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IRA A. FULTON COLLEGE

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Kiewit North Carolina LNG Storage Facility Geotechnical Evaluation

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OBJECTIVE

The objective of this project was to perform a geotechnical evaluation for Kiewit Engineering Group, Inc. as they prepare to submit a bid for a liquefied natural gas facility in North Carolina. Our tasks included:

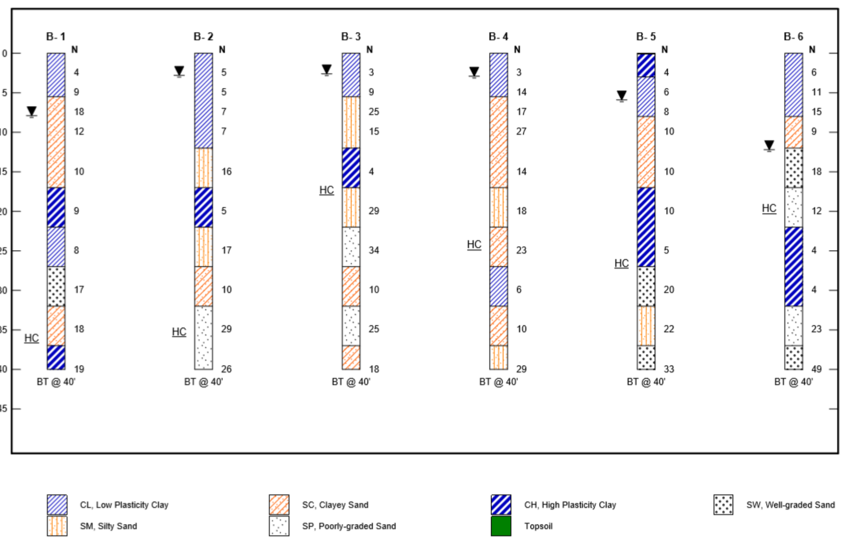
- Summarize geotechnical data and subsurface conditions.
- Evaluate constructability of local material.
- Determine seismic site class.
- Discuss potential geotechnical risks.
- Propose shallow and deep foundation types.
- Design appropriate pavement.

The above tasks were combined into a memorandum containing our research and suggestions.

SUBSURFACE CONDITIONS

The local soil profile consists of:

- Superficial low plasticity clay
- Deeper clayey sand and clayey silt
- Regions of poorly graded sand and well graded sand

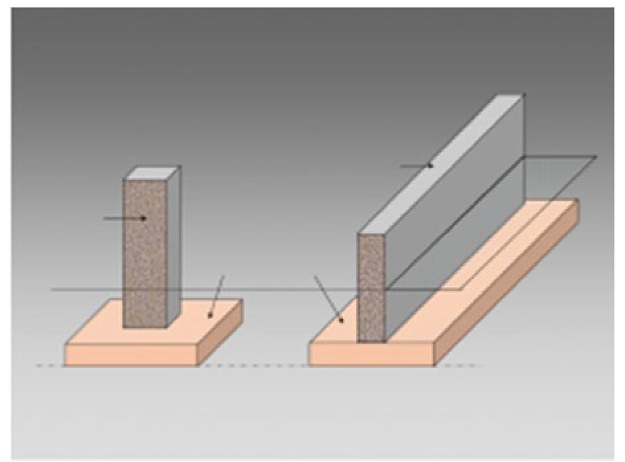


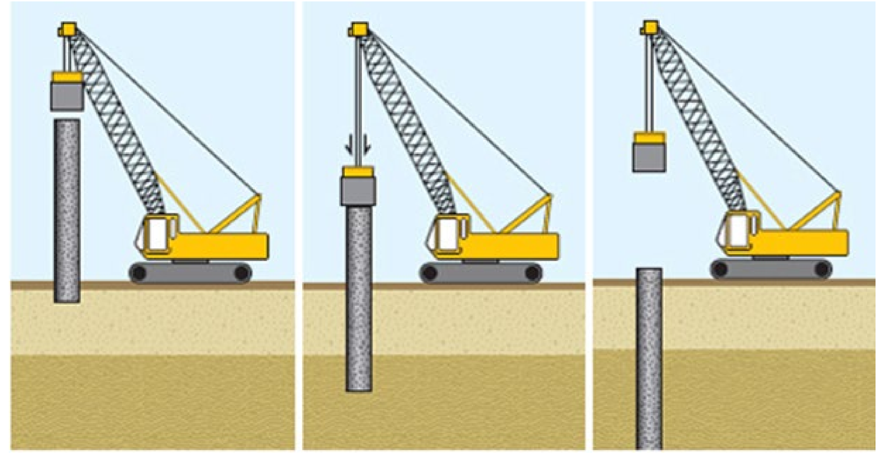
To the right is a graphic of the soil conditions at various boreholes.

CONSTRUCTABILITY

We were asked to determine the suitability of the local material for reuse as structural fill. The reuse of excavated soil and the use of new structural fill each have their merits. Reusing excavated soil means that new fill will not need to be purchased, but it also means that compaction costs will be higher since the local soil is fine-grained and prone to consolidation. On the other hand, using new structural fill provides high stability and lowers the compaction and labor costs. However, this would mean an additional cost to purchase and transport new fill.

FOUNDATIONS



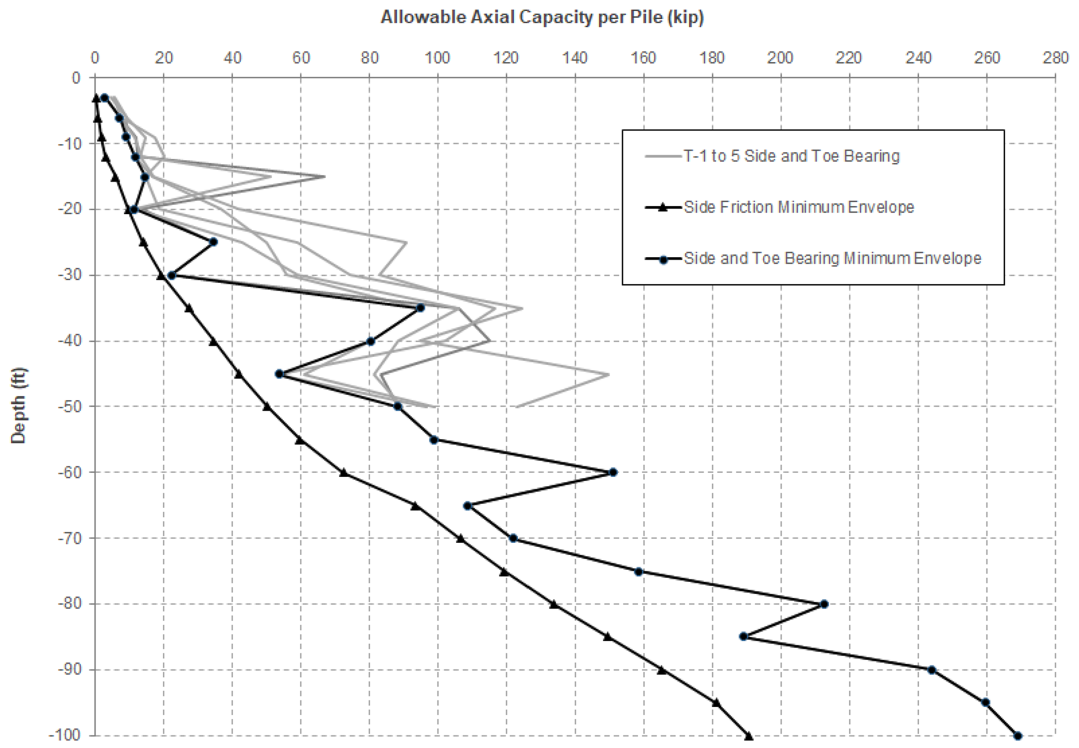


Above are diagrams of the foundation types that we suggest. For shallow foundations we were advised that strip footings would be best. Our calculations for deep foundations assumed driven pipe piles.

The objective of any foundation is o safely transmit building loads into the ground. Deep foundations accomplish this by placing long piles that penetrate deep into the soil intermittently around the structure footprint. Loads are transferred through the pile and into the soil along the length of the pile by side friction forces and at the bottom of the pile by axial forces. Because forces are distributed across the surface area of each pile, pressure from the building is minimized, thus preventing soil settlement and foundation failure.

Shallow spread footings only utilize axial bearing to transmit loads. A simple broad footing is used to maximize contact area while minimizing material cost. This reduces pressure from the building footprint and prevents foundation failure.

Below is a graph depicting allowable axial capacity for a single deep pile foundation against foundation depth.



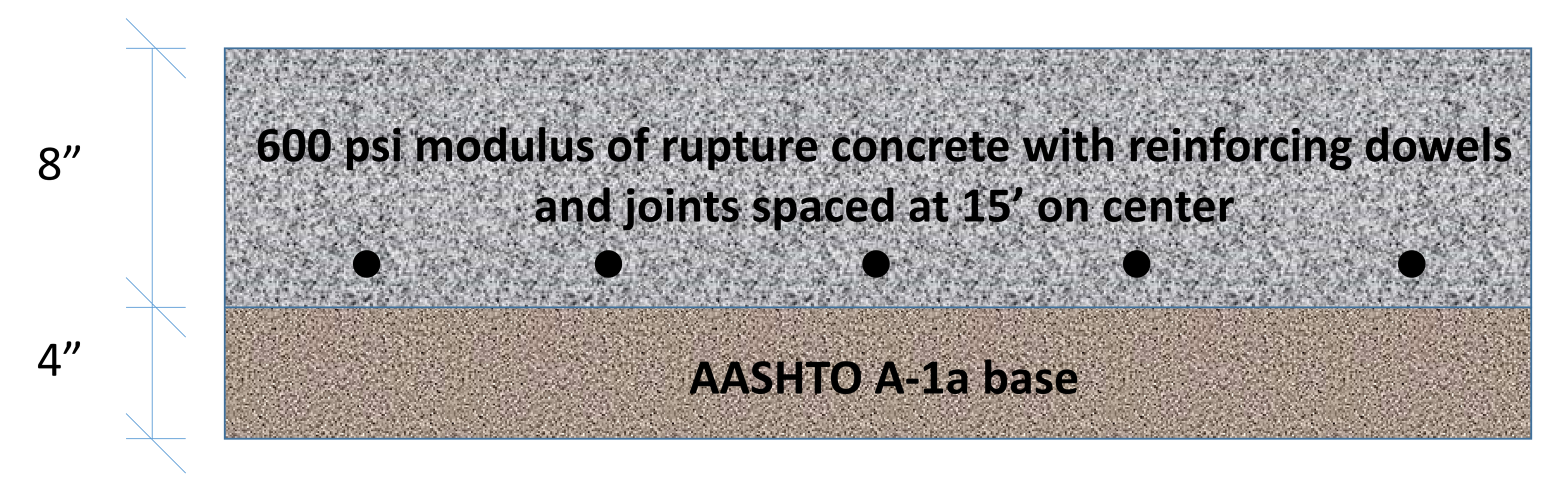
PAVEMENT

Roadways are built out of either asphalt or concrete. Because asphalt is comparatively vulnerable to creep deformation, concrete was chosen. The objective of any pavement design, like foundations, is to safely transmit loads into the ground. Concrete has the unique property of dispersing forces through itself to minimize pressure.

Concrete roadways, however, also have to withstand large flexural forces themselves, so a certain thickness, reinforcement, and jointing must be prescribed to prevent fracture. We prescribe:

- Concrete pavement thickness: 8”
- Subbase thickness: 4”
- Transverse joints 2.5” deep and spaced 15’ apart

Below is a profile slice of our suggested roadway.



RECOMMENDATIONS

- Shallow Foundations: Strip footings (up to 1500 psf allowable bearing capacity)
- Deep Foundations: 12” dia. driven pipe piles, 33-75’ deep (50-150 kip allowable capacity)
- Roadway: 8” concrete with 600 psi modulus of rupture, 2.5” joints at 15’, with dowels, on 4” AASHTO A-1a subbase
- Seismic Design Category D