Lake Marion Greenway Trail Boardwalk

Challenge:

The Lake Marion Greenway Trail Boardwalk is part of a greenway system that links the Minnesota River to the North Creek Greenway through multiple parks, trails, and reserves. The boardwalk intersects a wetland area in Keller Park, which is referenced as a "high priority natural resource area" by the Burnsville Park System Master Plan. The project aims to allow residents access to the wetlands with minimal impact on the environment.

The boardwalk is supported on 70 bents. Each bent's foundation consists of three helical piles: two vertical piles and one battered. Plans called for five helical piles to be load tested to check they achieved the required capacity. To reduce the testing duration while minimizing disturbance of the wetlands, dynamic testing was utilized in addition to static load testing.

Method:

GRL performed static load testing on one helical pile in accordance with ASTM D1143. Data was collected using a Static Load Tester (SLT) during static testing. The SLT recorded data from the jack's hydraulic pressure gage, and the two displacement transducers. This data was analyzed and a report was prepared by GRL that included graphic representation of "Load vs Displacement", "Load vs Time" and "Time vs Displacement".

To accelerate the project timeline, GRL provided dynamic testing for the balance of the load test piles. Utilizing the APPLE VII dynamic load testing system with a one ton ram, variable height impacts were applied to the tested piles. Strain transducers and accelerometers attached near the pile head monitored strain and acceleration under each impact. These signals were conditioned and converted by the Pile Driving Analyzer® (PDA) to force and velocity. During the high-strain dynamic pile tests, force and velocity records were viewed on the PDA screen to evaluate data quality, pile integrity and qualitative aspects of soil resistance. The dynamic test data was further assessed via CAPWAP® analysis to determine the total pile capacity, shaft and end bearing resistance.

Results:

The test results for the static load test and the APPLE dynamic load tests were compiled and summarized in two separate reports. All of the tested piles met or exceeded the maximum test capacity of 32.2 kips which was twice the 16.1 kip service load. Table 1 summarizes the test results along with select pile installation details.

Project Details

Client: JTS Construction

Helical Pile Supplier: Magnum Geoengineering

Owner: City of Burnsville

Location: Burnsville, MN

GRL Office: Illinois

GRL Services

- Static Load Test (SLT)
- Dynamic Load Testing (DLT) with APPLE VII System

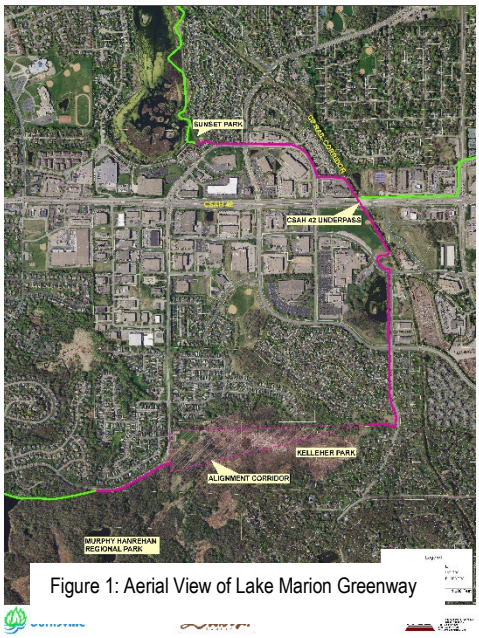

Figure 1: Aerial View of Lake Marion Greenway

Table 1: Pile Installation and Test Results Summary

Pile Number	Installation Date	Test Date	Total Length (ft)	Penetration Depth (ft)	Final Torque (ft-lbs)	Mobilized Capacity (kips)
Bent 6 TP 1 Dynamic Test	12/22/2020	1/12/2021	45	42.0	2,700	38.0
Bent 18 TP 2 Dynamic Test	12/22/2020	1/12/2021	65	61.3	2,600	41.3
Bent 35 TP 3 Dynamic Test	1/11/2021	1/12/2021	65	63.6	2,800	41.2
Bent 47 TP 4 Dynamic Test	12/10/2020	1/12/2021	65	63.6	2,800	34.0
Bent 62 TP 5 Static Test	1/11/2021	1/11/2021	25	23.3	2,700	32.2

The static load test was performed in one day with all four dynamic tests performed the following day. The APPLE dynamic load tests greatly sped up the test schedule by not requiring the contractor to install additional piles to act as reaction piles, build a reaction frame and then dismantle the frame and remove the reaction piles. This substantial reduction in time and effort, led to an early project completion.

"Our job last winter, Lake Marion Bike Trail, was challenging due to the time frame of completing the boardwalk portion in the winter of 2021. With SLT, given the permit schedule and with a mild January and February, we would not have been able to complete the boardwalk until winter of 2022. The APPLE test allowed JTS Construction to keep piling operations going… we were able to deliver a job complete one year early."

– Jeff Smith, JTS Construction

To learn more about GRL Engineers, visit www.grlengineers.com or email us at info@grlengineers.com.