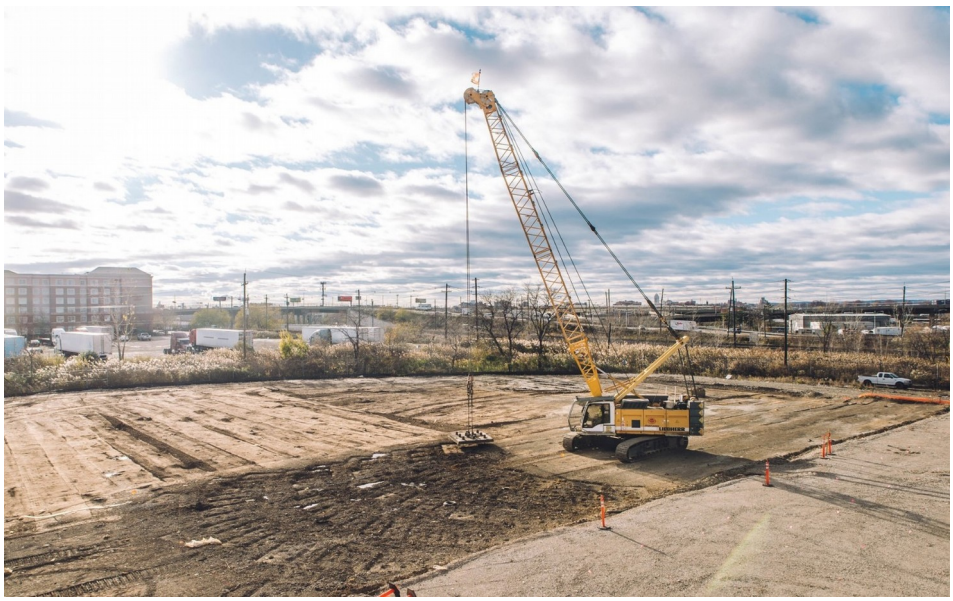
Industry

Flat Rock Data Center

UNITED STATES

Flat Rock, MI



Owner
Confidential Auto Manufacturer

Engineer
Mannik Smith Group (Geotechnical), IBI Group (Structural)

General contractor
Granger Construction Company

Dates of work
2017/09 2017/10

Main figures

Dynamic replacement
214 EA.

Stone columns
246 EA.

Description

A confidential client proposed the construction of a $200 million data center on the campus of its Flat Rock, MI, assembly plant to increase its grip into new mobility services and connected vehicles. The client predicted future data usage to increase by 1,000 percent, driven not only by connected, autonomous and electrified vehicles, but also from manufacturing needs. The 245,000 sq-ft, one-story data center would stand 30 ft high and include 13,000 sq ft of office and conference space, and small parking and loading dock areas. When complete, the building would be sturdy enough to withstand tornado-like winds, per Flat Rock's director of building and safety. The project also included the construction of two cooling towers. Due to poor soil conditions at the site, Menard USA was contracted to provide ground improvement – the selected techniques were dynamic replacement and vibro stone columns (VSC).

Ground conditions

The soil consisted of fill foundry sand overlying stiff silts. A layer of "environmental clay liner" existed on the site that capped the foundry sand.

Solution

Auger cast piles were originally considered for foundation support. However, Menard provided an economical and time-saving solution with dynamic replacement. This ultimately saved the client $1.5 million. Menard dynamic replacement is used to form granular columns with diameters up to 8 ft and to depths of up to 20 ft. A layer of coarse granular material is installed to provide a working platform and to confine soft surface soil. Dynamic replacement columns are formed by driving the coarse material into the soil with 15- to 30-ton pounders, dropped from heights of 30 to 120 ft. The column is refilled with granular material, which is again compacted. The process repeats until the desired depth and column volume are achieved. These large diameter granular columns (also called inclusions) have a very high modulus of deformation therefore reducing post-construction settlements.

For this project, dynamic replacement not only provided columns for very high bearing pressure, but also created a densified zone of sand around the building columns for improved slab performance. This was not a requirement of the design, yet provided an additional benefit to the client. Menard's solution included 214 dynamic replacement columns (5 ft in diameter) installed to a maximum depth of 12 ft for the main building. Menard excavated to loosen the dense upper layers prior to performing the dynamic replacement. To support the two cooling towers, Menard installed 276 VSCs to an average depth of 15 ft and a maximum depth of 19 ft. The design provided for 1 in of post-construction settlement with less than a ½-in of differential settlement, meeting the performance criteria of the data center and cooling towers. To support a new data center for a confidential client, Menard performed dynamic replacement and allowed the client to eliminate auger cast piles and costly pile caps and grade beams. Stone columns provided an economical solution to support two cooling towers.