

The Sandridge Surprise

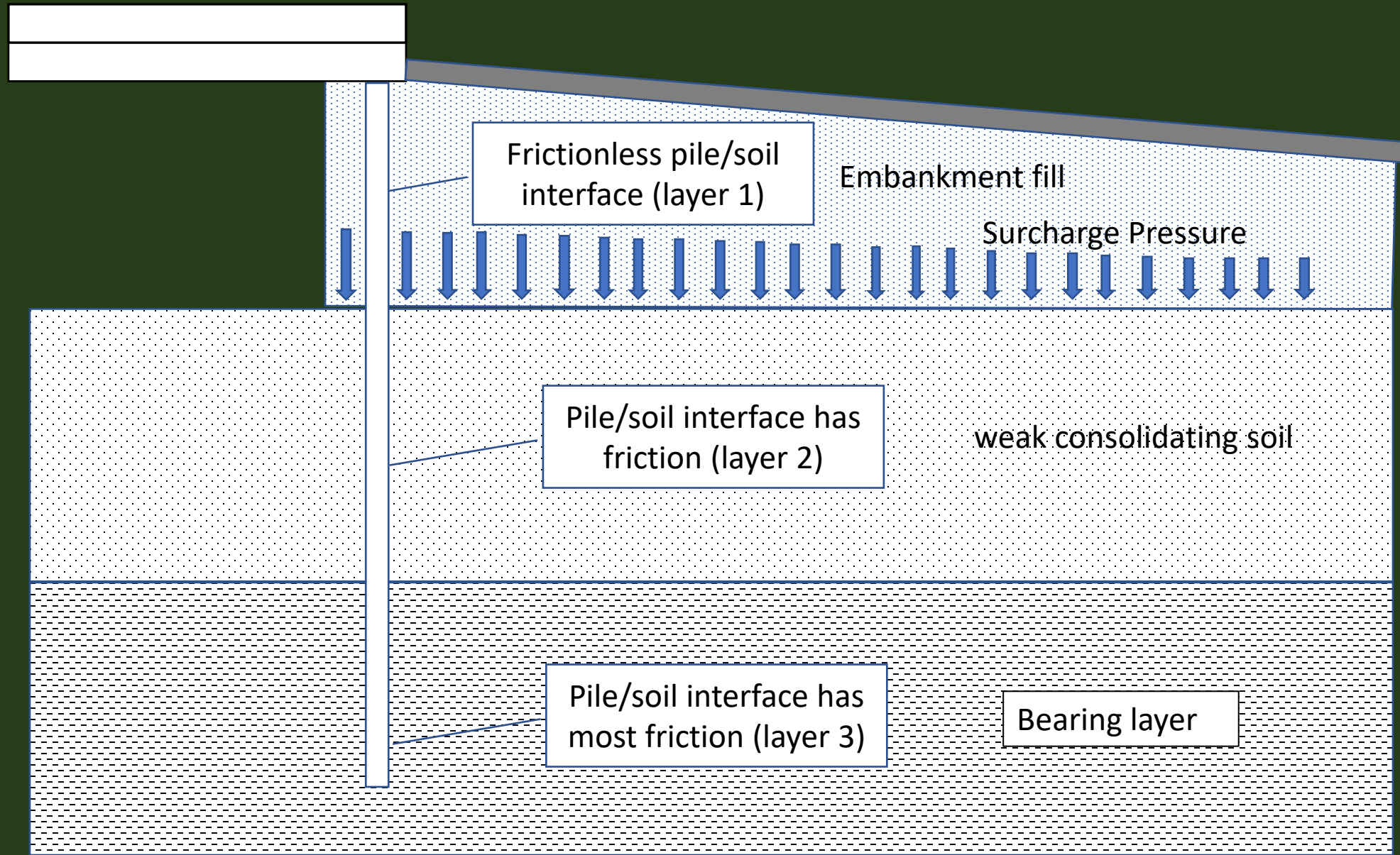
(a downdrag story)

Larry Jones, FDOT

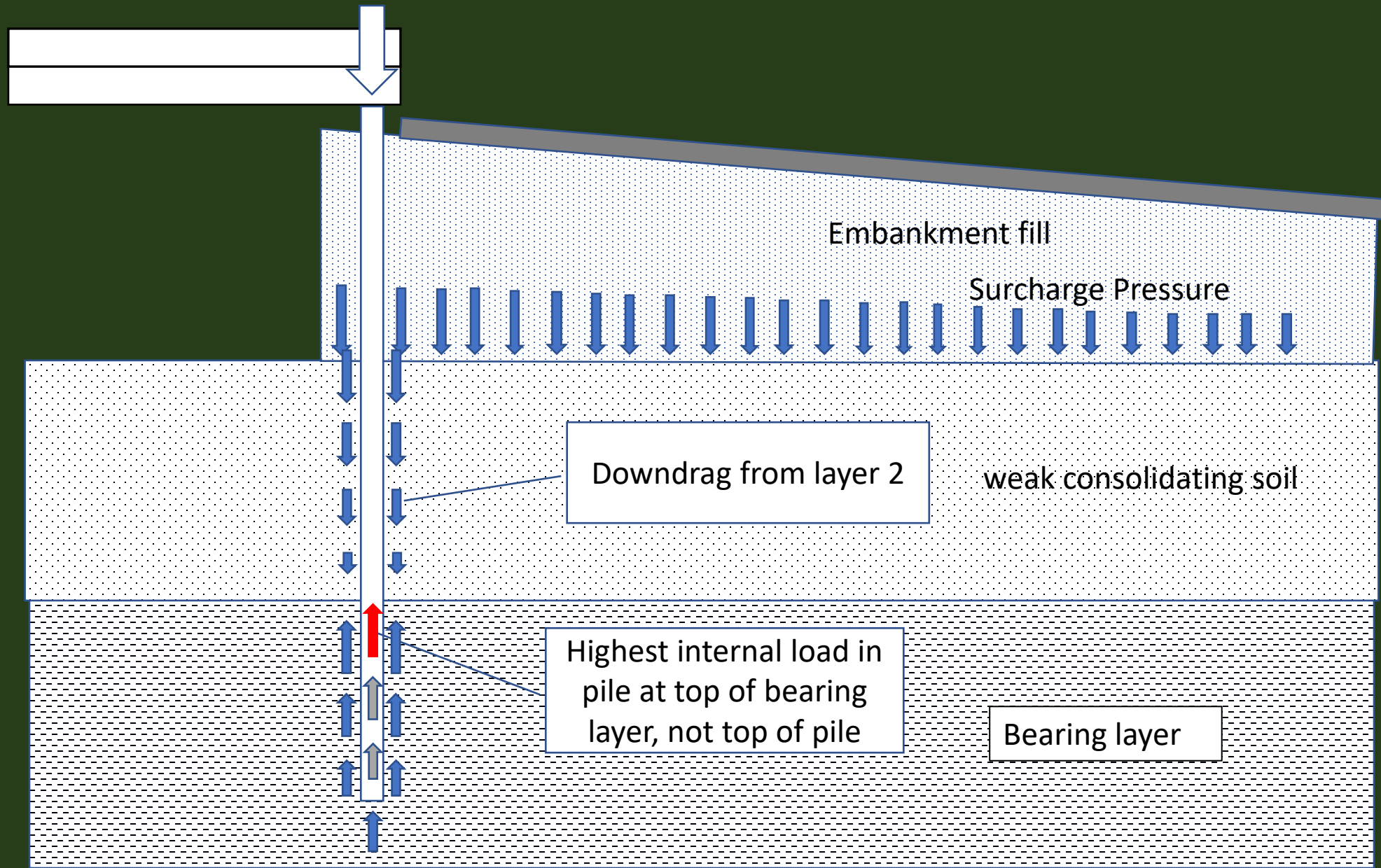
STGEC 2023

Charlotte, NC

Simple Embankment Model



Do structure loads on piles offset downdrag because they occur after the “immediate” settlements of sands supporting embankments are complete?



Sandridge Road Report -

- “Post-construction downdrag loading (negative skin friction) is not anticipated due to the primarily granular (sandy) nature of the soils encountered in the SPT borings.”

Research Project:

Field Investigation of DOWNDRAG on Concrete Piles in Sandy Soil



GRIP 2023

Project Manager
Larry Jones

Principal Investigator
Gray Mullins

Graduate Researchers
*M. Araujo, T. Mee, R. Pendyala
and A. Lewis*

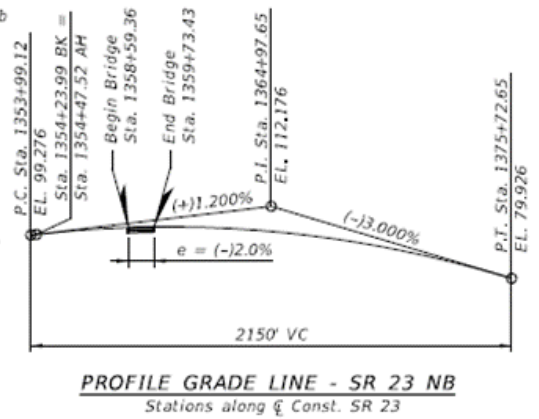
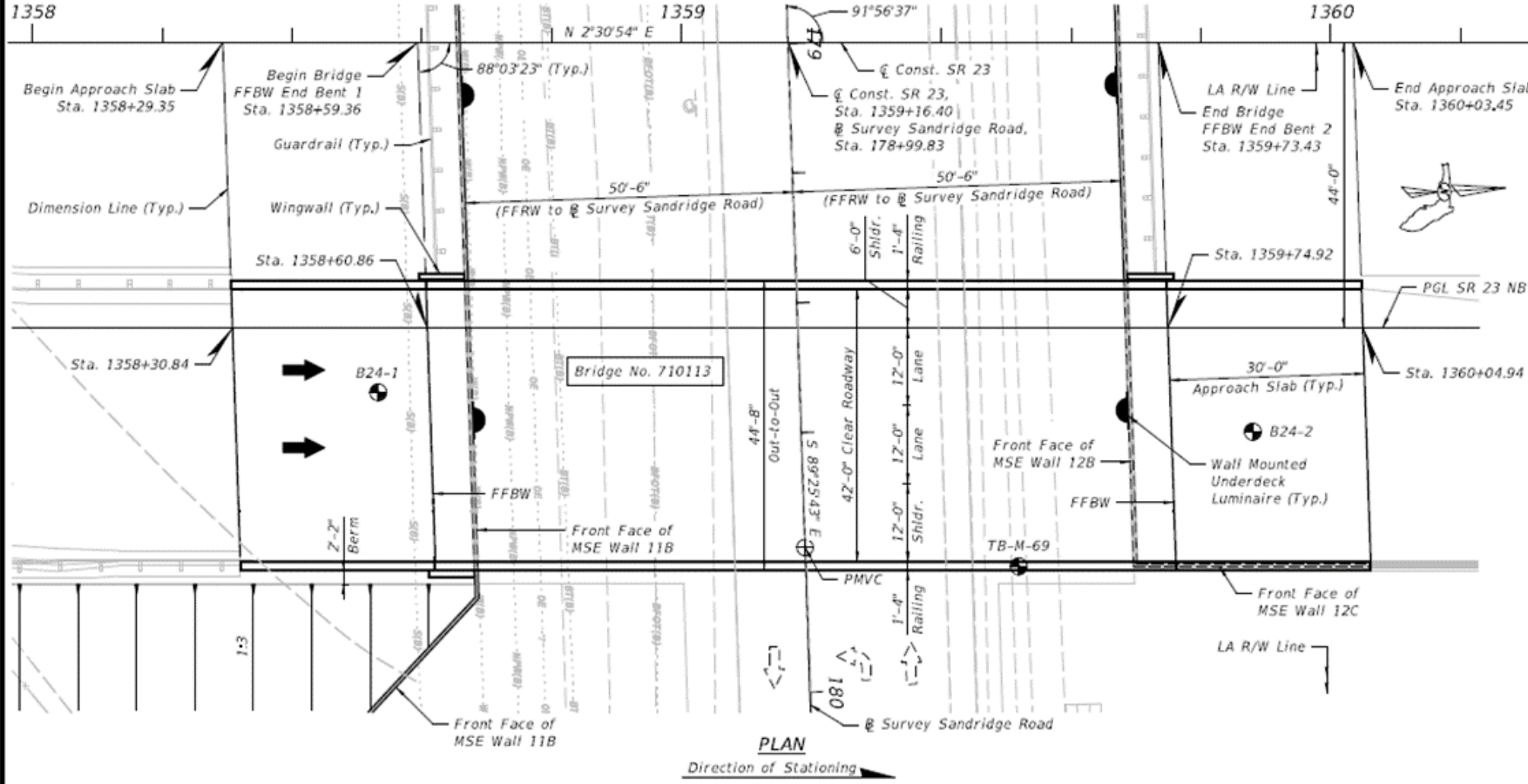


Research Project:

- 3 Bridges on Sandy Sites
 - Sandridge Road
 - Paseo Del Mar
 - Henley Road
- Internally Instrument piles
- Instrument existing soils with settlement sensors
- Long-term monitoring

Sandridge Road Bridge

- Bridge Geometry & Approaches
 - 114-ft single span bridge over existing roadway
 - 18-in PSC pile end bents
 - Wraparound MSE Abutments, approx. 26-ft high
- Soil Profile
 - Loose light gray sands in the upper strata over dense light gray sands
- Predicted Settlement
 - Modified Hough Method = 4.6 inches
 - Schmertmann Modified Method = 3.6 inches



LEGEND:

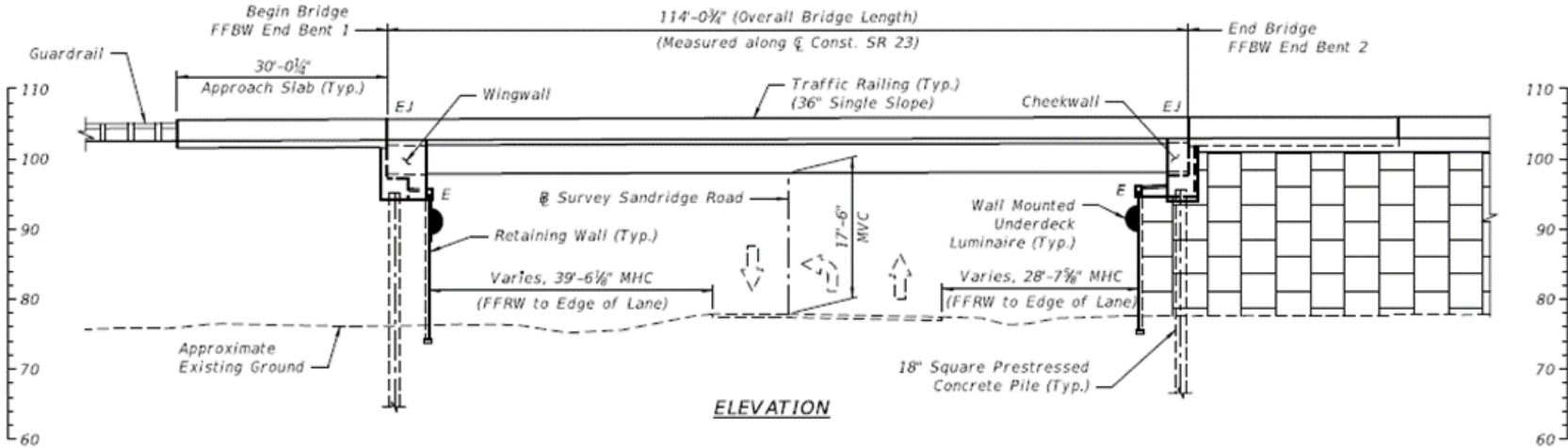
- = Boring Location
- = Luminaire

NOTES:

1. For Traffic, Horizontal Alignment, and Vertical Profile Data not shown here, see Roadway Plans.
2. For location of utilities, see FOUNDATION LAYOUT sheet.
3. All expansion joints are a poured joint with backer rod system, unless noted otherwise.

TRAFFIC DATA

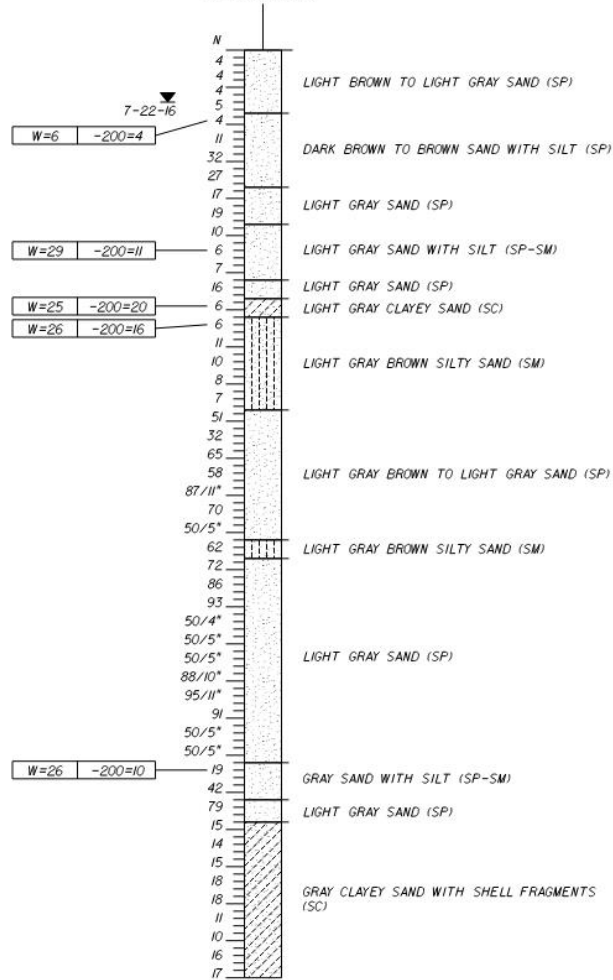
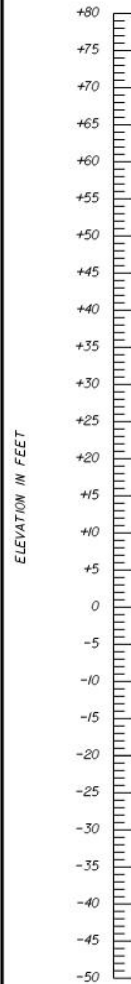
Current Year Estimate = N/A
 Opening Year Estimate = 2030 AADT = 11,400
 Design Year Estimate = 2050 AADT = 16,400
 K = 9.4%
 D = 55.0%
 T = 14.0% (24 Hour)
 Design Hour T = 7.0%
 Design Speed = 70 MPH



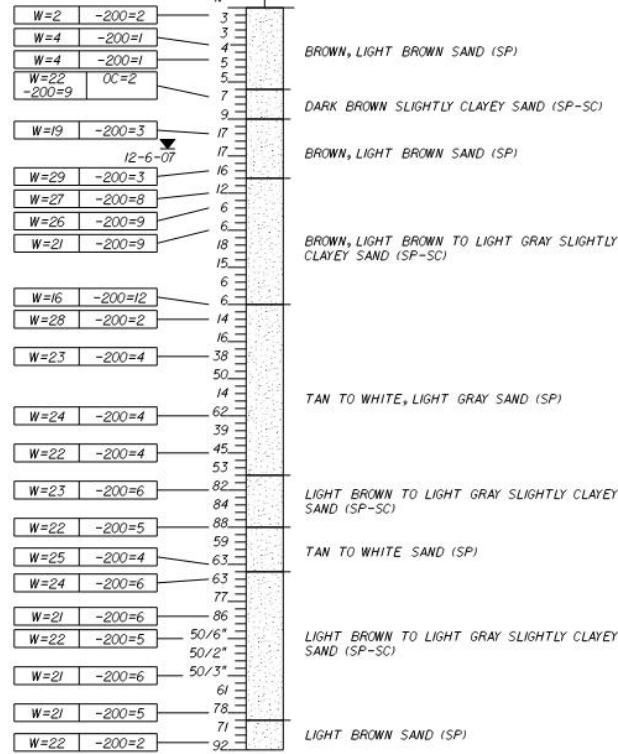
Bridge No. 710113

BORING No. B24-1
 STATION: 1358+54
 OFFSET: 55' RT.
 LATITUDE: 30.046190
 LONGITUDE: -81.779940
 ELEVATION: +77.8'

BORING No. TB-M-69
 STATION: 1356+95
 OFFSET: 81' RT.
 LATITUDE: 30.3046456
 LONGITUDE: -81.779844
 ELEVATION: +78.8'



BORING TERM. ϕ 125.0'
 NO CASING
 BORING DRILLED: 7-22-16
 HAMMER TYPE: AUTOMATIC
 RIG TYPE: CME-55
 DRILLED BY: PLANTIER



BORING TERM. ϕ 100.0'
 NO CASING
 BORING DRILLED: 12-6-07
 HAMMER TYPE: AUTOMATIC
 RIG TYPE: CME-55
 DRILLED BY: E. BLUEWKE



LEGEND



(SP) UNIFIED SOIL CLASSIFICATION GROUP SYMBOL

8-II-II ENCOUNTERED GROUNDWATER LEVEL (DATE OF READING)

W=0 NATURAL MOISTURE CONTENT (%)
 -200=0 FINES PASSING No. 200 SIEVE (%)
 LL=0 LIQUID LIMIT (%)
 PI=0 PLASTICITY INDEX (%)

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT UNLESS OTHERWISE NOTED

50/6" NUMBER OF BLOWS REQUIRED (50) TO DRIVE SAMPLING SPOON (6) INCHES

AUTOMATIC HAMMER

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA. 1 3/8 in.
 SPOON OUTSIDE DIA. 2 in.
 ASTM STANDARD DROP AUTOMATIC HAMMER
 AVG. HAMMER DROP 30 in.
 HAMMER WEIGHT 140 lbs.

GRANULAR MATERIALS

RELATIVE DENSITY	SPT (BLOWS/FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS

CONSISTENCY	SPT (BLOWS/FOOT)
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

NOTES:

1) LAYER BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL LAYERS AT EACH TEST HOLE LOCATION ONLY. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED.

ENVIRONMENTAL CLASSIFICATION:

SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE

SUBSTRUCTURE:

STEEL: EXTREMELY AGGRESSIVE (pH<6)

CONCRETE: EXTREMELY AGGRESSIVE (pH<5)

Design Loads

- Pile Loads (Service):
 - DL = 81 tons (162k)
 - LL = 41 tons (82k)
- Factored Design Loads:
 - DL = 1.25 (81) = 101.3 tons (202.6k)
 - LL = 1.75 (41) = 71.7 tons (143.4k)
 - FDL = 173 tons (346k)
- Required Nominal Bearing Resistance
 - $(173)/0.65 = 266.2 \Rightarrow 267$ tons (534k)

NBR=267 tons, FDL=173, DD=0

PILE DATA TABLE

INSTALLATION CRITERIA

DESIGN CRITERIA

PIER or BENT NUMBER	PILE SIZE (in.)	INSTALLATION CRITERIA						DESIGN CRITERIA							
		NOMINAL BEARING RESISTANCE (tons)	NOMINAL UPLIFT RESISTANCE (tons)	MINIMUM TIP ELEVATION (ft.)	TEST PILE LENGTH (ft.)	REQUIRED JET ELEVATION (ft.)	REQUIRED PREFORM ELEVATION (ft.)	FACTORED DESIGN LOAD (tons)	FACTORED DESIGN UPLIFT LOAD (tons)	DOWN DRAG (tons)	TOTAL SCOUR RESISTANCE (tons)	NET SCOUR RESISTANCE (tons)	100-YEAR SCOUR ELEVATION (ft.)	Ø COMPRESSION	Ø UPLIFT
End Bent 1	18	267	N/A	N/A	95	N/A	N/A	173	0	0	N/A	N/A	N/A	0.65	N/A
End Bent 2	18	267	N/A	N/A	95	N/A	N/A	173	0	0	N/A	N/A	N/A	0.65	N/A

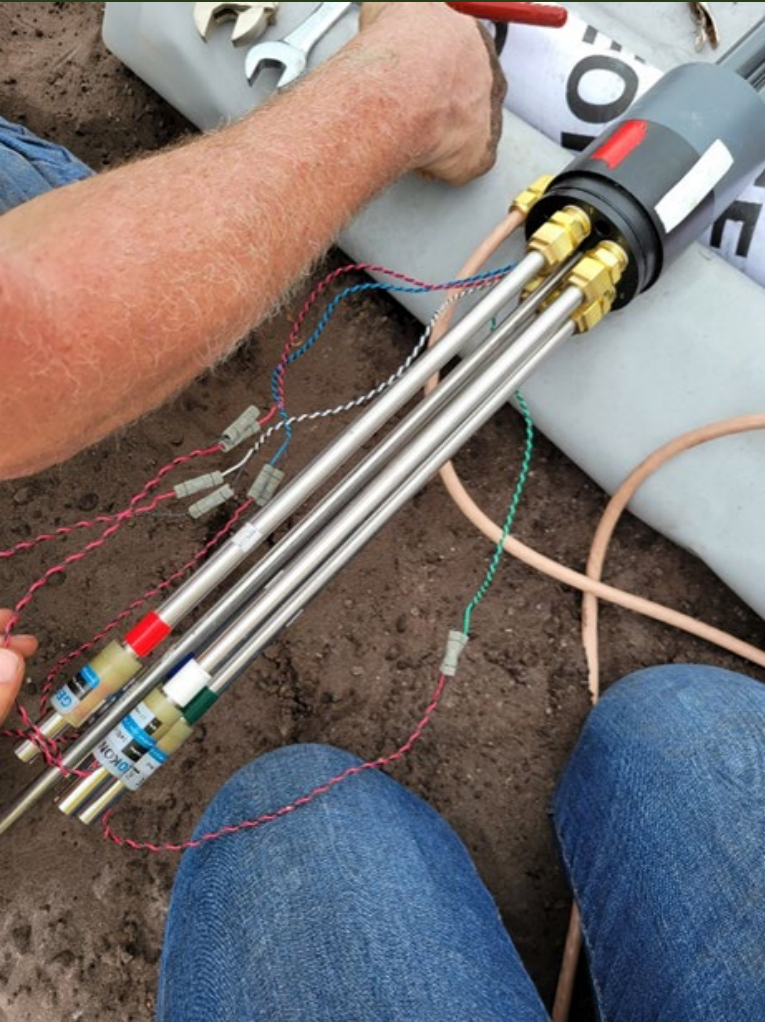
Instrumenting Piles



Pile Instrumentation



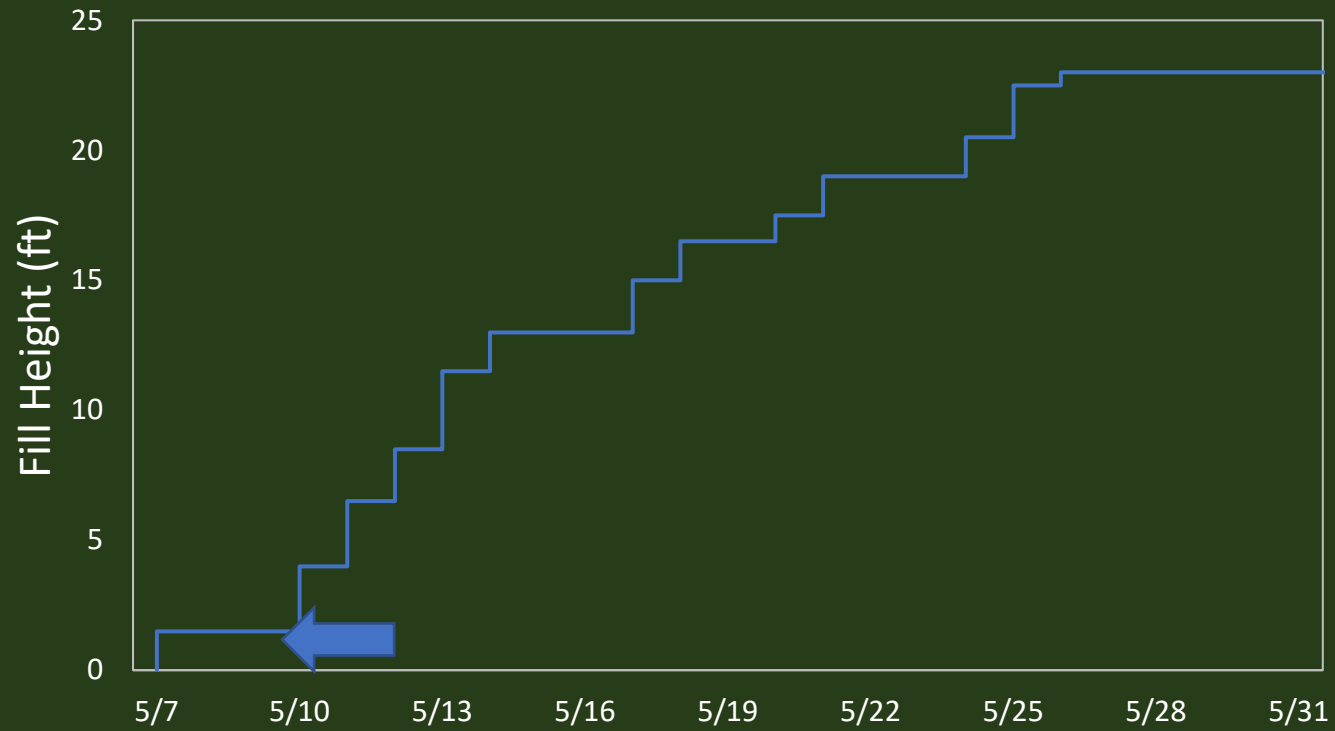
Instrument the Ground 15-ft from the Pile



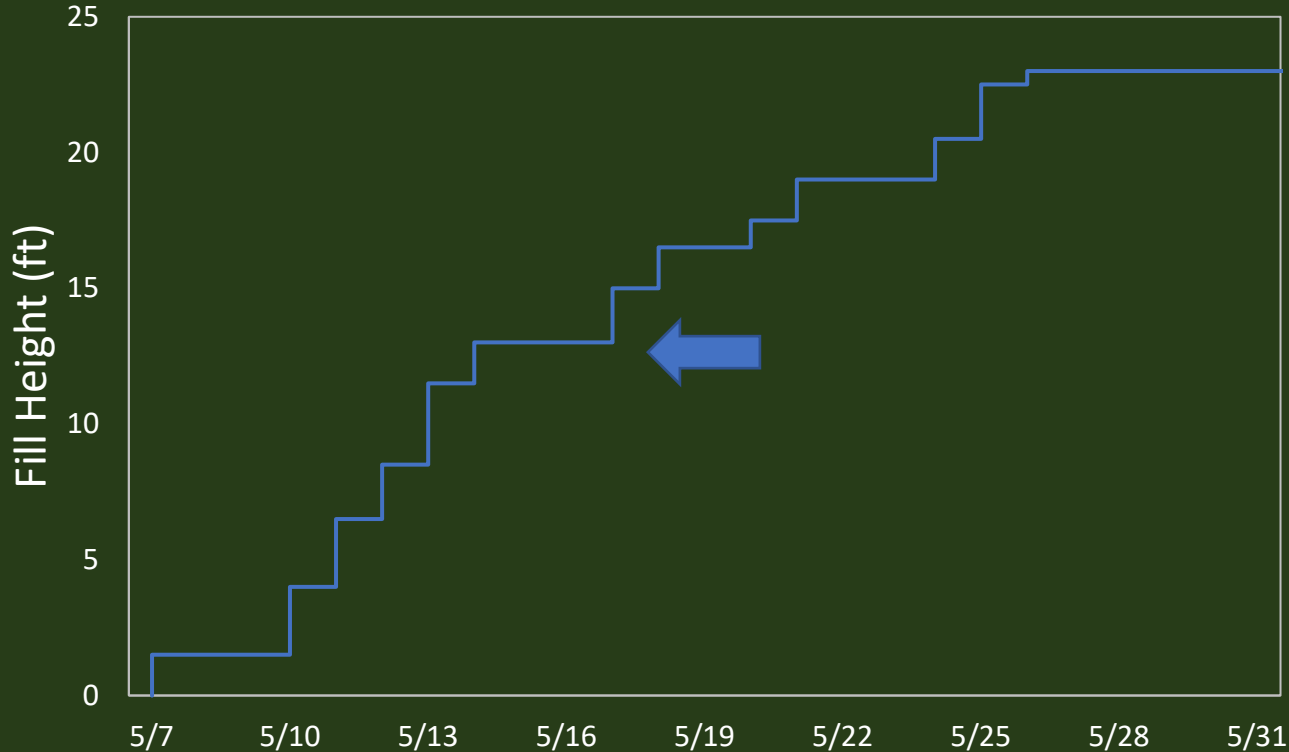
Protect Instrument Leads for Monitoring



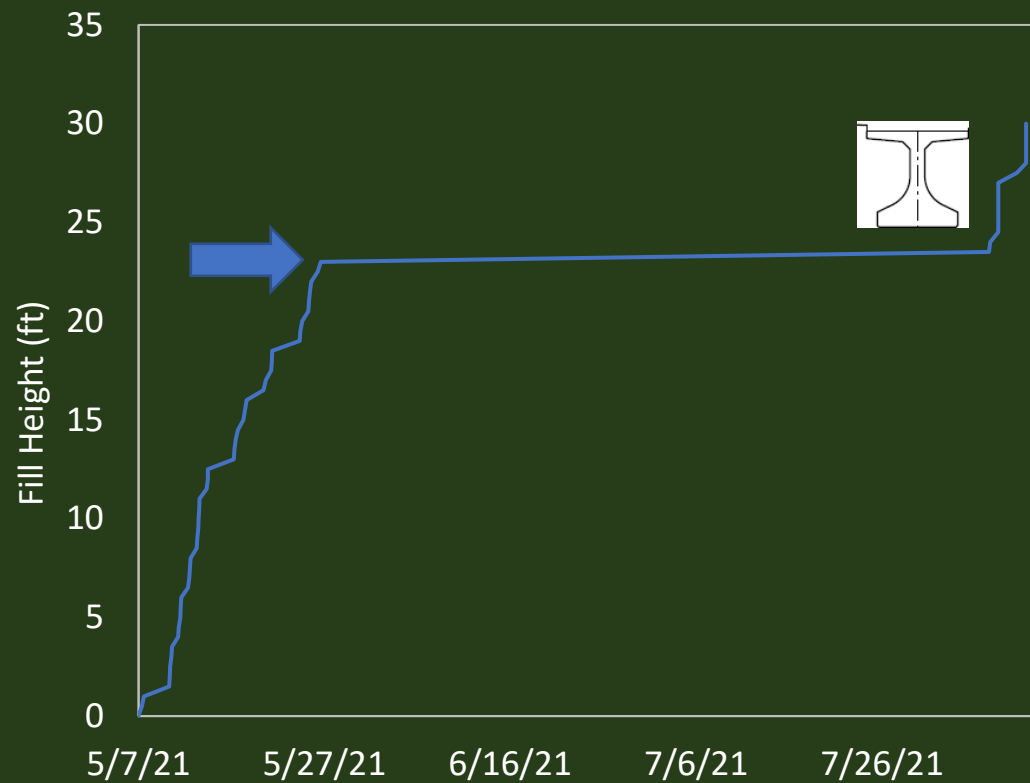
Sandridge Road Backfill



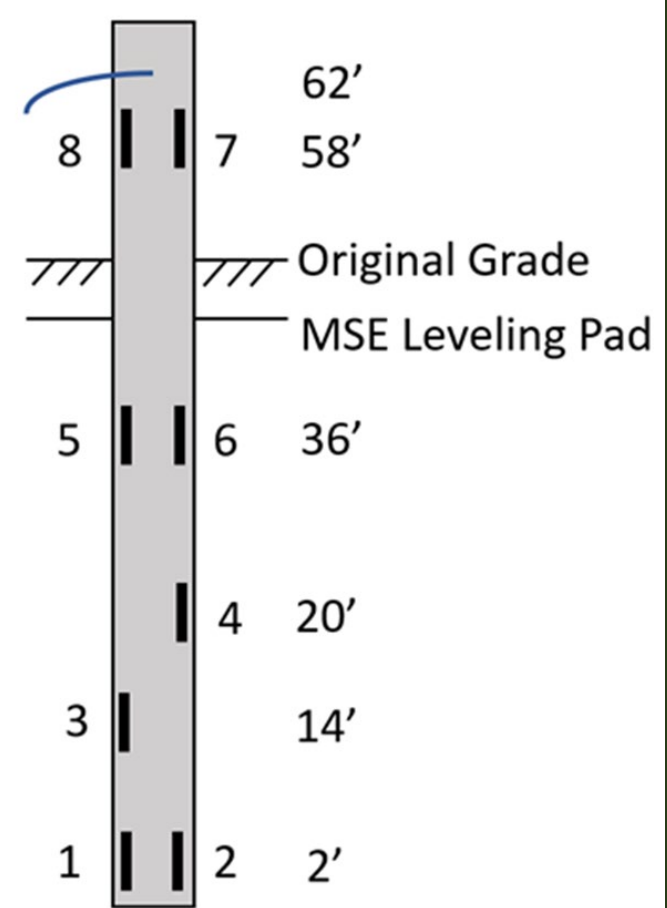
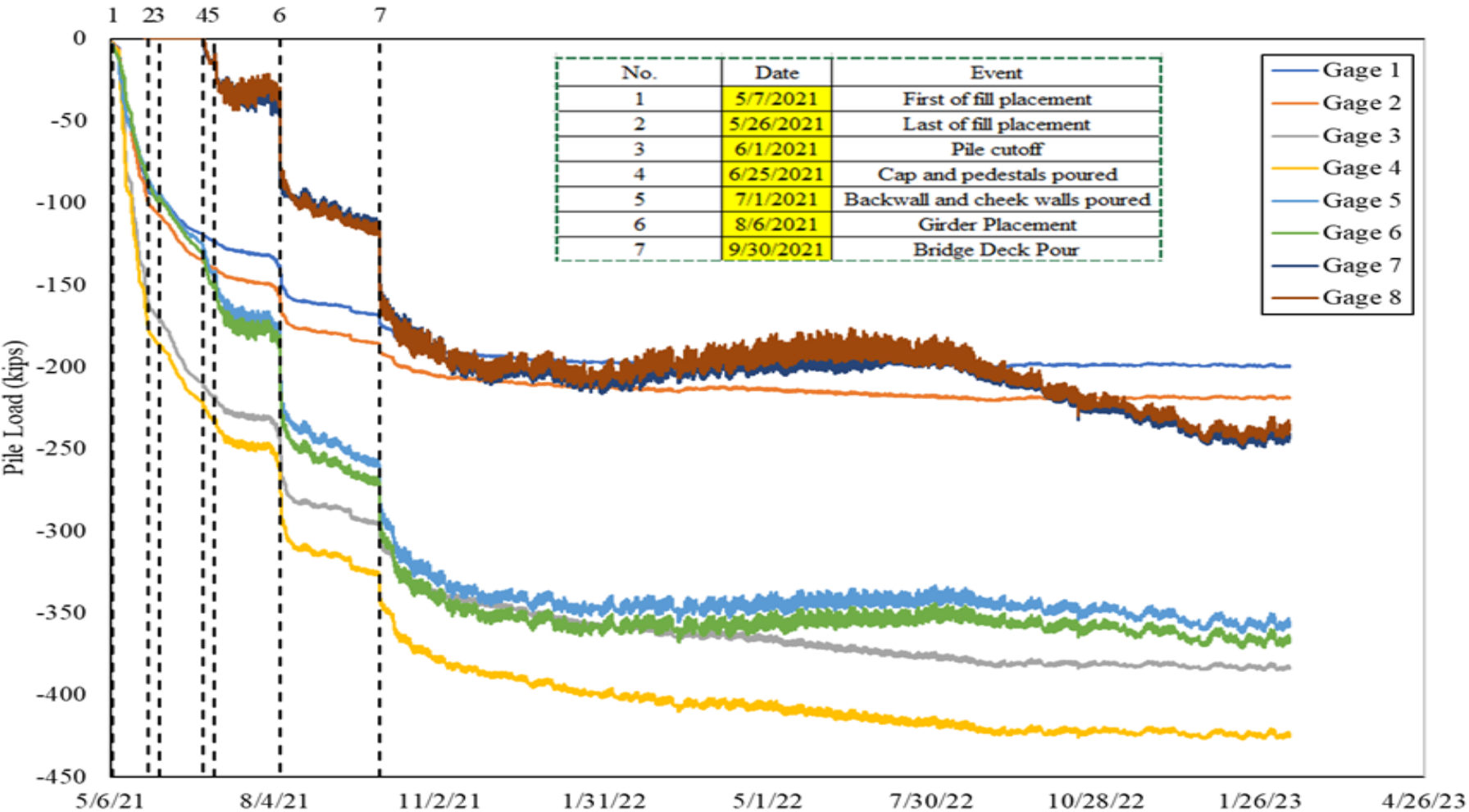
Sandridge Road Backfill



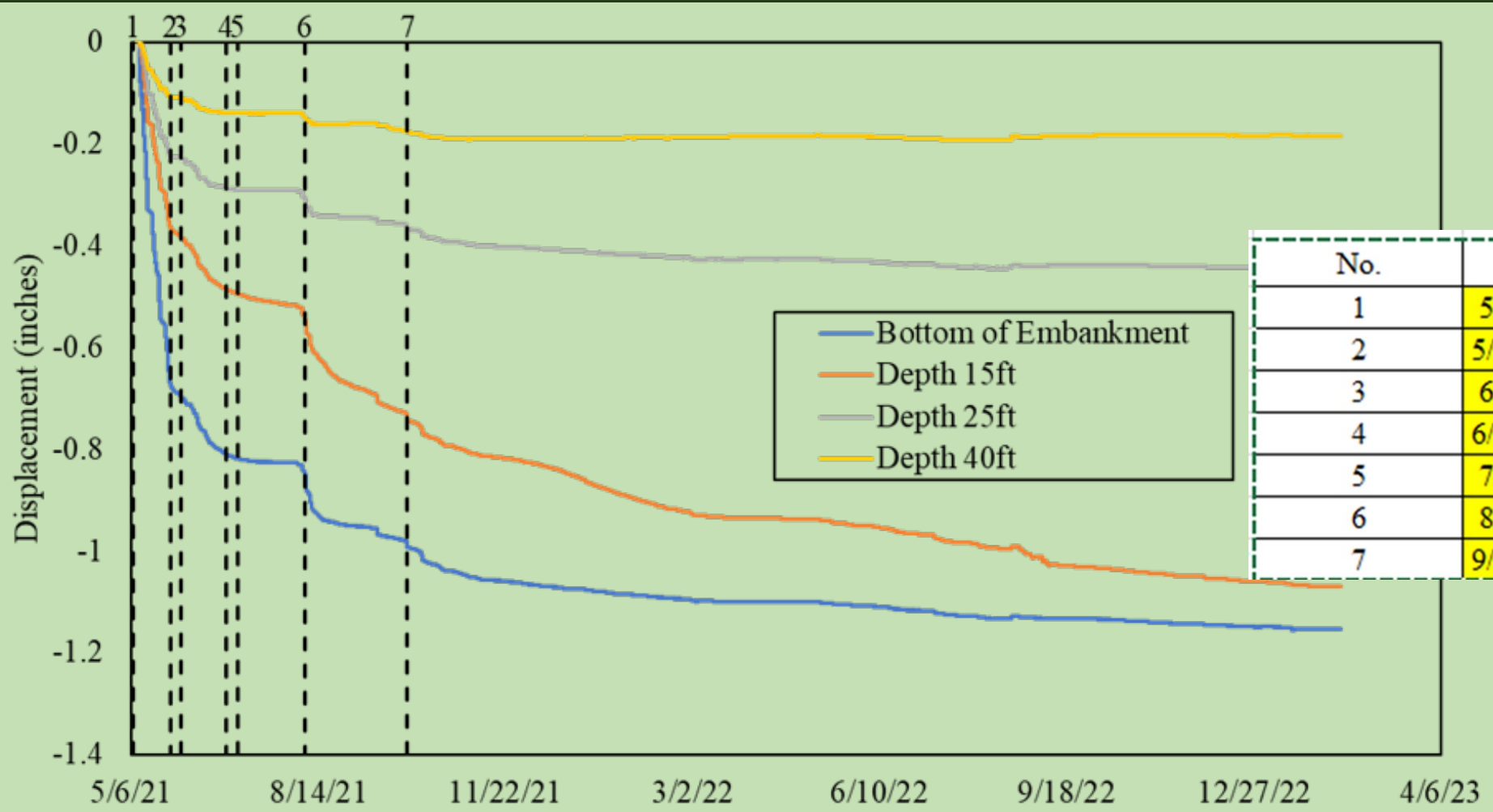
Sandridge Road Backfill



Pile Forces vs Time

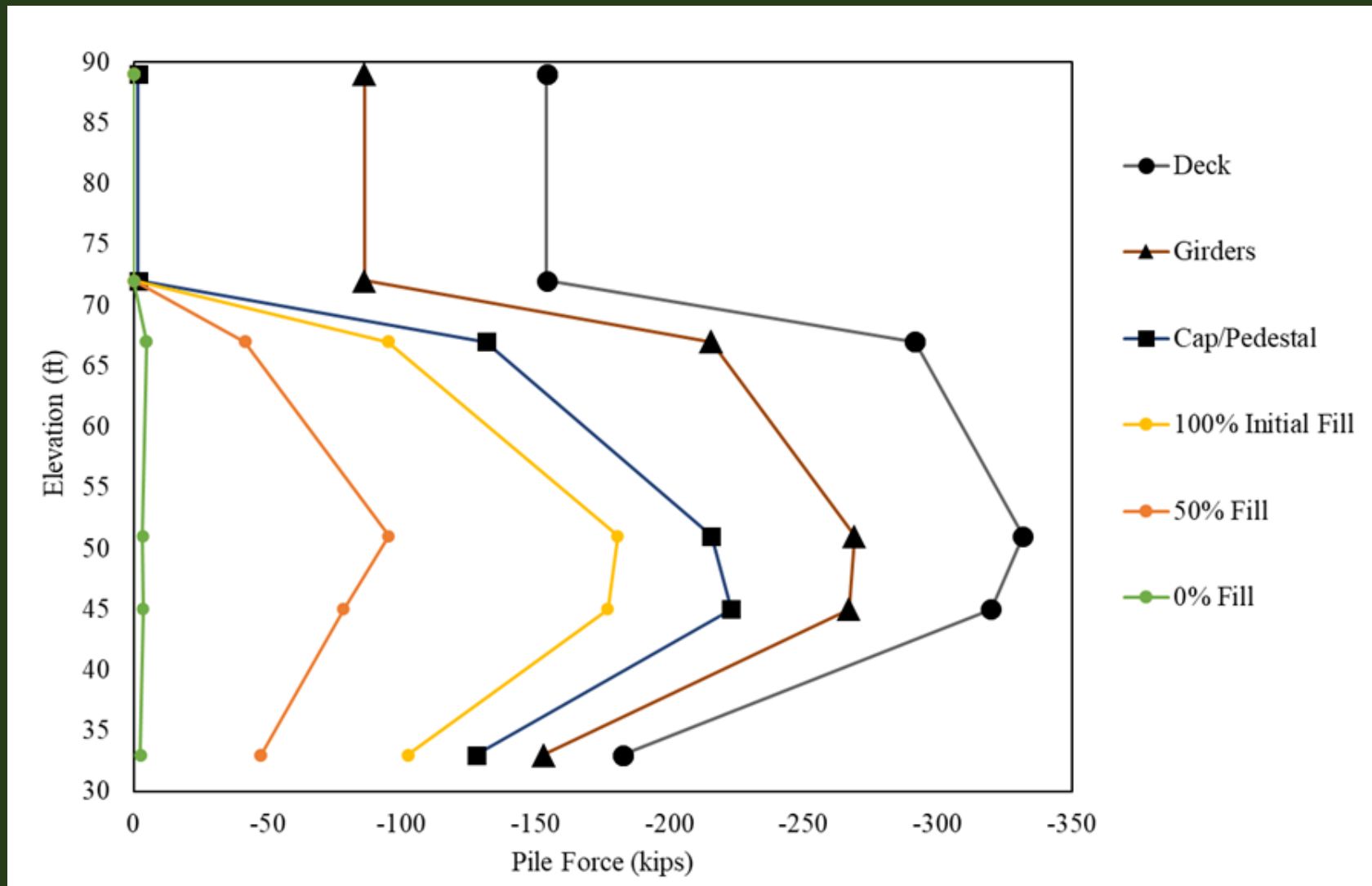


Settlements Measured by Extensometer



No.	Date	Event
1	5/7/2021	First of fill placement
2	5/26/2021	Last of fill placement
3	6/1/2021	Pile cutoff
4	6/25/2021	Cap and pedestals poured
5	7/1/2021	Backwall and cheek walls poured
6	8/6/2021	Girder Placement
7	9/30/2021	Bridge Deck Pour

Sandridge Road Pile Forces vs Construction



Force (kips)

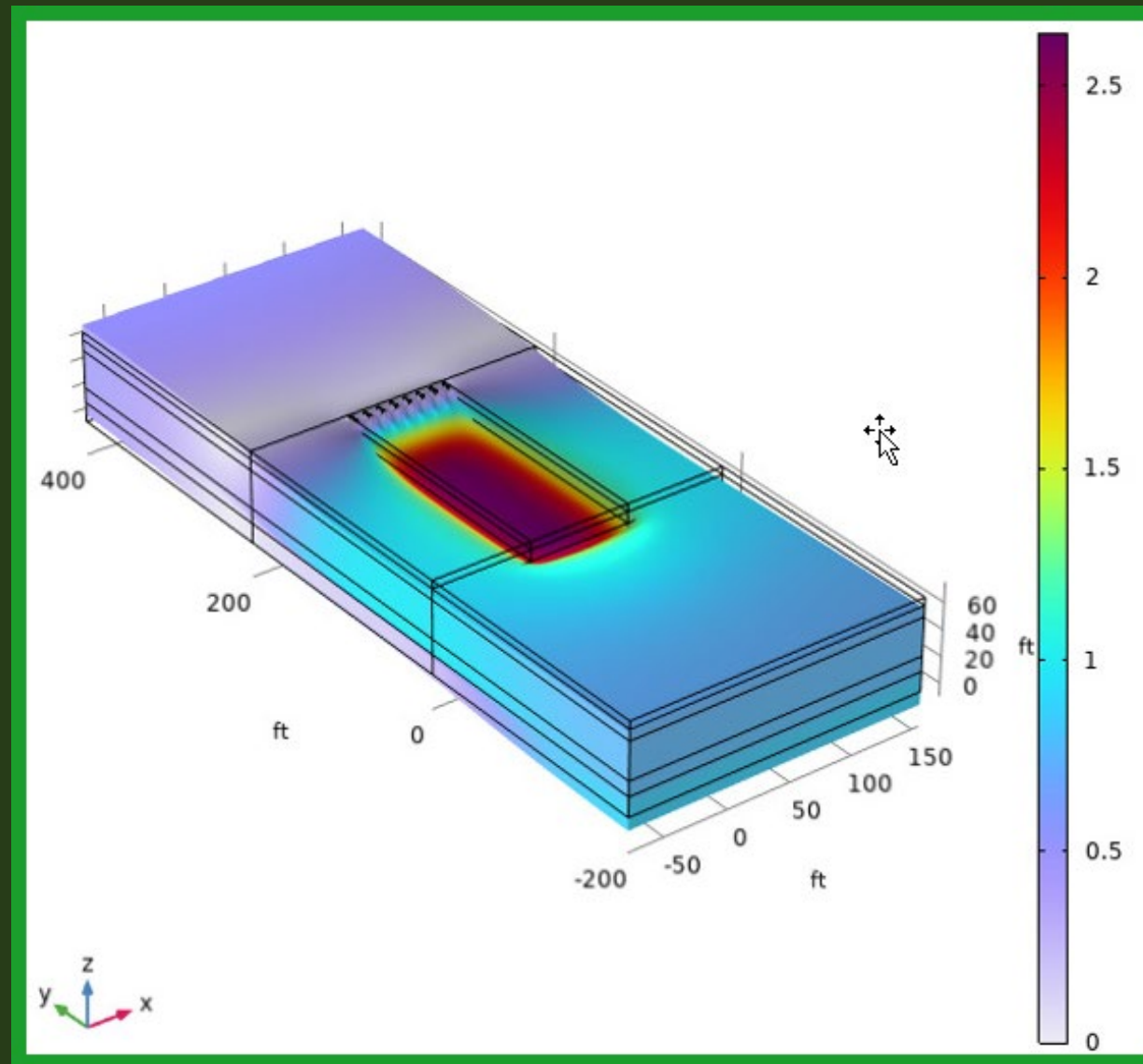
-280
-285
-290
-295

Feb 17, 2023 at 9:21:49 AM
2540-2548 Sandridge Rd
Green Cove Springs FL 32043
United States

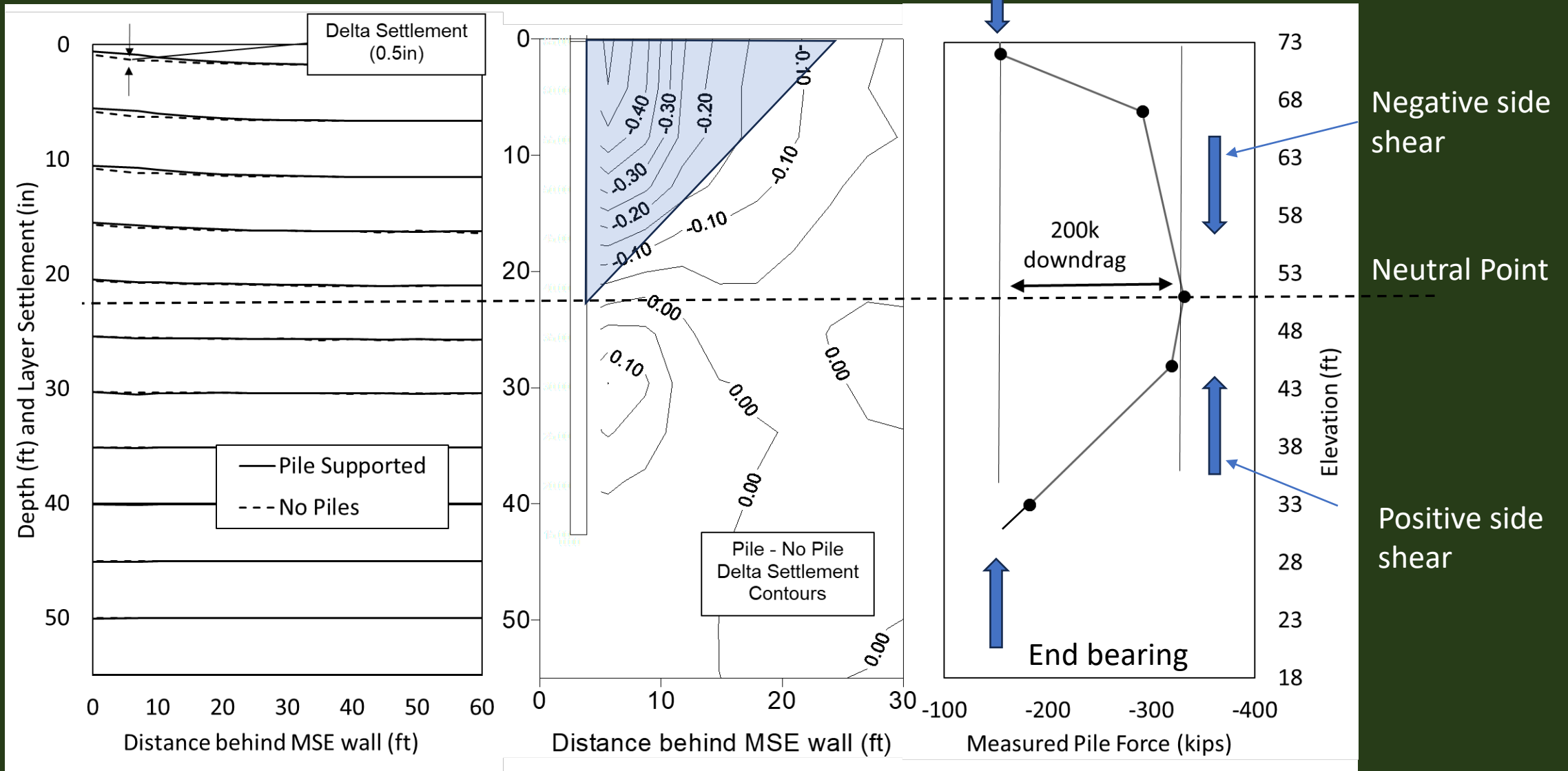


Full Truck Load (Event 4, 4.6mph)

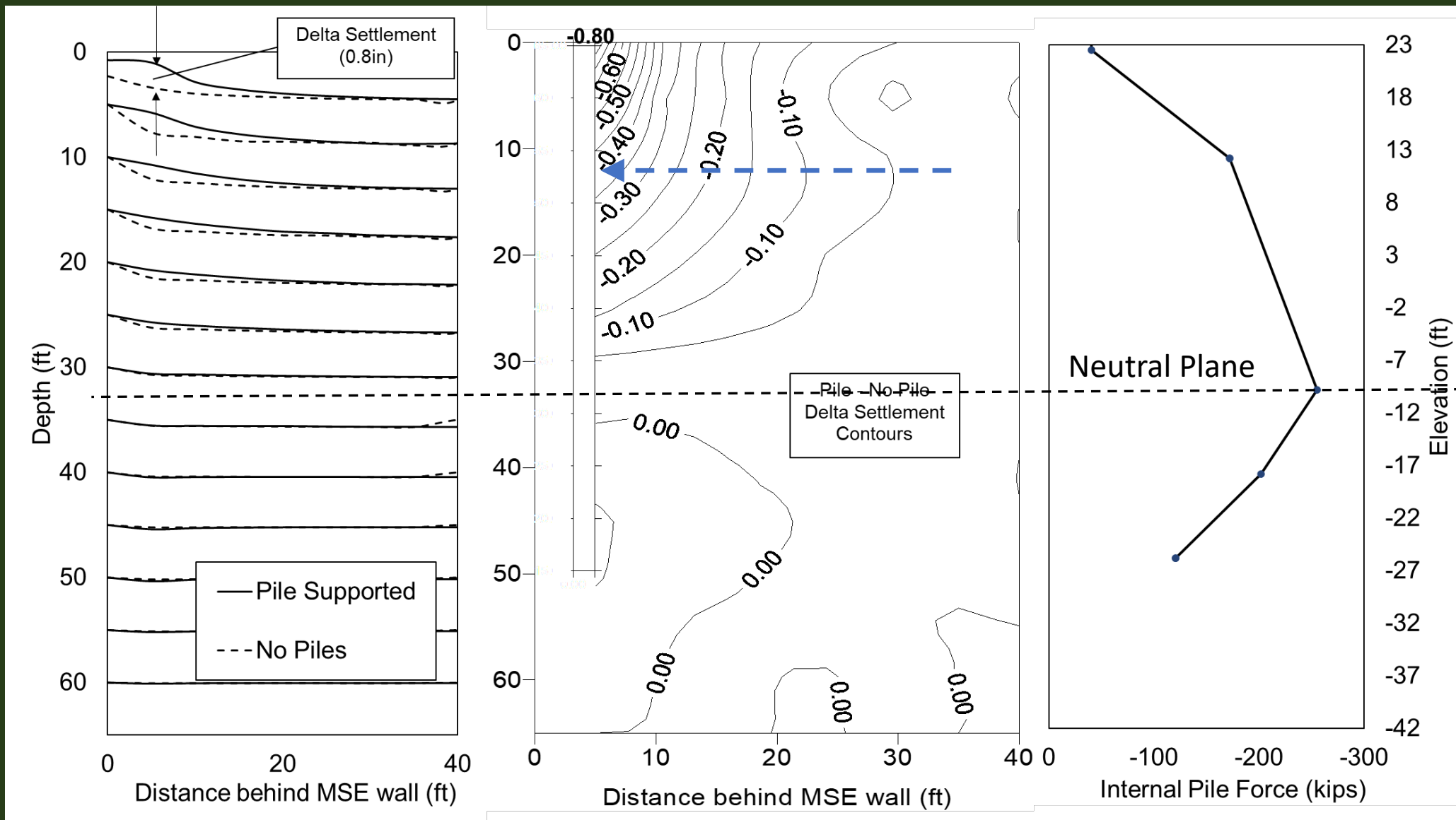
FEM of Soil Settlement



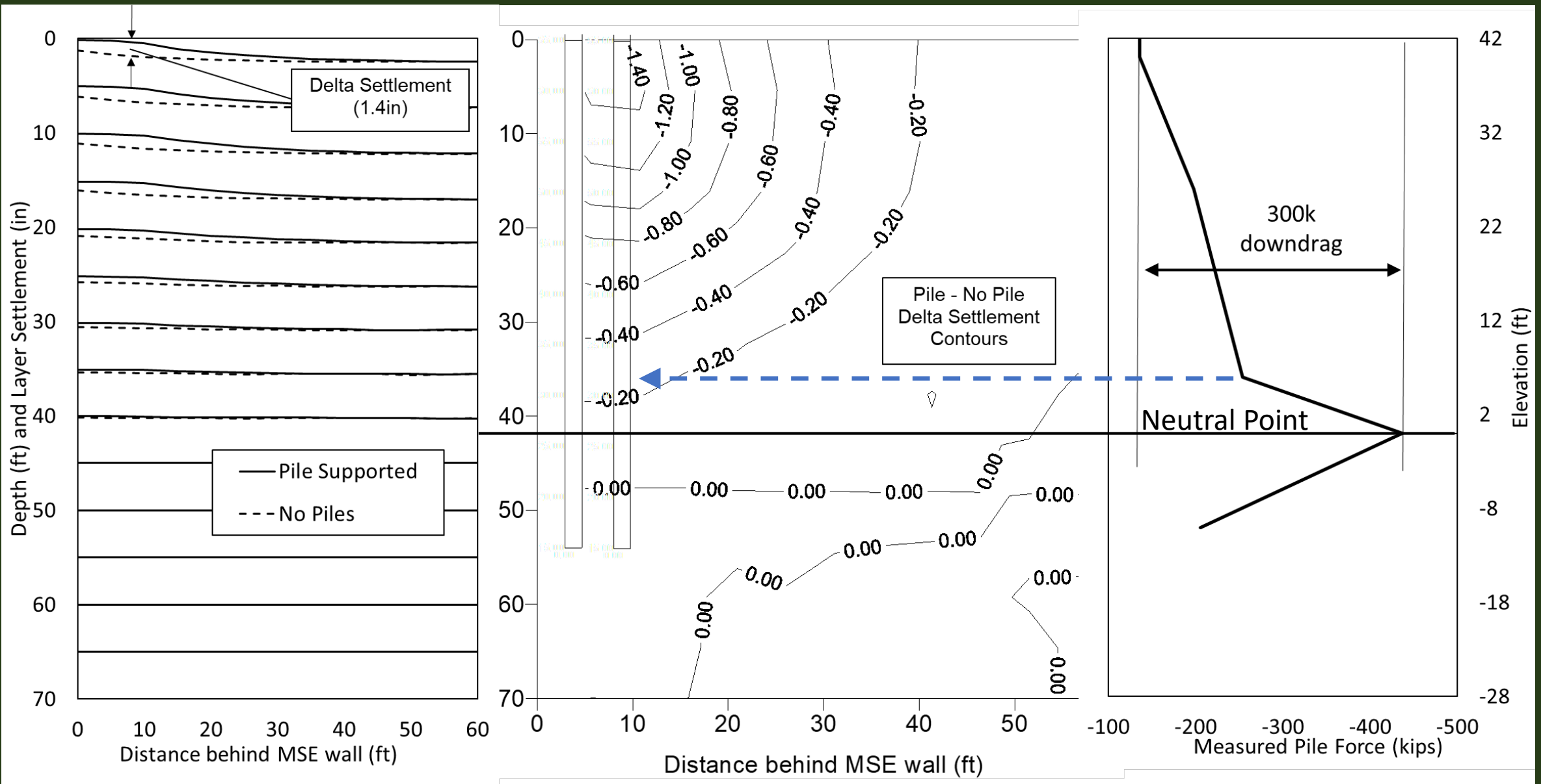
Sandridge Rd Delta Settlement



Henley Rd Delta Settlement



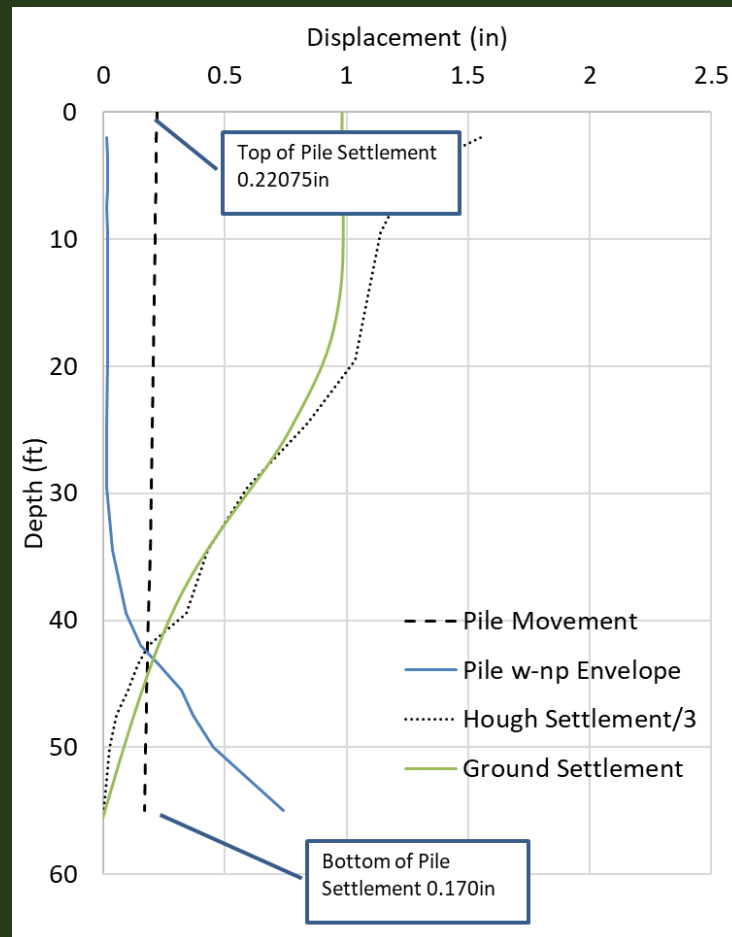
Paseo Al Mar Blvd Delta Settlement



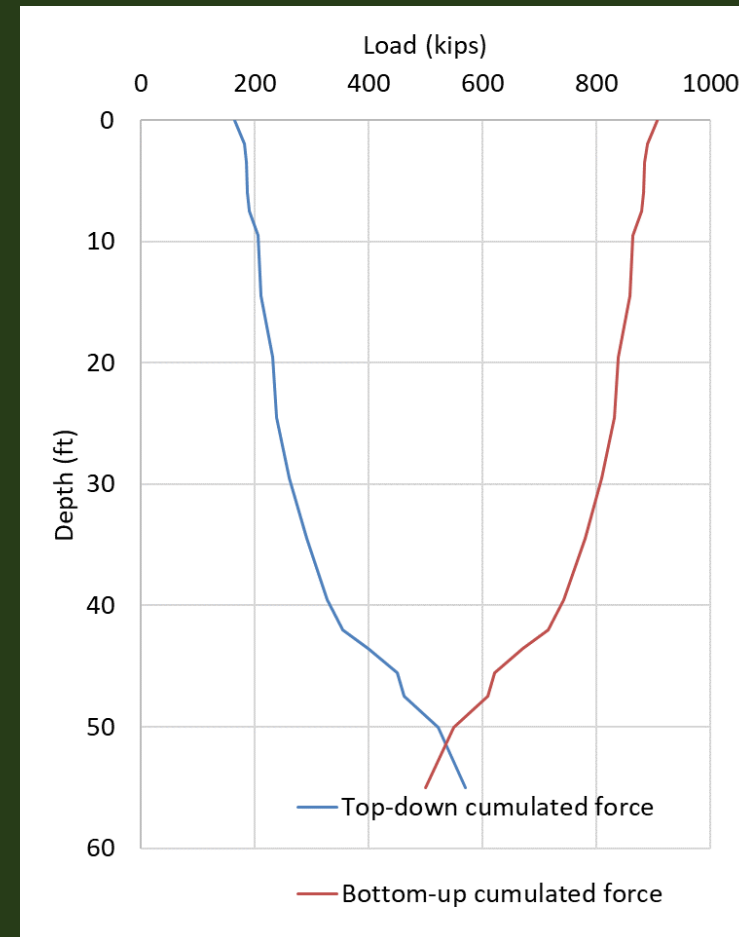
Predicting Downdrag (Paseo Al Mar shown)

Briaud & Tucker's

Neutral Point Method



Neutral Plane Method





Questions?