

UNIVERSITY OF PENNSYLVANIA GEORGE A. WEISS PAVILION AT FRANKLIN FIELD



PRESENTED BY:
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PEIRCE ENGINEERING, INC.



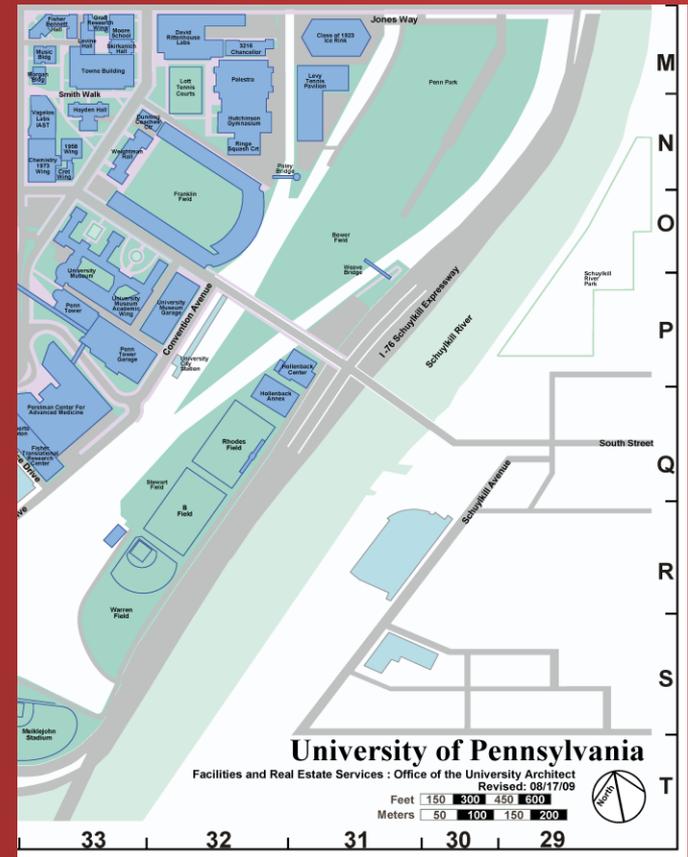
PROJECT INFORMATION



- Excavation/Shoring Contractor: JPC Group, Inc.
- Geotechnical Engineer: Geotech, Inc.
- Exc. Support/Retaining Wall Engineer: Peirce Engineering, Inc.

PROJECT LOCATION

- 33rd and South Sts.
- North side of stadium (parking lot entrance)
- Formerly Marston St.

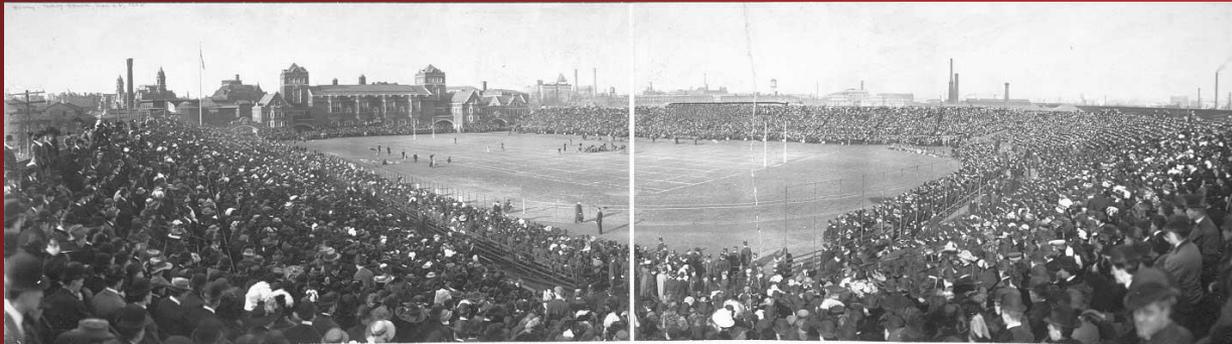


HISTORY OF FRANKLIN FIELD

- Existing brick structure was constructed in 2 phases
 - Lower stands, 1922
 - Upper stands, 1925
- Original cost \$100,000 in 1895 (equivalent to \$2.5 million in today's dollars)
- Oldest NCAA Stadium still in use for football
- Seating capacity = 52,000
- Penn Relays
- Past home of the Army/Navy game and EAGLES
- Location of 1st televised football game in 1940



Workmen laying bricks on south wall, circa 1922



Army/Navy Game, 1908

EXISTING CONDITIONS



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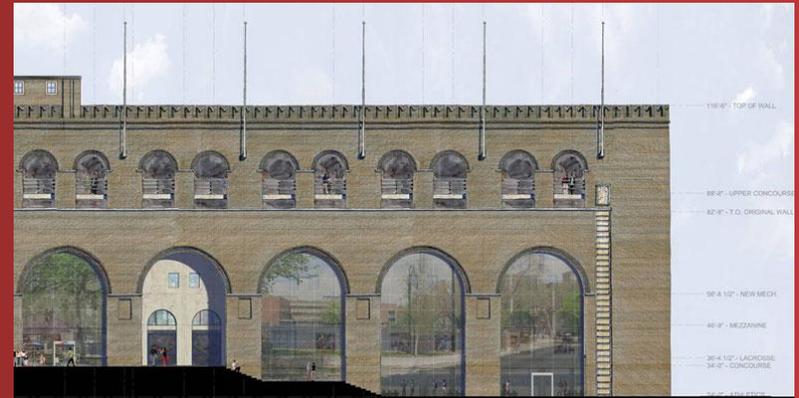
- North access road to parking lot



PROPOSED WEISS PAVILION



- Infill northern facade and concourse of Franklin Field
- 2 story, 22,500 SF facility
- Weight Training and Fitness Center and retail outlet space
- \$26.9 million dollars
- Exterior pedestrian promenade
- "Penn Connects" 30 yr. campus development and expansion plan
- Project started February, 2009
- Estimated completion late 2009



PROJECT CHALLENGES

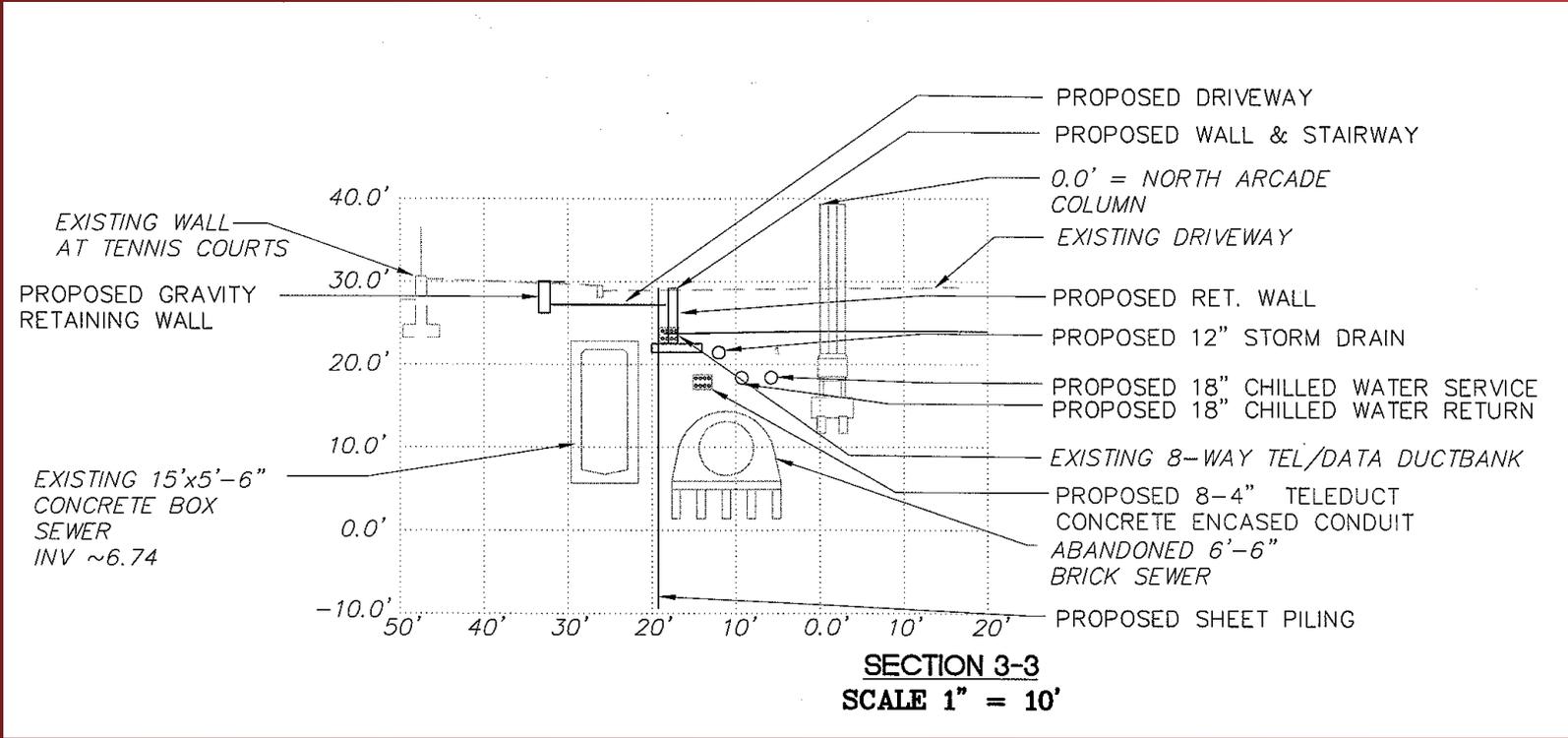
- Long, narrow site with poor construction access
- Poor fill soils (mixed sand silt clay with ash, cinders, wood, glass)
- Existing utilities (15'x5'-6" box sewer and 6'x6' brick arch sewer)
- Excavate 28 ft of fill under and around existing historic structure
- Maintain access for athletes during 2009 Penn Relays using temporary bridges over excavation (by others)
- Existing leaking track and field drainage system
- Concurrent construction operations (demolition, foundation wall micropiles, and overhead concourse structural steel)

PE INC. PROJECT TASKS

- Temporary excavation support
 - North access drive
 - Soldier beam and lagging to support existing utilities and work area
- Temporary lateral bracing of existing columns
 - Concourse ramp removal area
 - Dayton/Richmond wall braces
- Permanent retaining wall under existing structure
 - Under existing, northern, structural concourse slab
 - Around existing pile foundations
 - Soil nail wall with permanent shotcrete facing

NORTH DRIVE TEMPORARY EXCAVATION SUPPORT

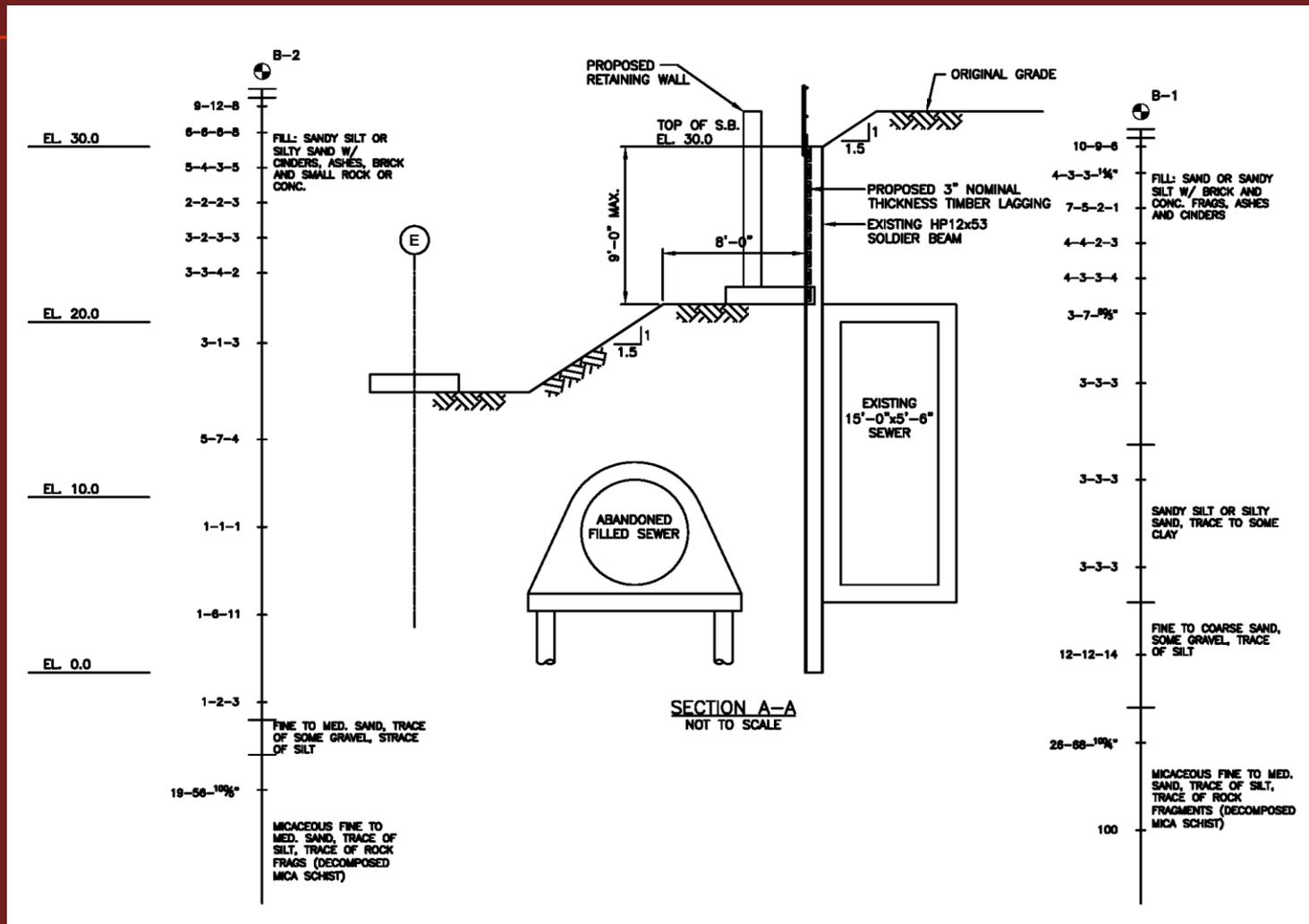
- Typical cross section (looking East)



NORTH DRIVE TEMPORARY EXCAVATION SUPPORT

- Obtained 1985 as-built plans for existing soldier beams at box sewer from previous contractor
- Located existing soldier beams by test pit
- Checked existing beams for 9 ft cantilever with 3 ft sloped surcharge and 2 ft construction surcharge
- Recommended soil values
 - $g = 125$ pcf, $\phi = 30$ deg, Rankine K_a and K_p
- PE, Inc. design soil values
 - $g = 115$ pcf, $\phi = 30$ deg, Coulomb K_a and K_p
- Saved 68 ea. HP12x53 soldier beams \$\$\$

NORTH DRIVE TEMPORARY EXCAVATION SUPPORT



NORTH DRIVE TEMPORARY EXCAVATION SUPPORT

- April, 2009



NORTH DRIVE TEMPORARY EXCAVATION SUPPORT

- August, 2009



TEMPORARY LATERAL WALL BRACING

- Installed braces at existing concourse elevation between columns where structural slab demolition occurred
- Design Load = 6.5 kips per column
- Dayton/Richmond B-4 pipe brace bolted to existing concrete columns

TEMPORARY LATERAL WALL BRACING

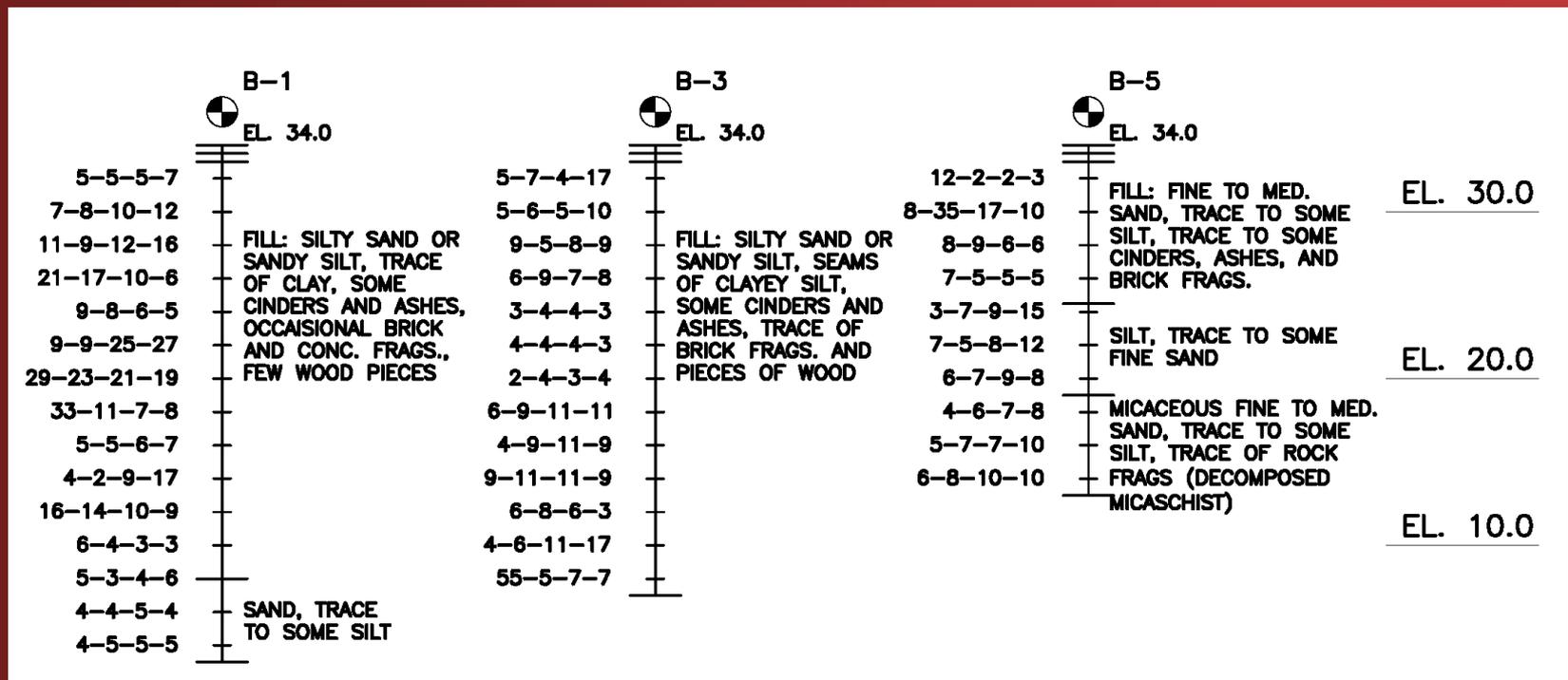


PERMANENT SOIL NAIL AND SHOTCRETE RETAINING WALL

- Geotechnical recommendations
 - In-situ soil values $\gamma = 125$ pcf, $\phi = 30$ deg, Rankine K_a and K_p
 - Pressure Grouting (Type?) for improved soil values $\gamma = 125$ pcf, $\phi = 40$ deg, soil/grout bond = 15 psi allowable
- PE, Inc. design values (JPC borings)
 - Soil values $\gamma = 125$ pcf, $\phi = 30$ deg, $c = 0$ psf, soil/grout bond = 10 psi allowable/20 psi ultimate

PERMANENT SOIL NAIL AND SHOTCRETE RETAINING WALL

- Additional soil borings from Geotech, Inc. for JPC taken along soil nail wall location

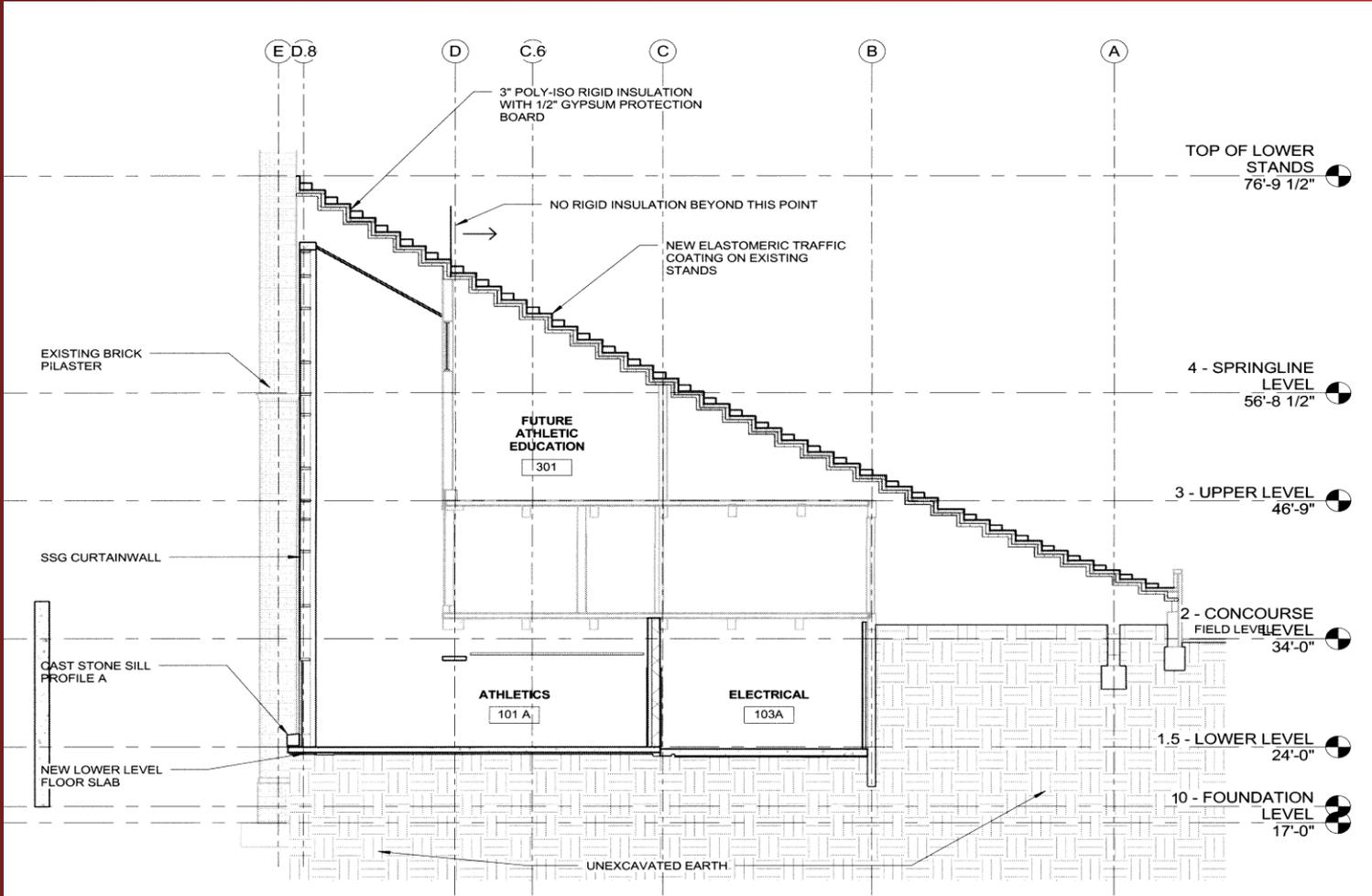


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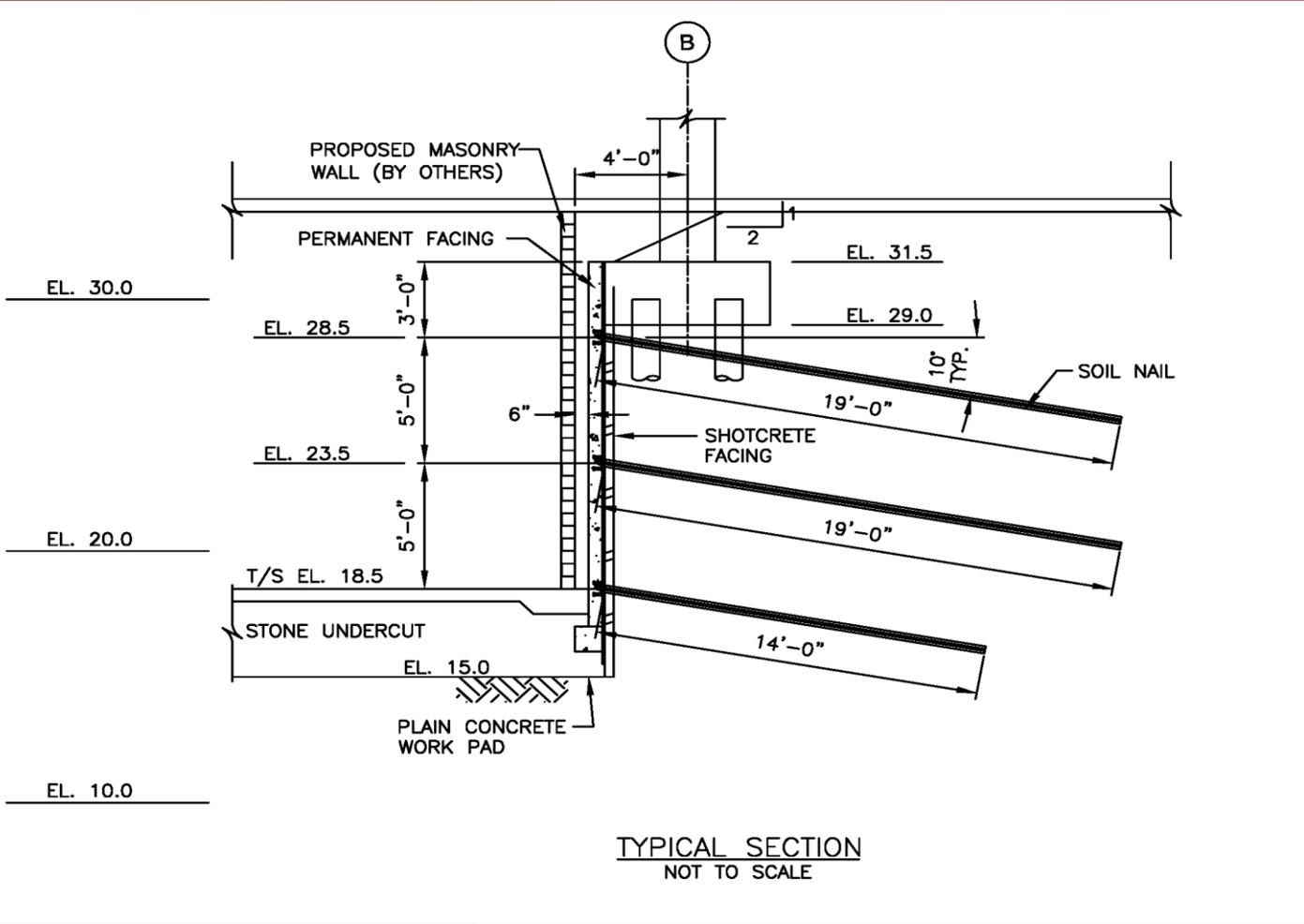
■ Design

- Goldnail
- Discovered space between structural slab and top of existing fill, therefore, reduced total wall height (2 ft wall height reduction \$\$\$)
- Preliminary cut verified stability of proposed vertical excavation lifts
- Wall length approximately 480 ft long
- Wall height $H = 16.5$ ft, $H' = 18.5$ ft
- 3 tier wall, 5 inch diameter drill holes
- Nail spacing 4.8 ft H x 5 ft V, top nail @ 3 ft
- #8, Grade 75, epoxy coated threadbars
- 4 in temporary shotcrete with 6 in permanent shotcrete

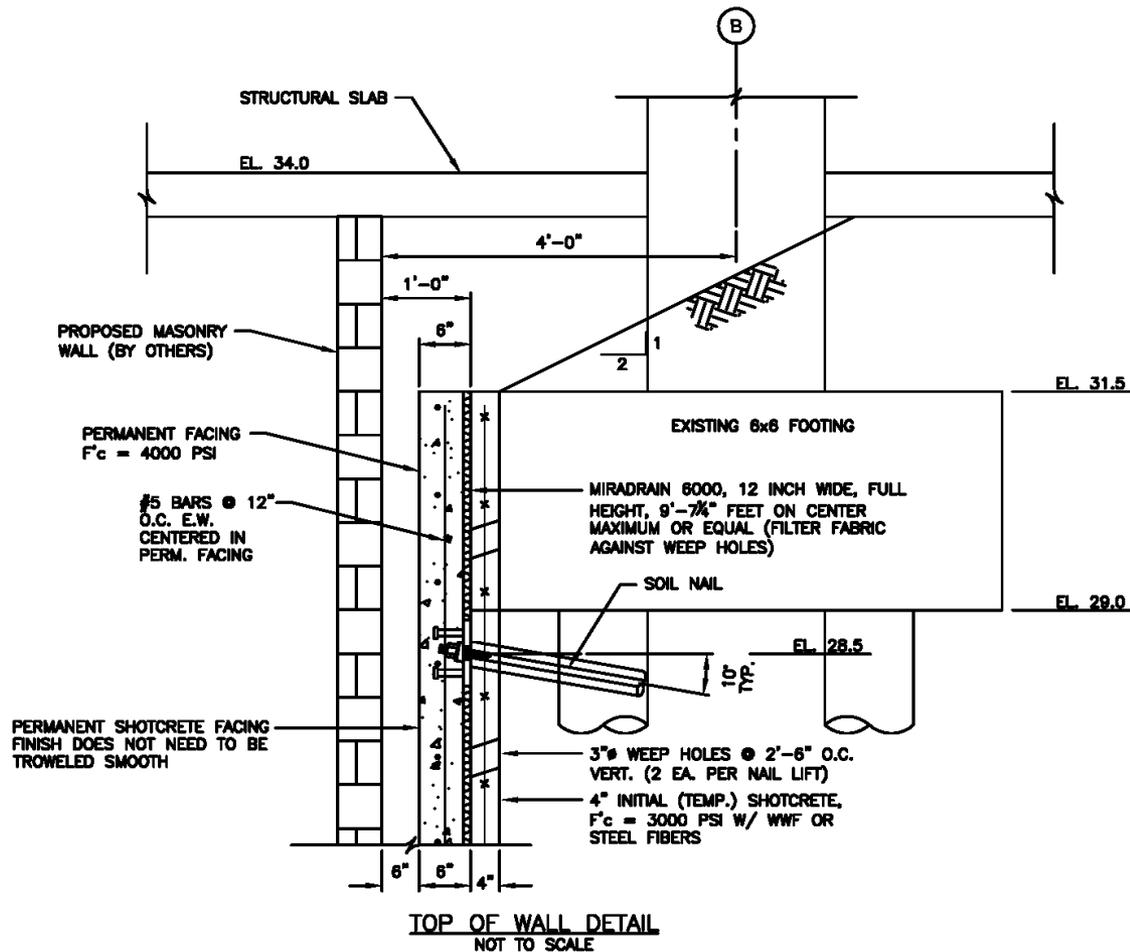
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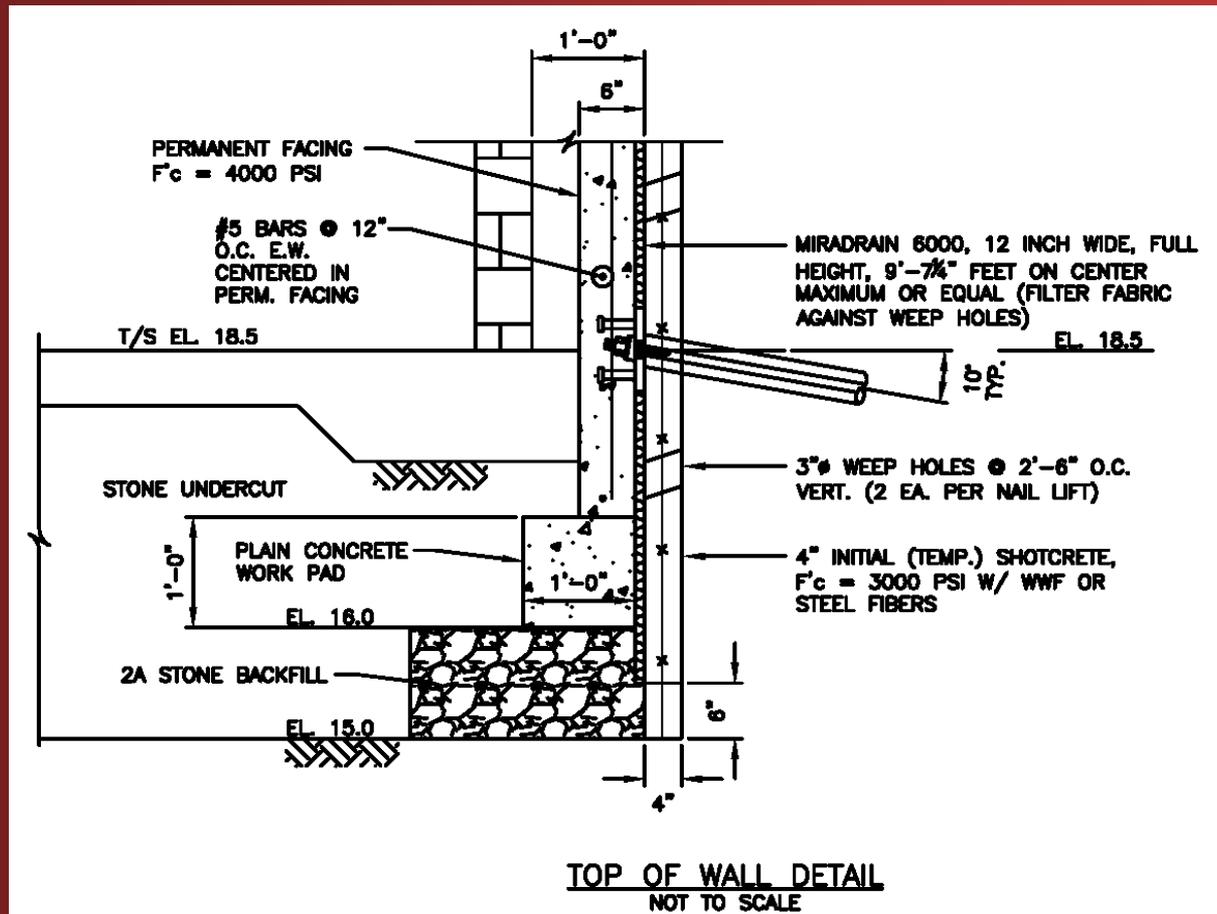
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PERMANENT SOIL NAIL AND SHOTCRETE RETAINING WALL



- Tight access between columns
- Low overhead clearance
- Adjacent construction operations

PERMANENT SOIL NAIL AND SHOTCRETE RETAINING WALL



- 2nd lift of temporary shotcrete face
- Finished temporary face with 12"x12"x1" studded plates

PERMANENT SOIL NAIL AND SHOTCRETE RETAINING WALL

- Dry mix shotcrete (gunitite) hopper



PERMANENT SOIL NAIL AND SHOTCRETE RETAINING WALL



PERMANENT SOIL NAIL AND SHOTCRETE RETAINING WALL

- 6 inch permanent shotcrete facing



CONCLUSION

- Despite tight working conditions and poor soil conditions, the soil nail wall was successfully designed and constructed
- Additional contractor borings allowed elimination of pressure grouting behind soil nail wall
- Pre-design communication and site investigation facilitated economical construction
- “Totally unique” facility that is built into and under a historical building!

**THANK YOU.
SEE YOU NEXT MONTH!**

Peirce Engineering, Inc.

Civil ~ Construction Engineering