Solo-Driver™: Driving Innovation in Transmission Structure Installation

Todd Maersch, Consultant Transmission Line Engineer, American Transmission Co.

Mark Sanzenbacher, Senior Project Manager, American Transmission Co.

SUMMARY

American Transmission Co. (ATC) has developed a new method for installing transmission structure foundations that is faster, safer, more economical and more environmentally friendly than traditional installation methods. Solo-Driver™ is an ATC new, patent-pending method for installing foundations using a vibratory hammer.

Solo-Driver™ revolutionizes the picking and placing of steel monopole transmission foundations through the use of an excavator mounted hammer and unique attachment design. This method uses smaller crews, requires less crew manipulation, uses fewer invasive machines and can install more foundations per day than previous practices, resulting in reduced costs with less stress to the environment.

This method can help alleviate some of the competing demands on resources facing utilities, ultimately helping to drive efficiency when it matters most. ATC recommends this new innovative method for companies installing transmission structure foundations.

BACKGROUND / PROBLEMS

Efficiency is key in utility construction projects. Utilities today are faced with smaller staffs, smaller budgets and increasing pressure to reduce their environmental footprint. Choosing the correct pole foundation installation method is a weighty decision that affects efficiency and the footprint size left behind when construction is complete.

To date, the utility industry has relied heavily on two methods for installing transmission structures in normal soil conditions when a concrete base is not needed: direct bury and traditional vibratory installation. ATC has developed a third choice, a vibratory installation method, called Solo-Driver™. Solo-Driver™ has proven to be faster, more affordable and more agile, especially when consecutively installing multiple foundations.

The direct bury method, using a digger derrick to drill a hole in the ground, has been used by utilities for years. Crews use a crane and taglines, or guiding cables, to lift and position the pole in the hole. The hole is backfilled to stabilize the pole. Direct bury requires heavy equipment, a significant amount of overhead clearance and a sizeable crew. Approximately two and one-half hours are required to install one foundation, which includes significant setup time. Leftover soil must be dealt with on site or removed.

Vibratory technology to install foundations has seen increased use since the technology can significantly decrease installation time seen in direct bury. Instead of using a digger derrick, crews use a vibratory hammer to embed the caisson into the earth. This traditional vibratory installation process is faster than direct bury and results in no leftover soil. However, it still requires a sizeable crew, two cranes, a flatbed truck, a power pack to run the vibratory hammer and taglines to manipulate the caisson into position. Crews use the taglines to align the foundation as it is lowered to the ground. Then, the crew must manuever the vibratory hammer over the foundation to drive it into the ground. Similar to the direct bury method, significant setup time is required. The entire installation process requires more than one hour per foundation.

Both methods require a minimum crew of five, and 60 to 80 feet of overhead clearance. A separate crane and at least two crewmembers must guide the pole or caisson into place manually using taglines during setup for both methods. ATC engineers have decreased setup times by developing Solo-Driver™ to eliminate the manual piece of the installation.

SOLUTION

Driving Innovation - How it works

The ATC Solo-Driver™ is the first of its kind to employ its unique pick and place method for installation of a vibratory foundation installation on transmission structures. This patent pending method relies on just one excavator to both set up and drive the caisson into the ground. To accomplish this, caissons have been modified to include side tabs. Side-mounted clamps on the vibratory hammer grip the side tabs, lift the caisson from its pre-positioned location on the ground, rotate the caisson vertically, and drive it into the ground, all without readjusting the vibratory hammer clamp. After the caisson has been driven into the ground a specified distance, the vibratory hammer releases the side tabs, is repositioned to the top of the caisson, and clamps onto an identical tab fastened at the top of the foundation. The vibratory hammer then drives the caisson to the required depth. See Figure 1.

Figure 1 – Solo-Driver™ at Work

Driving Results

A. Increased productivity

Solo-Driver™ dramatically reduces the total time to install a caisson, increasing productivity. See Figure 2 for comparison of installation methods.

Figure 2 – Method Comparison of Installation Needs

Method	Average Installation Time	Installations per Day	Crew size
Direct Bury	150 min*	4	5
Traditional Vibratory	75 min**	8	5
Solo-Driver™	30 min**	18	2-3

**per structure ** per caisson*

B. Smaller crews

Solo-Driver™ requires half the crew or less, required for direct bury or traditional vibratory since setup work and tagline positioning are not required.

C. Improved safety

With no taglines and no manual maneuvering required, Solo-Driver™ greatly increases crew safety. Safety interlock jaws on the excavator prevent dropping the caisson during installation, even if power is temporarily lost.

D. Less equipment and overhead clearance required

Solo-Driver™ requires significantly less equipment. One excavator, without a power pack, is required for installation. The vibratory hammer runs off excavator hydraulics. Half of the traditional overhead clearance is required because the single excavator grips, lifts and drives the caisson into place with no manual overhead readjustment required by a crew. See Figure 3.

Figure 3 – Method Comparison of Equipment Used and Overhead Clearance

Method	Equipment Required	Overhead Clearance Required
Direct Bury	1 digger derrick 1 crane 1 dump truck Taglines	60 to 80 feet
Traditional Vibratory	2 cranes 1 flatbed truck 1 power pack Taglines	60 to 80 feet
Solo-Driver™	1 excavator	30 to 40 feet

E. Fewer environmental impacts

Solo-Driver™ allows crews to install more foundations with fewer environmental impacts than either the direct bury or traditional vibratory installation methods.

Fewer pieces of large equipment means less weight, resulting in minimal ground disturbance. Less equipment combined with reduced operational overhead clearance means Solo-Driver™ can be used in locations where traditional methods are not options.

Solo-Driver™ harnesses the power of a vibratory hammer, rather than digging a hole, resulting in no leftover soil. The direct bury method can result in five to 50 yards of leftover soil per pole.

F. Improved landowner acceptance

The environmental benefits translate to greater landowner acceptance. Solo-Driver™ returns land to its owner faster with less soil compaction. Minimal impact occurs on agriculture operations, and less time is required for restoration after installation. Solo-Driver™ produces less noise, which landowners appreciate.

G. Cuts costs

Initial field studies have shown that Solo-Driver™ costs significantly less compared to traditional installation methods. Reduced labor and equipment costs drive this data. Smaller construction windows and expedited timelines have been shown to reduce project risk dollars.

H. Best practices

Solo-Driver™ has proven to be more efficient than other methods, even when navigating challenges that can impede any foundation installation project. Soil type and access are significant factors that determine the efficiency of all methods, including Solo-Driver™, and at ATC industry best practice continues to drive this new innovative method ATC has developed.

Sandy or loose soils are the most conducive option for any type of vibratory installation, including Solo-Driver™. See Figure 4.

Figure 4 – Soil Types and Installation Method

Category	Soil type	Installations per day with Solo-Driver™
Sandy or loose soil	Favorable	18-23
Higher clay content	Less favorable	6-8
Rocks and cobbles	Unfavorable	Vibratory installation not viable

Unrestricted access where foundations can be installed consecutively without multiple unloading and reloading events, referred to as 'one mobilization', allows for the most foundations installed per day regardless of installation method. Multiple mobilizations, where the crew must unload and reload multiple times to navigate around barriers, sensitive landscapes or other geographic obstacles, results in fewer foundations installed per day. See Figure 5.

Figure 5– Site Access and Installation

Access	Description	Installations per day with Solo-Driver™
One mobilization	Unrestricted access in which foundations can be installed consecutively	15-23
Multiple mobilizations	Restricted access requiring two or more loading/unloading events	7-9

Even in the most challenging conditions, less favorable soil conditions or multiple mobilizations, Solo-Driver™ delivers more foundation installations per day than either traditional method.

I. Preferred method

Solo-Driver™ is the preferred method for 69kV and 138kV foundation installation at ATC. It has proven to be the most efficient, safe, affordable and environmentally friendly method available. ATC believes this method can help alleviate some of the competing demands on resources facing utilities, ultimately helping to drive efficiency when it matters most.

CONCLUSION

ATC has developed a world class method for installing transmission structure foundations that increases safety and productivity, saves money and opens opportunities for landowner acceptance all while using a more environmentally friendly method. Solo-Driver™ will change industry standards for installing foundations using a vibratory hammer and makes good business sense. Partnering with ATC will allow companies to use this patent pending method. Solo-Driver™ is the future for installing transmission structure foundations.

About American Transmission Co.

American Transmission Company, based in Wisconsin, owns and operates the electric transmission system in portions of the Upper Midwest. Formed in 2001 as the nation's first multi-state transmission-only utility, ATC has invested $4.5 billion to improve the adequacy and reliability of its infrastructure. ATC now has $4.7 billion in assets. The company operates more than 9,600 miles of transmission lines and 554 substations. ATC serves both vertically integrated utilities as well as municipal and cooperative utilities.

The ATC Solo-Driver™ method is just one piece of ATC's commitment to innovation, efficiency, the environment and excellence in transmission. ATC is the country's premier energy delivery partner and its transmission expertise helps public power agencies deliver reliable service at reasonable rates. Solo-Driver™ is one of many resources available to utilities that partner with ATC.