

PROJECT PROFILE

GROUND IMPROVEMENT IN QATAR USING VIBRO-COMPACTION

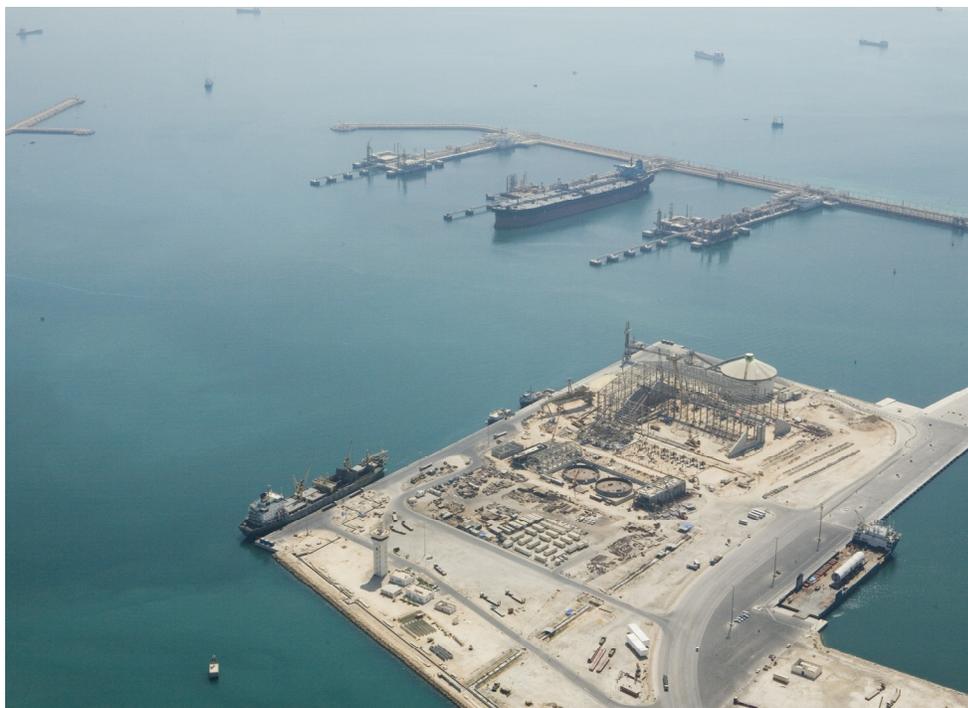
D'Appolonia served as a subcontractor to Washington Group International, Inc. (WGI) for providing geotechnical consulting services related to ground improvement for industrial structure foundations for the Common Sulfur Project (CSP) in the State of Qatar.

The CSP Facility was designed for collection of sulfur produced by 13 individual producers. Sulfur production rates from the existing facilities and as forecast for future projects within the Ras Laffan Industrial City (RLIC) anticipate a total of 11,500 tons/day of molten sulfur production by 2013. Each producer will pump molten sulfur to a common pipeline that transports the sulfur to the CSP Facility. At the facility, a pipeline will feed two Molten Sulfur Storage Tanks. From the storage tanks, the molten sulfur is pumped through sulfur filters and then to the Granulator Feed Heater/Coolers before entering the granulators. There are four Granulator Feed Pumps, each sized to transfer 6,000 tons/day of sulfur. The solid sulfur granules produced from the Sulfur Granulators are collected, cooled, and conveyed to a large storage pile located inside a large building. The stored sulfur is then reclaimed, using a stacker/reclaimer system, and conveyed to shiploaders for ship transport.

D'Appolonia's scope of services for the project was to evaluate subsurface conditions at the CSP site and to make recommendations such that settlement and



Vibro-compaction at the CSP site. Note the power generator to the left of the rig.



Common Sulfur Project (CSP) site in Ras Laffan Industrial City in the State of Qatar.

bearing capacity criteria for the heavy project structures were met. The governing criterion for settlement was one inch of maximum total settlement under combined, sustained-service, and repetitive live loads, excluding wind and seismic loads. The governing criteria for bearing capacity were:

- FS = 3.0 for combined, sustained-service, and repetitive live loads.
- FS = 2.5 for the same loads with the design wind loads included.
- FS = 2.5 for the same loads with seismic loads included.

Subsurface materials at the site consist of: (1) reclamation fill material at the surface to depths ranging from 5 to 13 meters, (2) natural marine sediments at depths between 5 and 13 meters, and limestone bedrock at depths generally between 13.7 and 14.7 meters.

D'Appolonia performed settlement calculations based upon Standard Penetration Test (SPT) blow-count data obtained from site borings. Based upon the results of these calculations, areas where soil treatment would be required were identified, and vibro-compaction

was employed in these areas to further densify the soil. Our analyses indicated that, where the settlement was limited to one inch, bearing capacity would not be a problem.



Initial entry of vibro-compaction probe.

D'Appolonia provided guidance as to the location and spacing of points for vibro-compaction and reviewed the results of the field effort. Our personnel visited the site and provided data review and guidance on secondary compaction locations.

Since completion of the project, settlements at the site have remained below the specified limit.