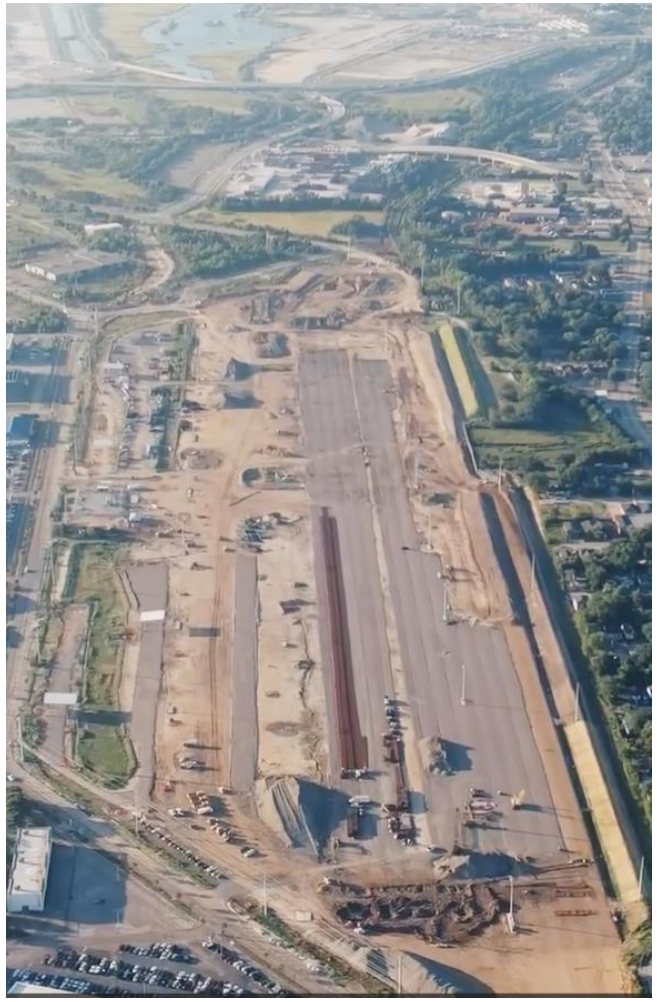
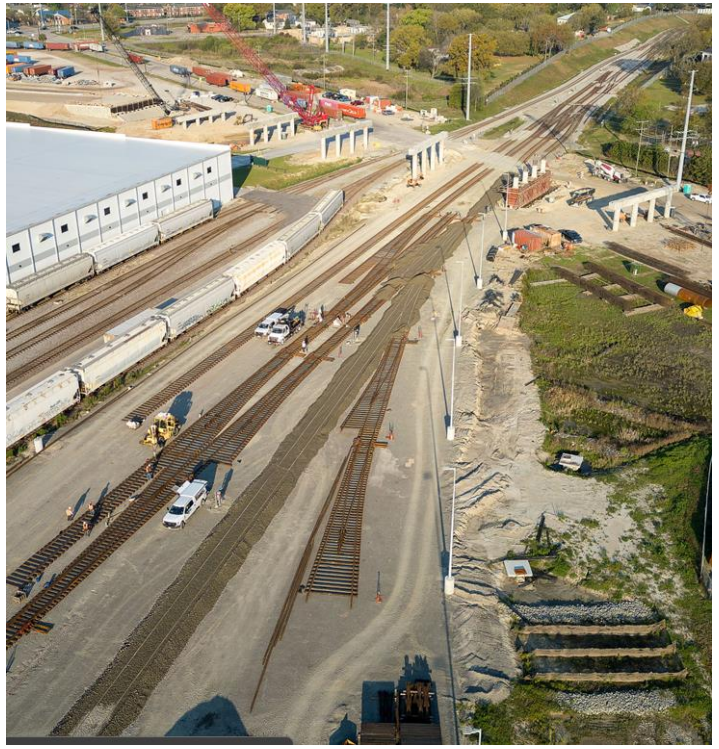
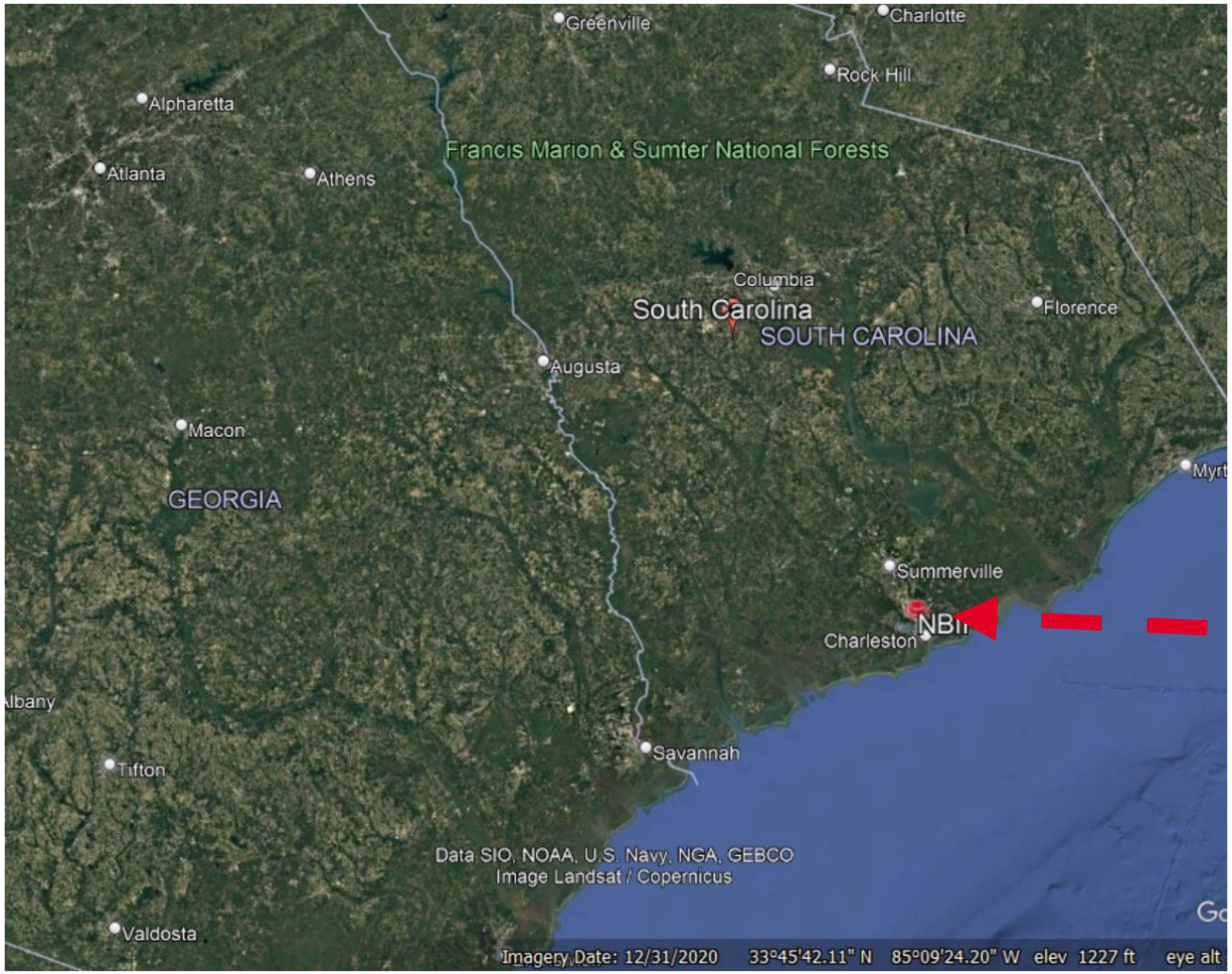
Navy Base Intermodal Facility (NBIF)



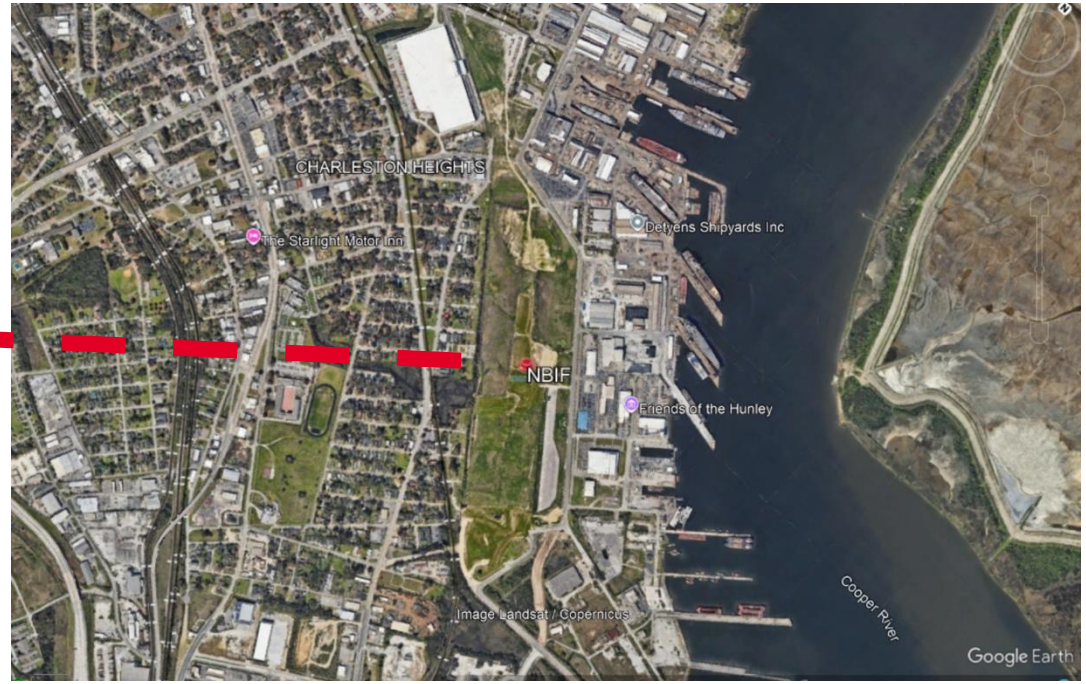




PROJECT LOCATION



The **Navy Base Intermodal Facility (NBIF)** is in **North Charleston, SC**, near the Cooper River, with direct rail access to Inland Ports Greer and Dillon. It connects to major highways **I-26 and I-526**, supporting freight movement for the Port of Charleston.

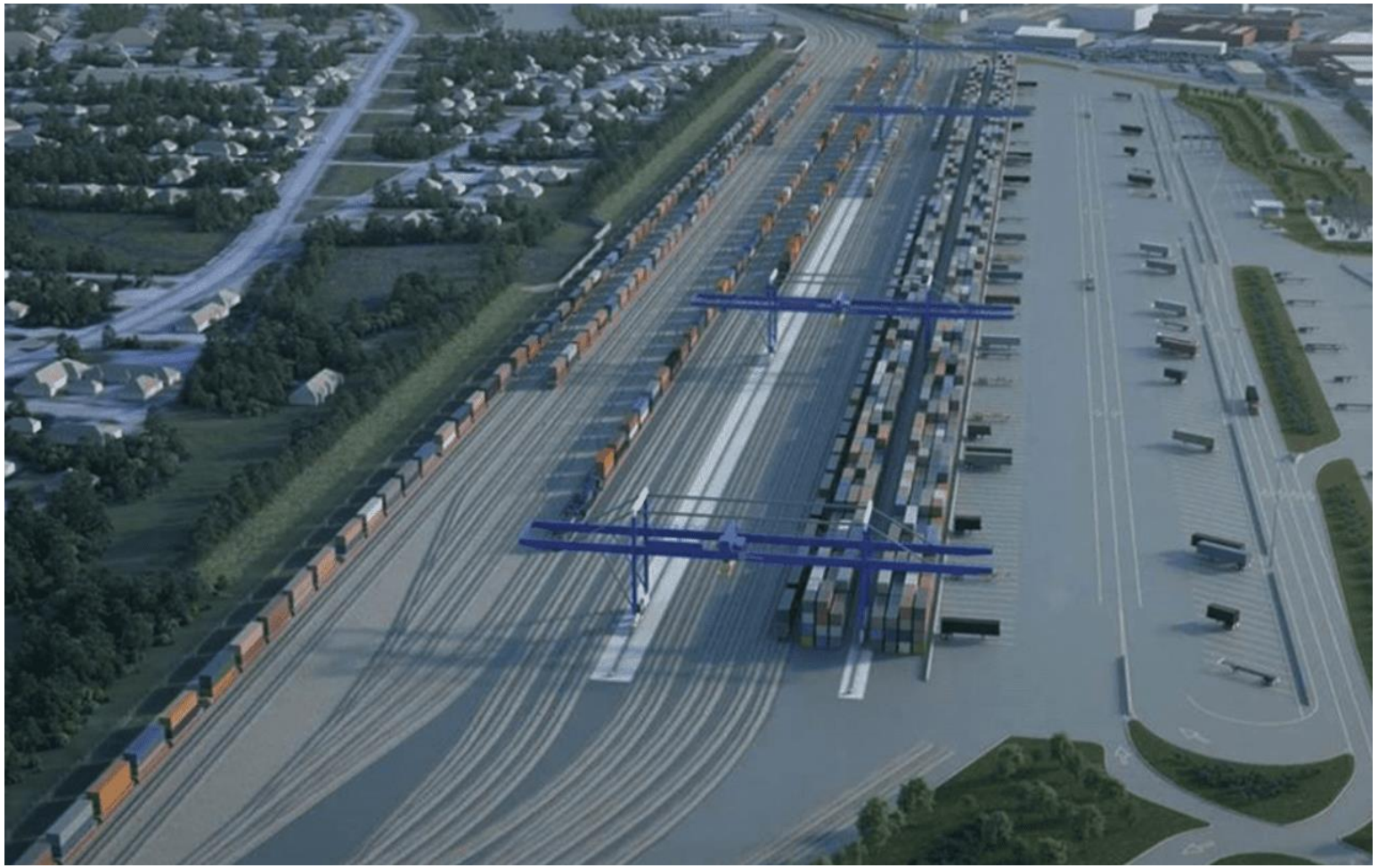


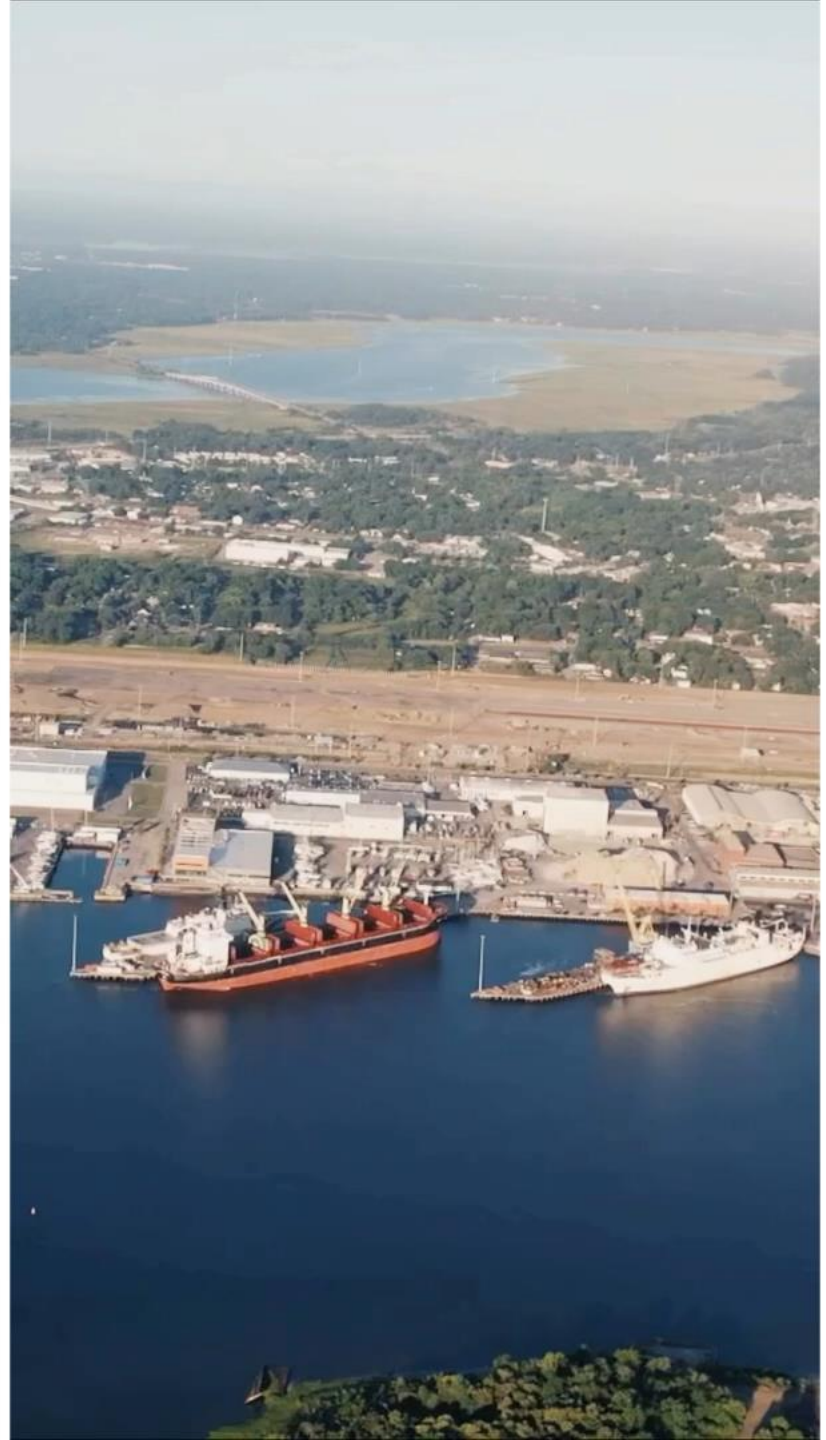
Owner: South Carolina Ports Authority (SC Ports).



KEY FEATURES OF THE NBIF INCLUDE:

- **Direct rail connections** to CSX and Norfolk Southern
- **On-dock rail service** to support seamless container transfers
- **Advanced cargo handling** systems for improved efficiency
- **Sustainable infrastructure** designed to reduce environmental impact
- **Project Cost:** Approx. $550 million

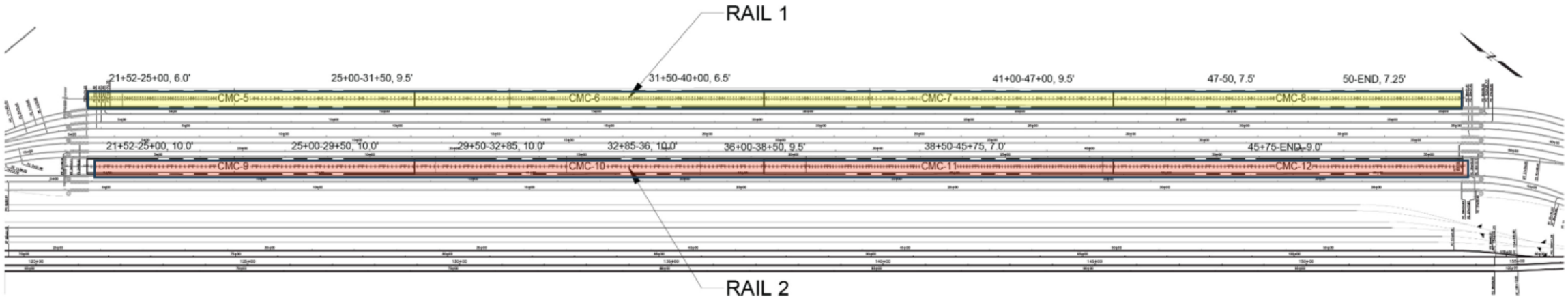




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LOAD AND SETTLEMENT



2000 PSF

2500 PSF

- The designed ground improvement was based on a maximum sustained load of 2,000 PSF for Rail 1 and 2,500 PSF for Rail 2

Settlement Criteria:

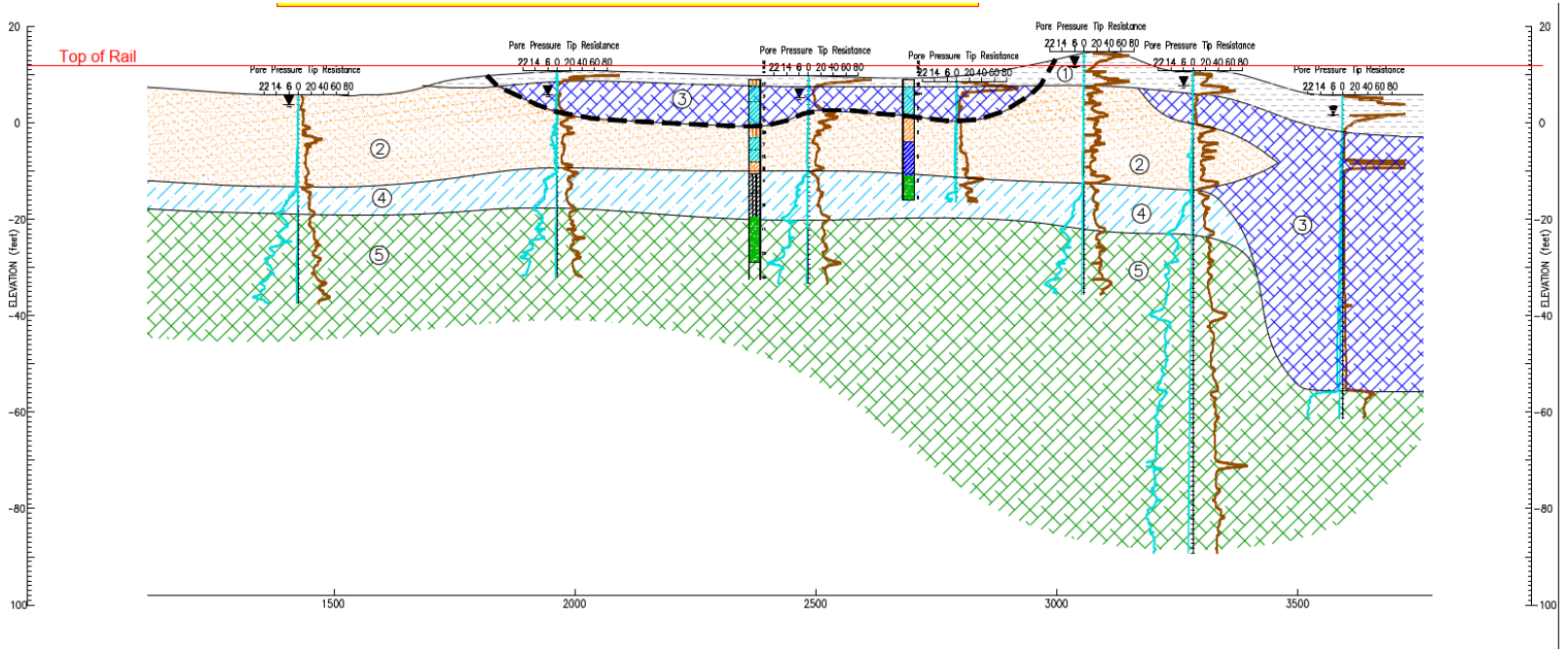
- Differential settlement between the crane legs (Legs A, B, C & D as identified) can not exceed 3/4 inches.
- 2 inches, post-construction settlement

GEOTECHNICAL CONDITIONS

The **Cooper Marl Formation** in Charleston, SC, presents several geotechnical challenges due to its composition and behavior under load.

- Low Shear Strength and High Compressibility
- Long-Term Settlement and Creep
- High Moisture Content and Sensitivity to Water
- Difficulties with Excavation and Dewatering
- Seismic Considerations:

Cooper Marl formation can **amplify ground motion** due to its soft nature.



Typical geotechnical section through the project.

LEGEND

① POSSIBLE FILL

② VERY LOOSE TO MEDIUM DENSE SAND

③ VERY SOFT CLAY

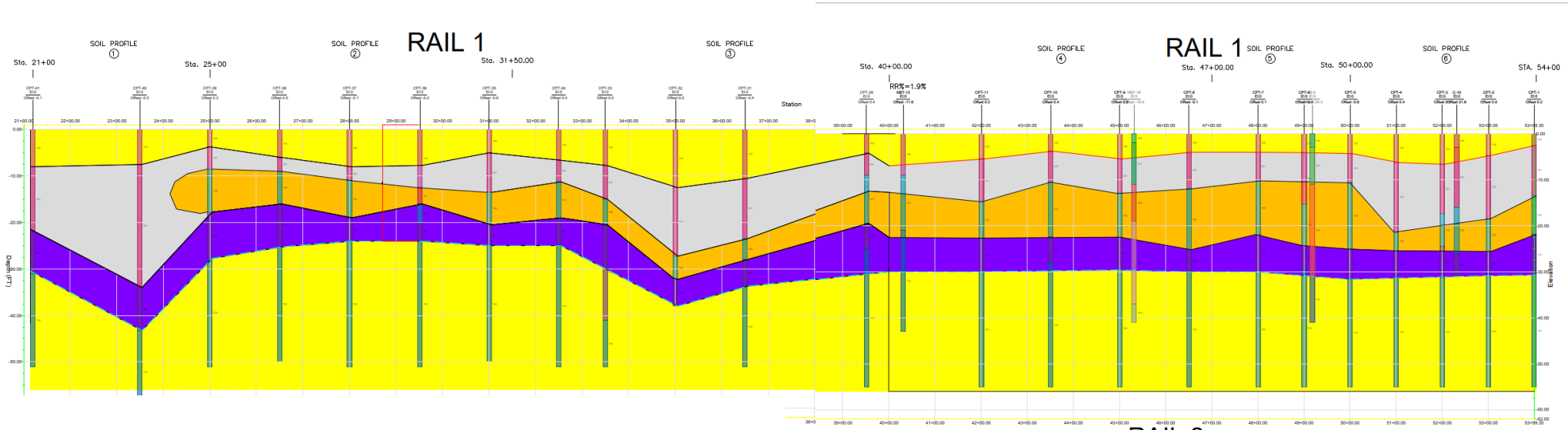
④ FIRM TO STIFF CLAY OR SIL

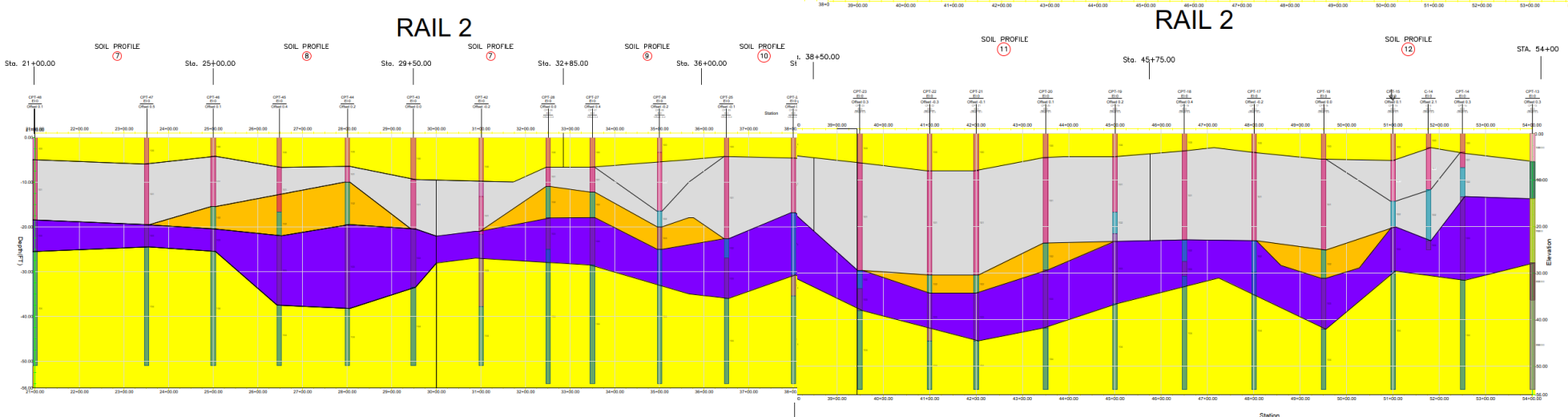
⑤ COOPER GROUP MARL

APPROXIMATE AREA OF MARSH IN 1919

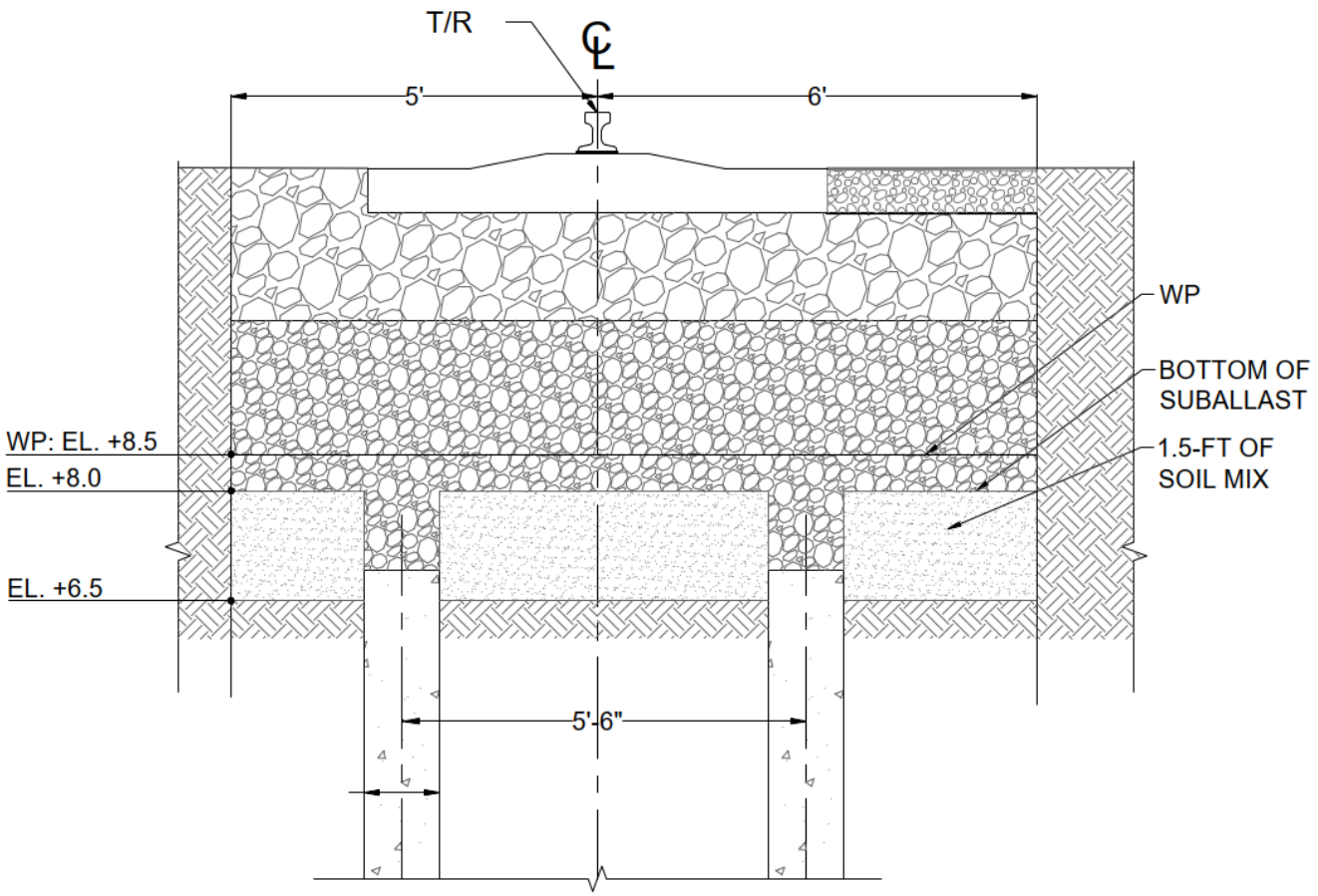
GROUND IMPROVEMENT DESIGN CONCEPT

10 different Soil profiles based on Soil Properties.





Soil mix - LTP



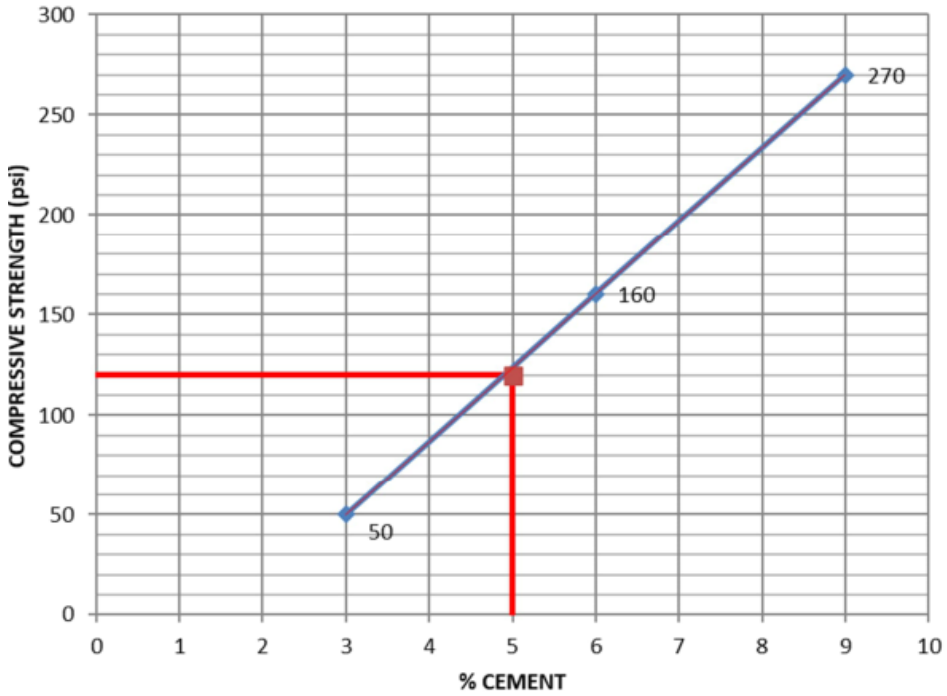
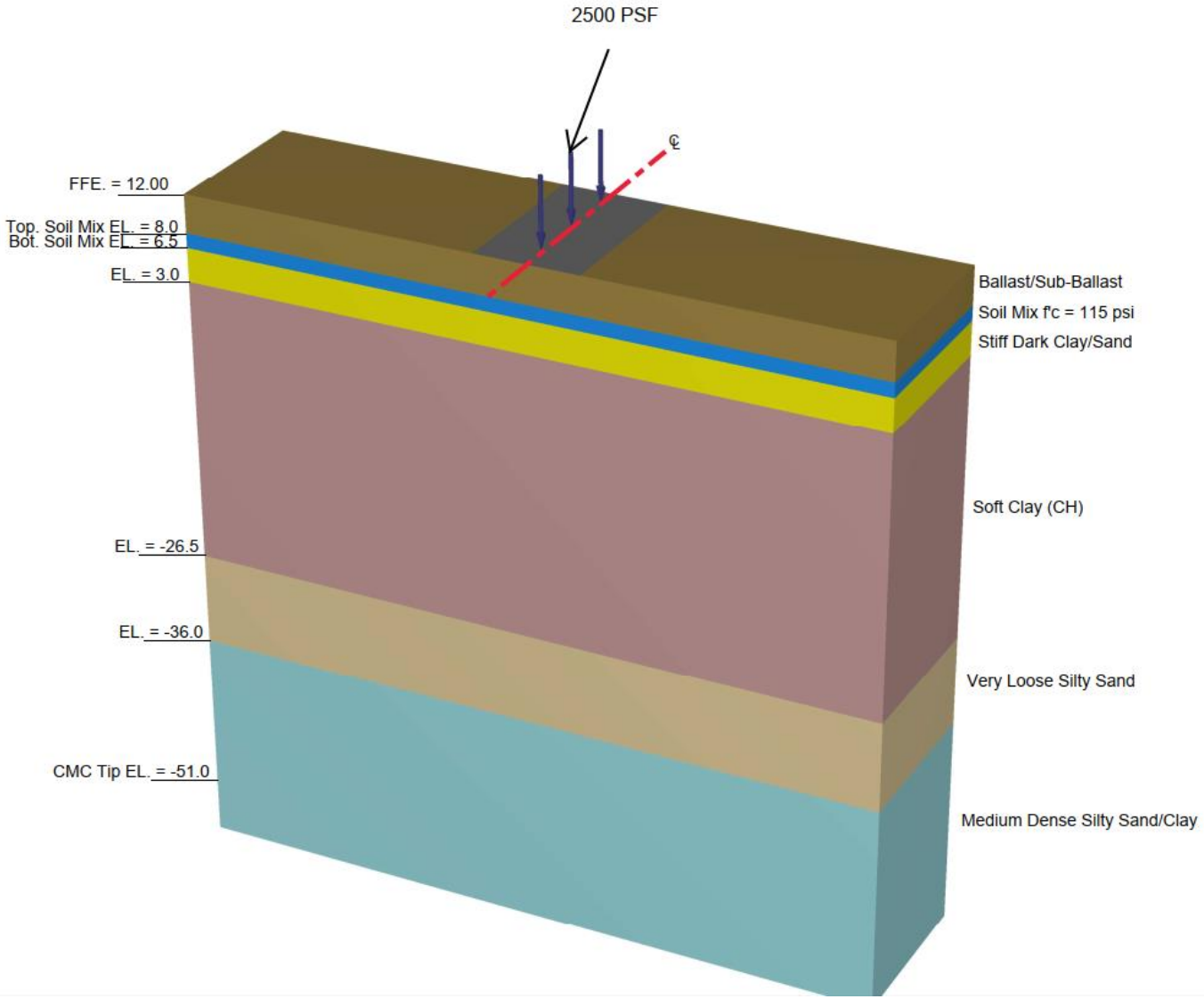


Figure 1. Summary of Cement Content vs. Unconfined Compressive Strength

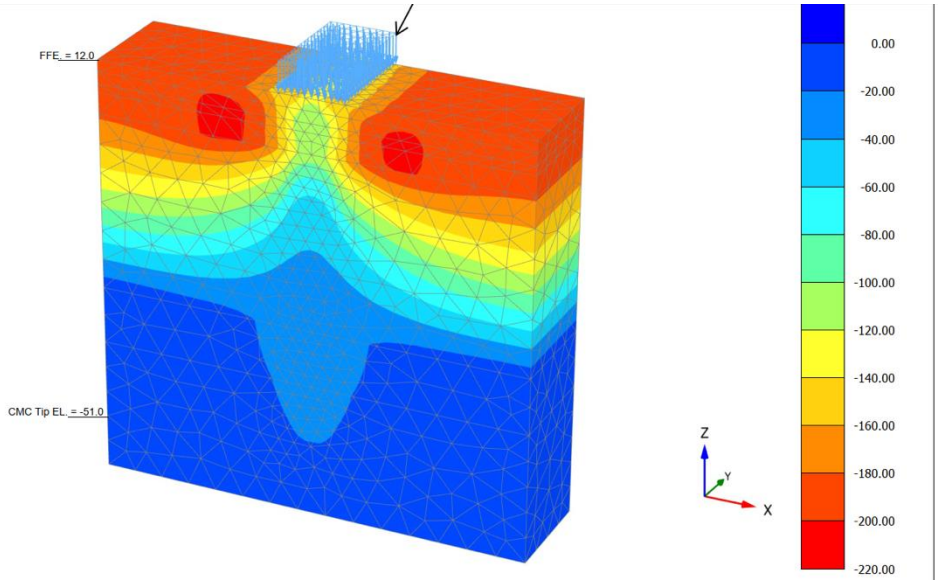
SOIL MIX (LTP)	OBSERVATION	LANDMARK CONSTRUCTION	VERIFY THICKNESS, LIMITS OF PLACEMENT, LIFTS, ELEVATIONS, MATERIAL STRENGTH MATCHES SPECIFICATION PER WORKING PLATFORM / LTP NOTE F.5 (CMC-2)	ONCE PER 100 LF	PROVIDE OBSERVATION REPORT DETAILING EACH SHIFT OF PRODUCT PLACEMENT. IF MATERIAL BATCH TICKETS DO NOT MATCH SPECIFIED MATERIAL STRENGTH, NOTIFY THE CONTRACTOR.	WEEKLY	
	COMPRESSIVE STRENGTH	COMPRESSIVE STRENGTH	2 90% OF SAMPLES ACHIEVE DESIGN STENGTH OF 120 PSI AT 7 DAYS. AVERAGE OF ALL UCS TESTS SHALL BE AT LEAST 120 PSI AT 7 DAYS, WITH NO INDIVIDUAL TEST BELOW 95 PSI. THE TEST SHOULD BE PERFORMED IN ACCORDANCE WITH SC-T-38	MINIMUM OF ONE SET OF CYLINDERS PER SHIFT DURING SOIL-MIX OPERATIONS, OR ONE SET PER DAYS PRODUCTION	2 SIX CYLINDERS PER SET OF SAMPLES. TWO SAMPLES SHALL BE TESTED AT 3 & 7 DAYS AND FOUR CYLINDERS FOR HOLD	WEEKLY	
	PROCTOR	LANDMARK CONSTRUCTION	MAX DRY DENSITY AND OPTIMUM MOISTURE CONTENT SHOULD BE CONSISTENT WITH INSIGHT REPORT. PER AASHTO T 99-21 METHOD A	1 test per 200 LF along rail alignment (Rail 1 & 2).	ALL PROCTOR LABORATORY REPORTS INCLUDING MOISTURE CONTENT vs MAXIMUM DRY DENSITY CURVES	WEEKLY	
	COMPACTION	LANDMARK CONSTRUCTION	95% OF MAX. DRY DENSITY PER STANDARD PROCTOR 18-IN THICK SOIL MIX LTP SECTION. THE SOIL MIX (LTP) MUST BE PROOF TESTED USING A FULLY LOADED TRI-AXLE TRUCK TO CHECK FOR PUMPING OR RUTTING AFTER COMPACTION.	ONE TEST PER 24,000 SQUARE FEET SPACED EVENLY THROUGHOUT THE TREATMENT AREA PER SCDOT CEMENT MODIFIED SUBBASE.	FOR TESTING INCLUDE TEST #, TEST TYPE, REFERENCE LOCATION OF TEST (WITH RESPECT TO NEAREST STATION NUMBER), TESTING DEPTH, ELEVATION, CAMPACTION RESULTS, PASS/FAIL DESIGNATION, AND IF FAILED WHICH TEST CORRESPONDS WITH THE RETEST.	WEEKLY	

Modeling and analyses



tter/ANSI A)

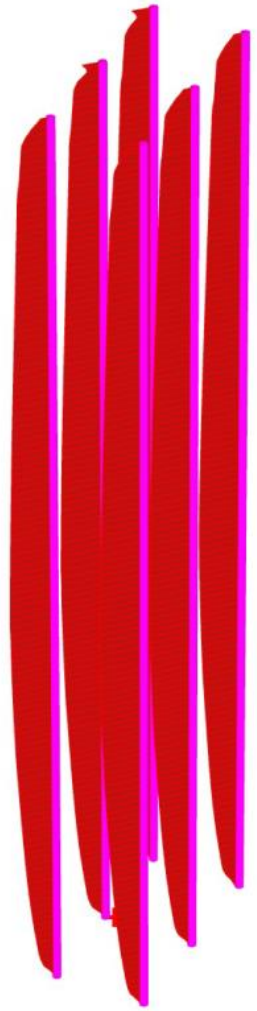
Deformation and Max. Load



CMC Maximum Load:

Max. Load = 127.2 kips
Core Stress = 665.5 psi

Approx. Neutral Axis +/- EL. = -26.0 ft.

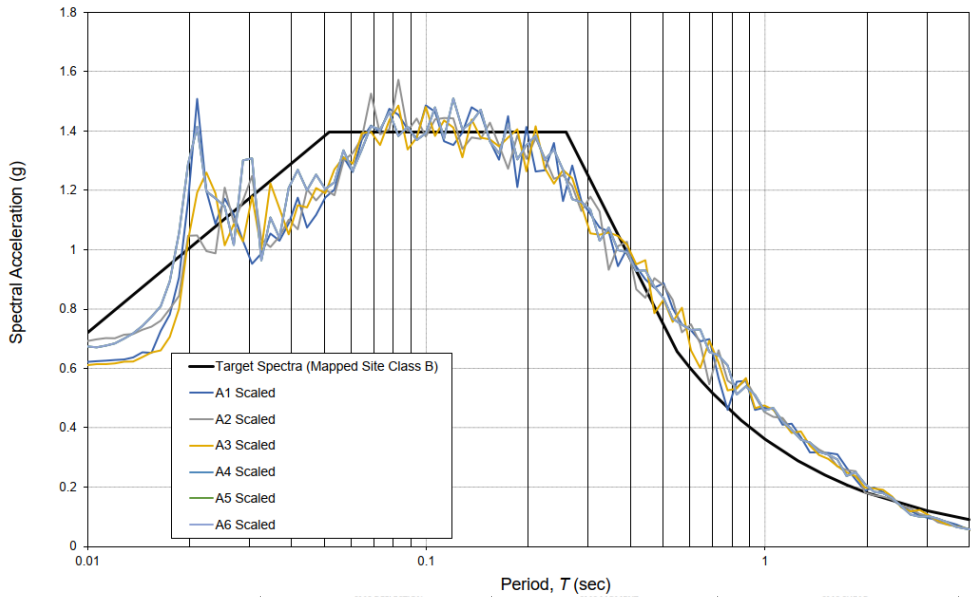


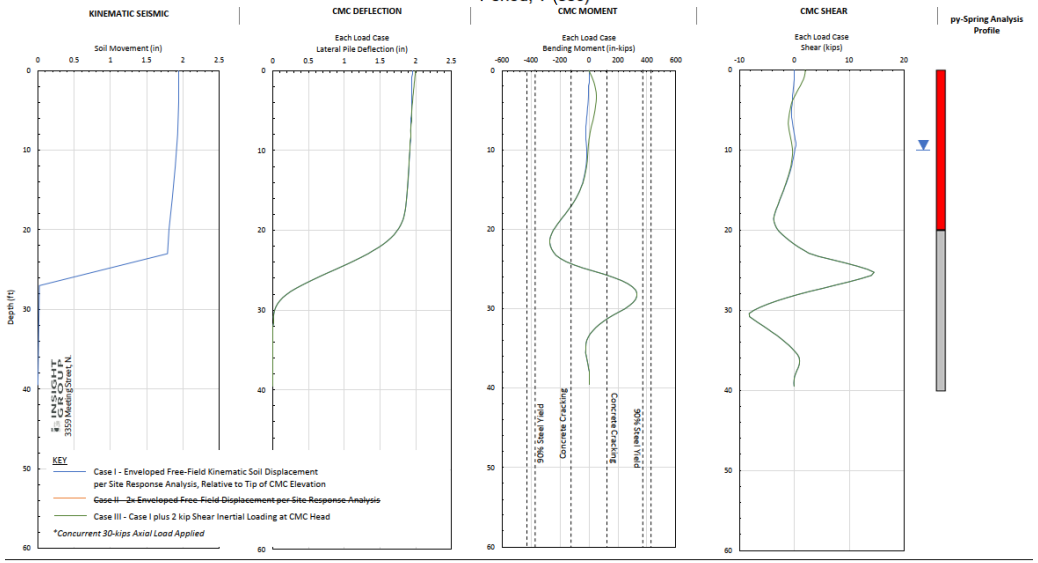
		Profile ID	Fom	to	L	Embedment	Top Bearing Layer EL.	Max.Load CMC	Settlement	N.A EL
1	Rail 1	①	21+52.23	25+00	348	15.0	-36.0	127.2	1.93	-26
2		②	25+00	31+50	650	16.0	-16.5	114.5	1.75	-9.72
3		③	31+50	40+00	850	15.0	-29.0	125.7	1.65	-18.85
4		④	40+00	47+00	700	15.0	-25.0	122.7	1.89	-16.87
5		⑤	47+00	50+00	300	15.0	-25.0	110.9	2.0	-16.21
6	END	⑥	50+00	54+00	400	20.0	-23.0	118.7	2.0	-16.28
7	Rail 2	⑦	21+52.23	25+00	348	15.0	-19.5	138.2	1.47	-12.1
8		⑧	25+00	29+50	450	15.0	-29.0	123.3	1.45	-12.1
9		⑦	29+50	32+85	335	15.0	-19.5	138.2	1.47	-12.1
10		⑩	32+85	36+00	315	15.0	-28.0	136.0	1.68	-11.2
11		⑪	36+00	38+50	250	15.0	-28	142.7	1.80	-17.94
12		⑫	38+50	45+75	725	15.0	-36.5	140.9	2.0	-23.88
13	END	⑬	45+75	54+00	825	15.0	-36.5	153.8	1.85	-22.64

Seismic Design

Scaling Time Histories

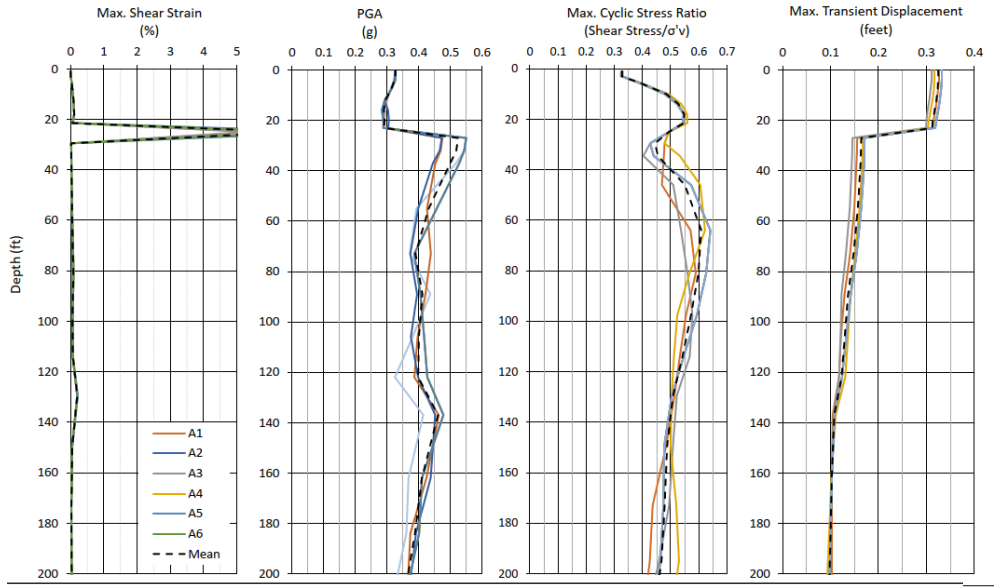
Factor: 0.540

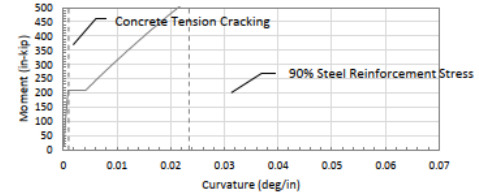


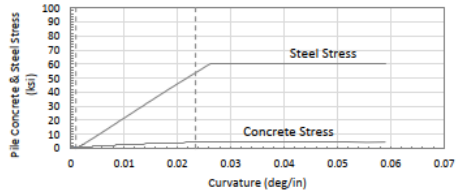


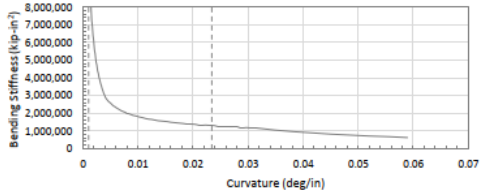
Parameters vs. depth for each input earthquake motion

MCE_R Hazard Level (2% Probability of Exceedance in 50 Years)









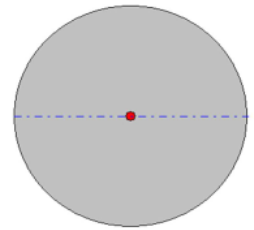
Pile Information

12.5" Diameter Grout CMC

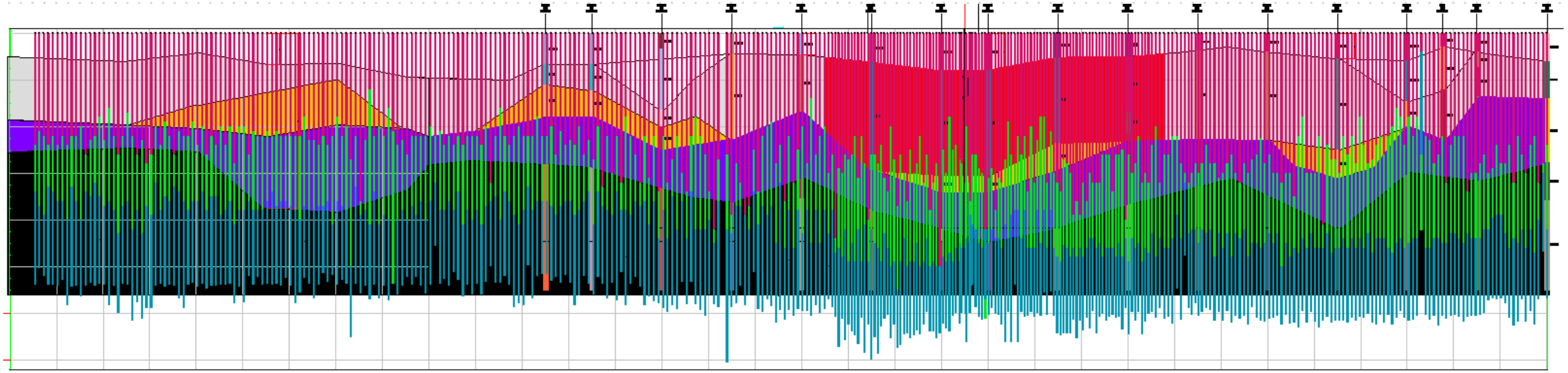
4000psi Grout Compressive Strength

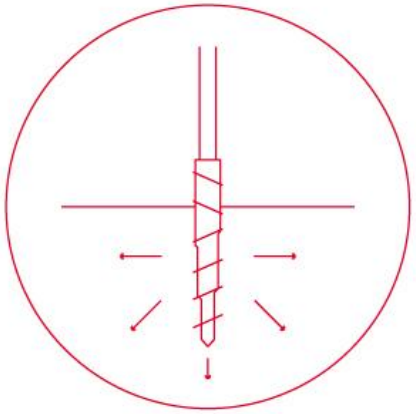
Single #10 Longitudinal Reinforcement Bar, 60ksi Yield to 20'

Concrete Tensile Cracking Stress	0.64	ksi
Steel Reinforcement Yield Stress	60	ksi
90% of Steel Reinforcement Yield Stress	54	ksi
Pile Bending Moment at Concrete Cracking	207	in-kip
Pile Bending Moment at at 90% Steel Yield	529	in-kip
Pile Maximum Bending Moment	639	in-kip

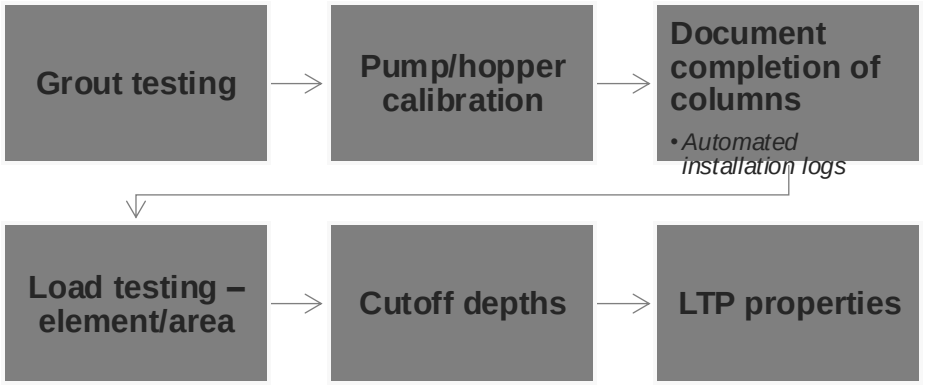


Installation

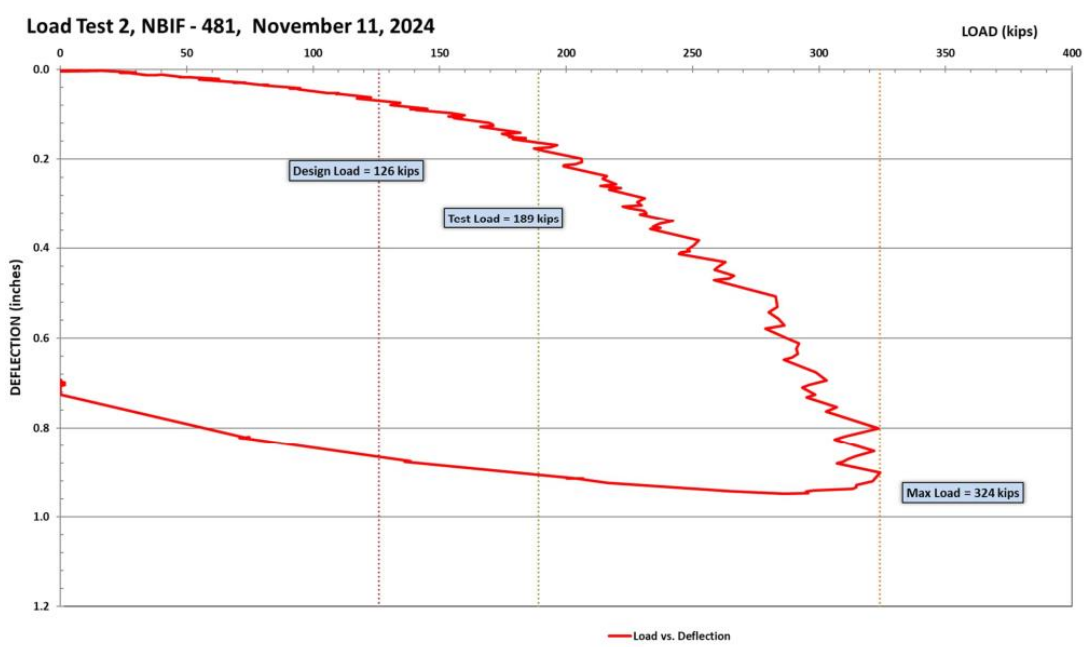


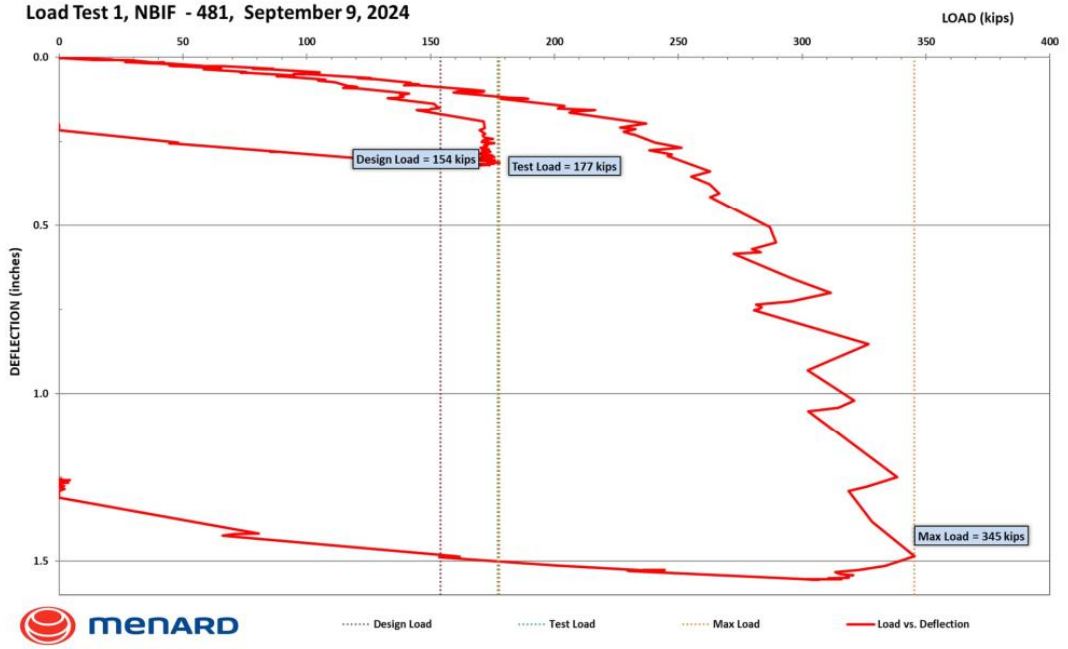


Quality Control



Load test performance





- The load test was performed in general accordance with ASTMD-1143 using the Quick Load Test procedure.

Team

- Project Manager – Ian Brake and Pedro Martinez
- Engineering and Design - John Myers, P.E
  - John Torres
- Superintendent – Albert Yarbrough
- Estimating – Matthew Mooney, P.E.
- Senior Management – Maysill Pascal, P.E.
- Health & Safety – Bill Byers


QUESTIONS