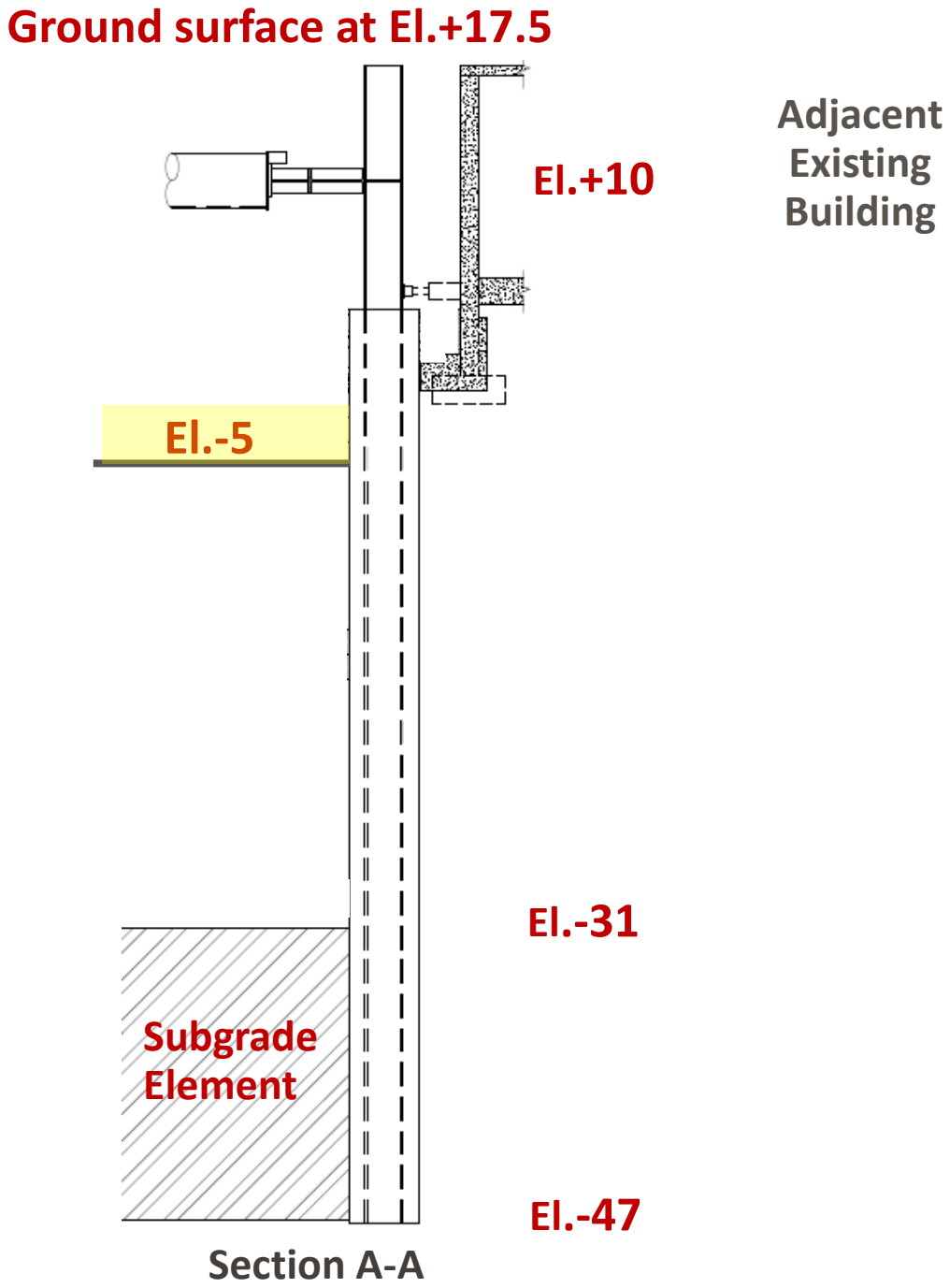

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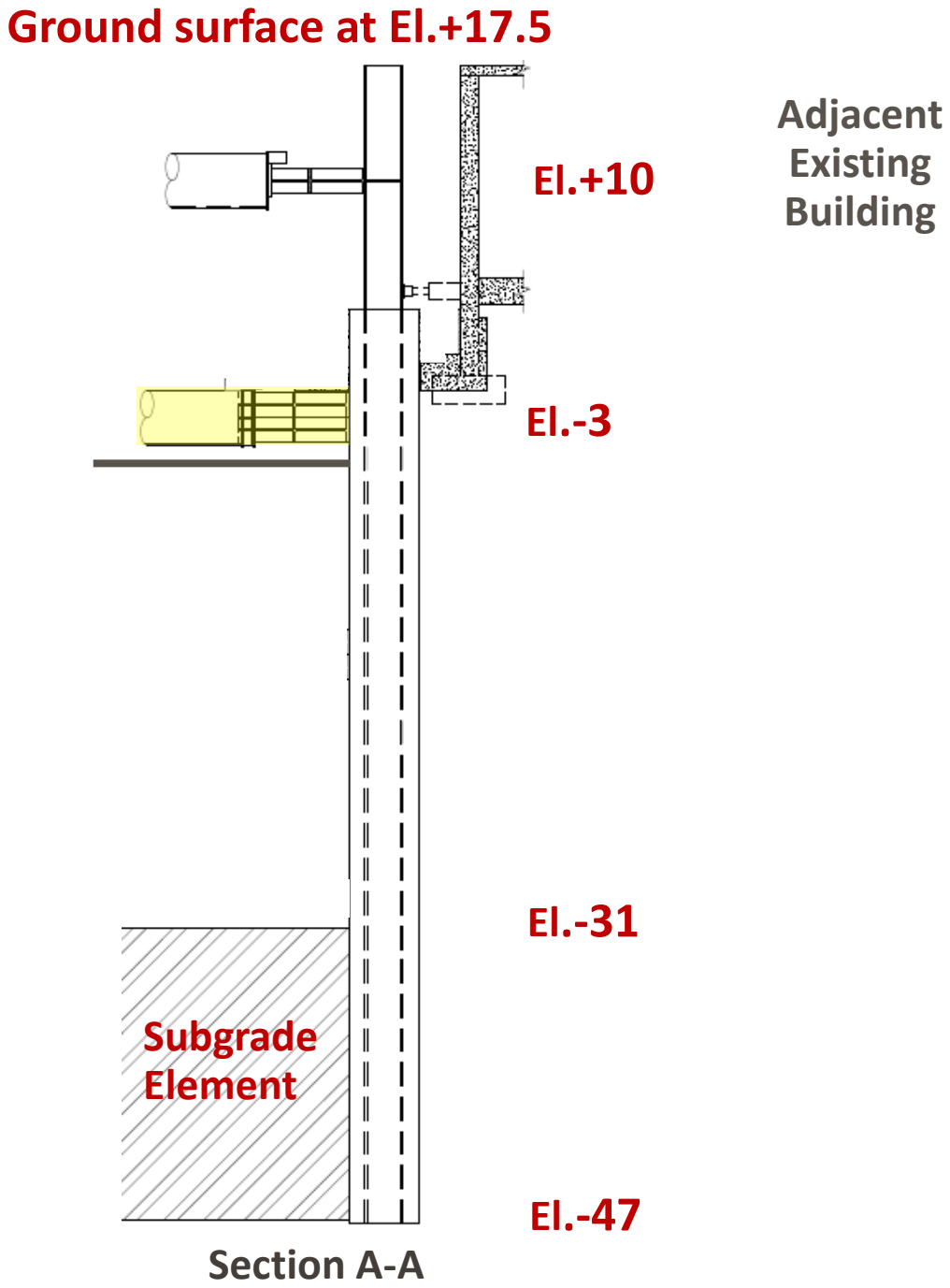

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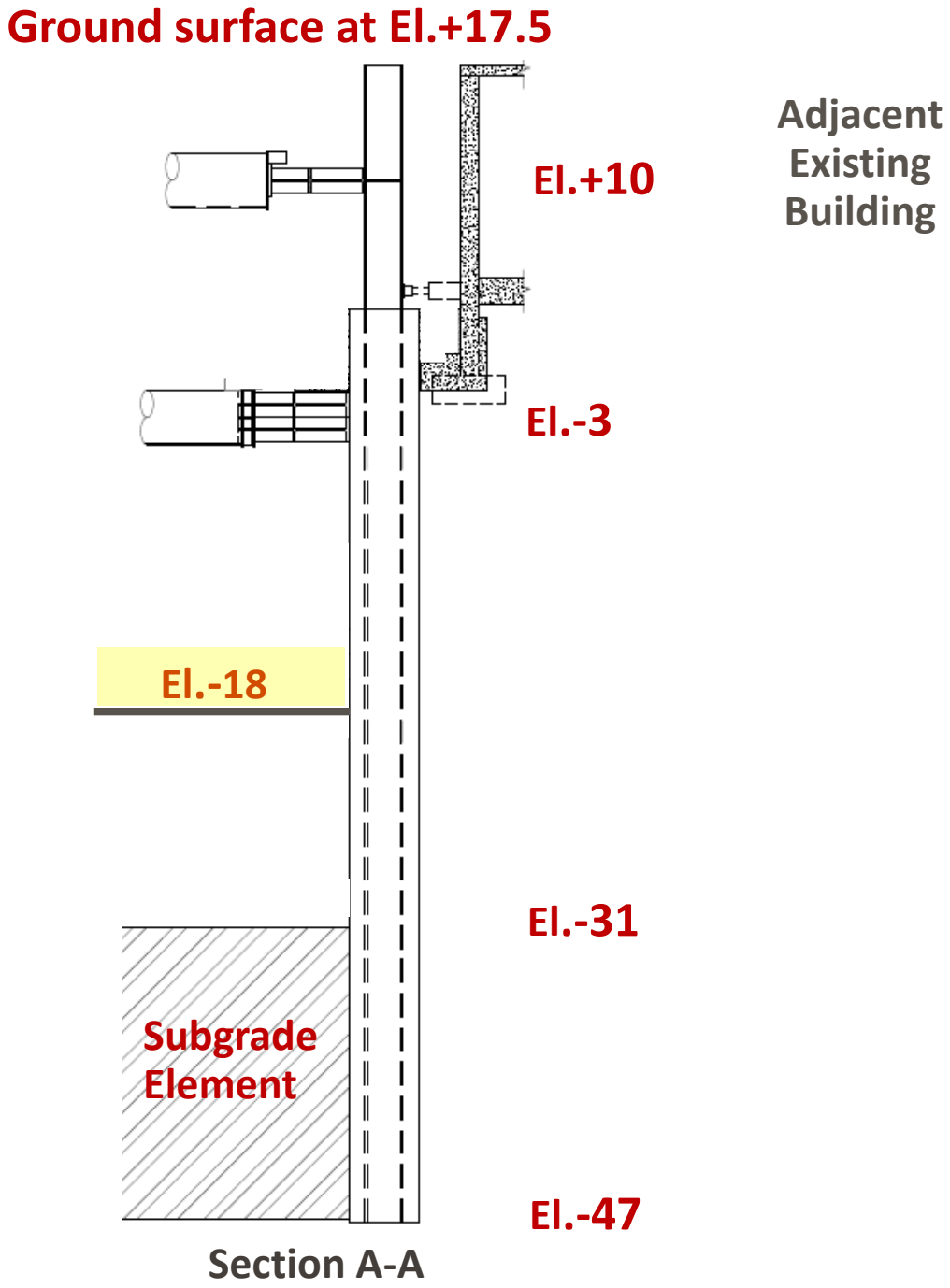

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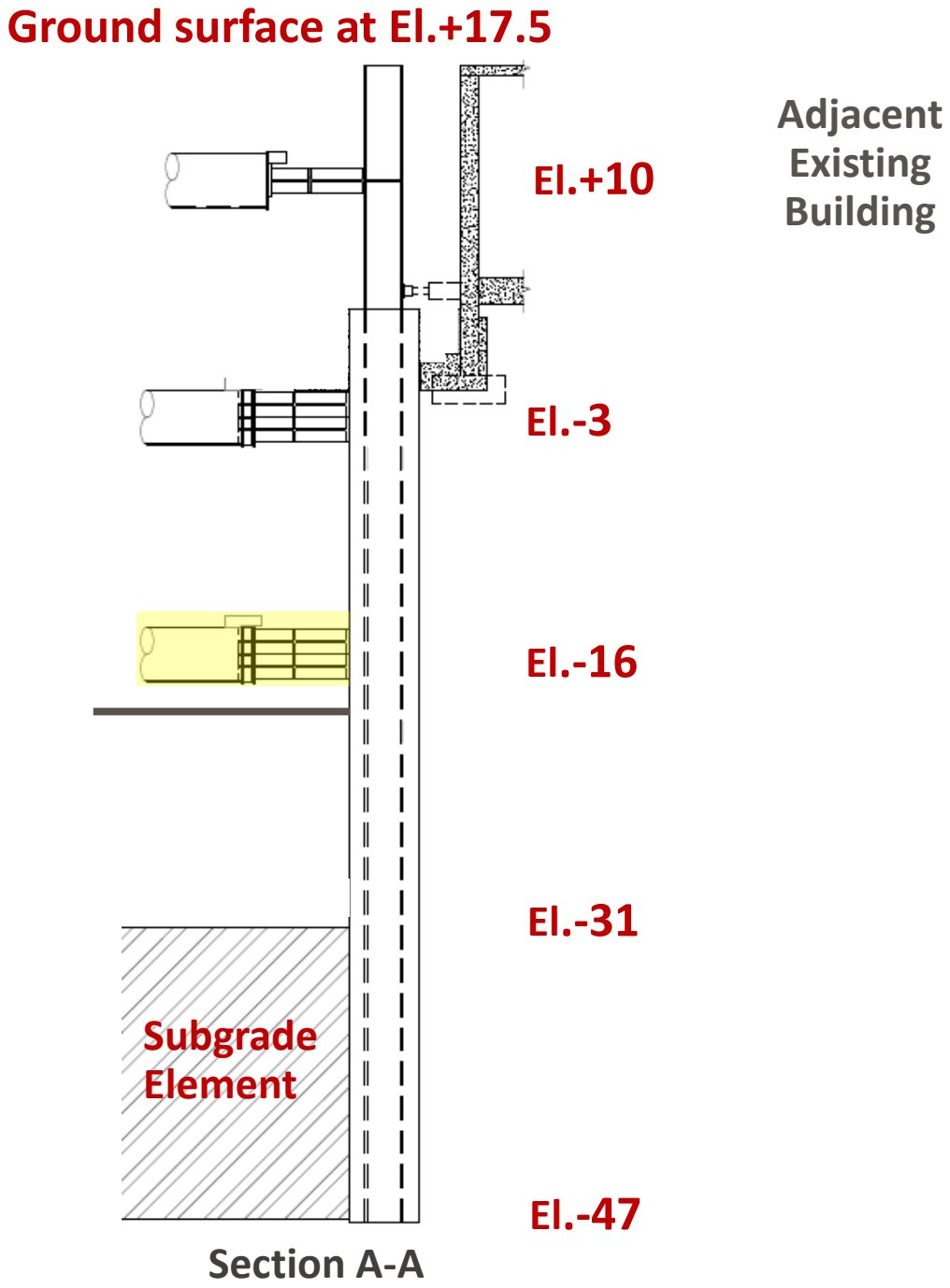

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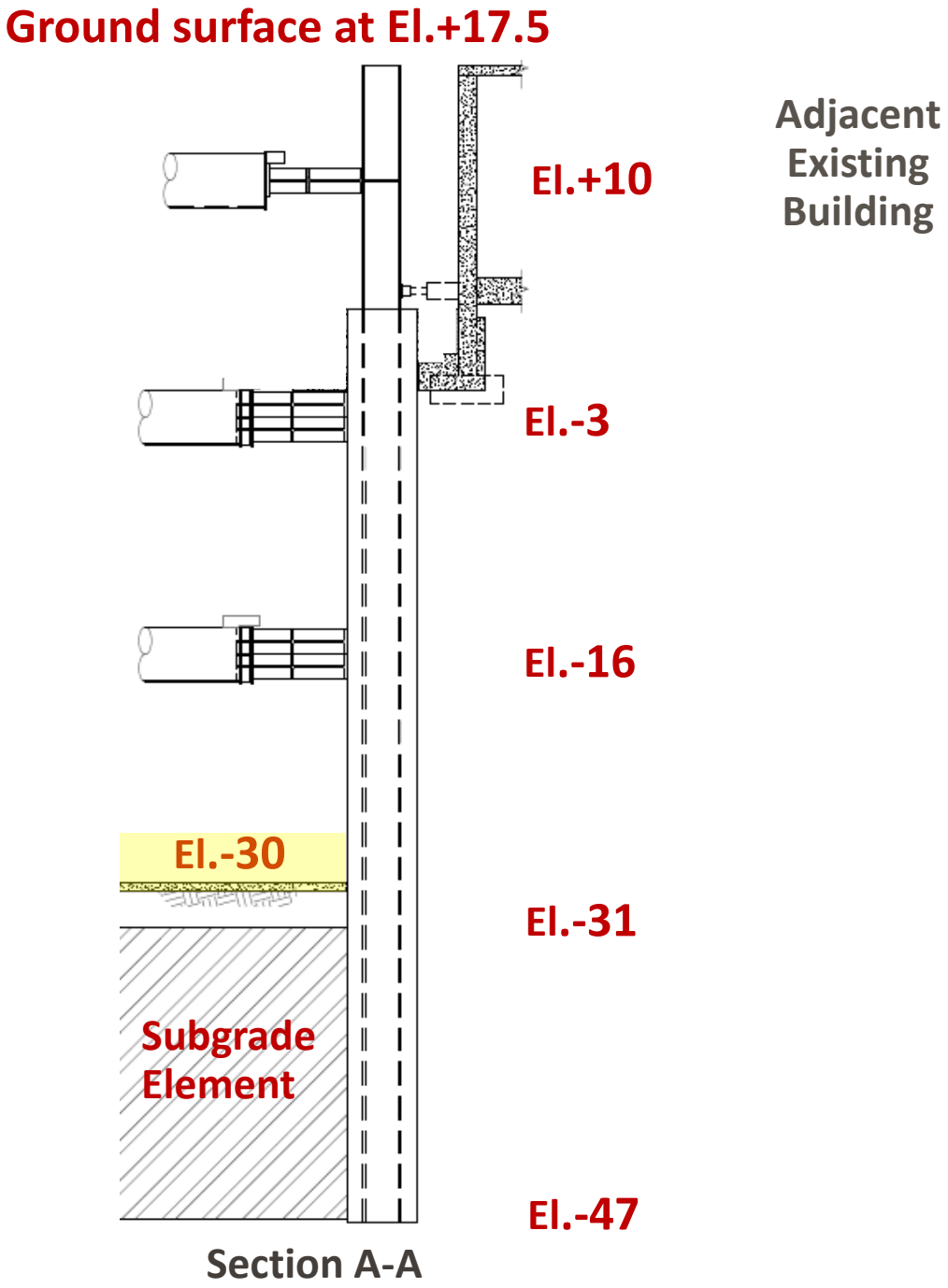
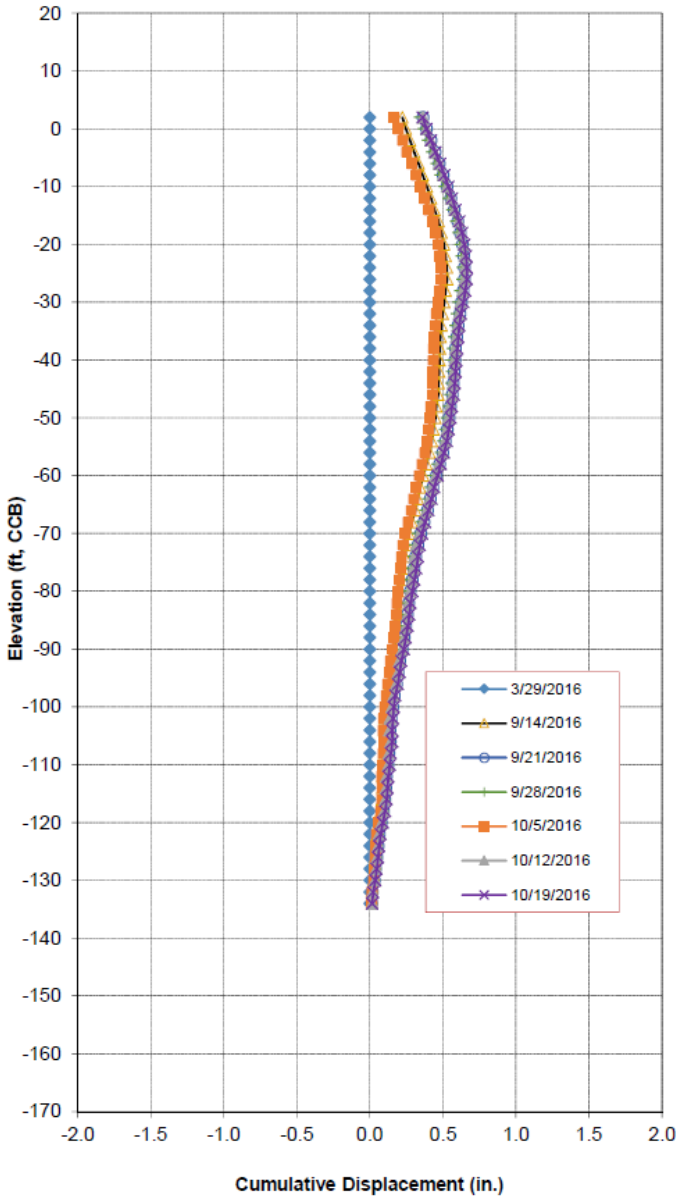
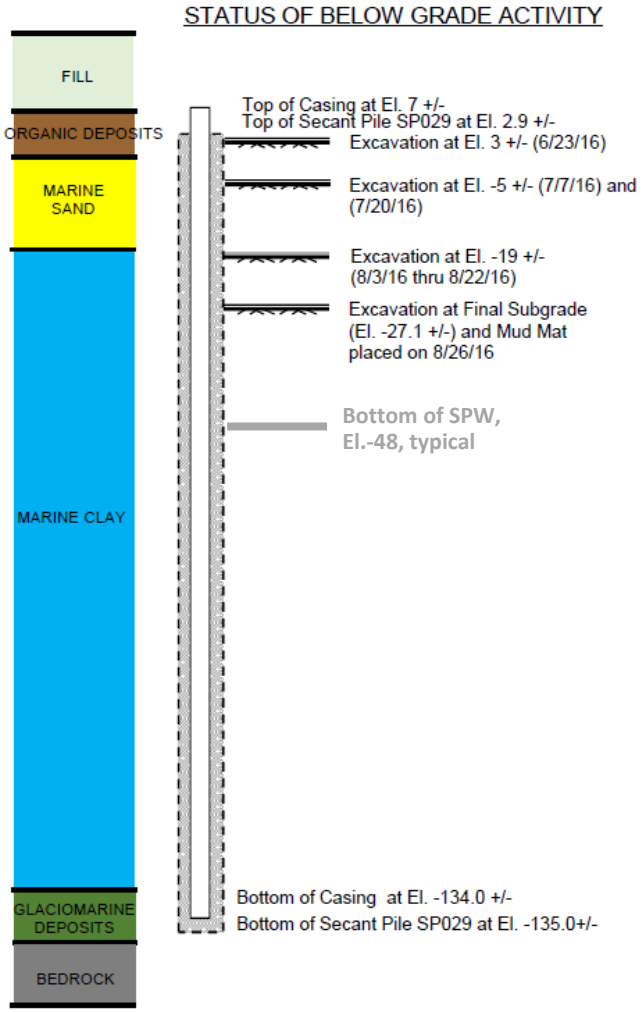


Wall lateral deflection – at end of excavation

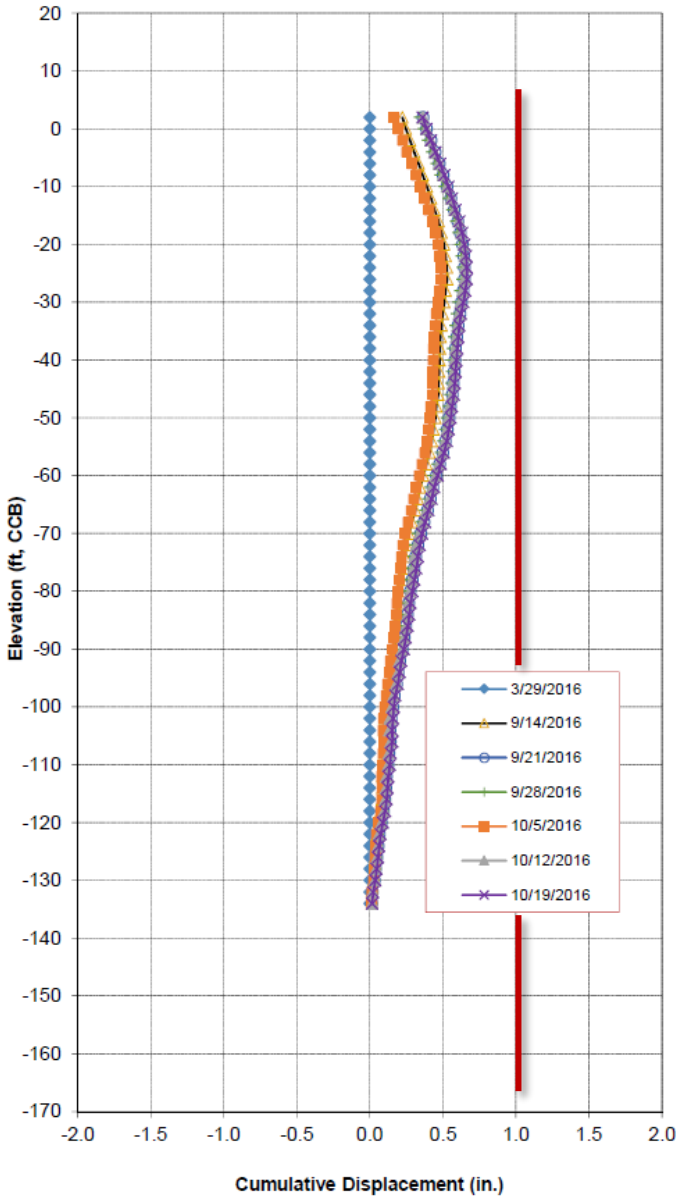
- Deflection profile at Secant Pile Wall

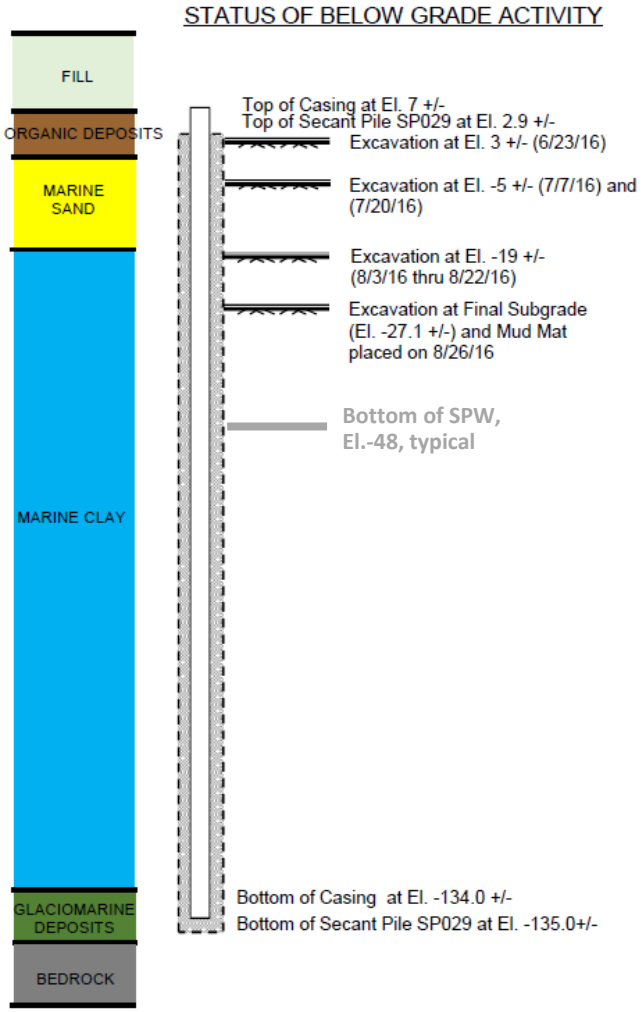




Wall lateral deflection – at end of excavation

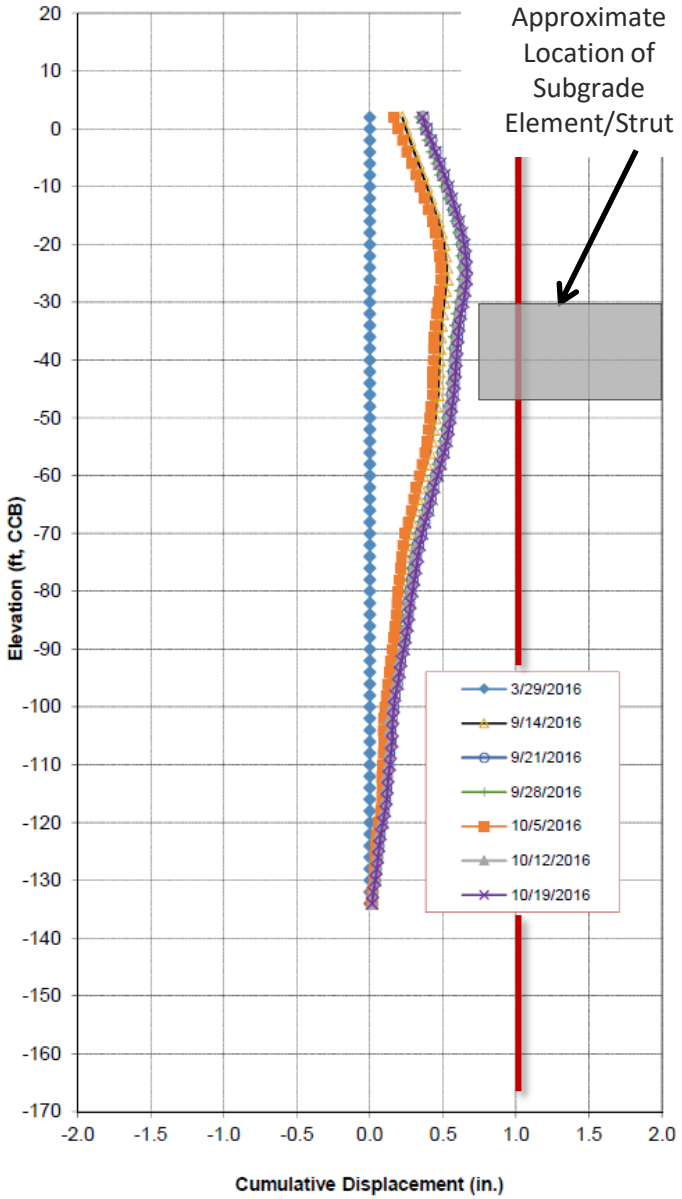
- Deflection profile at Secant Pile Wall
- Less than 1 inch lateral deflection

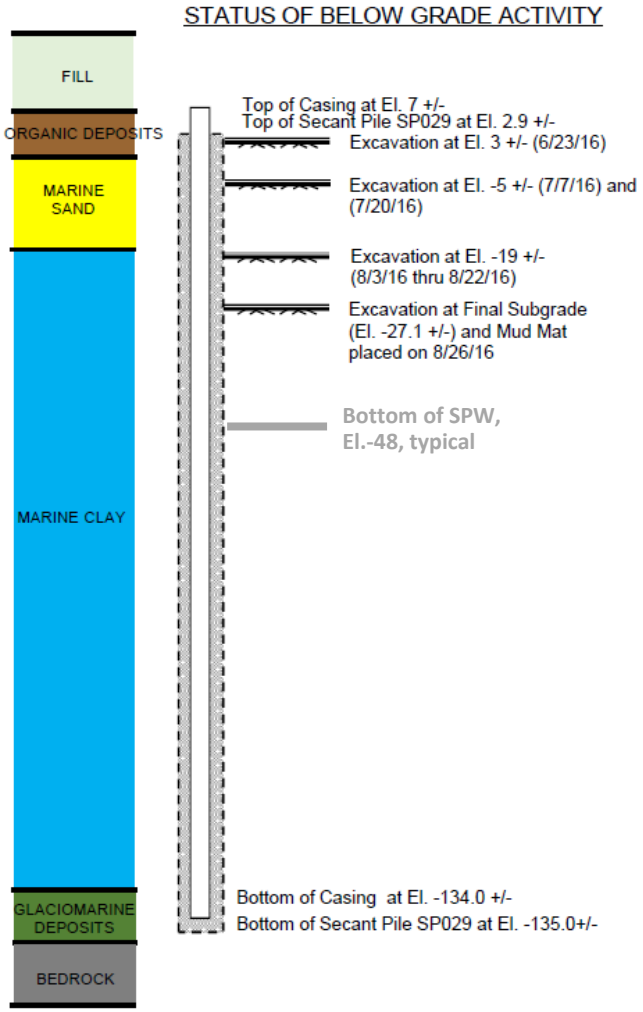




Wall lateral deflection – at end of excavation

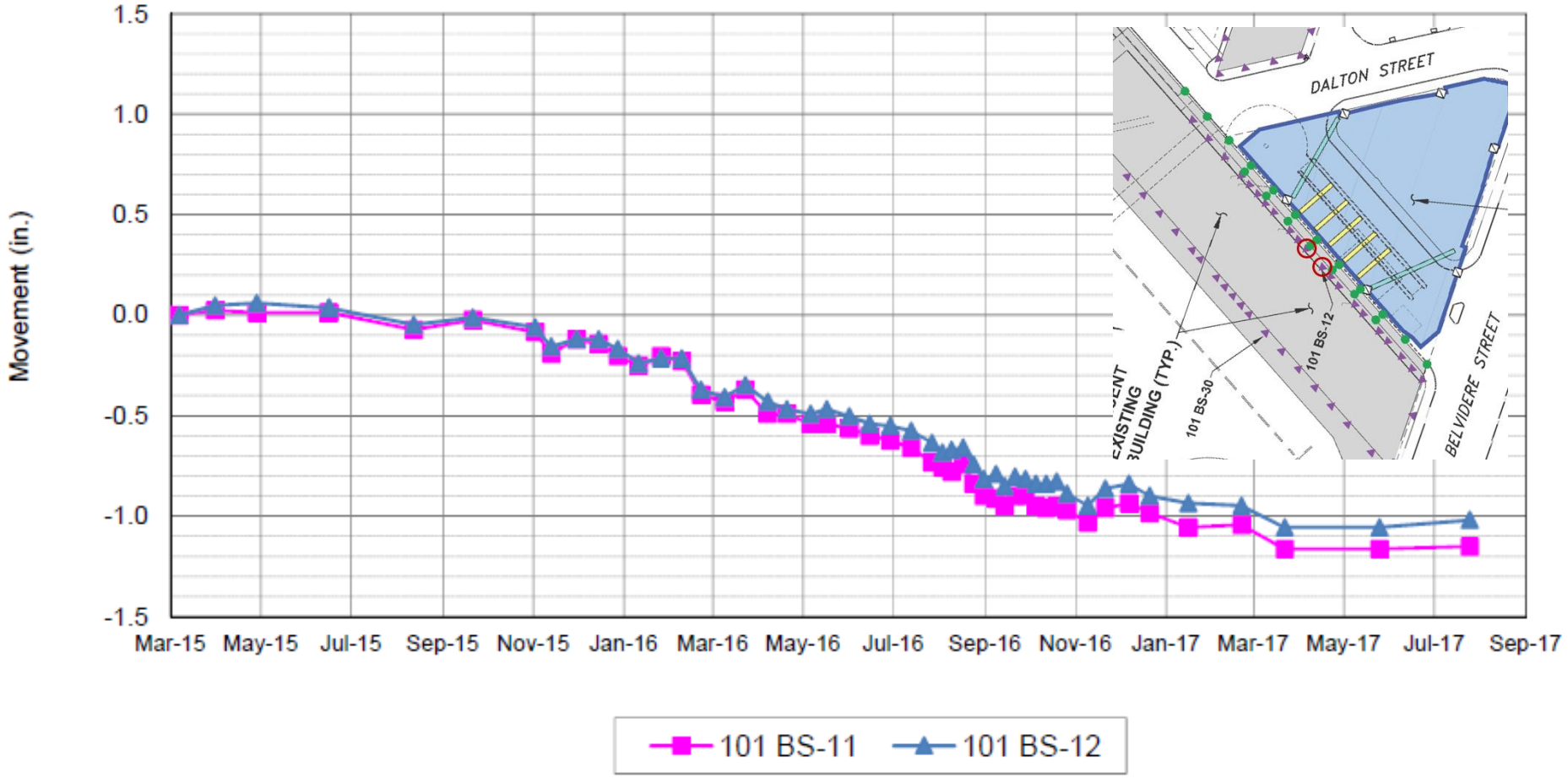
- Deflection profile at Secant Pile Wall
- Less than 1 inch lateral deflection
- Effect of subgrade element/ strut is apparent





Adjacent structure vertical movement

- Survey points on adjacent structure
- Movement monitored during construction



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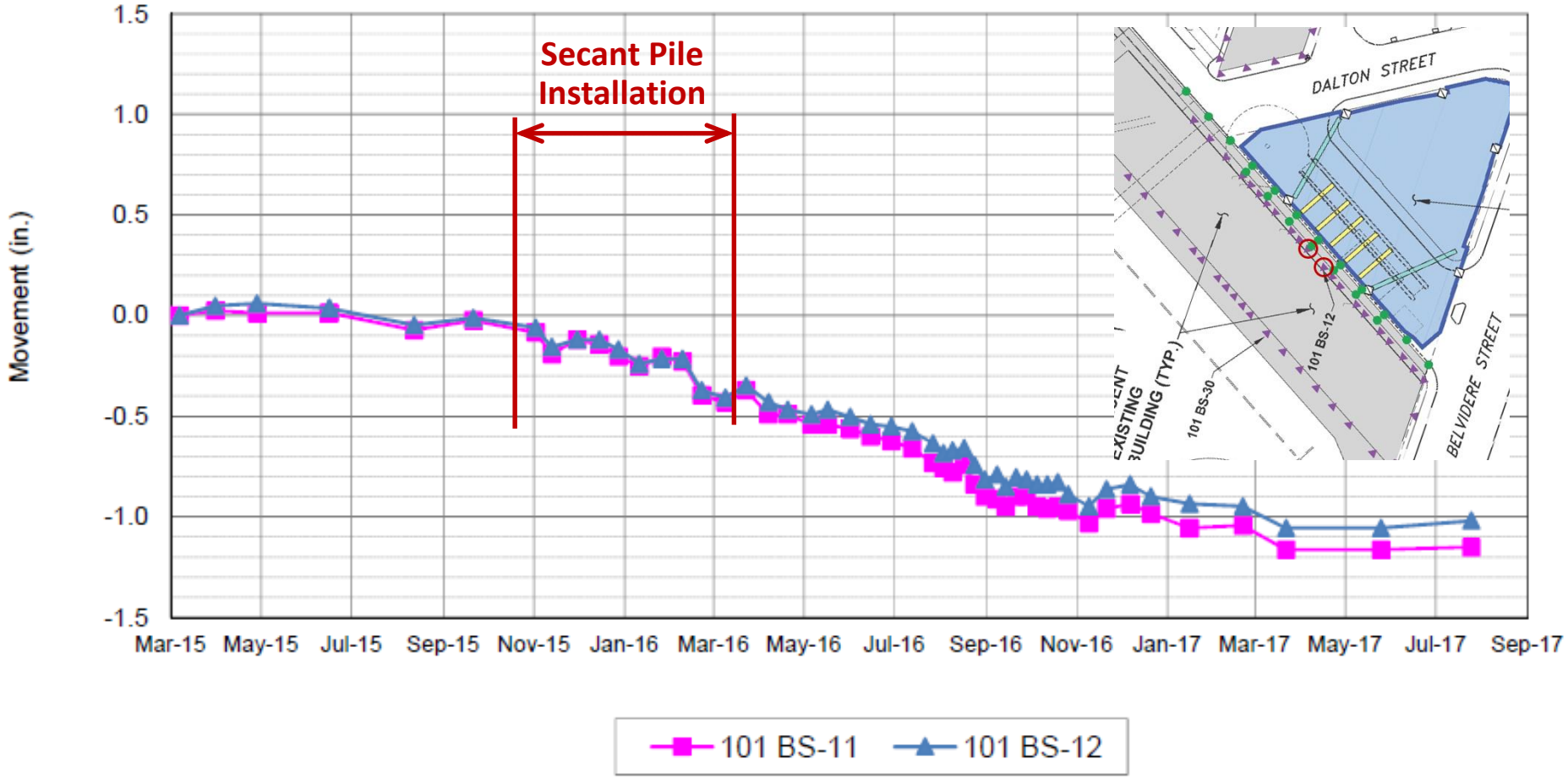

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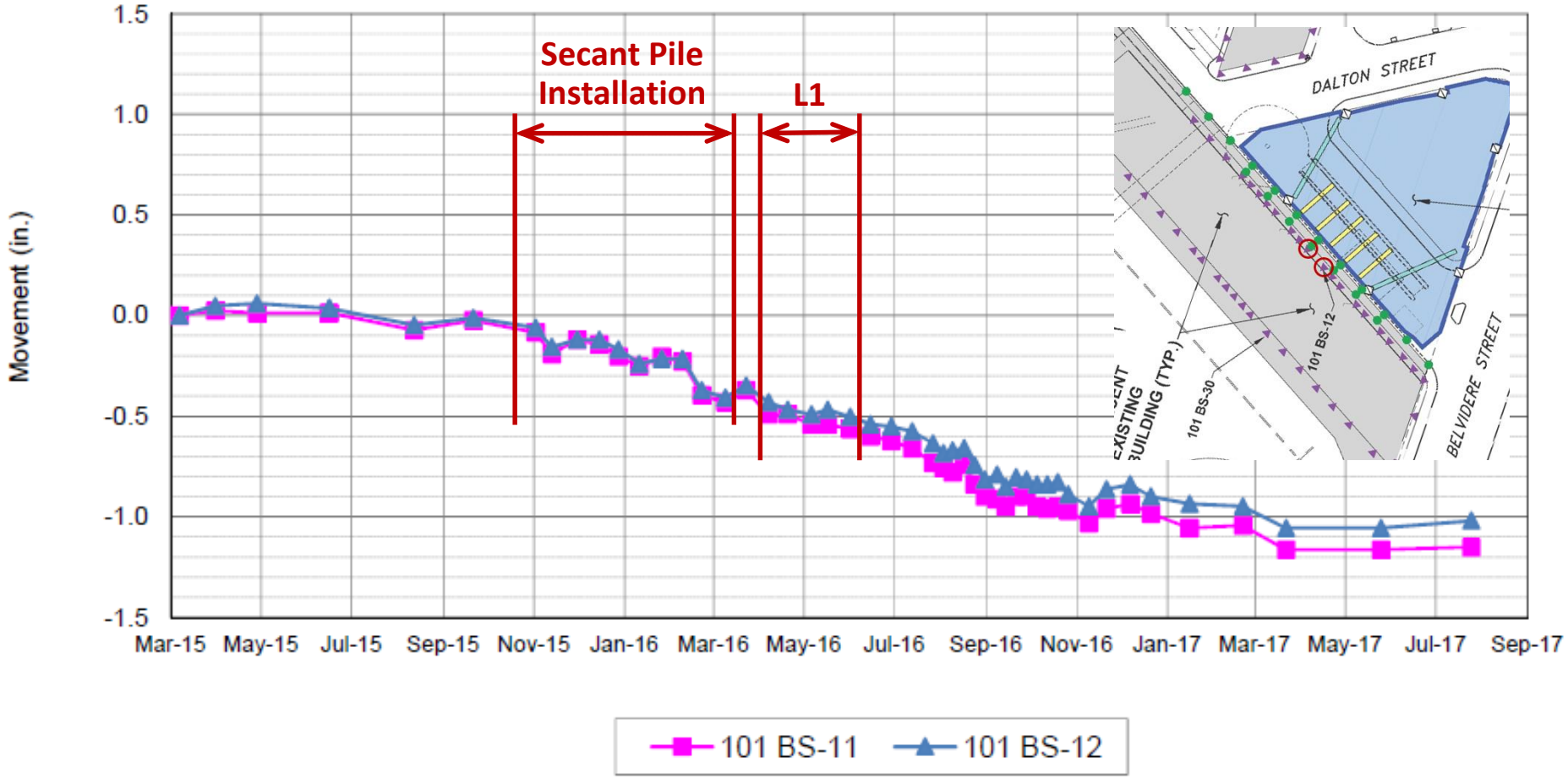

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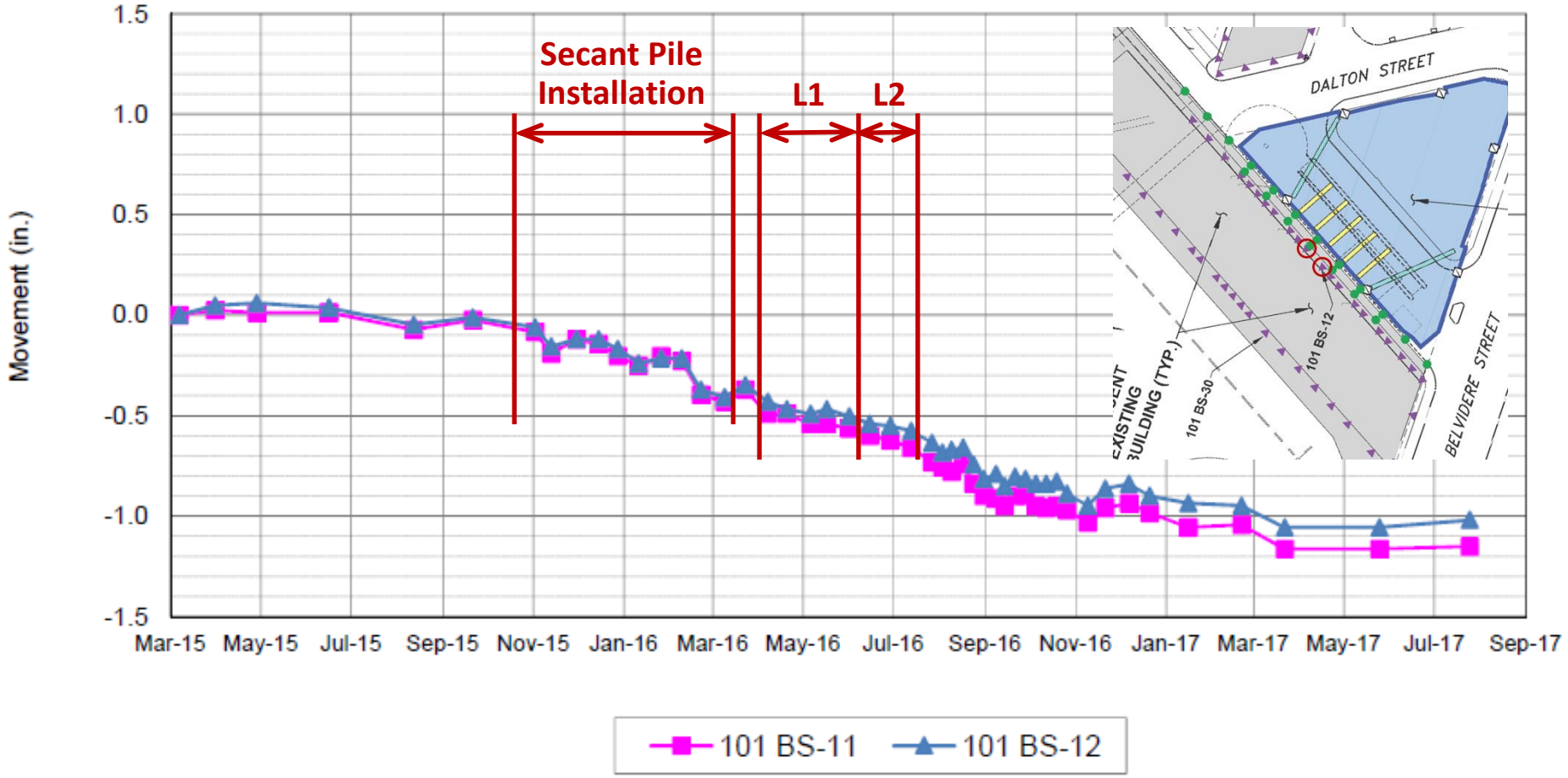

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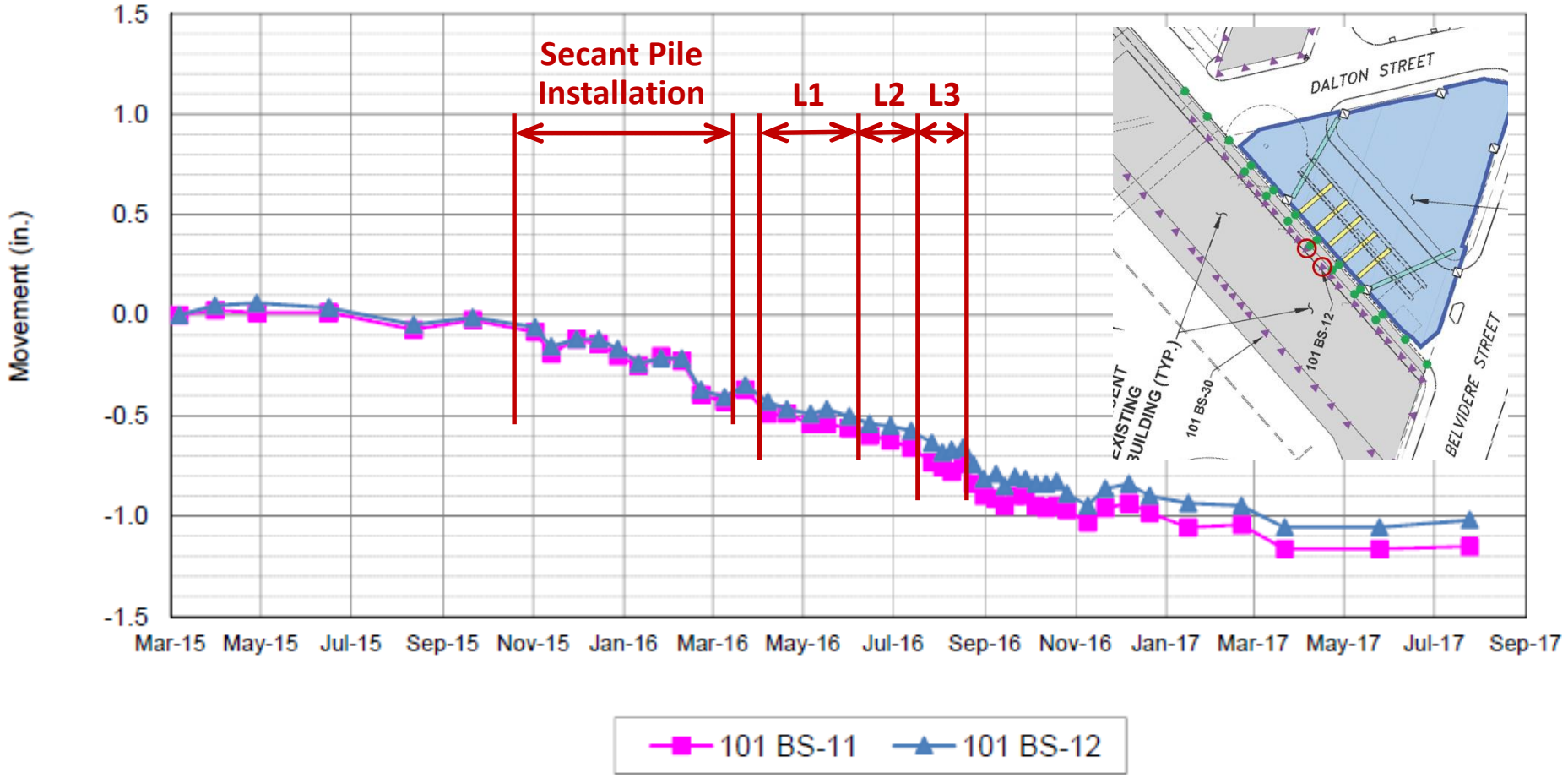

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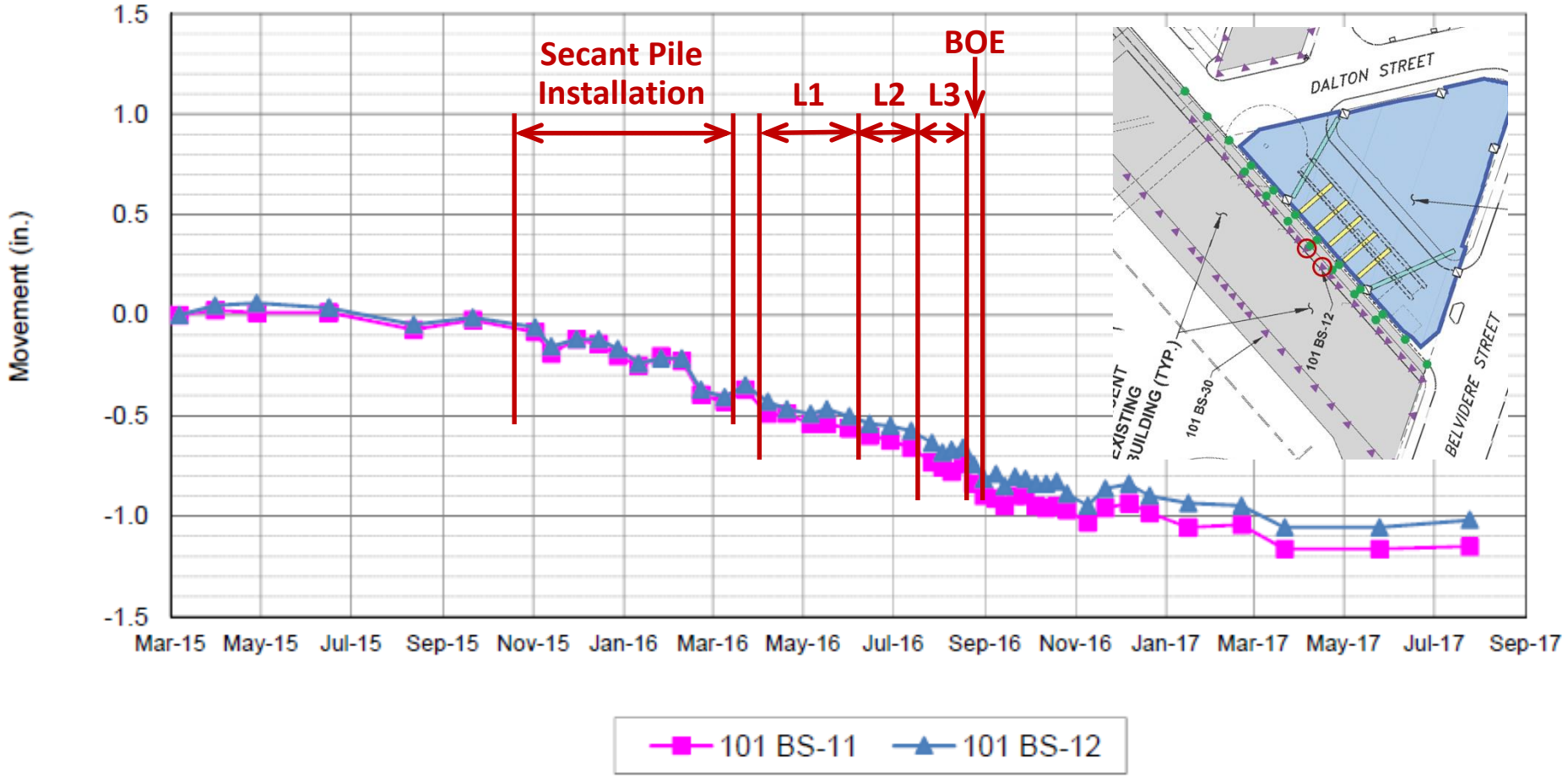

Conclusions

- Excavating through clay crust increases risk of excessive movement
- To control movement, subgrade elements and struts installed before excavation
- Roughly 50% of measured movement occurred during installation of SPW (difficult to predict)
- Owner and Design Team chose to be proactive to mitigate movement and reduce risk by constructing subgrade elements and struts
- Subgrade elements and struts were effective in controlling lateral movement of wall below bottom of excavation and resulting vertical movement of adjacent structure

Thank you…

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Questions?

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