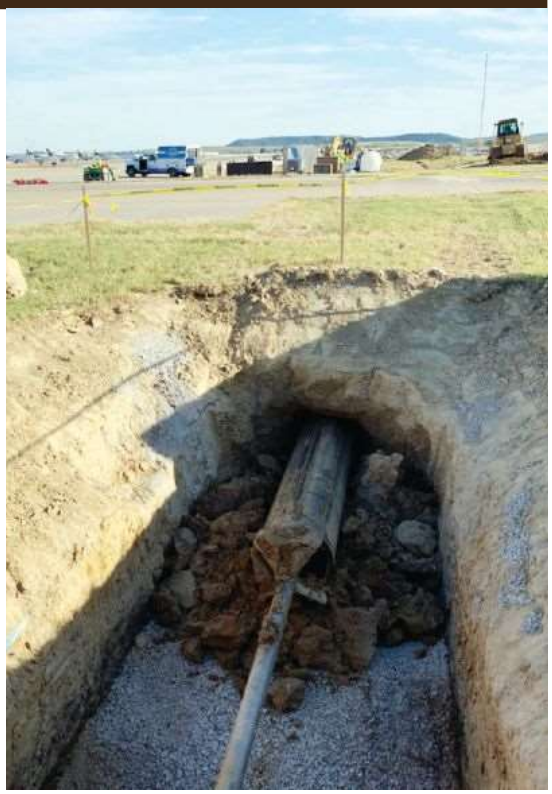
ACHIEVING ACCURATE AUGER BORING

By Laura Anderson



Auger boring contractors have a host of convenient tooling choices for tackling the expected and even unforeseen ground conditions for common diameter steel casing installations.

According to industry practice, a shortcoming with traditional auger boring is a lack of accuracy, limited to 1 percent. Over the years, contractors have developed manual methods to determine alignment, but they are limited to installation lengths up to 200 ft and are often time-consuming. These solutions to correct alignment are effective unless the bore requires installation within a narrow easement. From this necessity, technology emerged to ease the path for auger boring contractors.

Guided Auger Boring or Pilot Tube Guided Boring technology became available for the auger boring industry in the early 2000s and was a gamechanger. Borrowing the concept from horizontal directional drilling (HDD) using drill rods, called pilot tubes or guide rods, and adding a digital camera system, contractors could install a bore on line and grade, which held all subsequent tooling to specification.

The advantages of a guided auger bore do not end with accuracy. Pilot tubes also do three things: Determine alignment for surveying before committing to the bore, identify obstructions within the bore path and detect changes in geology by noticeable fluctuations in jacking pressures. The operator can identify the location of obstructions and geological changes by calculating the number of installed pilot tubes.

Using a pilot tube to guide an accurate course expedites the installation of steel casing , as contractors no longer need to trip augers. And with today's digital cameras, up to 600-ft installations have been achieved in the right ground conditions.

The known ground conditions and the

project's geotechnical data inform the appropriate tooling selection to upsize from the pilot tube to the steel casing diameter. An added benefit is that the crew will know locations of ground variability based on its pilot tube installation experience.

Tooling for Low Blow Count Geology

Low blow count geology is defined as soft, displaceable, non-compacted ground with N-values up to 30.

The most selected tool for low blow count geology for up to 36-in. steel casing is the weld-on reaming head, also known as a reaming head, needle or dart. It is welded to the last pilot tube and the lead steel casing section. Rigidity is provided through the pilot tube connection and reaming head casing arms to ensure proper alignment and quality of the bore. In this process, steel casing installation is accomplished in one step.

The two-step weld-on reaming head method, is recommended if the project's steel casing diameter is 36 to 72 in. in similar ground conditions. First, contractors follow the same installation procedure as the small-diameter weld-on reaming head. Next, per common industry practice, an intermediary steel casing section, approximately half the size of the final casing diameter, is connected to the first reaming head to hold the alignment, and the opposite end gets welded to the first final steel casing section. This two-step approach covers more surface area for alignment stability and is most successful using larger-capacity auger boring rigs.

The standard cutter head or lead auger with carbide teeth aids ground excavation and removal into the auger flighting.

Tooling for Harder Geology

Harder geology is defined as denser, more compacted ground with N-values greater than 30.

On projects with steel casing up to 24 in. in harder geology, inserting a small bearing swivel between the pilot tube and the cutter bit is a dependable approach. The bearing swivel accommodates continuous thrust loads and absorbs the pilot tube rotation to keep them stationary to maintain the alignment.

For more than 24-in. steel casing installations, a larger internal bearing swivel with a more robust connection is recommended on the second pass. Bearing swivels are typically inserted inside an intermediary casing linked between the auger flighting hex connection and function to withstand thrust loads and jacking forces as the borehole diameter is increased. A standard cutter head performs ground excavation.

Suppose pressures are higher with evidence of solidified material. In that case, the contractor is advised to add a cutter head with carbide cutter tooling and retractable wing cutters to the tooling string instead of a standard auger boring cutter head. This type of cutter

head serves three functions. First, it offers more robust cutting tools to excavate the ground as the auger flighting rotates. Second, the wing cutters extend slighting beyond the outside diameter of the steel casing to allow for a minimal overcut for clearance for the steel casing to slip inside the borehole easily. Last, suppose an obstruction prevents the auger string from turning. In that case, the contractor can retract and pull back the cutter head inside the casing, remove the obstacle, and reinsert it without losing alignment.

Tooling for Rock Geology

More aggressive tooling and a different strategy are necessary for projects where the geotechnical baseline report shows evidence of high compressive strength rock. Successful rock auger boring is all about knowing your options and selecting the right combinations of tooling and lubrication for each increase increment.

The steering head used with the pilot tubes displaces the soil as it is advanced, so choosing a steering head with cutting tooling has proven beneficial.

For even harder-density ground, contractors have turned to pneumatic hammers. They create rock chips, which are pressurized and removed by foam injection from the entry point. This process establishes a borehole typically up to 10 inches. Specialty rock pilot tubes and other tooling are necessary to withstand the thrust loads and vibration.

Small diameter boring units feature a full face of disc cutters to install steel casing up to 48 in. in common diameters. These assemblies are welded to the steel casing and can follow a bearing swivel in an interim casing section or even a smaller boring unit and bearing swivel. The boring unit's disc cutters fracture the rock. The outer disc cutters excavate a minimal overcut while scoops on the cutter head periphery transfer material from cutter head inlets into the auger flighting for removal. The operator maintains alignment using the boring unit's exterior stabilizer pads.

It is necessary to introduce cooling water to cool the boring unit's main bearing and assist with material transfer from the cutter head to the auger flighting. This practice will result in extended performance and reduced disc cutter wear.

Of significance to note is the positive impact lubrication or mud and a mud pump system can have on any steel casing installation. Appropriate selection and application of mud are essential to reduce friction, decrease jacking thrusts, and, if applicable, flush cuttings. Contractors are advised to consult with a qualified mud supplier to provide the correct choice for the project's geological conditions before embarking on the project.

With competence in guided auger boring tooling selection, auger boring contractors will find their expertise in high demand.

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