Case History

ECP Helical Torque Anchors™

I-70 Bridge at Manchester Street Supported During Hinge Plate Replacements

Kansas City, Missouri

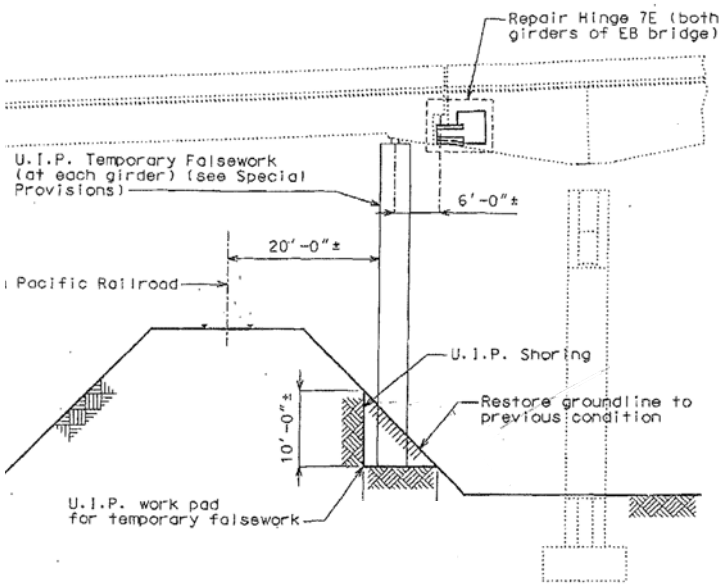
The Missouri Department of Transportation determined the need to replace hinge plates at the expansion joint of Manchester Street bridge as part of a renovation project along Interstate Highway 70 in Kansas City, Missouri.

Clarkson Construction Company located in Kansas City contacted Earth Contact Products for assistance with designing deep foundation piles for falsework supports. The falsework steel framing was required to temporarily support the weight of the bridge during the repair work. The soil at the site for the footings consisted of six feet of clay fill overlaying about 45 to 50

Project Summary	
Project:	Replacing Hinge Plates – I-70 at Manchester Street Bridge
Engineer:	Missouri Department of Transportation
Installing Contractor:	Clarkson Construction, Inc. 4133 Gardner Avenue, Kansas City, MO
Torque Anchor™ Products Installed:	TAF-350-60 10-12 Torque Anchor™ Lead Sections TAE-350-120 & TAE-350-60 Extension Sections TAB-350 N/C 3/4 (8x8) Pile Caps
Number of Placements:	12 – Helical Piles with Pile Caps
Avg. Depth to Bearing:	59 feet
Dead Load: Bridge Each Girder	44 tons
Dead Load: Bridge, Footing & Bracing	70.5 tons
Avg. Pile Ultimate Capacity:	29 tons per pile – 174 tons per footing
Avg. Pile Service Load:	14 tons per pile – 85 tons per footing
Factor of Safety:	2.5 : 1 Ultimate To Dead Load

The photographs show a pile being installed with a 12,000 ft-lb motor.

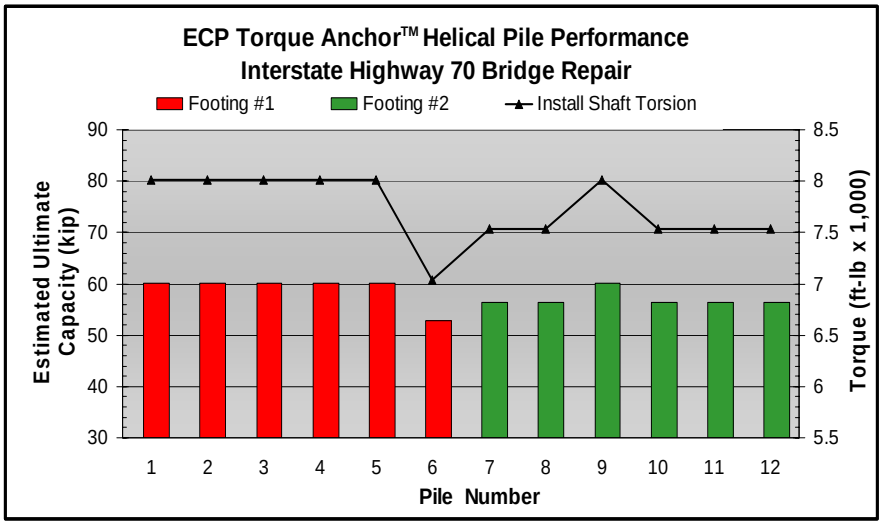
feet of very soft to medium stiff clay. With groundwater at 16-1/2 feet, helical piles seemed like an economical solution for foundation support for two footings that measured six feet by sixteen feet and two feet thick.



These photographs show the falsework in place under the bridge, the steel beams under the bridge girder and one of the concrete footings.

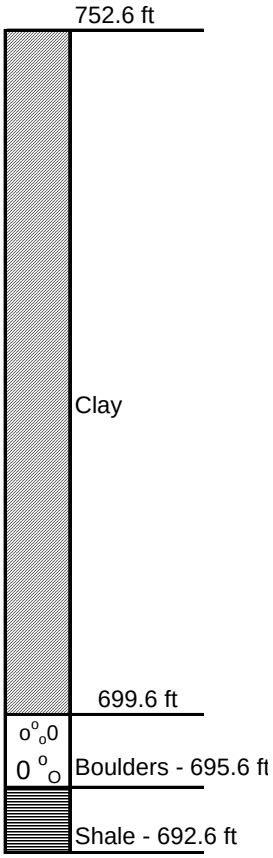
The foundation underpinning plan called for six helical piles at each of the proposed concrete footings. The piles were installed to a depth from 57 to 60 feet below grade into a stratum of shale.

The 3-1/2 inch diameter tubular pile shafts were configured with two helical plates. The lead of the pile had a ten inch diameter helical plate near the tip of the shaft followed by a twelve inch diameter helical plate located 30 inches higher on the shaft. The lead shaft length was five feet. Five extension sections that measured ten feet long were attached to each lead along with one five foot extension to provide sufficient pile depth to reach the depth of the load bearing shale stratum.



The piles were advanced into the soil using a 12,000 foot-pound hydraulic torque motor that was powered by a mini-excavator. A boulder was encountered during installation of one of the piles, which required a slight modification to the original pile layout plan.

SOIL LOG - 7



Representative Pile Installation Log - Location P-3				
Depth	Shaft Extension	Δ Pressure	Motor Gear Ratio	Torque
5 ft	5 ft	550 psi	High	1,231 ft-lb
15 ft	10 ft	350 psi	High	112 ft-lb
25 ft	10 ft	750 psi	High	1,679 ft-lb
35 ft	10 ft	950 psi	High	2,127 ft-lb
45 ft	10 ft	1,050 psi	High	2,351 ft-lb
55 ft	10 ft	750 psi	Low	3,638 ft-lb
58 ft	2 ft	1,650 psi	Low	8,004 ft-lb

The average final shaft torsion was 7,721 ft-lb at an average depth of 58.6 feet below grade.

The cluster of six Torque Anchors™ provided a combined ultimate capacity of 174 tons. With the total structural dead load at each bridge girder support estimated at 70.5 tons, the project enjoyed a factor of safety of 2.47.

Once the piles were installed and the concrete footings cast, the falsework steel framing was installed. The weight of the bridge was transferred to the temporary supports as shown in the photograph above.

With the tongue and groove joint now free, workers were able to remove and replace the hinge plates. The delicate process took place on a platform high in the air. A close view of the new hinge plate is shown below.