

Beneath the Surface: A Deep Dive into Geotech for

I-75 Interchange at I-24
TDOT Design Build Project DB2101
Hamilton County, TN

STGEC 2025



Atefeh Asoudeh, PhD, PE, PMP, DBIA
Project Delivery Leader, Geotechnical, RKK



I-75 Interchange at I-24

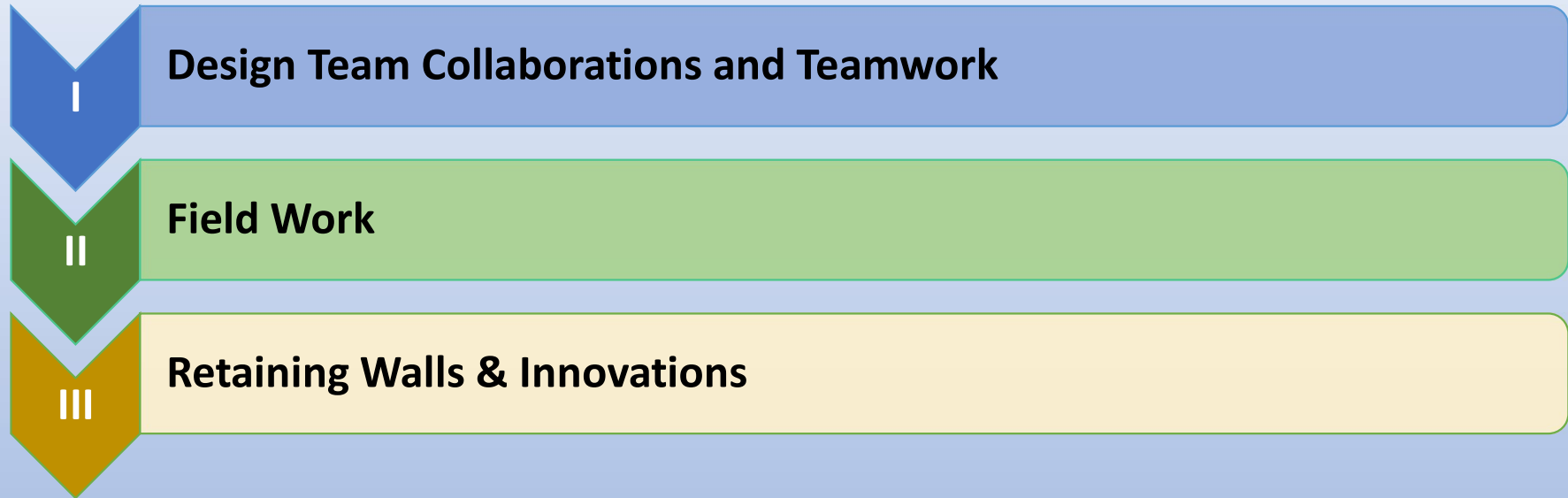


I-75 Interchange at I-24



I-75 Interchange at I-24

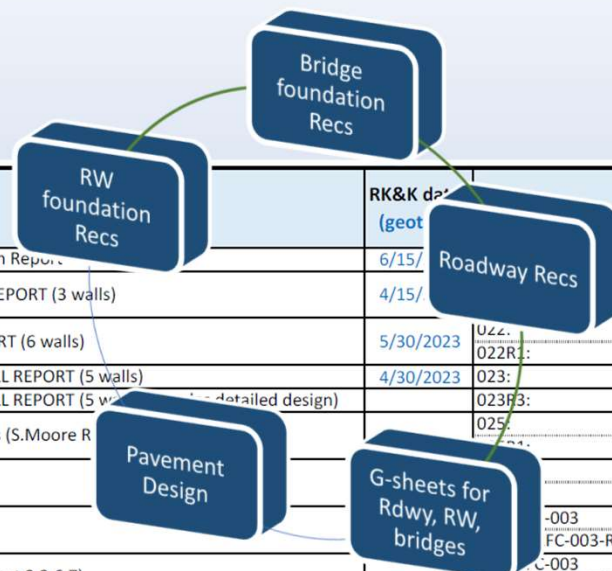
Geotechnical Highlights



I-75 Interchange at I-24

| Geotech Deliverables | RK&K dates (geotech) | Submittal No. | Submission Date |
|---------------------------------------------------------------------------|-------------------------|-----------------------|-------------------------|
| Pavement Design Report | 2/16/2023 | 002: DD-002 008R1: | 12/16/2022 4/17/2023 |
| Temporary Pavement Design Report | | 012: 012R1: | 3/1/2023 4/6/2023 |
| S. Moore Rd Bridge Foundation Report-Early Start Package (ESP), (IB only) | 2/28/2023 | 002: DD-002 | 12/16/2022 |
| S. Moore Rd Bridge Foundation Data Sheets-ESP for RFC (IB only) | 2/28/2023 | 006: RFC-001 | 2/13/2023 |
| S. Moore Rd Bridge Foundation Data Sheets-ESP for RFC (full bridge) | 4/10/2023 | 006R2: RFC-001 | 4/12/2023 |
| S. Moore Rd Bridge Foundation Report (full Bridge) | 2/28/2023 | 010: | 3/1/2023 |
| S. Moore Rd Retaining Walls Report (Walls 2 & 6b) | 3/15/2023 | 013: 013R2: | 3/28/2023 6/8/2023 |
| RFC, S. Moore Rd Bridge Foundation data sheet | 3/18/2023 | 015: RFC-002 | 4/25/2023 |
| RFC, S. Moore Rd Bridge R-Sheets (R02 & R06) | 3/18/2023 | 015: RFC-002 | 4/25/2023 |
| RFC, S. Moore Rd Bridge R-Sheets (R02) | | 015R3: RFC-002 | 9/5/2023 |
| RFC, S. Moore Rd Bridge R-Sheets (R06) | | 015R4: RFC-002 | 10/11/2023 |
| RFC, McBrian Rd Bridge R-Sheets (R03 & R07) | | 015R1: RFC-002 | 7/10/2023 |
| RFC, McBrian Rd Bridge R-Sheets (R07) | | 015R3: RFC-002 | 9/5/2023 |
| RFC, McBrian Rd Bridge R-Sheets (R03) | | 015R4: RFC-002 | 10/11/2023 |
| McBrian Rd Bridge Foundation Data Sheet-ESP (IB only) | | 006R3: RFC-001 | 6/1/2023 |
| McBrian Rd Bridge Foundation Data Sheet-Revised RFC (Full Bridge) | 7/7/2023 | 006R5: RFC-001 | 7/6/2023 |
| S. Moore Rd Bridge Foundation Report | 2/28/2023 | 010: | 3/1/2023 |
| South Moore Road Walls Report | 3/15/2023 | | |
| RFC, South Moore Road Bridge Foundation data sheet, initial | 3/18/2023 | | |
| RFC, South Moore Road Bridge RW-sheets for soil nail wall, initial | 3/18/2023 | | |
| RFC, South Moore Road Bridge RW-sheets for MSE wall, initial | 3/18/2023 | | |
| RFC, South Moore Road Bridge Foundation data sheet, Second | 4/10/2023 | | |
| RFC, South Moore Road Bridge RW-sheets for soil nail wall, RESUBMIT | 4/10/2023 | | |
| RFC, South Moore Road Bridge RW-sheets for MSE wall, RESUBMIT | 4/10/2023 | | |

| Geotech Deliverables | RK&K dates (geotech) | Submission Date |
|----------------------------------------------------------------|-------------------------|-------------------------|
| McBrian Rd Bridge Foundation Report | 6/15/2023 | 5/26/2023 |
| SOIL NAIL RETAINING WALL REPORT (3 walls) | 4/15/2023 | 4/24/2023 10/17/2023 |
| MSE RETAINING WALLS REPORT (6 walls) | 5/30/2023 | 5/24/2023 |
| SOLDIER PILE RETAINING WALL REPORT (5 walls) | 4/30/2023 | 8/9/2023 |
| SOLDIER PILE RETAINING WALL REPORT (5 walls - detailed design) | | 8/15/2023 |
| Pile Hammer Approval Letters (S. Moore Rd) | | 12/8/2023 |
| Soil and Geology Report | | 6/12/2023 |
| Roadway G-sheets | | 8/8/2023 |
| Retaining Wall Sheets (all except 2,3,6,7) | | 6/26/2023 |
| Retaining Wall 13 Sheets (R-13)+G41+NW sheets | | 8/15/2023 |
| Geotech Sheets for Noise Walls | 5/15/2023 | 10/12/2023 |
| CSX Bridge Foundation Report | 6/30/2023 | 6/30/2023 |
| CSX Bridge Foundation Geotech Data Sheet | 7/20/2023 | 10/12/2023 |



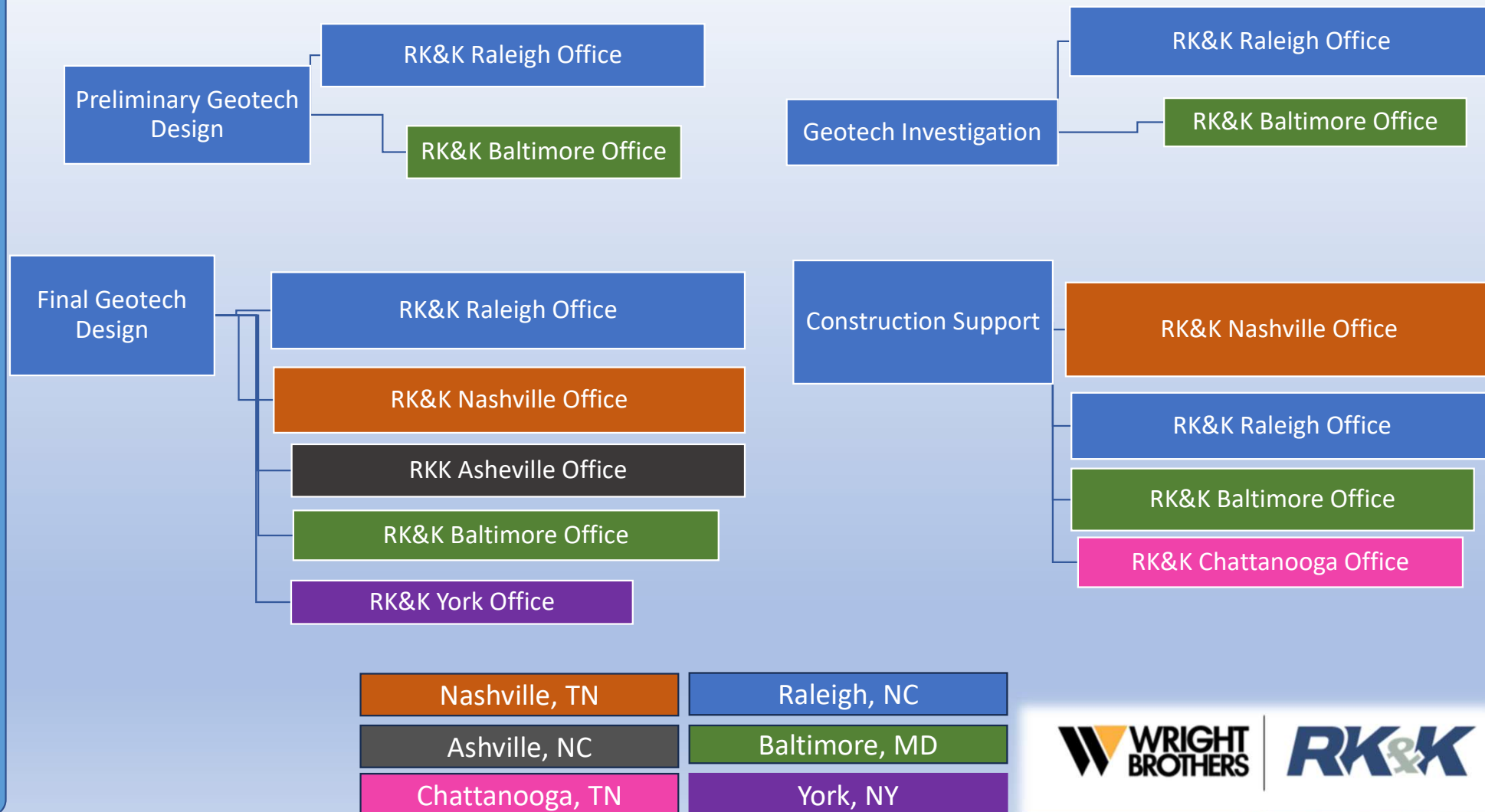
Pavement Design

Geotech Standalone submittals

Geotech sheets

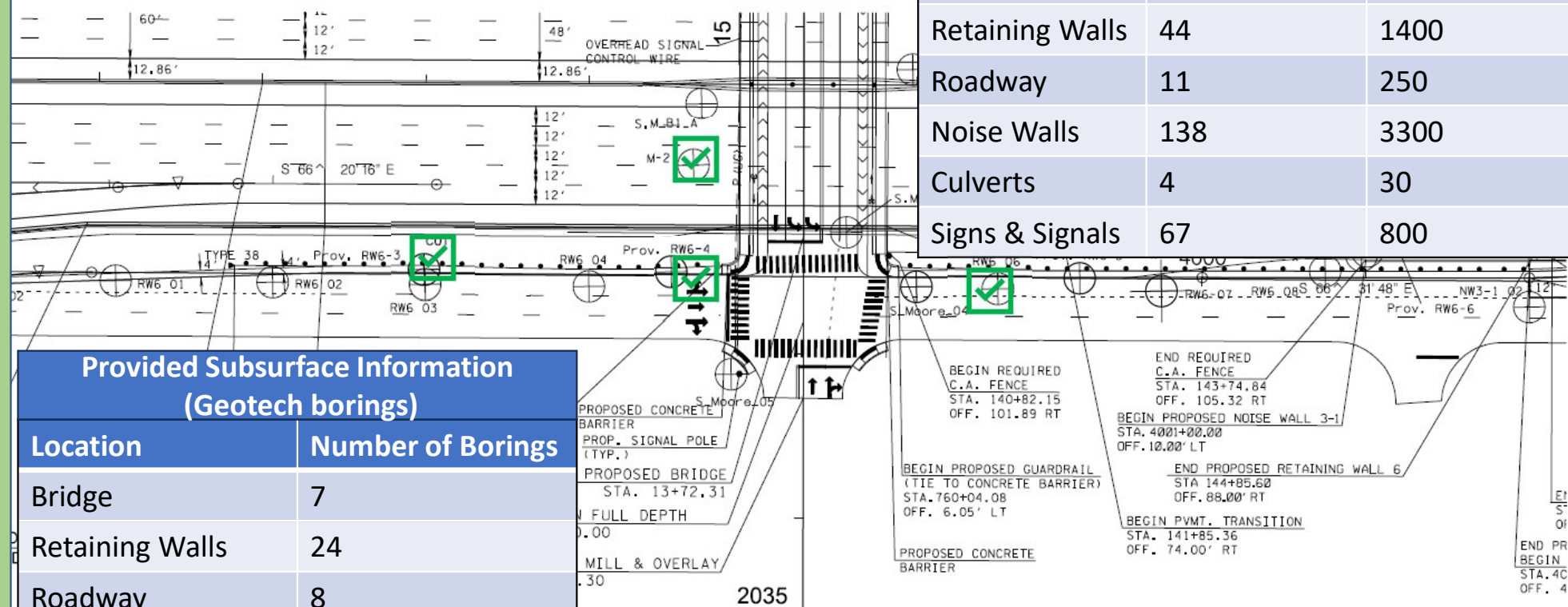


I-75 Interchange at I-24



I-75 Interchange at I-24

6 ALIGNMENT



Provided Subsurface Information (Geotech borings)

| Location | Number of Borings |
|-------------------|-------------------|
| Bridge | 7 |
| Retaining Walls | 24 |
| Roadway | 8 |
| Noise Walls | - |
| Culverts | - |
| Signs and Signals | - |

Additional Subsurface Investigation (Borings)

| Location | No. of Borings | Total Drilling (ft) |
|-----------------|----------------|---------------------|
| Bridge | 16 | 1000 |
| Retaining Walls | 44 | 1400 |
| Roadway | 11 | 250 |
| Noise Walls | 138 | 3300 |
| Culverts | 4 | 30 |
| Signs & Signals | 67 | 800 |

WRIGHT BROTHERS

RK&K

Geotech Highlight: 11) Field Work



I-75 Interchange at I-24

| Additional Subsurface Investigation | | | | | |
|-------------------------------------|-------------------|-----------------------------|-------------------|----------------------------|-----------|
| Location | Number of Borings | Total drilling footage (ft) | Total Coring (ft) | Estimated Days of Drilling | TC days |
| Bridge | 17 | 1000 | 127.6 | 13 | 13 |
| Roadway | 3 | 195 | 0 | 3 | 3 |
| Retaining Walls | 51 | 1495 | 70.7 | 19 | 19 |
| Noise Walls | 138 | 3265 | 70.6 | 41 | 41 |
| Culverts | 2 | 30 | 0 | 1 | 1 |
| Signs/Signals | 51 | 805 | 0 | 11 | 11 |
| TOTAL | 262 | 6790 | 269 | 88 | 88 |

ESP Drilling
Week of
11/21/2022

Borings along
I-24 EB
January 2023

Borings along
I-24 WB
February 2023

Borings along
I-75
March 2023

Additional Borings drilled on
July 2023

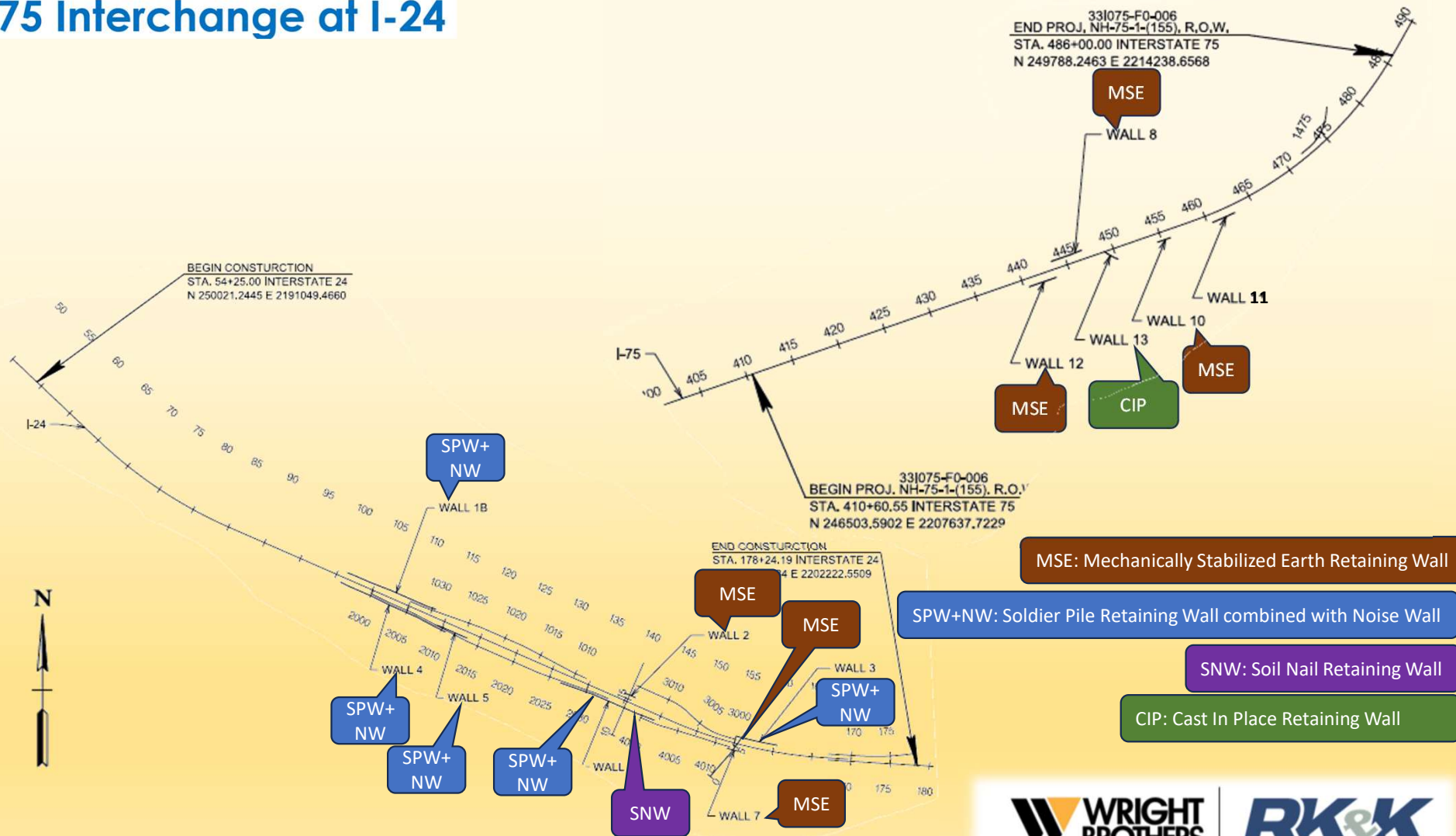


Geotech Highlight: II) Field Work

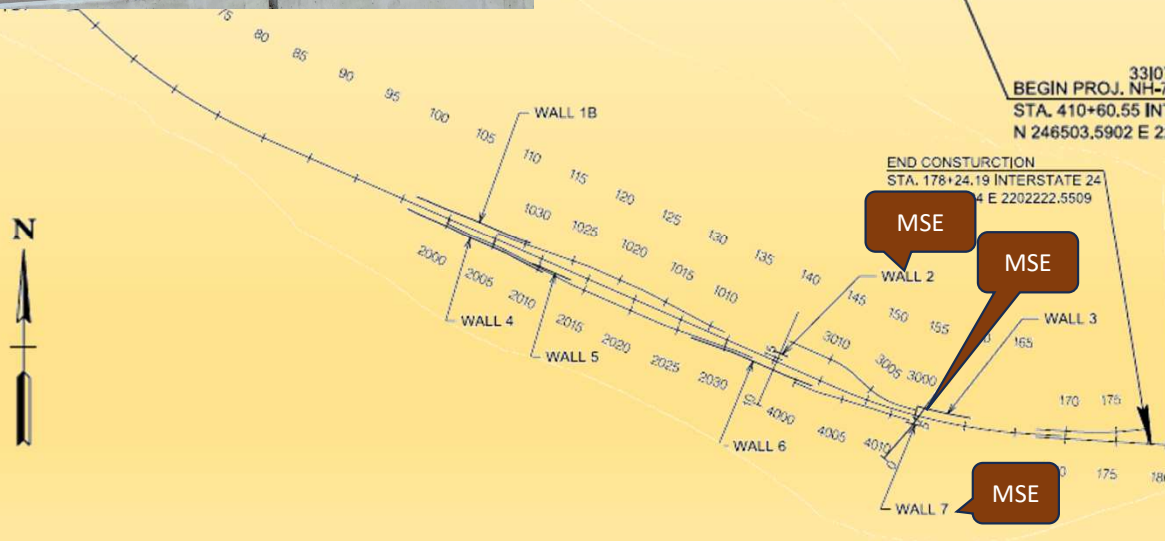


Four blue 3D blocks are arranged in a circle, each containing a risk factor: "Weather", "Night work", "Traffic control", and "Two rigs working".

I-75 Interchange at I-24



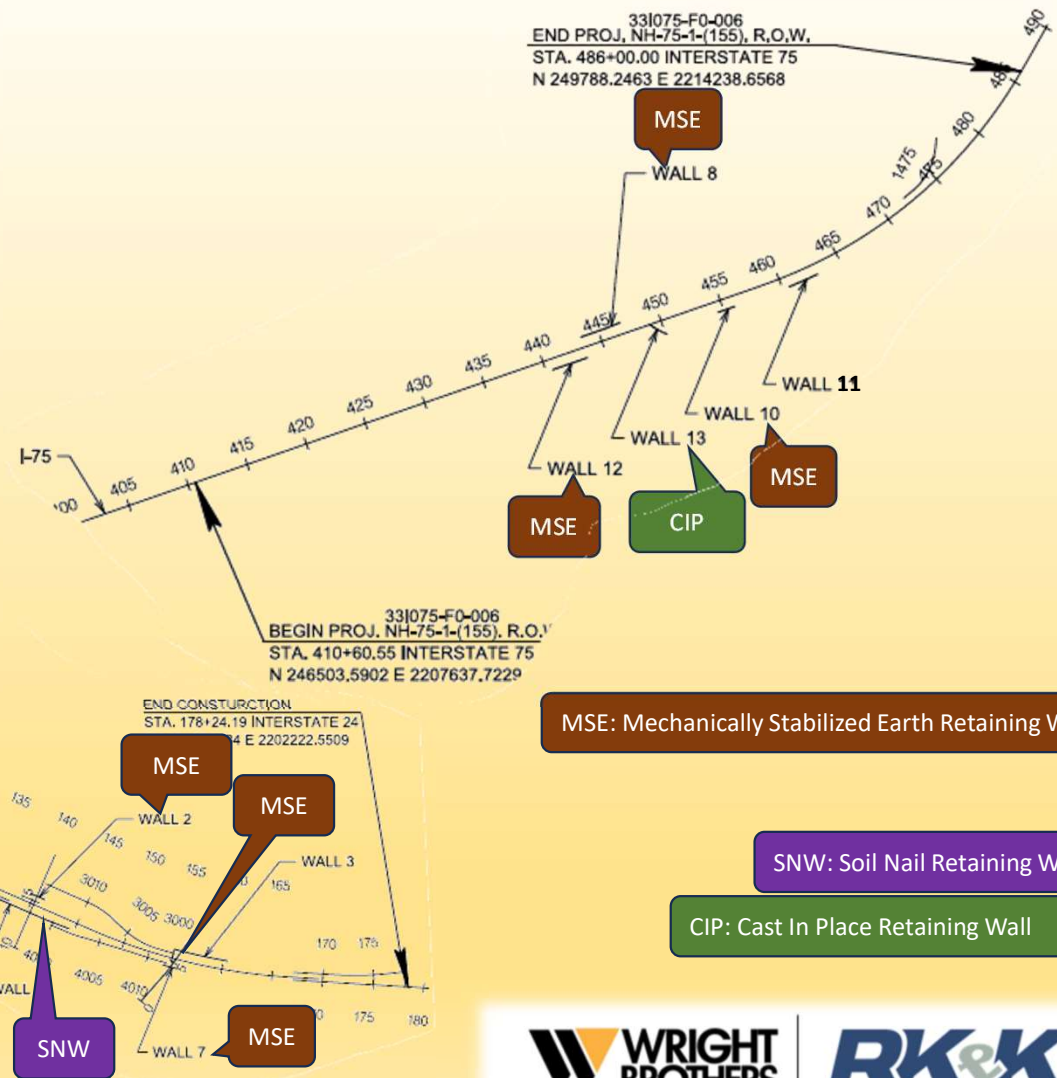
I-75 Interchange at I-24



MSE: Mechanically Stabilized Earth Retaining Wall

Geotechnical Highlight: III) Walls

I-75 Interchange at I-24



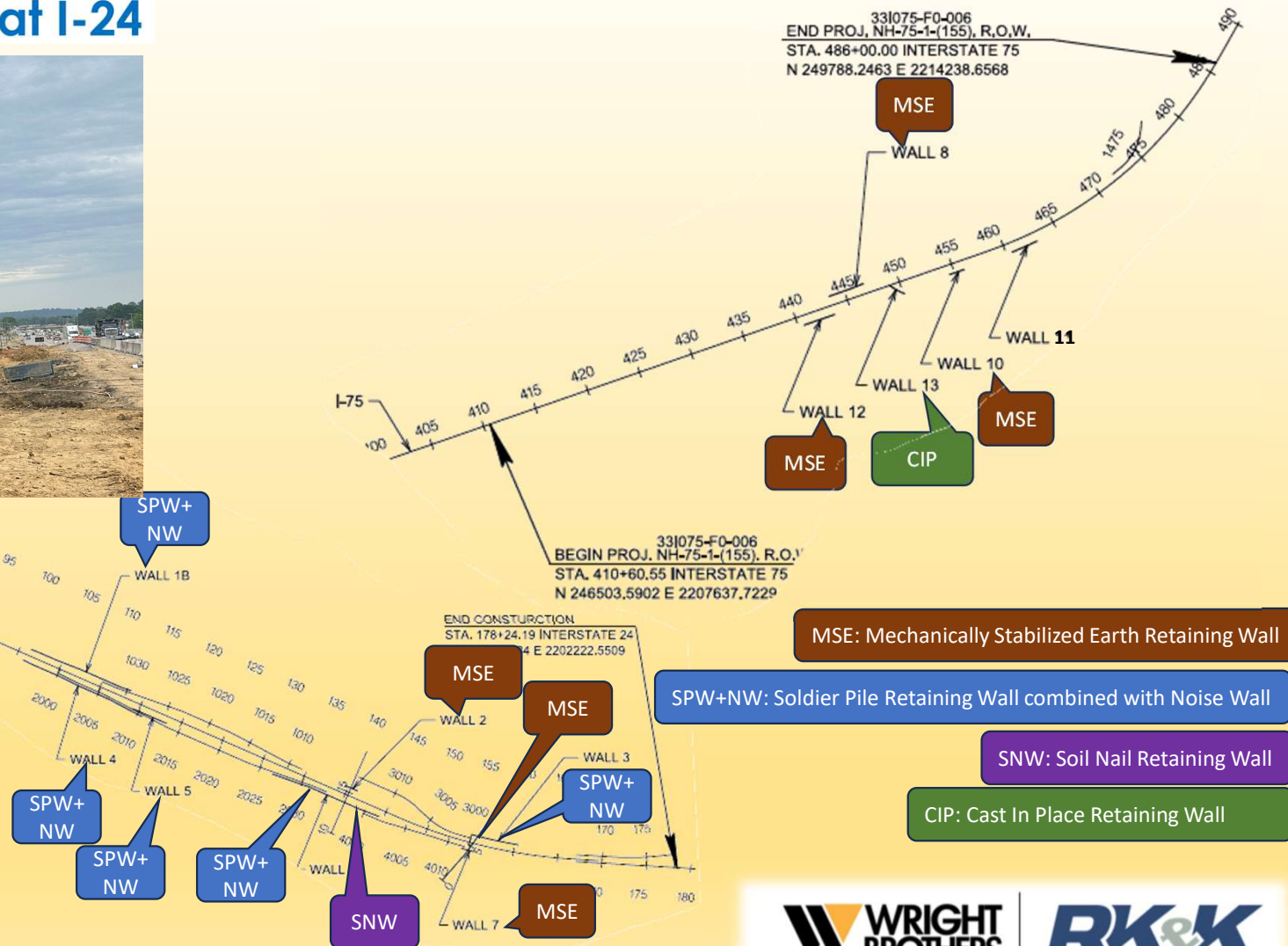
MSE: Mechanically Stabilized Earth Retaining Wall

SNW: Soil Nail Retaining Wall

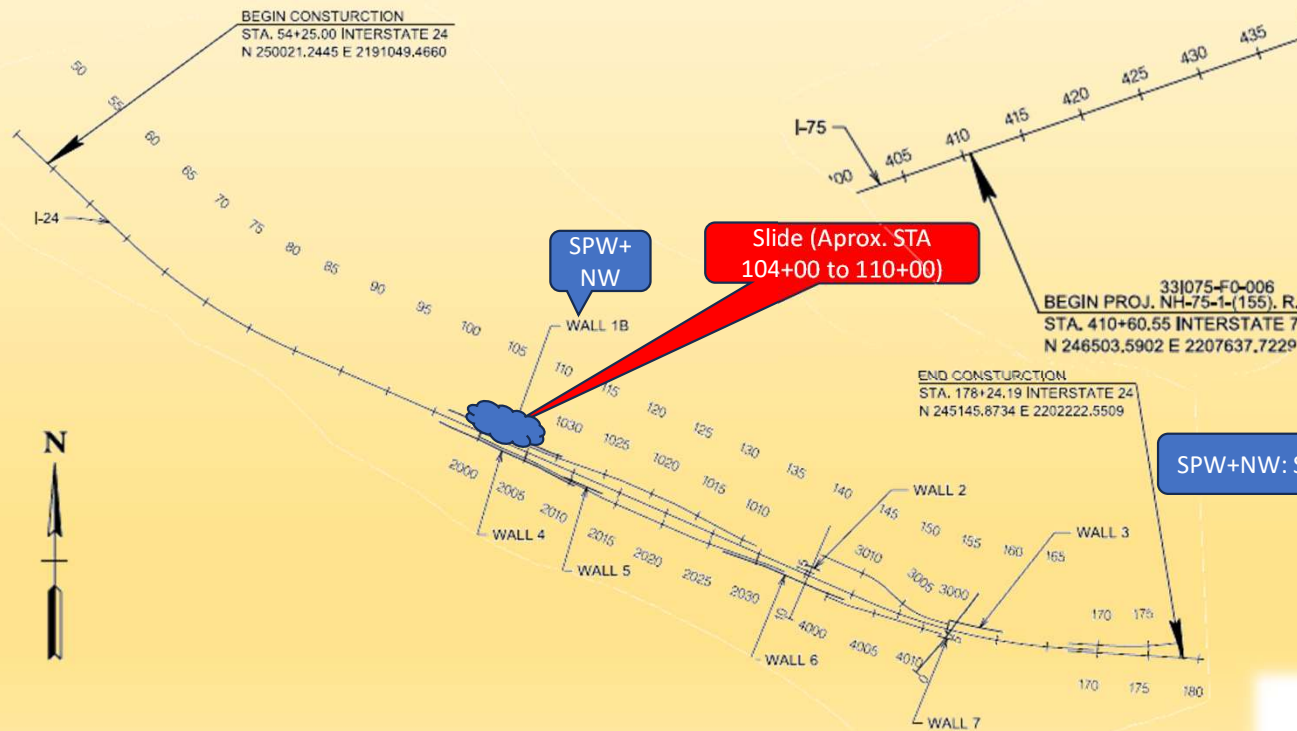
CIP: Cast In Place Retaining Wall



I-75 Interchange at I-24



I-75 Interchange at I-24



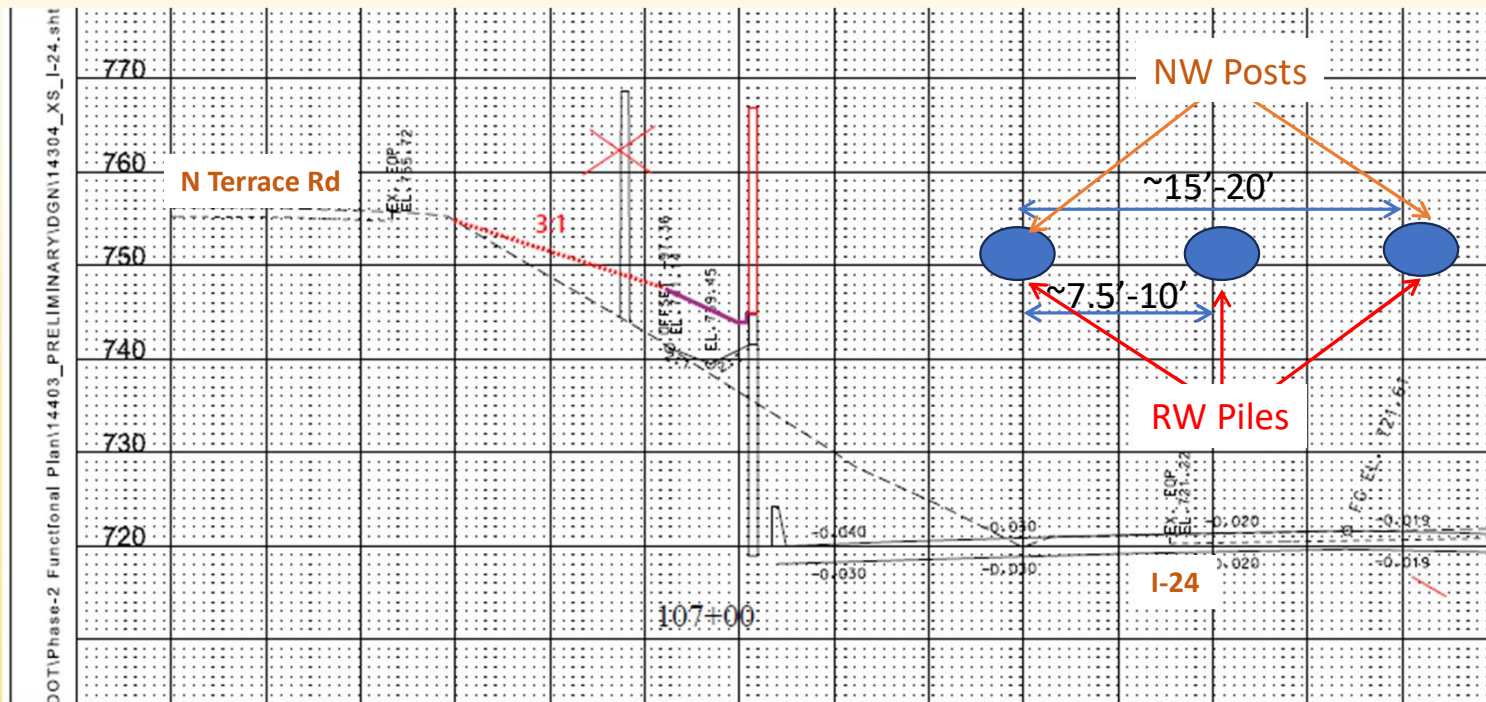
RKK Site Visit,
Jul 2022



SPW+NW: Soldier Pile Retaining Wall combined with Noise Wall



I-75 Interchange at I-24



ATC No. 4 - Use Combined Noise Barrier and Retaining Wall

I-75 Interchange at I-24

| Wall | Chain / offset | STA Range | Wall STA Range | Noise Wall on Top | Tieback anchors | Pile Section | Pile Embedment (ft) | Potential Drilling in Rock (ft) | Total Pile Length (ft) |
|------|--------------------------|--------------------------|-----------------------|-------------------|-----------------|--------------|---------------------|---------------------------------|------------------------|
| 1b | I-24 / LT | 101+18 to 103+00 | (begin) 01+00 to 2+82 | No | 1 row | HP 12X63 | 9 | | 598 |
| | | 103+00 to 103+50 | 2+82 to 3+32 | No | 1 row | HP 12X63 | 9 | | 164 |
| | | 103+50 to 107+50 | 3+32 to 7+32 | No | 2 rows | HP 12X63 | 9 | | 1,809 |
| | | 107+50 to 108+50 | 7+32 to 8+32 | Yes | 2 rows | HP 12X63 | 9 | 5 | 492 |
| | | 108+50 to Ramp L 1030+27 | 8+32 to 12+49 (end) | Yes | 1 row | HP 12X63 | 9 | 5 | 1,492 |
| 4 | I-24 / RT | 100+85 to 103+00 | (begin) 01+00 to 3+15 | No | 1 row | HP 12X53 | 10 | | 413 |
| | | 103+00 to 105+50 | 3+15 to 5+65 | No | - | W 16X77 | 18 | 5 | 632 |
| | I-24 / RT to Ramp K / RT | I-24 / RT to Ramp K / RT | 5+65 to 10+25 | Yes | 1 row | HP 12X53 | 10 | 5 | 1,014 |
| | Ramp K / RT | 2005+00 to 2010+56 | 10+25 to 15+80 (end) | Yes | 1 row | HP 12X53 | 10 | 5 | 1,733 |
| 5 | I-24 / RT | 114+35 to 114+85 | 114+35 to 114+85 | No | - | HP 12X53 | 12 | | 120 |
| | | 114+85 to 119+05 | 114+85 to 119+00 | Yes | 1 row | HP 12X63 | 10 | | 1,157 |
| 6 | Ramp M / RT | 2026+50 to 2027+10 | 1+00 to 1+60 | No | 1 row | HP 12X63 | 10 | 10 | 126 |
| | | 2027+10 to 2032+41 | 1+60 to 6+92 | Yes | 1 row | HP 12X63 | 10 | 5 | 1,190 |
| 3a | I-24 / LT | 157+00 to 157+58 | (begin) 2+97 to 3+54 | No | 1 row | HP 12X63 | 10 | 5 | 124 |
| | | 157+58 to 160+52 | 3+54 to 6+41 (end) | Yes | 1 row | HP 12X63 | 9 | 5 | 819 |

Piles are to be installed in 30" drilled holes

| | | |
|-------------------------------------------------------|-------|----|
| Total Pile length for HP 12 x 53 = | 3,280 | ft |
| Total Pile length for HP 12 x 63 = | 7,971 | ft |
| Total Number of Piles for W 16 x 77 = | 632 | ft |
| Total Number of Tiebacks= | 486 | |
| Total footage for predrilled holes= | - | ft |
| Total footage for potential predrilled holes in rock= | 1,505 | ft |

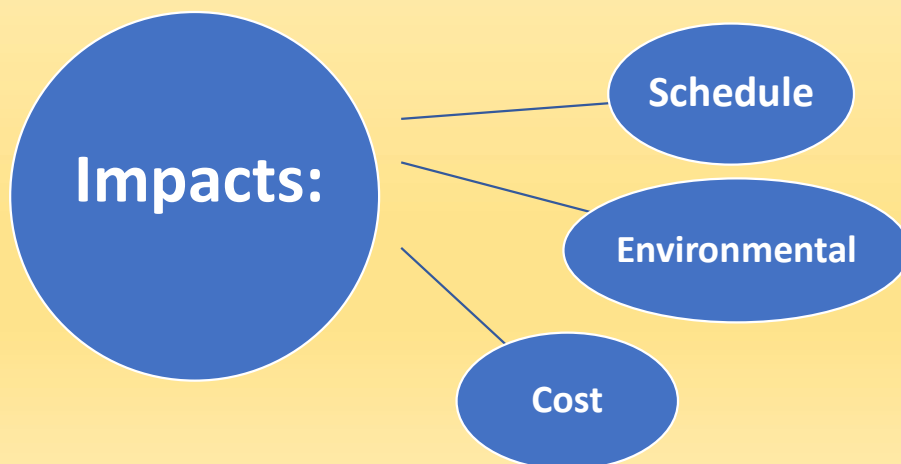


I-75 Interchange at I-24

Deviations

1) Contract Book 3, Section 4. Structures

- Noise Barrier Walls
- The new noise walls shall be constructed using concrete posts and concrete panels. The post spacing shall not exceed 20 feet. Ground mounted noise wall posts shall be embedded into drilled shaft foundations. Bolted connections will not be allowed.



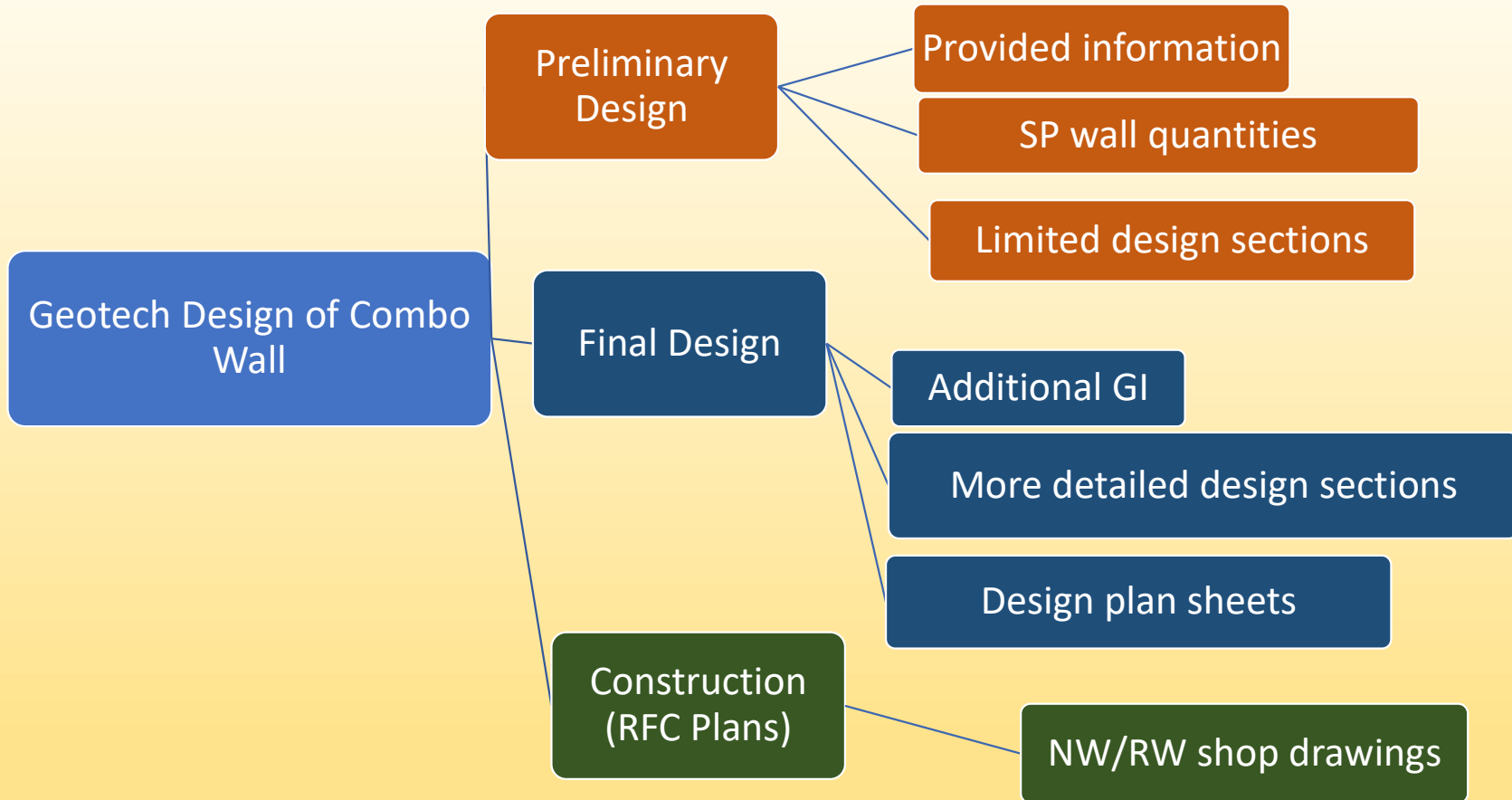
Slide 18

AA0

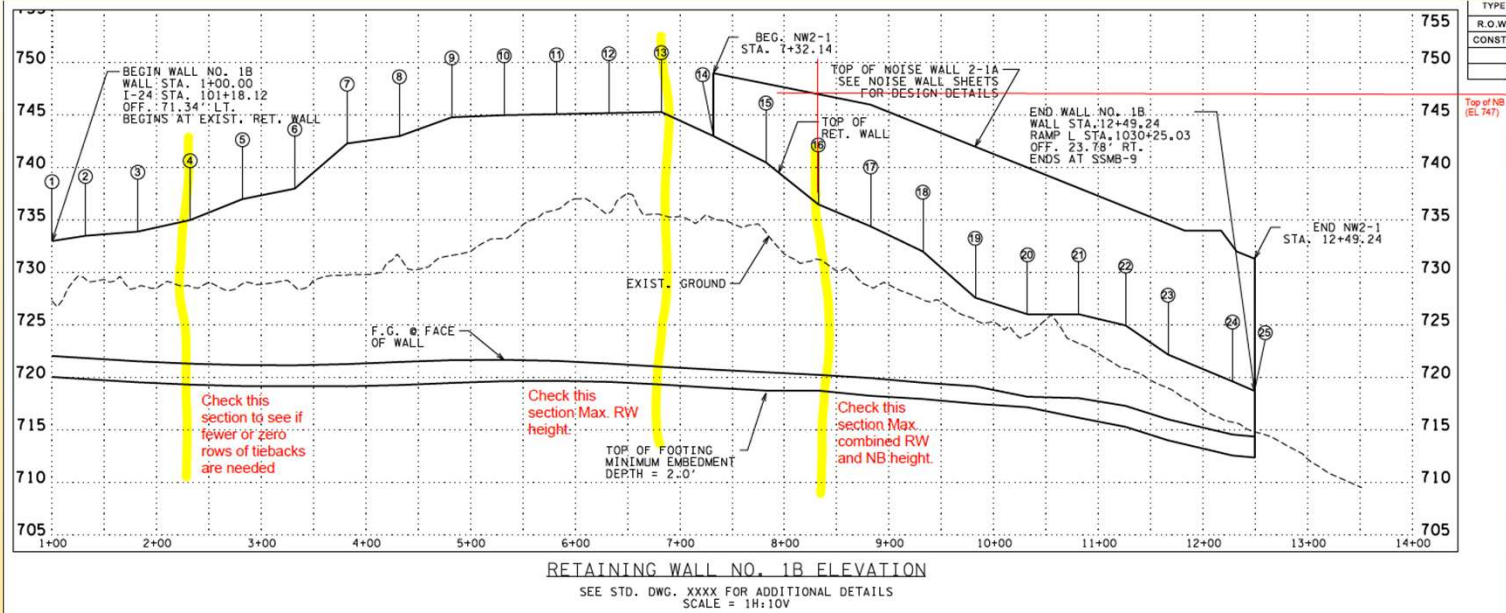
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Atefeh Asoudeh, 2025-09-13T11:57:57.843

I-75 Interchange at I-24



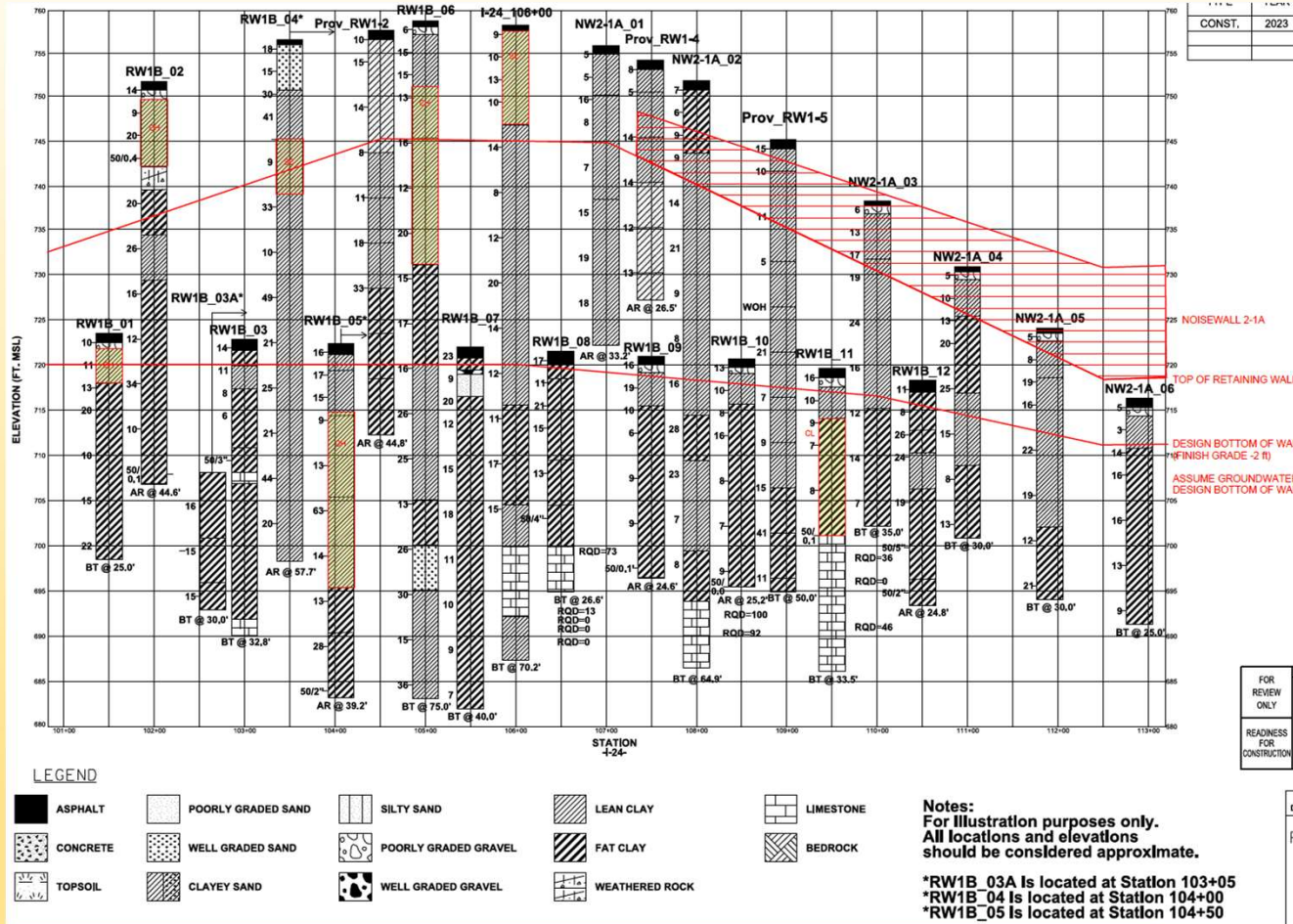
I-75 Interchange at I-24



| | POINT | WALL STATION | BASELINE | BASELINE STATION | BASELINE OFFSET | TOP WALL EL. (ft.) | F.G. @ FACE OF WALL (ft.) | TOP OF FOOTING (2' COVER) (ft.) | WALL HEIGHT (ft.) | | POINT | WALL STATION | BASELINE | BASELINE STATION | BASELINE OFFSET | TOP WALL EL. (ft.) | F.G. @ FACE OF WALL (ft.) | TOP OF FOOTING (2' COVER) (ft.) | WALL HEIGHT (ft.) |
|-------|-------|--------------|----------|------------------|-----------------|--------------------|---------------------------|---------------------------------|-------------------|-----|-------|--------------|----------|------------------|-----------------|--------------------|---------------------------|---------------------------------|-------------------|
| START | 1 | 1+00.00 | I-24 | 101+18.12 | 71.34' LT. | 733.00 | 722.04 | 720.04 | 13.0 | | 14 | 7+32.30 | I-24 | 107+50.00 | 87.06' LT. | 743.00 | 720.74 | 718.74 | 24.3 |
| | 2 | 1+31.95 | I-24 | 101+50.00 | 72.96' LT. | 733.50 | 721.84 | 719.84 | 13.7 | | 15 | 7+82.30 | I-24 | 108+00.00 | 88.00' LT. | 740.50 | 720.49 | 718.49 | 22.0 |
| | 3 | 1+82.01 | I-24 | 102+00.00 | 75.48' LT. | 733.90 | 721.53 | 719.53 | 14.4 | | 16 | 8+32.30 | I-24 | 108+50.00 | 88.00' LT. | 736.50 | 720.24 | 718.24 | 18.3 |
| | 4 | 2+32.03 | I-24 | 102+50.00 | 76.00' LT. | 735.00 | 721.31 | 719.31 | 15.7 | | 17 | 8+82.30 | I-24 | 109+00.00 | 88.00' LT. | 734.40 | 719.94 | 717.94 | 16.5 |
| | 5 | 2+82.03 | I-24 | 103+00.00 | 76.00' LT. | 737.00 | 721.17 | 719.17 | 17.8 | | 18 | 9+32.30 | I-24 | 109+50.00 | 88.00' LT. | 732.00 | 719.49 | 717.49 | 14.5 |
| | 6 | 3+32.03 | I-24 | 103+50.00 | 76.00' LT. | 738.00 | 721.15 | 719.15 | 18.9 | | 19 | 9+82.30 | I-24 | 110+00.00 | 88.00' LT. | 727.60 | 719.15 | 717.15 | 10.5 |
| | 7 | 3+82.03 | I-24 | 104+00.00 | 76.00' LT. | 742.30 | 721.27 | 719.27 | 23.0 | | 20 | 10+32.30 | I-24 | 110+50.00 | 88.00' LT. | 726.02 | 718.15 | 716.15 | 9.9 |
| | 8 | 4+32.05 | I-24 | 104+50.00 | 76.00' LT. | 743.00 | 721.47 | 719.47 | 23.5 | | 21 | 10+81.29 | I-24 | 111+00.00 | 88.00' LT. | 726.02 | 718.02 | 716.02 | 10.0 |
| | 9 | 4+82.12 | I-24 | 105+00.00 | 77.04' LT. | 744.80 | 721.64 | 719.64 | 25.2 | | 22 | 11+26.10 | RAMP L | 1031+94.81 | 19.78' RT. | 724.95 | 717.28 | 715.28 | 9.7 |
| | 10 | 5+32.16 | I-24 | 105+50.00 | 79.04' LT. | 745.00 | 721.67 | 719.67 | 25.3 | | 23 | 11+66.53 | RAMP L | 1031+50.00 | 26.00' RT. | 722.18 | 716.00 | 714.00 | 8.2 |
| | 11 | 5+82.20 | I-24 | 106+00.00 | 81.05' LT. | 745.10 | 721.57 | 719.57 | 25.5 | | 24 | 12+28.20 | RAMP L | 1031+00.00 | 25.84' RT. | 719.62 | 714.50 | 712.50 | 7.1 |
| | 12 | 6+32.26 | I-24 | 106+50.00 | 83.05' LT. | 745.20 | 721.32 | 719.32 | 25.9 | END | 25 | 12+78.18 | RAMP L | 1030+74.02 | 24.31' RT. | 718.34 | 714.00 | 712.00 | 6.3 |
| | 13 | 6+82.28 | I-24 | 107+00.00 | 85.06' LT. | 745.30 | 721.01 | 719.01 | 26.3 | | | | | | | | | | |

Geotechnical Highlight: III) Combo Walls

I-75 Interchange at I-24



WRIGHT BROTHERS

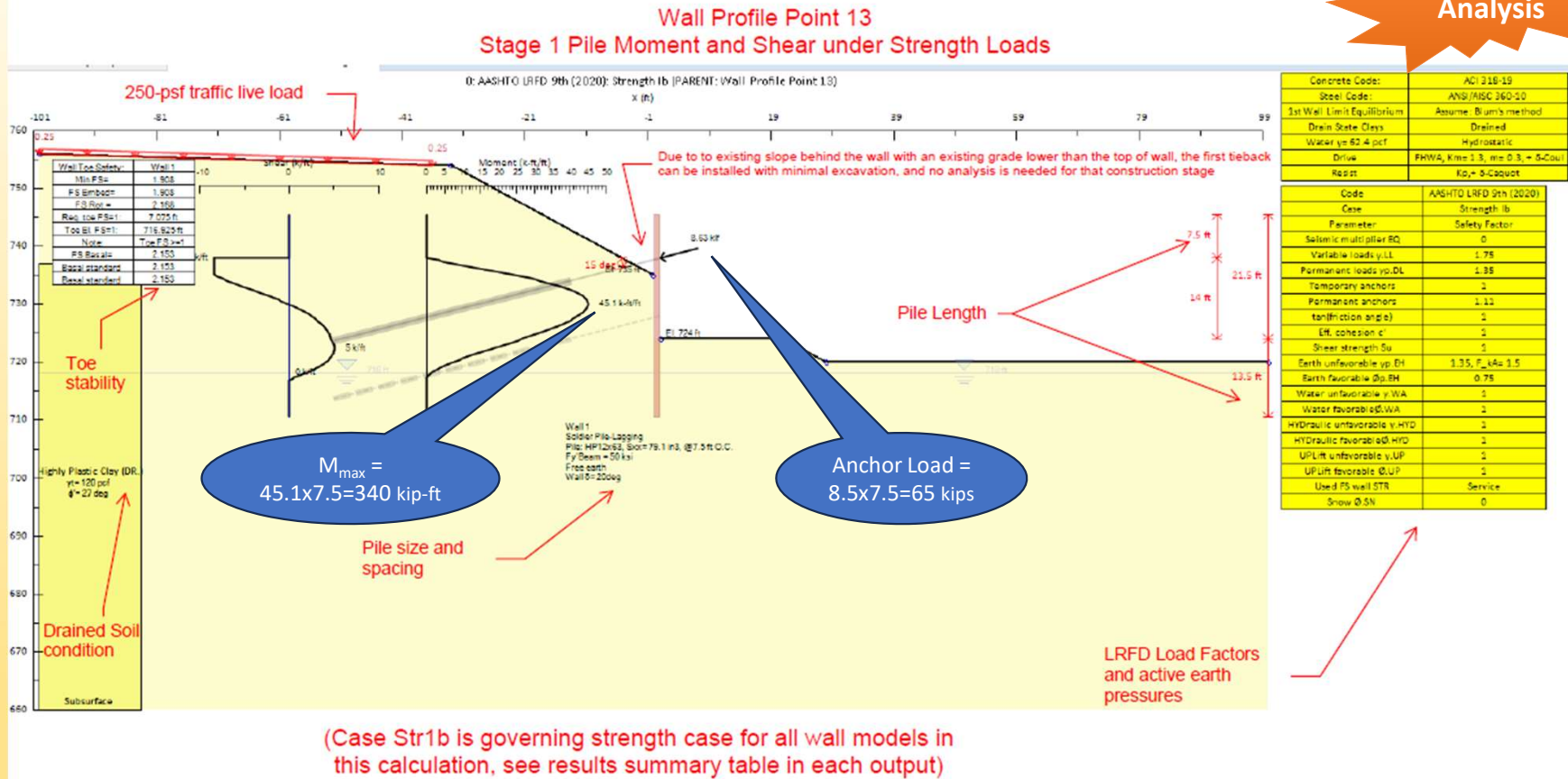
RK&K

I-75 Interchange at I-24

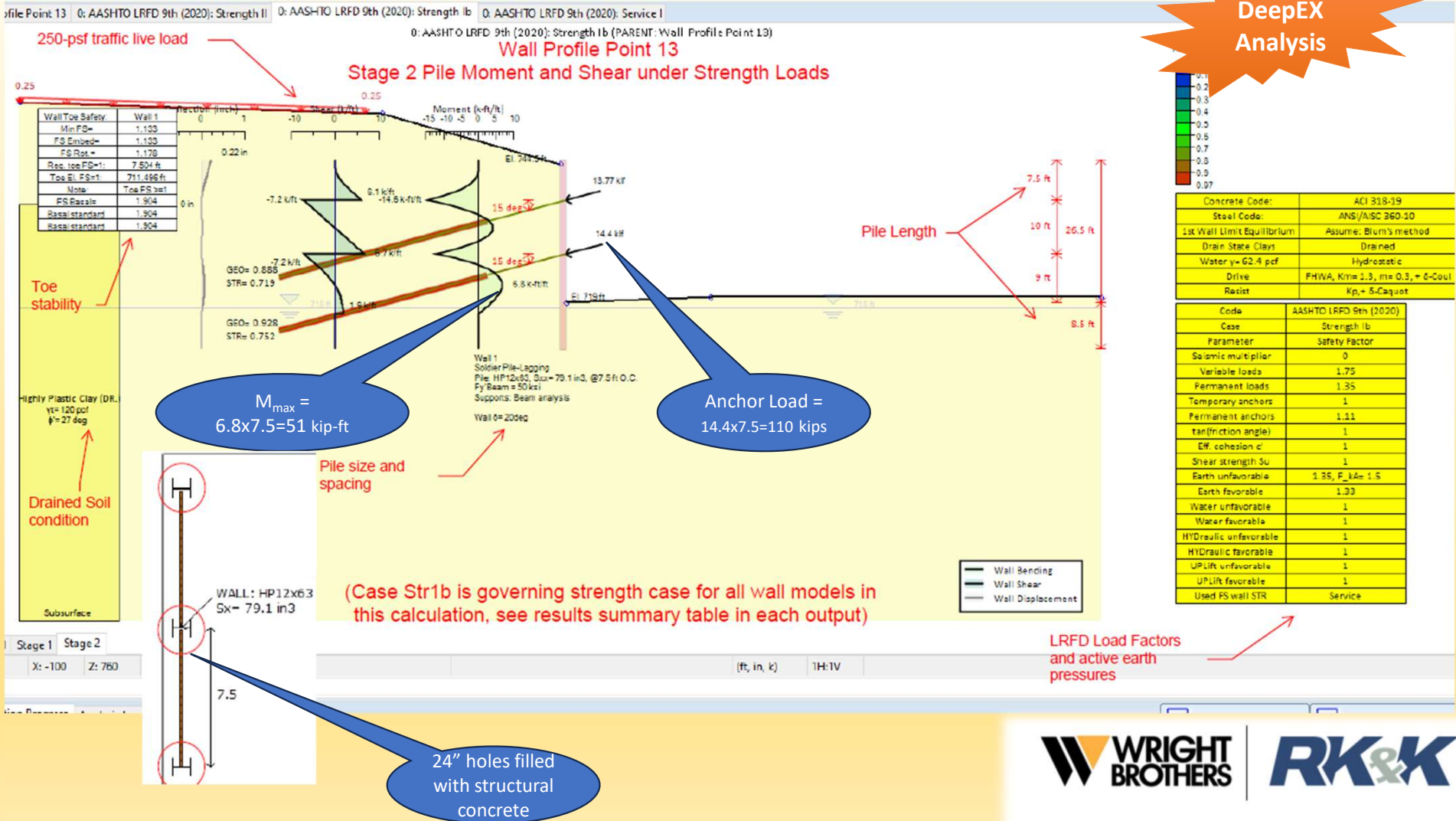


I-75 Interchange at I-24

DeepEX
Analysis



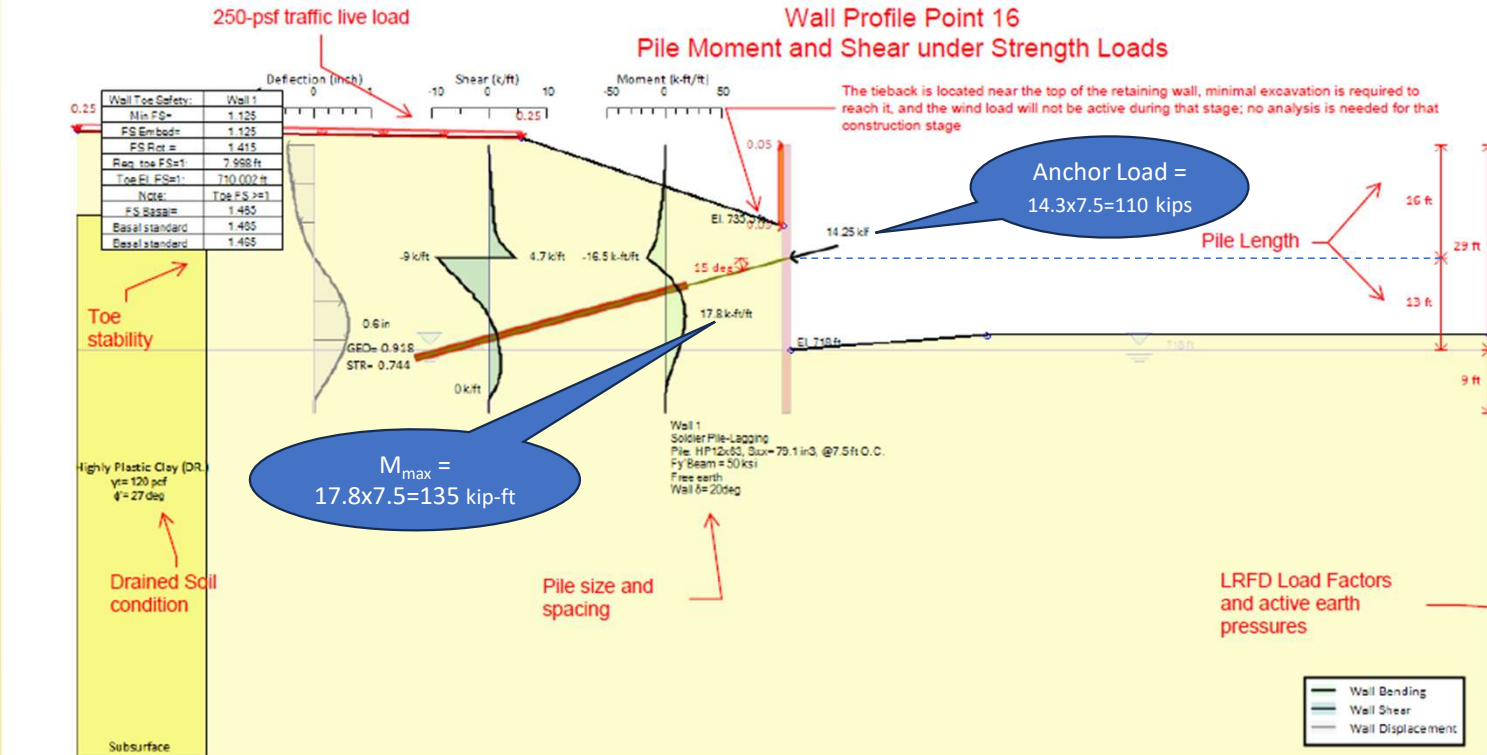
I-75 Interchange at I-24



I-75 Interchange at I-24

Wall Profile Point 16 0: AASHTO LRFD 9th (2020): Service I 0: AASHTO LRFD 9th (2020): Strength Ib 0: AASHTO LRFD 9th (2020): Strength II

0: AASHTO LRFD 9th (2020): Strength Ib (PARENT: Wall Profile Point 16)



DeepEX Analysis

| | |
|----------------------------|---------------------------------------------|
| Concrete Code: | ACI 318-19 |
| Steel Code: | ANSI/ASCE 360-10 |
| 1st Wall Limit Equilibrium | Assume: Blum's method |
| Drain State Clays | Drained |
| Water $\gamma = 62.4$ pcf | Hydrostatic |
| Drive | FHWA, $K_m = 1.3$, $m = 0.3$, ± 8 -Co |
| Resist | $K_p = 5$ -Caquot |

| | |
|-----------------------|------------------------|
| Code | AASHTO LRFD 9th (2020) |
| Case | Strength Ib |
| Parameter | Safety Factor |
| Seismic multiplier | 0 |
| Variable loads | 1.75 |
| Permanent loads | 1.35 |
| Temporary anchors | 1 |
| Permanent anchors | 1.11 |
| tan(friction angle) | 1 |
| EM cohesion c' | 1 |
| Shear strength S_u | 1 |
| Earth unfavorable | 1.35, $F_{1.4} = 1.5$ |
| Earth favorable | 1.35 |
| Water unfavorable | 1 |
| Water favorable | 1 |
| HYDRAULIC unfavorable | 1 |
| HYDRAULIC favorable | 1 |
| UPLIFT unfavorable | 1 |
| UPLIFT favorable | 1 |
| Used FS wall STR | Service |

Stage 0 Stage 2

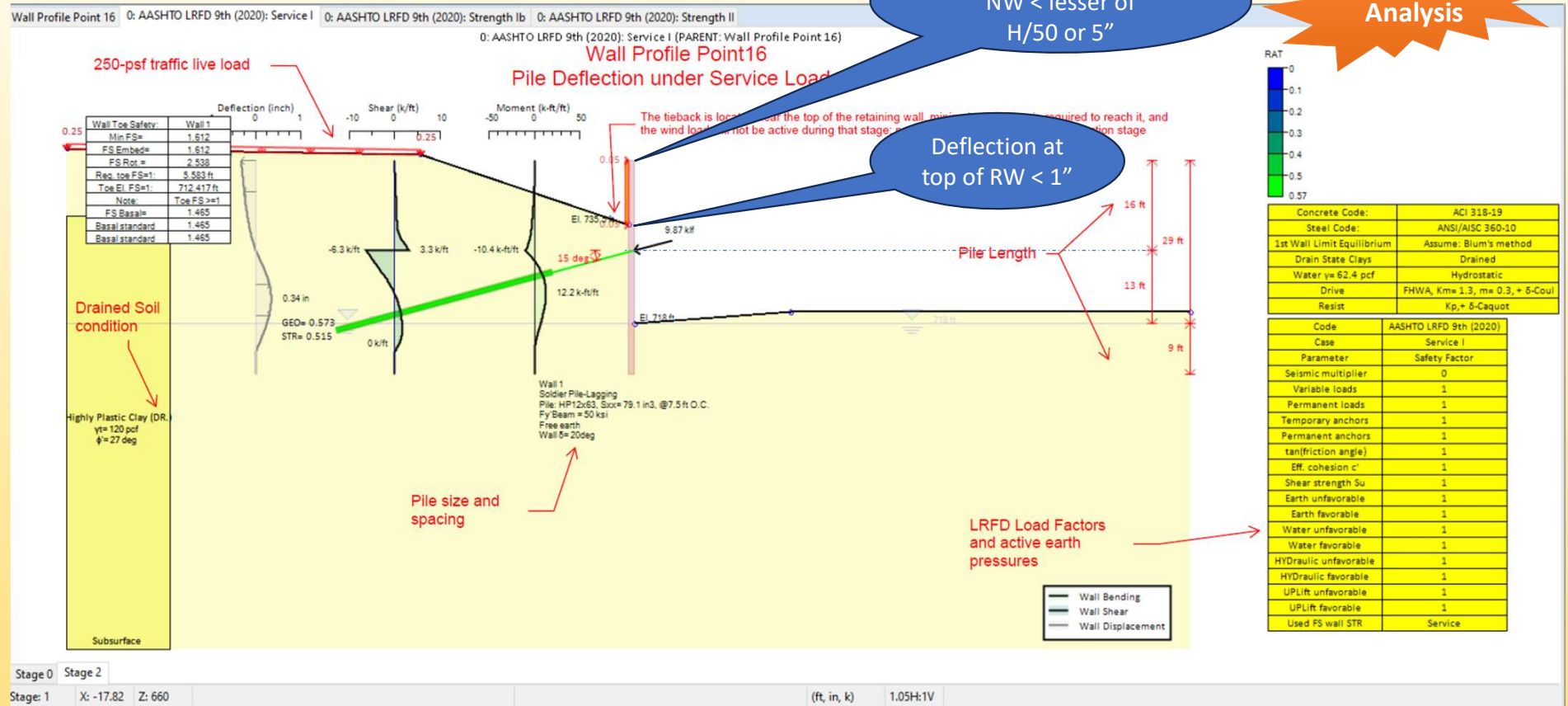
Stage 1 X: -73.43 Z: 660

(ft, in, k) 1.05H:1V

WRIGHT BROTHERS

RK&K

I-75 Interchange at I-24



I-75 Interchange at I-24

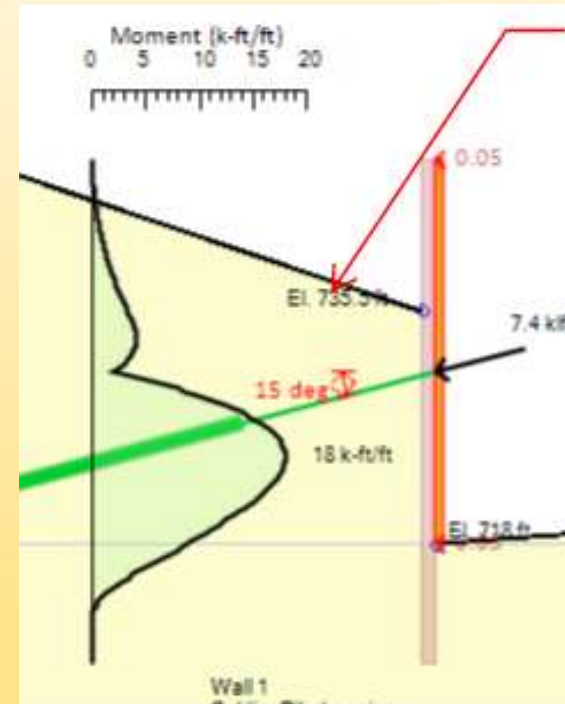
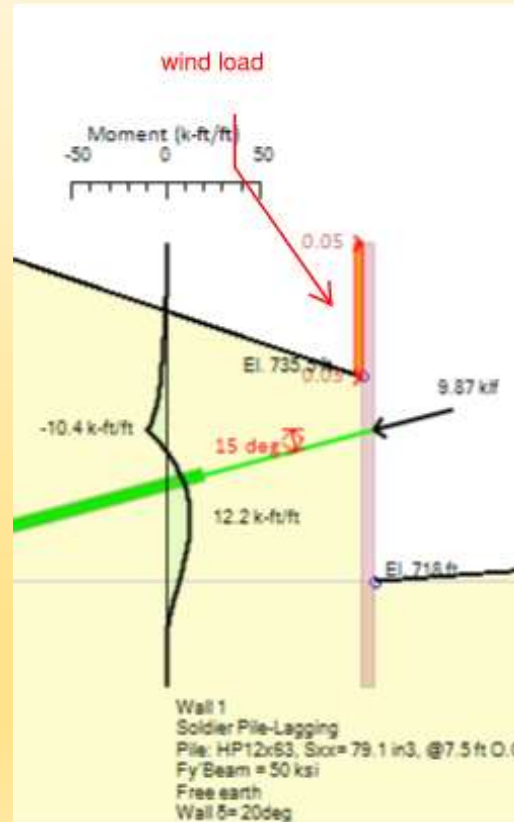
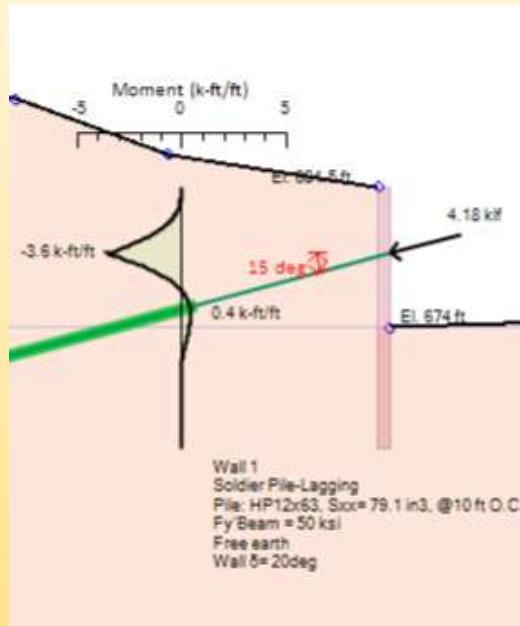
Soldier Pile Retaining Walls: Progressing Complexity

Cantilevered

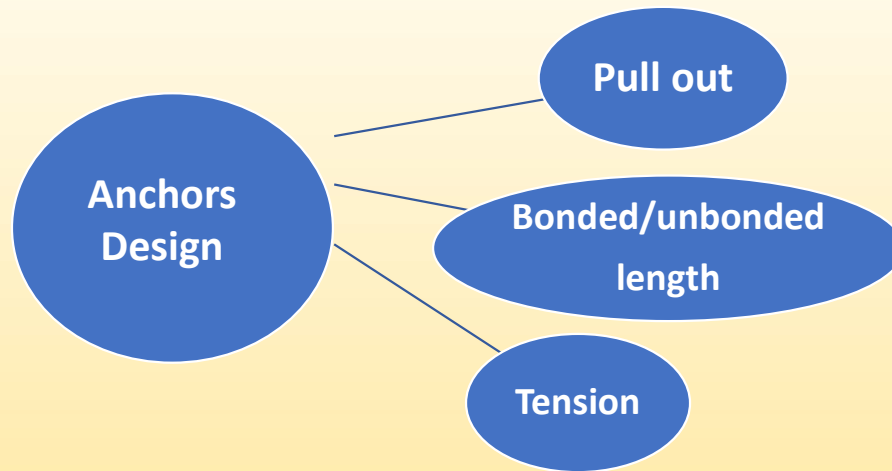
Anchored

Combo RW/NW 1

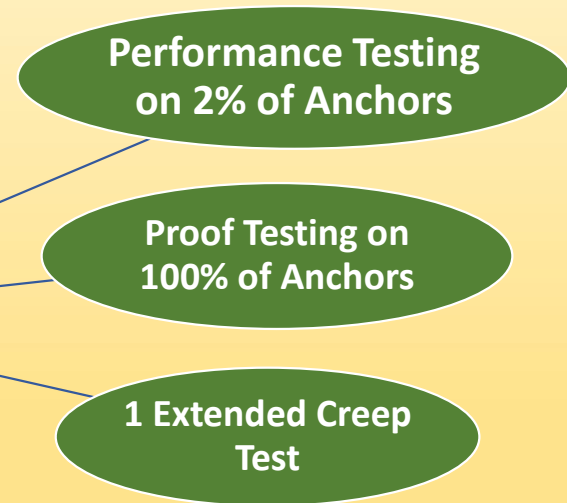
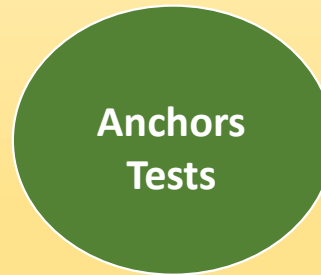
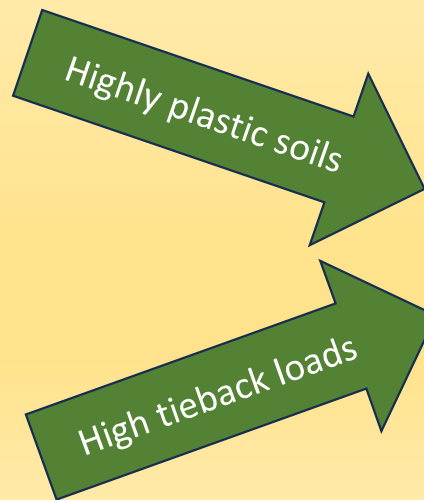
Combo RW/NW 2



I-75 Interchange at I-24



Other Considerations



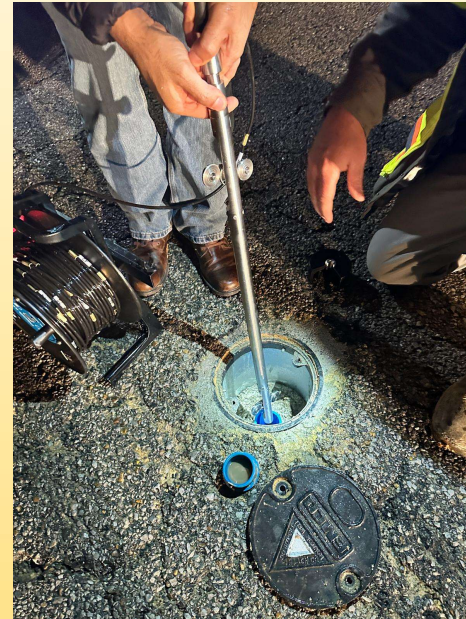
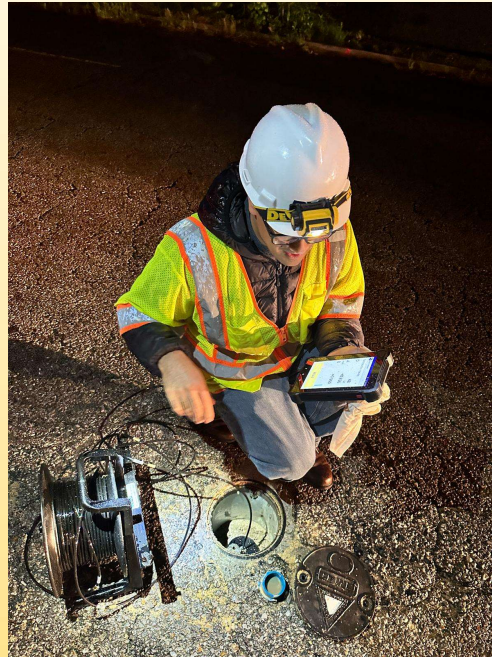
Geotechnical Highlight: III) Inclinerometers

I-75 Interchange at I-24



Two Inclinerometers
Installed on Apr 2023
Reading until Oct 2024

I-24 STA 106+00
I-24 STA 108+50



WRIGHT BROTHERS

RK&K

Thank you!

Any Question?!



I-75 Interchange at I-24

W WRIGHT
BROTHERS

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