Energy - Oil and Gas

LNG Storage Tank

UNITED STATES

Bethlehem PA

Owner
UGI Energy Services

Engineer
Langan Engineering and Environmental Services

General contractor
American Tank & Vessel, Inc.

Dates of work
May 2019 May 2019

Main figures

Controlled Modulus Columns
120 EA.

Description

The Bethlehem Planning Board approved the construction of an 80 ft-high, 40.5 ft radius liquefied natural gas (LNG) storage tank on Lehigh Valley Industrial Park VII land. The tank would be built on 98.5 acres at Easton Road and Ringhoffer Road. The concrete LNG Tank, the first of its kind in the Lehigh Valley, would supplement local distribution supply and be operational only on the coldest days of winter, likely 5-10 times per year. The tank's design bearing pressure was 2,500 psf. Due to the conditions of the soils at the site, Menard USA was contracted for ground improvement. Menard's concept would utilize a grid of grouted Controlled Modulus Column (CMC)® rigid inclusions beneath the tank to reinforce the base and to lower the risk of sinkhole formation.

Ground conditions

The soils consisted of variable consistency colluvium overlying alluvium soils and dolomite bedrock associated with the Leithsville formation. Highly weathered rock and more competent bedrock were encountered at depths ranging from 28 to 34 ft below surface grade. The dolomite is prone to dissolution in water and karst processes including sinkholes. The project's geotechnical engineer, Langan Engineering, was concerned with two issues – the potential risk of sinkholes opening up within the underlying karstic bedrock, and settlement within the overlying soils.

Solution

Initially, aggregate piers were considered for ground improvement. But the client was concerned with the karstic geology of the site – and the use of stone, which would be vulnerable to flow pathways beneath the tank in the future, leading to potential sinkhole formation. The client selected CMCs as a risk mitigation technique to prevent the formation of sinkholes. The CMC grouting process enabled Menard to identify and fill soft soil zones, while also providing settlement control and enhancement of bearing capacity. Menard installed 120 CMC rigid inclusions, which extended to a maximum depth of 40 ft. To ensure that settlement and bearing capacity requirements were met and that the risk of sinkhole development was minimized for an 80-ft high tank, Menard Group USA installed 120 CMC rigid inclusions at the project site. Work was completed in three weeks and met the client's requirements for quality, safety and schedule.