CEEn-2016CPST-005

Power Transmission Foundation Design

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Project Parameters

- Design foundations for Power Transmission towers
  - Lattice Tower
  - Monopole
- 80 year design life
- Meet working load requirements
- Consider corrosion effects
- Settlement and displacement under 1”
- Follow design codes
- Provide constructability thoughts

Project Demands

	Monopole	Lattice Tower
Location	Swampy meadowlands near Ocean	Railyard year ocean
Loading	28,000 kip-ft moment and 230 kips shear	416 kip downward load and 340 kip uplift for each foot
Displacement	1 inch in any direction	1 inch in any direction
Structure Height	160 ft	115 ft
Soil Type	Silty clay with bedrock 110 ft from surface	Underconsolidated Clayey silt with no apparent bedrock
Connection Size	10 ft diamter base	19.5in X19.5 in foot

Lattice Tower Monopole

Challenges and Solutions

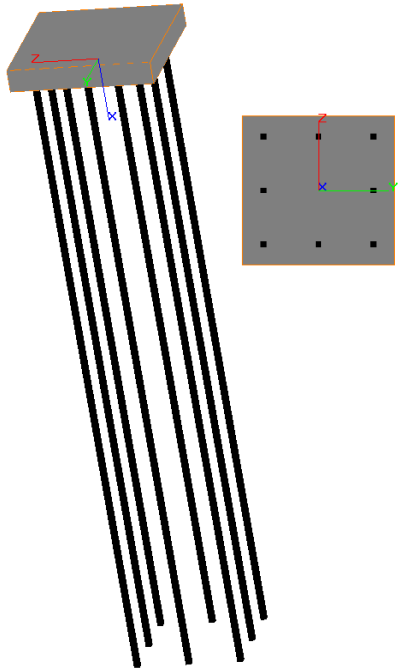
- None of us have taken the advanced classes needed to do the project.
- Didn't know how to read CPT from geotechnical report.
- Didn't know how to design piles or reinforced concrete.
  - Struggled finding internal forces
- Didn't know the codes and not sure about how they apply.
- Advisors at BYU not as helpful as hoped.

- We failed to specify corrosion protection and testing requirements

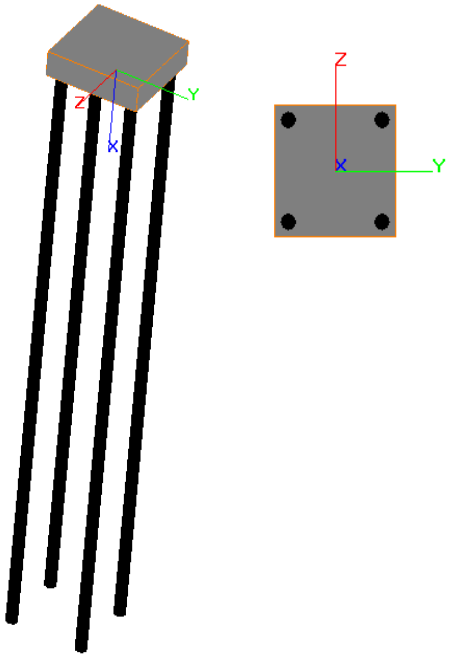
Project Design

- Lattice Tower uses 4 friction piles
- Monopole uses 8 end bearing piles

Monopole Foundation



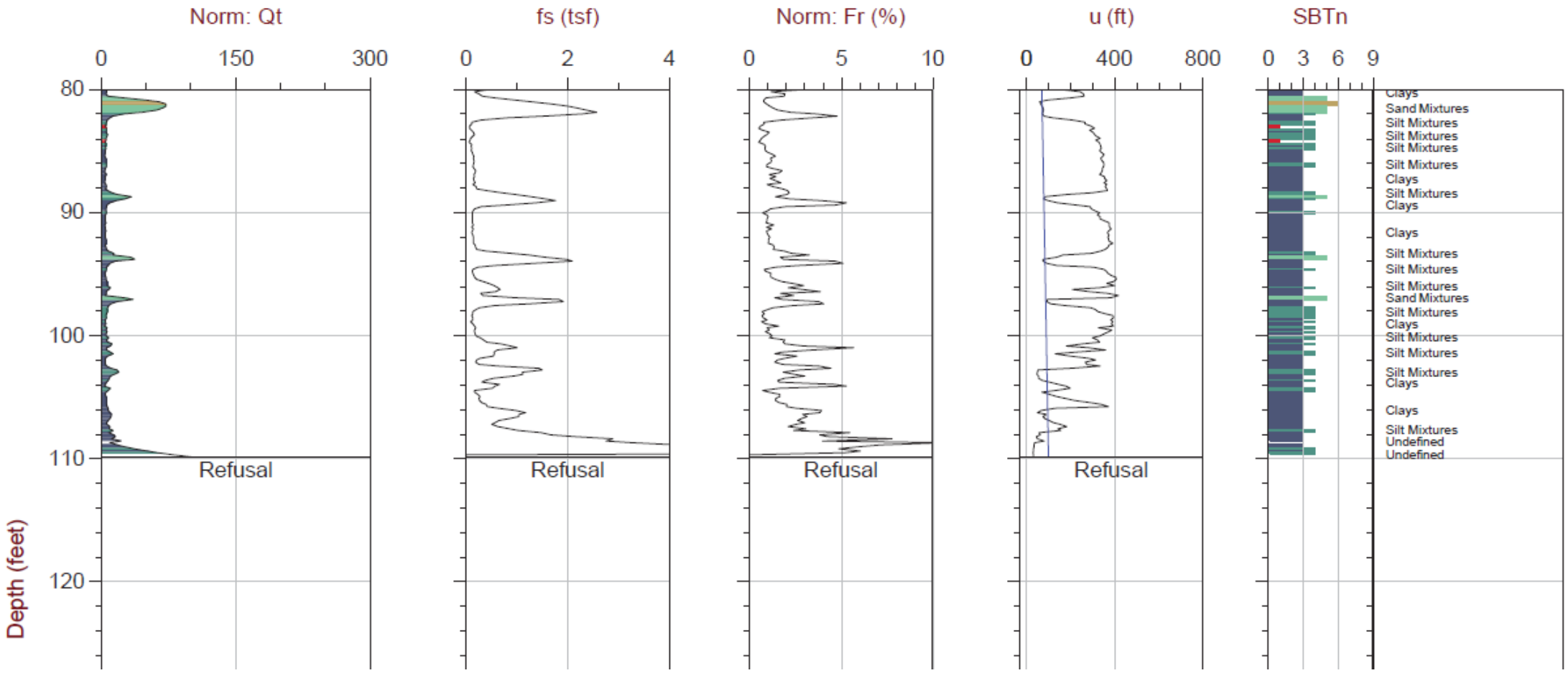
Lattice Tower Foundation



Foundation Dementions

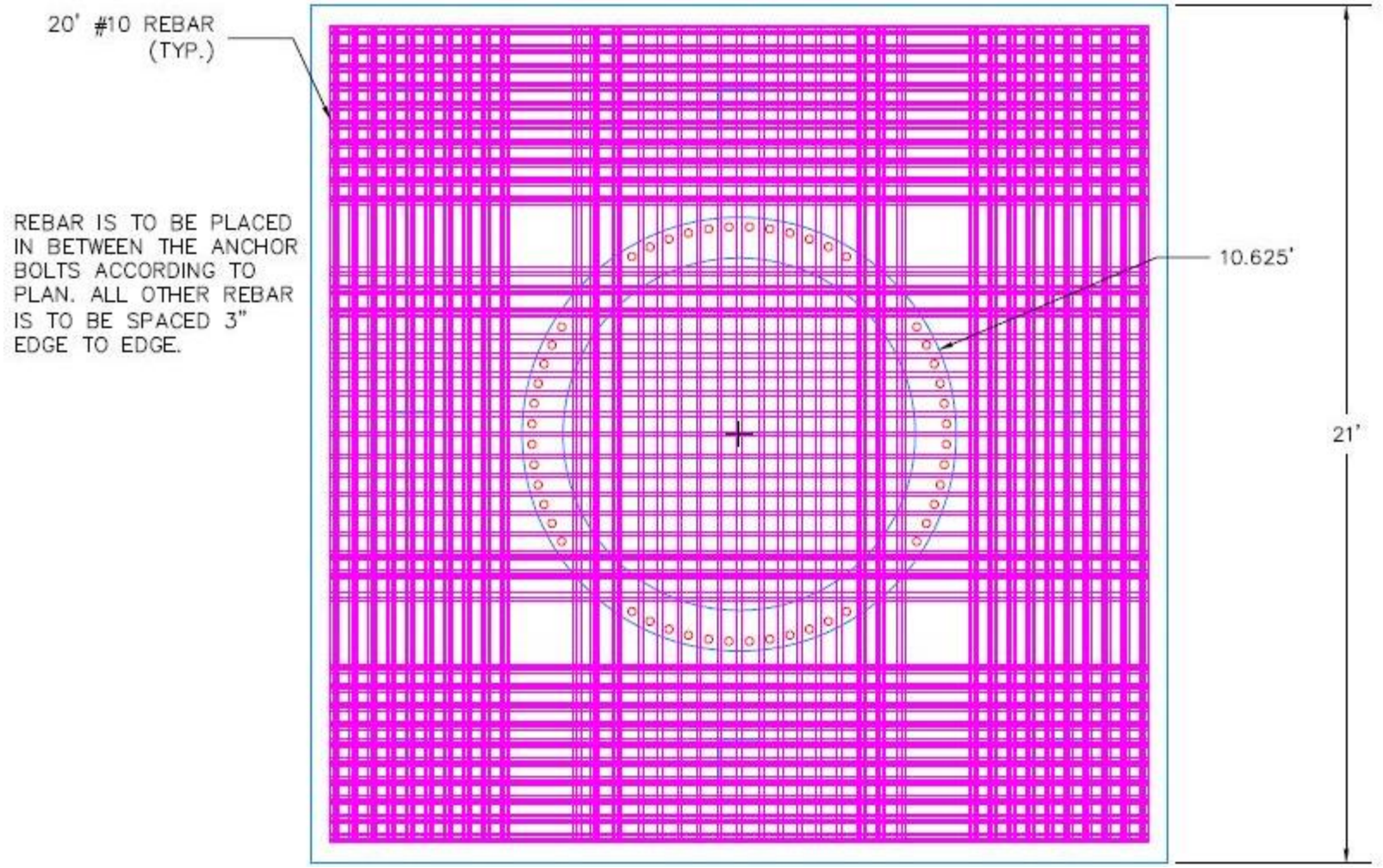
	Monopole	Lattice Tower
Depth of piles	110 feet from surface	100 feet from surface
Pile Type	Square prestressed concrete	Steel HSS Circular Pile
Pile Spacing	8 feet on center	10 feet on center
Pile Size	1 foot square	22 inch diameter and 5/16 inch thick
Pile Cap dimentions	21 feet square with a thickness of 4 feet.	15 foot square with a depth of 3.5 feet

Monopole Geotechnical Design

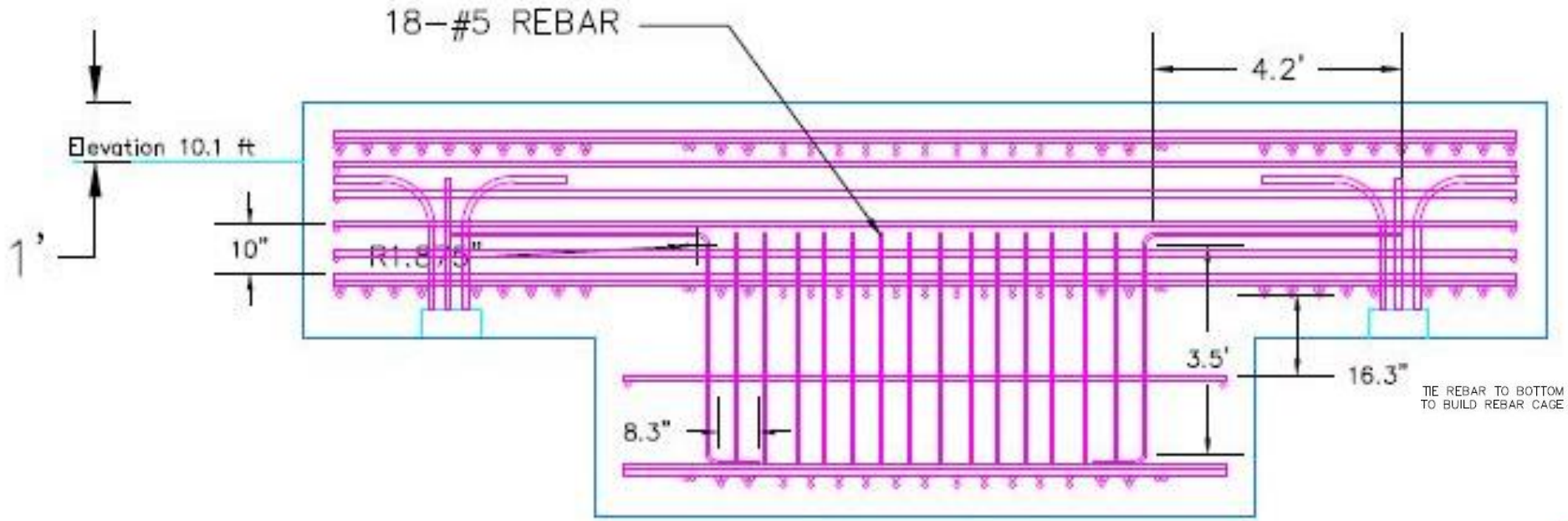


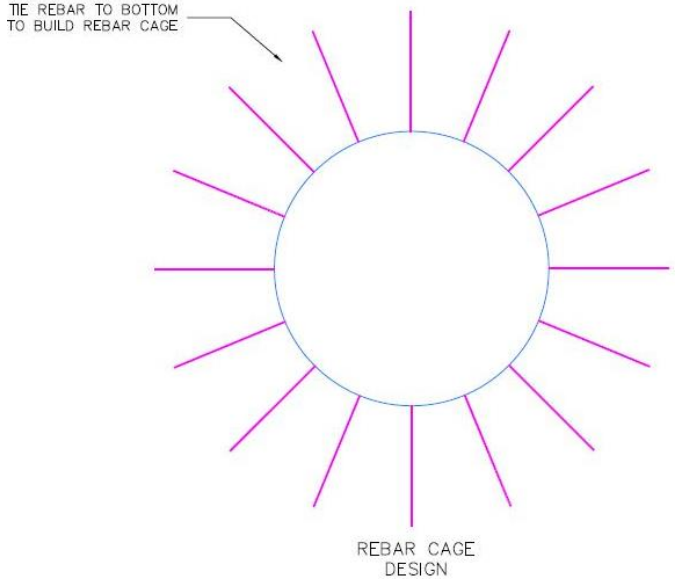
Monopole Design

- Pre-stressed concrete piles
- Pile Depth of 110’ from surface

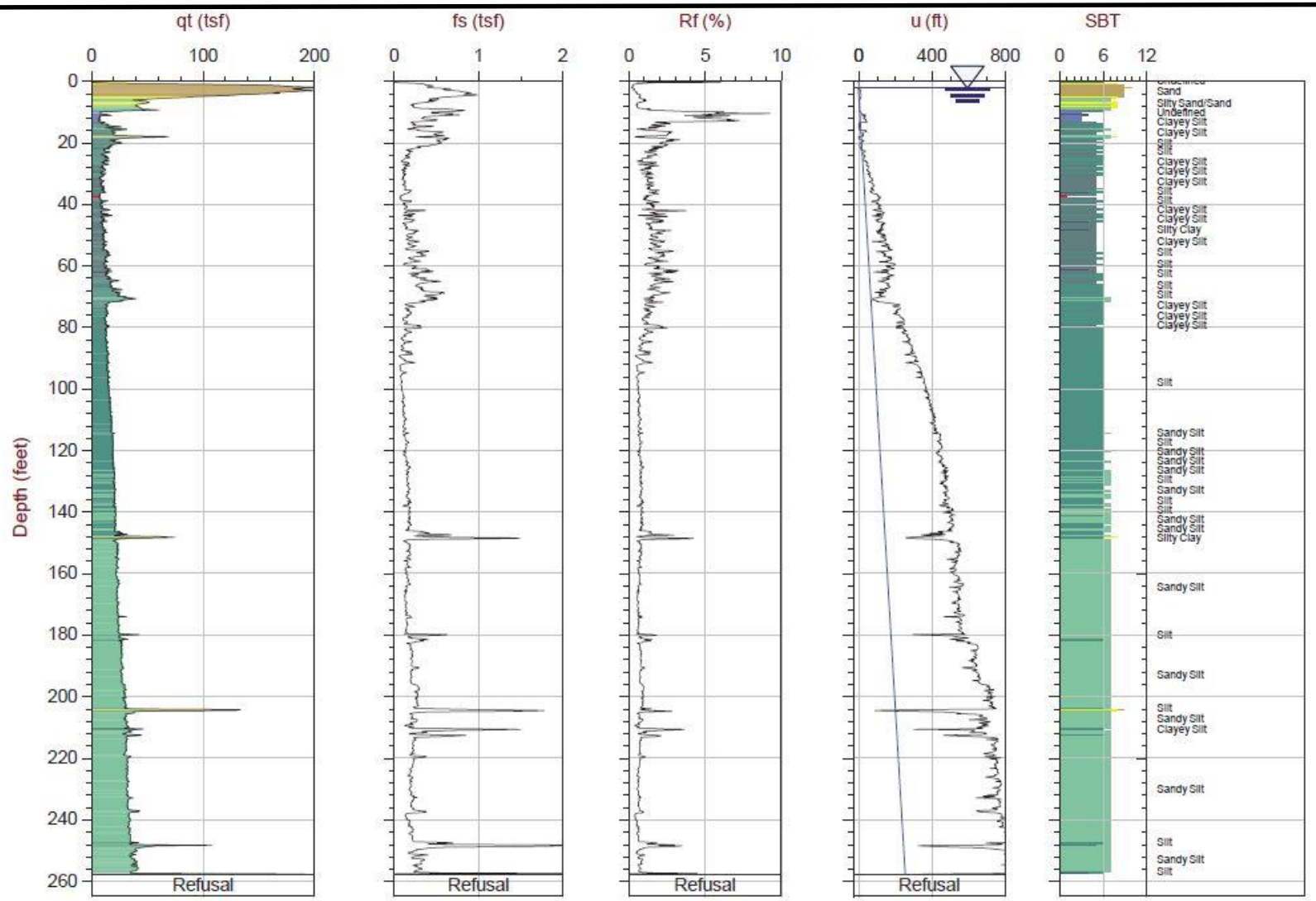


Monopole Design



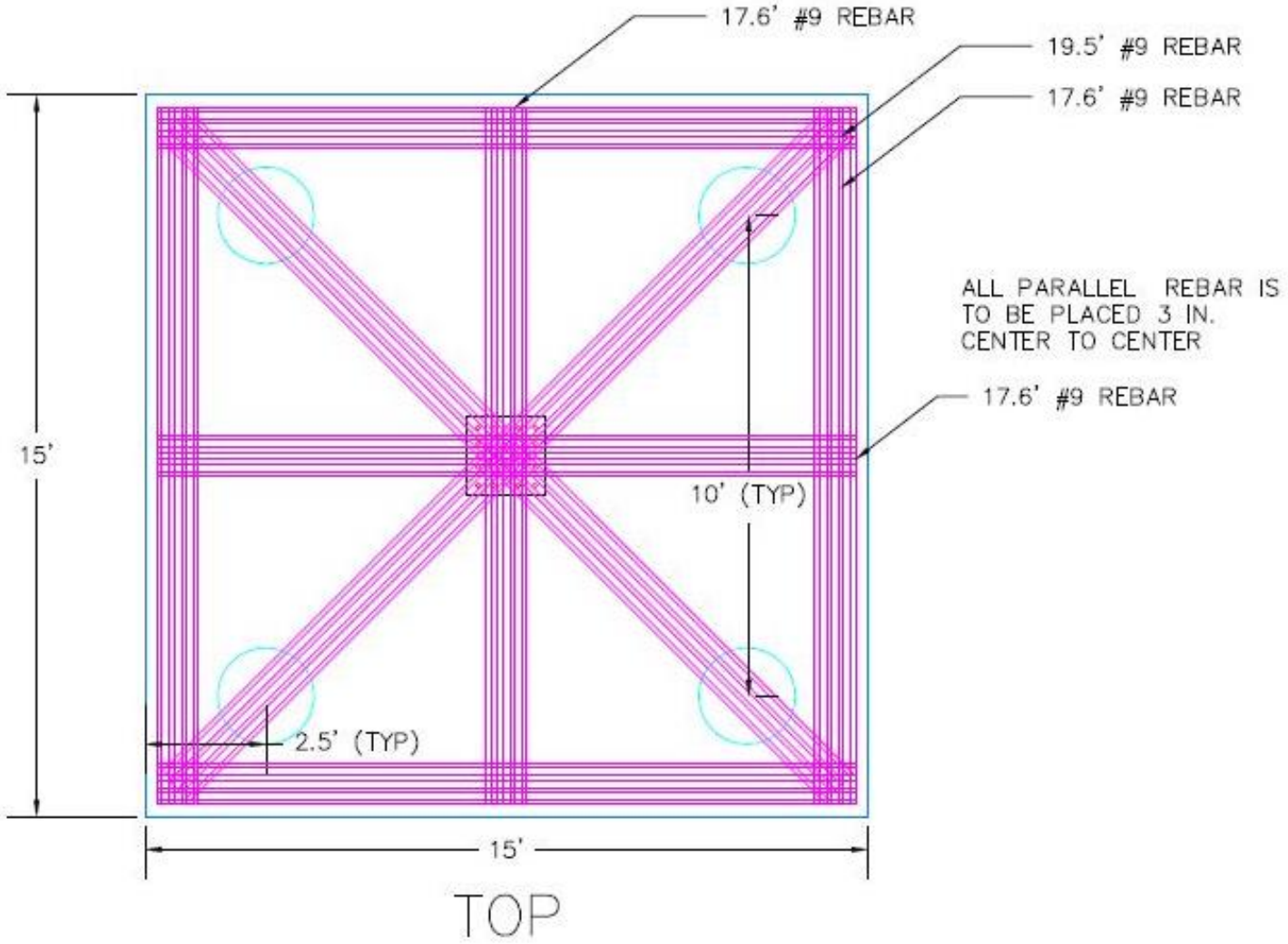


Lattice Tower Geotechnical Design

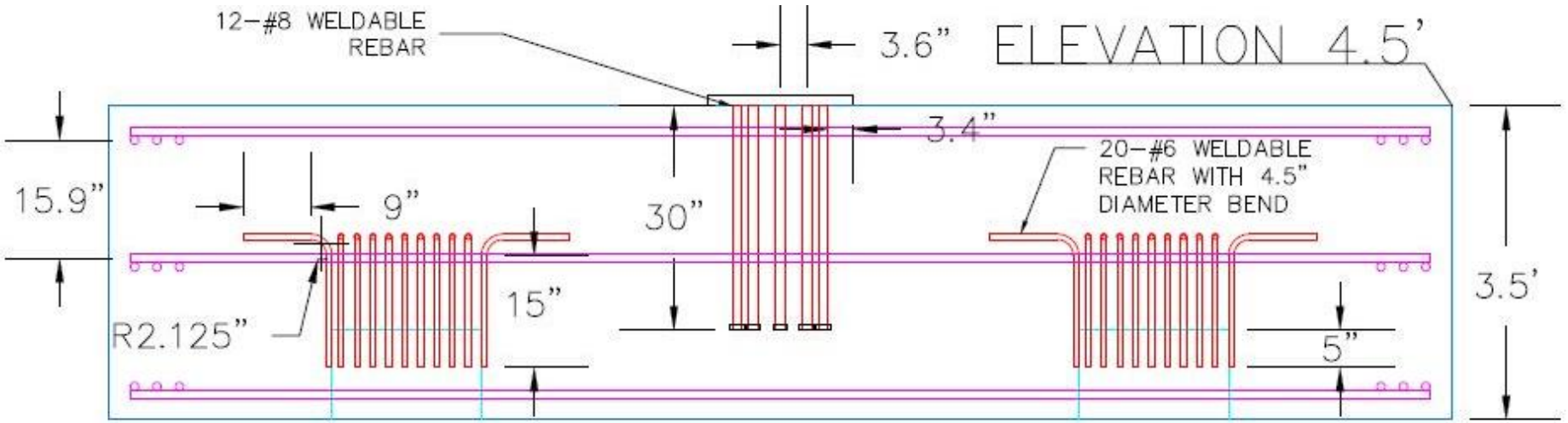


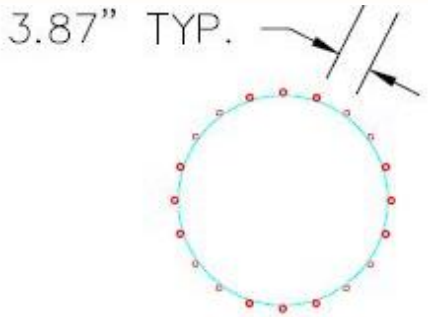
Lattice Tower Design

- HSS 20X0.5 Steel Pile
- Pile Depth of 100’ from surface

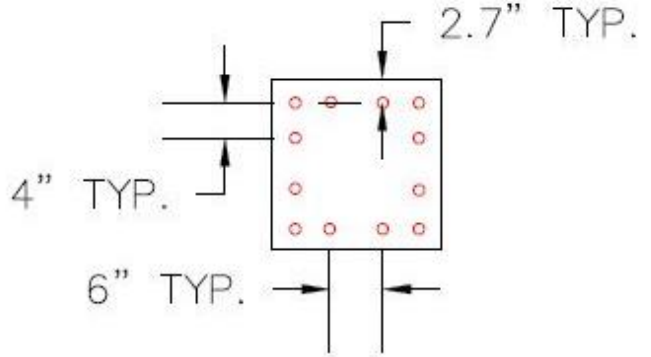


Lattice Tower Design





PILE CAP REBAR DESIGN



ANCHOR BOLT DESIGN FOR SHOE

What We Learned

- Learned how to break down complicated problems.
- Learned to read through books to get information rather than “School Read”
  - Most school textbooks are useless
- Learned limitations we have
  - We don’t understand some engineering concepts as well as we thought
- Engineering is not simply equations to a fuller extent
- We could ask for more help when needed instead of spinning our wheels
- How to describe calculations clearly
- We learned how to design deep foundations (according to our limitations)

Thank You, Matt and Jeramy