

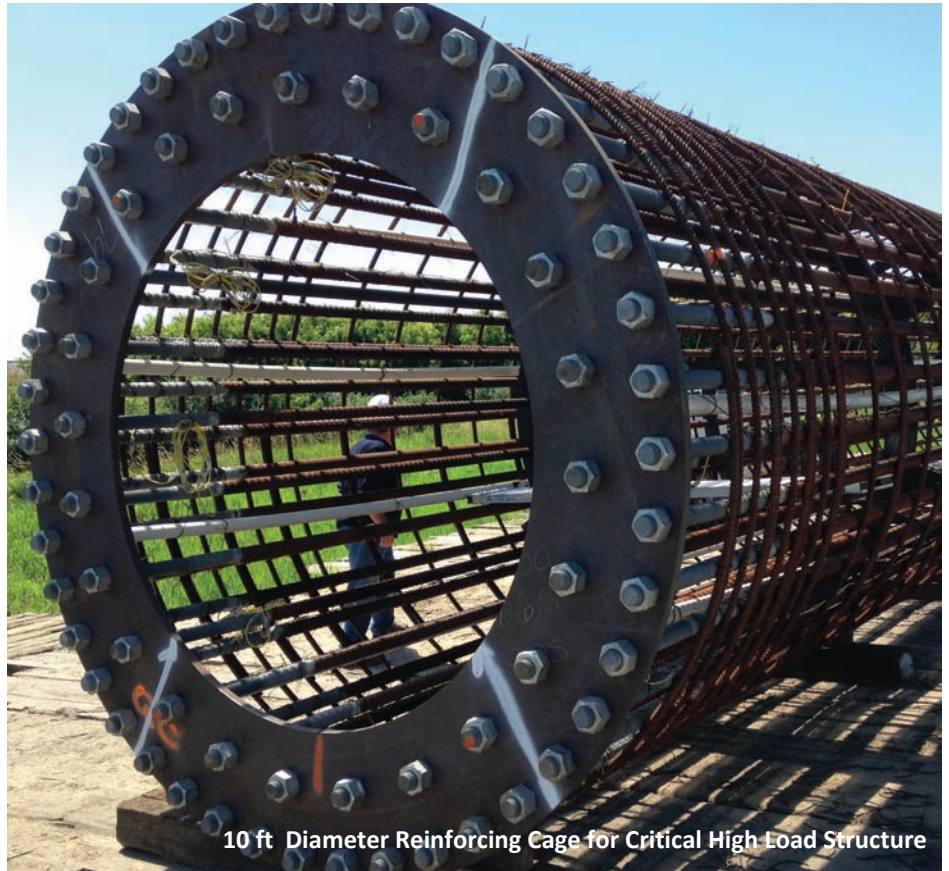
MidAmerican Energy Company (MEC) projects MVP-3 and MVP-4

This is an abbreviated article that appears on the GRL January newsletter, by Danny Belardo and Travis Coleman, GRL Engineers, Inc. and Neil Russo, EC Source Services.

In the electrical power transmission industry, Multi-Value Projects (MVP) are large, strategically planned projects that provide regional benefits through upgrades to the electrical transmission infrastructure. The MidAmerican Energy Company projects MVP-3 and MVP-4 construct or upgrade four electrical substations, upgrade existing 161kV transmission lines, and add new 345kV lines across the state of Iowa. These projects total approximately 191 miles of upgraded or new lines, allowing the grid to transmit additional energy, including from renewable wind sources. A total of 1,068 new drilled shaft foundations will be completed over the 2 1/2 year project to support the transmission line towers. Towers include tangent structures (located along straight portions and designed for wind and dead weight loads) and dead-end structures (larger towers located where a transmission line ends or turns at a very wide angle and designed for significantly higher loads, including high lateral loads).

EC Source Services provides engineering, procurement, and construction services for these projects. The project QA/QC originally required Cross Hole Sonic Logging (CSL) with confirmation from Pulse Echo Pile Integrity Tests (PIT) on these shafts. (CSL assesses concrete integrity using sonic waves that travel between transmitter and receiver probes inserted in parallel tubes pre-installed in the shafts. It cannot assess the concrete cover outside the reinforcing cage. Pulse Echo integrity tests evaluate integrity based on reflections from a stress wave created by the impact of a hand held hammer. In some situations it has depth limitations.) However, CSL had yielded false positives in some shafts, which led to coring and coring costs of US\$5 to 10K per shaft.

Thermal Integrity Profiling using the Thermal Wire® method, was presented as



10 ft Diameter Reinforcing Cage for Critical High Load Structure

an alternative due to the fast analysis turn-around time (one to 3 days versus up to 7 days after construction), potential cost savings over CSL and PIT (fewer false positives), and the unique ability to eval-



uate the positioning of the rebar cage and thickness of concrete cover. Concrete cover is of particular importance, structurally, in shafts subject to lateral loads such as those caused by wind. TIP using the Thermal Wire method consists of attaching specialty cables fitted with thermal sensors at every 300 mm along the

rebar cage. The sensors record concrete temperatures as the cement cures; the analysis of temperature patterns helps identify shaft anomalies and evaluate the position of the rebar cage.

GRL Engineers, Inc. was retained to provide TIP services on the foundations of 86 tangent structures (5 to 7 feet in diameter and approximately 32 feet long). Good results led to the test of five critical dead-end shafts that were approximately twice the size of the tangent shafts. Following those, EC Source proposed converting the QA/QC of several other foundation structures from CSL to Thermal Integrity Profiling. EC Source's Neil Russo remarked that due to the magnitude and scheduling challenges of the projects, the change in testing methods was invaluable to successfully complete its foundations, allowing EC Source to speed up production and reducing the need for additional testing and coring. ❖