

PROJECT SUMMARY

Application:
Soil Stabilization/Ground
Improvement

Product Used:
AV-275 Soilgrout™

Contractor:
Shams Geotek Nigeria
Limited

Location:
Delta State, Nigeria

GROUTING FOR GROUND IMPROVEMENT OF FOUNDATION SOILS BENEATH CONCRETE TANK

INTRO

Shams Geotek in Nigeria was tasked with completing various geotechnical soil tests to develop a plan to execute the necessary soil improvements beneath a 4,500,000 gallon capacity petroleum product tank in Delta State, Nigeria. This was in a bid to determine the viability of the subsoil to sustain the proposed increased vertical stresses, so they reached out to Avanti.

PROBLEM

Improvement of the subsoil beneath a 4,500,000 gallon capacity petroleum product tank was decided upon in Delta State, Nigeria in 2018. The tank was to be loaded with a product of higher density and thus an increase in induced vertical stress was foreseen. Professional geotechnical firm, Shams Geotek Nigeria Limited, was tasked with performing a myriad of geotechnical tests to determine the viability of the site. Through the various testing, it was determined that the soil would require modifications before dispensing of the new product into the tank could begin. After initial soil testing was completed, Shams Geotek developed a plan to execute the necessary soil improvements.

CHALLENGE

Laboratory analysis results revealed that the soils underlying the tank area are essentially medium grained sands with about 30% porosity. The sands contain a higher percentage of fines within the tank area than outside it. Having extensive training and a thorough understanding in soil modification and improvement grouting, Chris Hamilton, International Sales Manager at Avanti International, knew what soil reports would assist Shams Geotek determine the right product to present for the project. It was determined that a moisture-activated polyurethane resin would be injected at 113 points within the tank area, and at 16 additional points immediately outside it (Figure 1). The data from initial soil testing would be used as a benchmark to compare with post grouting testing results with a view to ensuring adequate improvement of bearing capacities, and/or to determine the need for additional grouting.

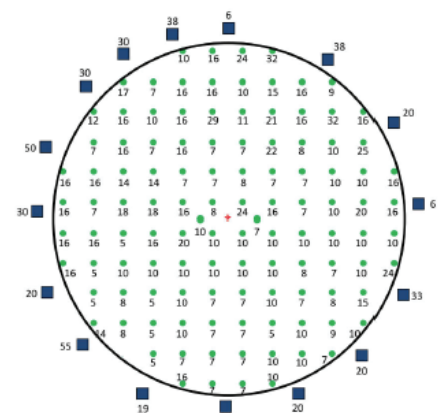


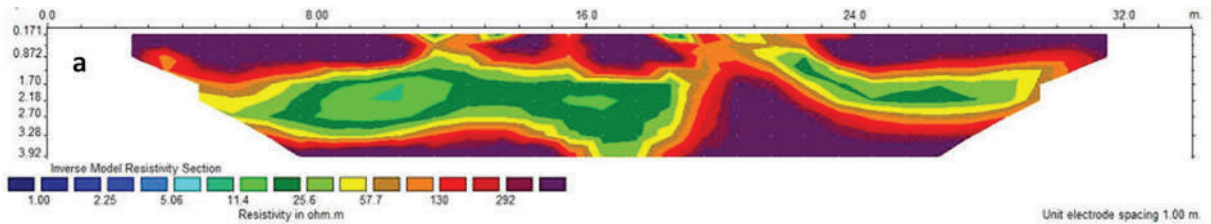
Figure 1. Chemical Injection Points and Volume of Resin Injected

SOLUTION

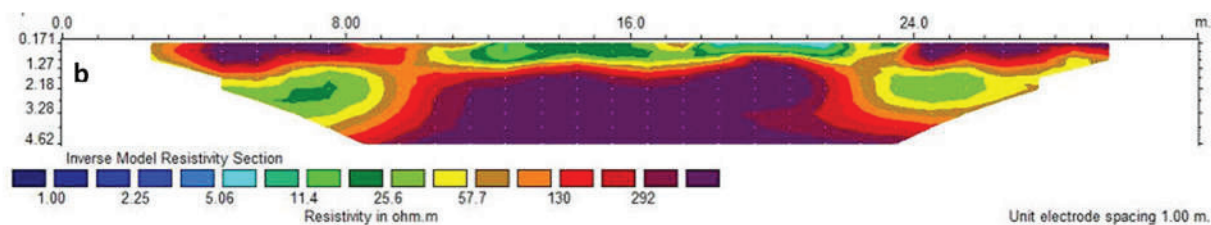
After reviewing the pre-grouting soil characteristics and some data collected, it was collectively determined that AV-275 Soilgrout™ and its catalyst, AV-276 Soilcat™,

GEOTECHNICAL CASE STUDY

from Avanti International was the right answer. AV-275 is a hydrophobic, moisture-activated polyurethane designed to bind together and waterproof loose granular soils. AV-275 withstands wet/dry cycles, permeates well, and reacts quickly with water to form a dense, impermeable semi-rigid foam with high compressive strengths. Shams Geotek completed extensive research to understand the injection grout material, and developed a grouting plan to introduce the product into soils up to five meters below the ground surface. Because groundwater was present at a depth of one meter below land surface, there was sufficient moisture to initiate the reaction of the AV-275 in the soil. Approximately 500 gallons of AV-275 was injected following the plan, taking two days to complete. As a means to verify the positive effect of the soil grouting, Shams Geotek performed post-grouting soil strength test using seismic method after the project was complete. This would determine the level of success of the product, the performance, and to identify if additional material would need to be injected.



Pre-Grouting Cross Section



Post-Grouting Cross Section

The pre-grouting model indicated heterogeneity of subsurface materials particularly within the uppermost 3-5 meter column beneath the tank area. In the post-grouting model however, it was observed that subsurface materials were relatively uniform. This is an indication of the successful effect of the grouting process. Calculations of bearing capacities of subsoil materials along the seismic lines revealed an increase in strength of subsoil materials as high as 37% or more than 2,200 psf in bearing capacity in some areas after grouting.

The post-grouting test results were nothing short of a success, and Shams Geotek was able to greenlight the dispensing of the new product into the tank and ensure the tank would be on a firm foundation.

“We at Shams Geotek Nigeria Limited appreciate Avanti International for the technical expertise provided throughout the project phase and after. We look forward to a continuity of our relationship.”