One of the Largest Prefabricated Vertical Drains Installations in US Accelerates Port of Charleston Expansion

Aaron D. Goldberg, PE, D.GE,[1] Richard A. Goodrum,[2] Martin G. Taube, PE, PG[3]

[1]S&ME, Inc., 620 Wando Park Blvd, Mt. Pleasant, SC 29464; e-mail: agoldberg@smeinc.com
[2]ClockSpring | NRI, 43 Eagle Crest Way, Fairview, NC 28730; e-mail: rgoodrum@cs-nri.com
[3]Menard USA, 150 E. Main St., Carnegie, PA 15106; e-mail: mtaube@menardgroupusa.com

INTRODUCTION

In 1670 explorers and English colonist sailed into what is now the Charleston South Carolina harbor and by 1682 Charles Towne had been declared the "port of entry" into the new colony. From that time until now the port of Charleston SC has played a vital role in developing the economy of the southeastern US, in both the importing and exporting of goods. With the recent expansion of the Panama Canal to handle larger vessels, many US east coast ports have been frantically trying to expand their facilities to accommodate the anticipated increase in traffic and Charleston was at the forefront of this activity. This talk will present a case history, showing site subsurface conditions, prefabricated vertical drain (PVD) design basics, and equipment and materials used in the 2016-17 PVD installation.

CASE HISTORY

A portion of the $1.6B port expansion included a new container terminal at the former North Charleston Naval Base. To accommodate this rapid expansion, in 2016-17 over 20 million linear feet of prefabricated vertical drain (PVD) were installed to expedite the consolidation settlement of the compressible soils underlying the container storage yard. The site at the time of PVD installation is shown in Figure 1.

Figure 1. Project site with ship unloading fill soil in foreground.

Once the soils are consolidated, the new Hugh K. Leatherman, Sr. Container Terminal will be constructed, greatly expanding the capacity of the port. The new terminal required a 24-hectare reclamation as well as substantially increasing the site grade on the upland portion; the needed fill soil resulted in predicted settlements of over 1.5 meters, taking many decades to complete. The use of a surcharge load and installation of PVDs allowed the settlement period to be accelerated, with a surcharge idle time of less than 2 years incorporated into the construction schedule.

Geocomposite drainage material. A bonded-drain type of PVD, i.e., a PVD that incorporates a nonwoven filter fabric that is fully bonded to the polypropylene core, was selected by the installer to keep the project on schedule and within budget. 300-m long rolls of the PVD are spooled onto the specialized installation equipment shown in Figure 2 below. The drains are then forced into the ground protected by a tubular steel mandrel to depths up to 27 meters to fully penetrate the soft soils on site.

Figure 2. Installation of prefabricated vertical drains.

CONCLUSION

Soil surcharge load with PVDs accelerated consolidation settlement of thick soft soil deposits so that post-construction settlement of container storage yard areas met the target design criteria. Settlement times during construction were reduced from decades to less than 2 years with over 1.5 meters total settlement.