Locating Buried Utilities - Past, Present, Future

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Not too long ago I was asked to testify at a city council hearing of a large Midwestern city that had just suffered an all-too common tragedy. An underground natural gas line had been severed during excavation and the escaping gas had migrated through a sewer line into the basement of an apartment building causing a fatal explosion One councilman had a particularly sensible, but troublesome, question. He had watched. as had we all, guided cruise missiles; travel in excess of 100 miles from American naval vessels, and target directly down the smokestack of Iranian factories - why couldn't locators accurately indicate the location and depth of an underground gas line that was a mere three feet below the road grade and therefore eliminate these "avoidable" errors?

Although my answer was accurate, it was not altogether convincing since the council proceeded to pass a law that required depth without a tolerance zone to be submitted to an excavator along with the above ground horizontal location (that fortunately did have a tolerance zone). My unconvincing answer was this: Locators could accurately find these underground facilities, including depth and therefore avoid these errors, if the locating devices we used were equipped with the multimillion dollar anti-jamming radar technologies that cruise missiles employ. The problems the missiles solve when navigating hostile territory is, in effect, the same a locator has distinguishing the "true" and desired signal (location) from the "false" and competitive ones.

Although packaged and presented in more sophisticated and "digital appearing" formats, the technologies employed to locate underground lines have not substantially changed in the last 50 years. The method employed is still essentially the same: conductivity place a "tone" by direct attachment with a transmitter to an access point of an underground facility, and then trace the path of that tone with a detachable receiver. In other words, a locator actively conduces (or induces) an electromagnetic field on a conductor and then measures the sustaining strength of that field to dissipation, and then starts again. Years ago when water, or the occasional natural gas line, was all that was underground, this method was easy and effective. Now, with the overwhelming preference of placing all types of utility lines underground instead of overhead (and all of them confined to the same narrow easement and maybe even the same grounding pattern), the process of accurate location of these lines after placement is barely adequate for the task. The underground city is a jungle and the jungle is growing largely out of control.

Prior to excavation, the accurate location of buried utilities is increasingly being assigned to specifically trained locate technicians under contract to facility owners. These contract locate technicians are confronted with the same challenges that their utility employee predecessors faced, i.e. poor utility records. uneven construction practices, and competing underground line interference. However, these contract locators are additionally faced with the challenge of becoming omni-talented in the location of not just one underground utility, telephone for example, but now need to be proficient in the location of all the underground utilities at a site - telephone, gas,

power, cable television, water and server lines - and often, multiple providers of each. Imagine the challenges of accurately identifying each specific underground line a confined easement when each line is generating its own electromagnetic field, each is at a different depth, and each contains a variable amount of metallic continuity. It is not enough to say that "There is a line underground at this location." A locator is expected to identify the type and size of the line as well. The underground city, as it has been constructed, and is presently being located, is a tangled and confusing analog world that is not getting anything but worse.

So what is the solution? Is the infrastructure of North America destined for inevitable and unavoidable damage since once it is placed it cannot be accurately found again without multimillion dollar locating devices? Are we forever trapped in an underground electromagnetic analog world when it comes to facility location? As in many other things, the answer to these problems is already here. There are many people and industries working on individual parts of the solution, but the integration of all the parts into the "total solution" has not yet been implemented. In my opinion. it begins in the design process and continues - uninterrupted - into the final as-built deliverable.

The answer is in highly accurate digital locational information integrated with equally accurate base mapping to "forever" capture the world on a three dimensional plane. The solution lies with the integration of the Global Positioning System, geographic information systems, standardized mapping projections, orthographic photography and ongoing locational updating. The surface of the Earth has been mapped with increasing accuracy for the last several thousand years. It is time that the underground is mapped as well.

The remainder of this talk will concentrate on this solution.

If you have any questions, please contact **Dr. C.Vipulanandan**