Potholing from a Contractor's Perspective

Arvid Veidmark, III

Specialized Services Company, 2001 W. North Lane, Phoenix, AZ 85021, PH 602-997-6164, FAX 602-997-4811, email: arvid@sscboring.com

Abstract

There are numerous utility locating/potholing companies in the U.S. This is evident when you open any phone book or service directory. A customer can request potholing service on any given day and fully expect the pothole service provider to perform the job exactly as requested with no questions asked, supplying location, diameter, and depth of the utility the customer is looking for.

At first glance one might consider this ideal, however from the contractor's perspective "performing the job exactly as requested" can often mean wasted time and expense.

In two case studies, the value of subsurface utility engineering is demonstrated from design through job completion. The significance of potholing using a reputable, experienced subcontractor and the ability to transfer field data into CAD drawings and lad based maps is demonstrated.

Introduction

To a contractor, engineer, and owner, potholing should be much more than merely exposing an underground utility. It is the ability to fully understand the scope of the project in order to provide detailed assessment and make recommendations to avoid conflict. It is a relationship building process where data is collected and shared among all team members via data depiction methods. It is a process that employs common sense, skill, and experience to evaluate immediate cost versus long-term benefit. It is a true understanding of underground construction and its special ongoing challenges

Potholing Services

There are many potholing services throughout the United States, serving a diverse base of customers who provide gas, electric, telephone, CATV, water and sewer utility service. Many companies use state-of-the art equipment and are well equipped to locate, mark, and report on underground utilities as specified in their contract.

Customary Utility Locating Services

Most locaters utilize electronic locating techniques to determine the approximate horizontal location of underground utilities. Some offer potholing services to expose the located utilities, and often provide some type of reporting to customers. Unfortunately most are not experts in underground construction and cannot provide full subsurface engineering services.

Common Pitfalls

Utilities buried at shallow depths can often be located easily. But many types of utilities, especially small non-conducting utilities at greater depths are extremely difficult to locate and require expert interpretation.

Records are often poor with inaccurate utility positions and/or depths. Some live services do not even appear on the utility plans. This means that the ability to physically determine on-site, the location, nature, and depth of underground utility services is critical to reducing the risk and consequences of inadvertent damage during construction.

What is Meant by Full Service (S.U.E.)

A combination of technology is needed to increase the reliability of utility detection in terms of the size, depth, and pipeline materials that can be detected and exposed without incidence.

Subsurface Utility Engineering (S.U.E.) is a viable solution to the far too common “hits” to underground utility lines. Subsurface Utility Engineering is an all-around better method of locating subsurface utilities. This field has grown increasingly popular, and is now being mandated by several federal and state highway administrations, such as the City of Phoenix.

Advantages of using S.U.E. Potholing Companies

- Fewer conflicts with utilities
- Reduce delays in construction schedules because unforeseen conflicts with utilities have been eliminated.
- Elimination of added construction costs because unexpected utility adjustments are no longer needed.
- Fewer contractor claims based on utility delays
- Chance of severing a utility line is greatly reduced and therefore the safety level is increased.

Basic S.U.E. Processes

A. Data Analysis

Once a job has been negotiated and accepted, the project manager analyzes the data as provided by existing records or oral recollections. Necessary data is provided by the engineering staff and the S.U.E. Analysts and Surveyors are briefed as to what to expect on-site.

B. Designation & Location

Utility designation is the use of geophysical techniques to determine the existence and approximate location of existing underground utilities. Service may include records research, paint markings, traffic control, and field sketches. Surveying work is done utilizing benchmarks and necessary tie-ins are made to relate the project with real world coordinates.

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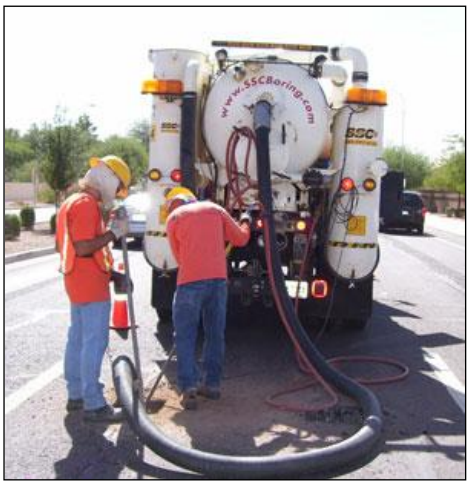
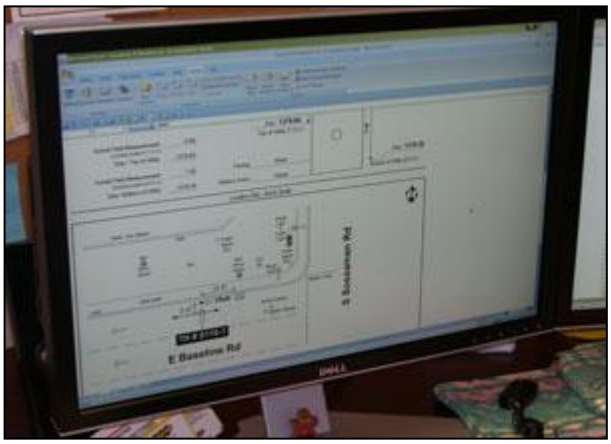
Location services include *vacuum excavation* (potholing) which is used to create 0.3 to 0.5 m diameter holes to physically confirm the position and depth of an underground utility. A hole is first cut in the road pavement using a rotary core drill and then the excavation is advanced using compressed air jets in conjunction with a vacuum excavator wand. The excavation process will not normally damage an existing utility and the hole in the street pavement is kept to a minimum and is easily repaired. This procedure can only be used to confirm the position of known utilities or previously located utilities.



C. Evaluation & Report



This service involves surveying the utility information obtained by designating and locating to the project control. Data is electronically collected in the field, processed, checked, and provided to clients in CAD or GIS format.

Modern utility mapping techniques that can be layered and detailed are utilized to produce base maps customized to client specific design requirements. They provide simple comparison of data for different pipelines and topography.

To create utility maps, survey information is converted into computer-generated plots in CADD format. Designation and location data is used to create a subsurface utility overlay of the existing road design. Test hole reports are made for each test hole with a computer-generated sketch of the test hole location and all other pertinent

information to form a concise, informative data sheet for the utility, geographically referenced to the county Geographic Information Systems (GIS). A geographically accurate base map makes it easier to maintain the accuracy of a utility location as new jobs are designed and completed.

Conclusion

S.U.E. offers data management methods that allow a rapid interface between a field crew and a multi-utility database including:

- Easy updating of utility records with new locating information
- Field alerts as to discrepancies between expected positions of utilities and field measurements
- Graphical displays of utility layouts in field based on most current information

Based on these factors and others, the Federal Highway Administration (FHWA) has recognized Subsurface Utility Engineering as a professional engineering service and a necessary part of highway construction. This field has grown incrementally in the past few years and, by all indications, will continue to grow for years to come

Case Study #1

Project: City of Phoenix, Deer Valley Wastewater Treatment Plant Security Improvements. (Construction Manager at Risk)

Owner: City of Phoenix Water Services Dept.

Prime Contractor: Felix Construction Company, Phoenix, AZ

Prime's Sub-Contractor: Specialized Services Company (SSC)

Project Overview:

Vacuum Potholing

Since 90% of Felix's projects each year are derived from alternative delivery methods such as CM@Risk and Design Build (DB) projects they were awarded the City of Phoenix contract for security improvements at the Deer Valley Waste Water Treatment Plant.

Marking

The Deer Valley Plant was just one of many facilities targeted by the City of Phoenix to receive high-level security upgrades. The new system consisted of advanced infrared intrusion detection, combined with cameras and monitors that use an intelligent software application to alert security of potential threats.

Covering over an 80,000 square foot area, including the plant's new perimeter wall and all access areas such as windows and doors, installation of thousands of feet of co-axe and fiber cable was required.

Project Scope:

SSC was contracted to provide the following service:

1) Designate utilities:

a. Identify utilities to be located. Coordinate with Felix Construction.

b. Arrange Blue Stake marking of utilities. Coordinate with public and private utility companies, and Black & Veach (representing the City's Water Services Dept. at the plant)

c. Verify that all utilities are marked.

d. Maintain Blue Stake markings.

2) Locate utilities:

a. Remove existing asphalt concrete if required.

b. Excavate all subsurface native materials.

c. Locate utilities using vacuum excavating method.

d. Locate utilities using electronic method.

e. Backfill excavations with salvaged native subsurface materials, and compact excavation.

f. Furnish and install cold mix asphalt concrete if required

3) Measure and report utilities:

a. Measure all utilities located. Provide horizontal and vertical distances from existing and recognizable plant site features and surfaces.

b. Report results. Provide utility identification report on Specialized Service's forms.

Process:
Start: 6/27/07
End: 7/17/07

The process began with a meeting between SSC & Felix. The initial consultation meeting is spent getting an overview of the bid picture and the responsibility Felix has to the client. Many hours were spent walking the site to absorb the area. What is meant by absorb? Absorbing the area means taking in all visual and non-visual data in an attempt to identify underground issues. After this initial meeting SSC obtained access to the records department and spent many hours

reviewing the original drawings from 1960 to present. The site visit is designed to help avoid conflict during construction. Identifying and potholing the known utilities is relatively easy, finding the unknown abandon utilities and structures is something else all together. Using electronic locating SSC identified the known underground utilities like telephone and electric. Using proven trade methods SSC located other structures and conflicts. Using vacuum technology over 55 potholes were dug, many of which were 2' wide x 15' long. SSC worked with Felix to make recommendations for relocation of the proposed duct bank during the potholing so the potholing would move alignment as the duct bank moved. This is a critical issue in full service SUE, the ability to make quick field adjustments by working directly with the CM@Risk manager. This ultimately saved the company valuable time by advising them ahead of time of areas where conflict would be unavoidable. SSC also provided state-of-the-art potholing reports and an overlay map of the whole project showing where the potholes were located. SSC also keeps an extensive digital photo data base to allow SSC to return and help Felix or others as needed.

Challenges:

Built in the early 1960s, the plant has since been enlarged and modernized resulting in a maze of private and public underground utility conflicts, including gas, fiber, electric, water mains, and storm drains.

Blue Stake markings inaccurate, requiring multiple potholes to locate single utility. As Builts out-of-date and unreliable.

Felix's pre-construction services allowance for utility locating was limited.

Result:

55 potholes completed on time and within budget:

"This was our first project of this nature," said Bob Hughes from Felix. "Our pre-construction services allowance was limited and SSC did a great job of working within our time and dollar constraints." "We chose SSC because we really needed a company that could understand the scope of the project and they have a great reputation with the City," he said.

Bob's statements are a testament to hiring a contractor with decades of underground experience installing everything from a ¾" PVC irrigation line to an 89" gravity fed sewer line. The ability to move the proposed duct bank based on the immediate data from the potholing then moving to the next pothole on the new alignment saved thousands of dollars.

Case Study #2

Project: City of Mesa 6th Street Service Center

Owner: City of Mesa

Prime Contractor: Specialized Services Company (SSC)

Project Overview:

A lingering contamination site beneath Mesa's Sixth Street Service Center contains a variety of contaminants that are routinely found in petroleum products and include benzene, toluene, ethyl-benzene and xylene as well as MTBE (methyl tertiary-butyl ether). According to a city report, all of the chemicals, except for the MTBE, are confined to the groundwater beneath the service center.

Mesa is the third largest City in Arizona and the nation's 40th largest city. It encompasses 131.2 square miles and is home to over 400,000 residents, whose drinking water has so far not been affected by the chemicals.

According to city officials the cleanup wasn't started earlier because the Arizona Dept. of Environmental Quality wouldn't approve the plan until the full extent of the contamination was evaluated.

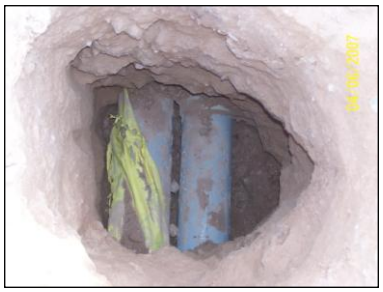
Although the extent of MTBE contamination outside the service center area is still yet to be determined, new state mandates are pushing for a faster clean-up, according to Christine Zielonka, Mesa's development services director.

Project Scope:

In response, the City of Mesa contracted Specialized Services Company to prepare the site for a $1 million clean-up system to remove the toxic chemicals from the ground. Approximately 12-14 interconnecting monitoring wells (200 ft. deep) and a new building, to house pumping equipment necessary for testing, was planned.

SSC was contracted to provide the following service:

Process:



Start: 4/5/07

End: 10/9/07

Job required 40 hours of electronic locating and 150 potholes.

The project began with a meeting with CRA informing SSC they had been selected as the CM@R for the remediation project. At this time SSC held the contract with the COM for potholing in the engineering department. It was that SSC would provide all the design potholing under the COM contract. During construction SSC would work for CRA to vacuum excavate where the conflicts were identified. In order to avoid any conflict with the existing underground infrastructures, SSC utilized state-of-the art vacuum excavating technology to expose and map utility lines in the path of the new system and pump building. This technique eliminated the possibility of further environmental damage to the area. Vacuum technology uses air to break up soil around the utility and a high-powered vacuum to remove the excavated material.

Challenge:

Beneath the Sixth Street Service Center exists a web of documented and undocumented private utilities that service the area. The other challenge was that the designer and the COM were using two different survey datums, therefore the pothole request started 150' off the marks where the work was to take place.

Blue Stake & As Builts were unreliable and the original survey was inaccurate. Unable to layout potholes as originally requested by the City as they were not tied to city coordinates.

Result:

SSC completed over 150 potholes and rendered the site safe for construction. The City of Mesa hired Conestoga-Rovers & Associates, well known for their work at the Love Canal to complete the project. In the meantime SSC plans to begin clearing 6-ft. deep holes for the monitoring wells. SSC worked with CRA to vacuum excavate multiple areas where the utilities were dense and using a backhoe was un-wise.

References

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