Egmont Channel Range Rebuild

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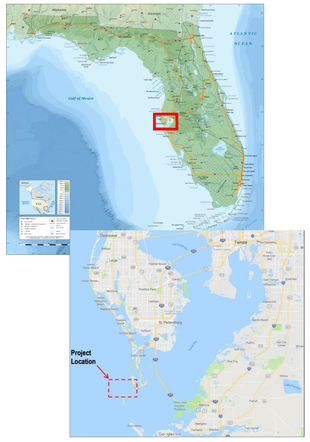
Appledore Marine Engineering, LLC

Introduction

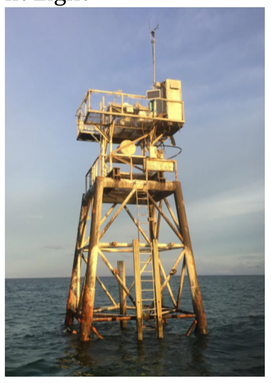
- Egmont Channel into St. Petersburg, Florida
- Leads into the Tamp Bay Port from the Gulf of Mexico (only current entrance)
- Handles over 37 million tons of cargo every year
- Design of two well-lit range lights that will guide the ships into the port



Existing Range Light Conditions

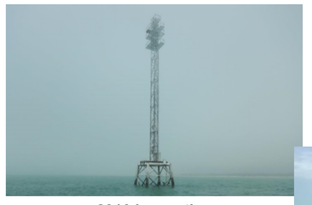
Range Front Light

- Located 2 miles offshore
- Constructed 1990, prefabricated steel jacket structure
- 10 foot water depth
- Focal height of 30’
- Severely corroded



Range Rear Light

- Located 300 yards offshore
- Constructed 1990, prefabricated steel jacket structure



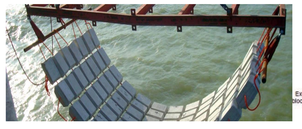
2016 Inspection

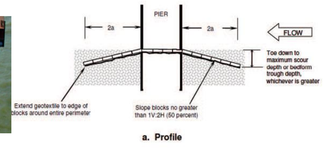
- Focal height 115’
- Severely corroded
- Light destroyed in 2017 hurricane season

2019 Inspection

Achieving Scope Requirements

- Challenges: Scour, Corrosion, minimal maintenance
- Designing a well-built structure that can maintain a 100-year return period for wave and wind
- Corrosion
  - Sacrificial anodes and steel with an epoxy coating
  - Increased steel member to desired thickness for corrosion resistance
- Scour- Concrete Block mattress

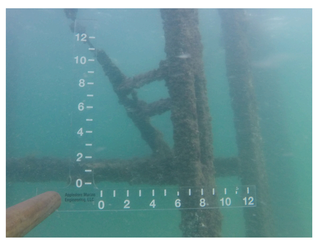




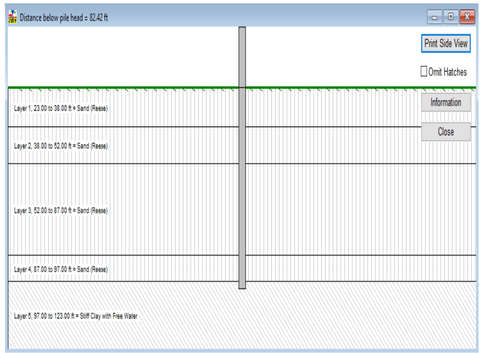
a. Profile

Design Goals and Criteria

- Both structures are to have a 50-year design life with little to no maintenance required
- 100-year return period for the wind and wave loads
- Monopile and multi-pile design
- Reasons for past failure: scour, steel corrosion, high wind and wave loads
- Efficiently using old structure
- Considering climate change factors

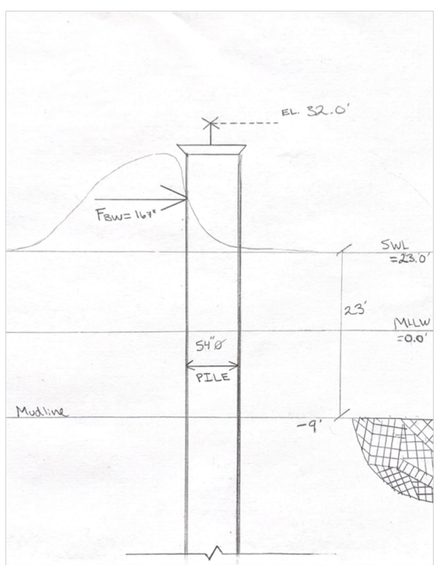


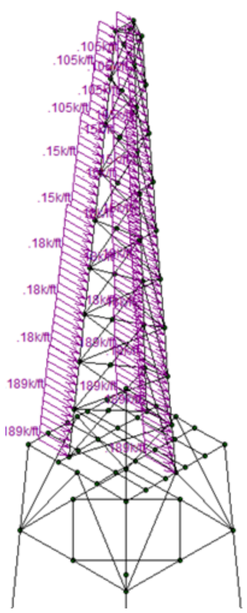
Charts

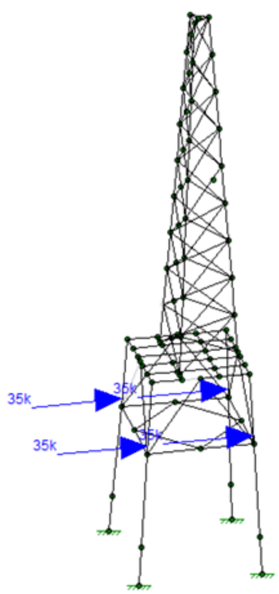


Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand (Reese, et al.)	23.0000	51.0000	--	30.0000	--	56.0000
		38.0000	51.0000	--	30.0000	--	56.0000
2	Sand (Reese, et al.)	38.0000	53.0000	--	33.0000	--	108.0000
		52.0000	53.0000	--	33.0000	--	108.0000
3	Sand (Reese, et al.)	52.0000	49.0000	--	27.0000	--	20.0000
		87.0000	49.0000	--	27.0000	--	20.0000
4	Sand (Reese, et al.)	87.0000	51.0000	--	29.0000	--	24.0000
		97.0000	51.0000	--	29.0000	--	24.0000
5	Stiff Clay with Free Water	97.0000	48.0000	0.00	--	default	752.0000
		123.0000	48.0000	0.00	--	default	752.0000

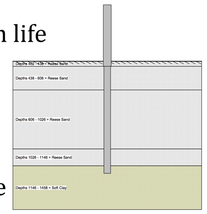


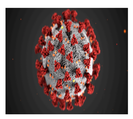




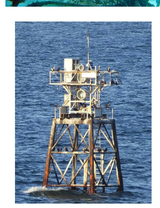
Challenges/Solutions

- Soil Conditions: four layers of sand, with clay at 100 ft. below MLLW (Mean Lower Low Water)
- Minimum design criteria: 50-year design life with little to no maintenance
- LPILE issues
  - Only access to a demo version provided by UNH
  - Mono-pile file too large to save
- Complexity of a lattice tower
  - Used resources such as sponsor to provide insight and direction
- Coronavirus
  - Led to difficulties accessing resources and communication





Life Cycle Analysis Considerations



- Goal of our LCA: analyze the potential environmental impacts and determine if the life cycle of the structures will meet design requirements designated by the scope
- Making sure the structures have sacrificial anodes and extra thick steel with an epoxy coating
- Climate change
- Old Structure into a reef structure: If not removal of old structure to reduce physical risk
- Recommend same locations, same impact
- Not in scope: recommend putting solar panels on the top of the structures to power the lights

Acknowledgements

The project team would like to express our gratitude to the project sponsor and advisor, Thomas Ducharme and Jean Benoit for the continuous support and guidance they have provided thus far for this project. The team would also like to thank Raymond Cook for his help with the understanding of foundation and structure alternatives, Majid Ghayoomi for his help with structural elements, and Thomas Ballestero for his help with load development. This project and its development would not have been made possible without the resources or help provided by the University of New Hampshire.

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