

Vacuum Excavation



Arizona Uses Vacuum Technology to Address Aging Underground Utility System Challenges

By Arvid Veidmark

With more than 200,000 people migrating to Arizona each year, the demand for residential and commercial construction services continues to soar. Of all of the news headlines, most are centered around the same theme: the metro area is growing like crazy and mega construction projects such as the Valley Metro Light Rail, the Phoenix Convention Center expansion, an extensive upgrade at Phoenix Sky Harbor and a new downtown entertainment district means major construction on almost every corner.

The construction industry employed 242,000 people in 2006, representing one out of every 11 jobs, which accounted for 9.5 percent of gross domestic products.

With all this growth, Arizona state and local officials face major challenges when it comes to upgrading and expanding aging underground utility systems — which is why they are looking to emerging technologies to assist in providing sustainable solutions to address this ongoing situation.

Effective damage prevention and good management of buried utilities require attention to a number of details, including proper planning, coordination between utility contractors, one-call systems and facility owners. In addition, adherence to evolving regulations, reliability of existing data involving infrastructure changes and utilization of new technologies are also important.

Traditional methods of underground utility installation and renewal generally employed conventional open-cut methods and was less coordinated than today. These trenching methods typically created significant traffic disruption and were at high risk for unintentional conflict with existing infrastructure. Over the years, damage to underground utilities in the United States has resulted in the loss of millions of dollars and hundreds of deaths — not to mention the exorbitant construction costs.

Recent mandates prohibit mechanized exploration within a few feet of a known pipeline or cable. Often, hand digging or vacuum excavating — an emerging technology that utilizes air to expose underground utilities — are the only approved options.

Of all the excavation methods available today, vacuum technology is currently the safest and most cost-effective. Like many Arizona construction professionals, more and more contractors around the United States are beginning to recognize its benefits.

High-pressure air, which is safer than water, has many advantages. The spoils can be used as backfill, it is faster in a variety of soils and it leaves a smaller footprint. High-pressure water can cut utilities and is a conductor for electricity. Utilizing water as a means of breaking down surface materials creates mud (which does not meet the MAG standards for backfill) and thus requires a need to import backfill. Since the spoils must be hauled away and disposed of, this requires a dumpsite for the excavated materials, which adds to the cost of the project. The standard for backfill is MAG 601.4.3 and COP MAG supplements, which addresses the quality of the backfill, the maximum lift height for the size of the trench and adequacy and uniformity of the compaction. The correct type of backfill must be used for the location of the trench.

Applications

Vacuum excavation is perfect for a variety of other applications also, including vault cleaning, manhole and catch basin cleaning, culvert cleaning, debris removal, vertical excavating, water meter box cleanout, landscape rock removal and confined space excavation.

Procedures to Avoid Conflict

Reliable data is necessary to design an underground construction project, even though traditionally existing records

relied upon in the design phase are notoriously inaccurate. Contractors are still responsible by law to identify, verify and safely locate all underground utilities at the construction phase. In order to minimize the possibility of litigation and dispute, it is imperative that a contractor go beyond reliance on the ground surface markings of a local one-call center and physically perform a surface and often a subsurface survey prior to the dig.

Relying on visual signs in addition to the markings is critical for avoiding conflict. A good surveyor will look for visual clues such as manholes, catch basins and power lines to detect unmarked conduits. A trained eye can usually detect storm drains, irrigation lines and private electric and gas conduits, as there are often no evident physical markings. The key is to use trained professionals with knowledge and experience to identify and interpret the clues when performing the survey.



Vacuum is a form of trenchless excavation that utilizes 95 percent air at a volume of 100-plus psi and 5 percent water to break up soil in record time. Using an air-vacuum system, you can dig a 12-in. by 12-in. by 5-ft pothole in just 15 minutes in most soils. The kinetic energy of the high-velocity air stream penetrates, expands and breaks up the loose soil, which is then removed from the hole with a powerful vacuum.

It is also necessary to determine soil conditions and be aware of the actual soil stratifications at a given site. This is accomplished by obtaining soil samples that evaluate the depth and nature of the bedrock, the surface drainage conditions and groundwater levels.

Once underground infrastructure have been identified, a contractor should produce an underground utility profile. This collection of information helps to manage risk associated with placement of future utilities.

Steps for Excavation

1. Secure the site. Use barricades, signs and other measures to ensure public safety.

2. Break up the surface. A jackhammer may be used initially to break up the surface concrete, asphalt, hard dirt or rock depending on the conditions.
3. Use the air lance. The high pressure breaks up loose soil and creates a pit of the desired depth.
4. Vacuum. Vacuum the loose soil and safely uncover the utility. Vacuum up the dry spoils for easy backfilling. Remember that this eliminates the time and expense associated with mud disposal.
5. Backfill, compact and cold patch. The same material that is removed from the excavation site can be reused as backfill. This meets MAG standards for backfill.



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SAFETY & DAMAGE PREVENTION

Safety Standards

Compliance with all OSHA safety standards is of the utmost importance when using vacuum technology. This includes securing the site with barricades, signs and other measures to ensure public safety.

The standard guidelines for the collection and depiction of existing subsurface utility data (the ASCE standard) presents a system for classifying the quality of existing subsurface utility data. This allows the project owner, engineer and constructor to develop strategies to reduce risk, or at minimum, to allocate risk due to existing subsurface utilities in a defined manner. The ASCE standard assists engineers, owners and contractors in understanding utility level classifications and their allocations of risk.

The demand for companies that provide locating services is increasing. Such service may be beyond the scope of small operators who work on a locate project basis only rather than taking on a broader support role. It would be wise to choose a subcontractor with proven knowledge of underground construction and its special challenges, with the ability to balance both safety and profitability.

Vacuum excavating provides a practical, cost-effective solution for utility locating without sacrificing safety. Utilizing the right equipment and the right resources will ensure your next design-build or construction project is a big success.

Arvid Veidmark III is co-owner and senior estimator of Specialized Services (SSC), a Phoenix-based underground construction and consulting company specializing in directional drilling, auger boring and vacuum excavation.



This project involved a historical structure on the campus of Arizona State University in Tempe, Ariz. SSC used its System 4000 vacuum trucks to clear the crawl space of this historic house. The challenge was working in a limited space and preserving the structural integrity of the house. The vacuum excavation crew used its high-powered vacuum to remove the accumulated debris from the crawl space. Approximately 111 yds of debris was removed, creating a 27-in. crawl space that could then allow for the reinforcement of the aging foundation.

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