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Utility companies get straight to the point

An OXEMS discussion starter
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UTILITY UNDERGROUND ASSET MANAGEMENT

Utility companies are demanding increasingly in-depth, asset-specific intelligence. GIS is delivering major advances in this direction … but, on its own, it is not enough.

Digital technology has transformed our lives. And perhaps because it has brought such miraculous changes, there is a danger that we overestimate some of its capabilities. Consider how GPS technology has changed the way we drive anywhere these days. "Turn left." "Second exit at next roundabout." And, we hope, "You've reached your destination." Easy. It's a miracle made so familiar that we no longer pause to marvel at it. And yet, beyond the slowly scrolling screen and silky voice, our journey from A to B depends upon an intricate network of satellites orbiting 12,000 miles above us. That it takes us straight to a target address is impressive. But, it's not exactly precise.

Standard GPS has an accuracy of around 10 to 15 metres. On a good day. But poor atmospheric conditions, urban canyons or wooded landscapes can worsen that range or, worse, cause complete loss of signal. Although an accuracy of 10 to 15 metres is more than most of us strictly need, for utility companies there is still a way to go. For a utility company contractor's team locating a possible underground asset fault, a 15 metre search radius is 'a big help'. But too big.

THE PROBLEM WITH RELYING ON LUCK

Unless they get lucky early, that's a big hole. More sinkhole than manhole, with plenty of irritated residents and diverted traffic. And even the more accurate versions like RTK lack the absolute precision needed to home in on specific asset features.

Another way round the problem is to dig more small holes. But the more this goes on, the more dry holes are created and the greater the risk of accidental strikes on other underground assets. It's easy to see how costs, disruption and man hours escalate. The statistics speak for themselves. For every three holes a team digs, they'll dig the next one in the wrong place.

The environmental damage, associated accidental infrastructure strikes, increased health & safety risks, disruption to local communities and economies – all these factors make the reliance upon imprecise excavations to find specific underground assets increasingly unacceptable. Both economically and socially.

THE LONG DIG

As if the road crew didn't have enough on their plate, when they do finally find what they are looking for they need to determine the depth and track of the asset. As-laid drawings and underground mapping often don't provide sufficient, or sufficiently accurate, information. The goal, almost always, is a joint, ferrule or valve where most maintenance issues occur. Ask any road crew and they'll tell you: the capability of digital re-location techniques only gets you so far.

We seem to be back where we started. The GPS/GIS tools available to road crews get them close, but not close enough. GPS is good but not accurate enough. GIS holds information but not enough.

Photographs in this paper are real deployed tag images from a water utility - this image shows a tagged valve

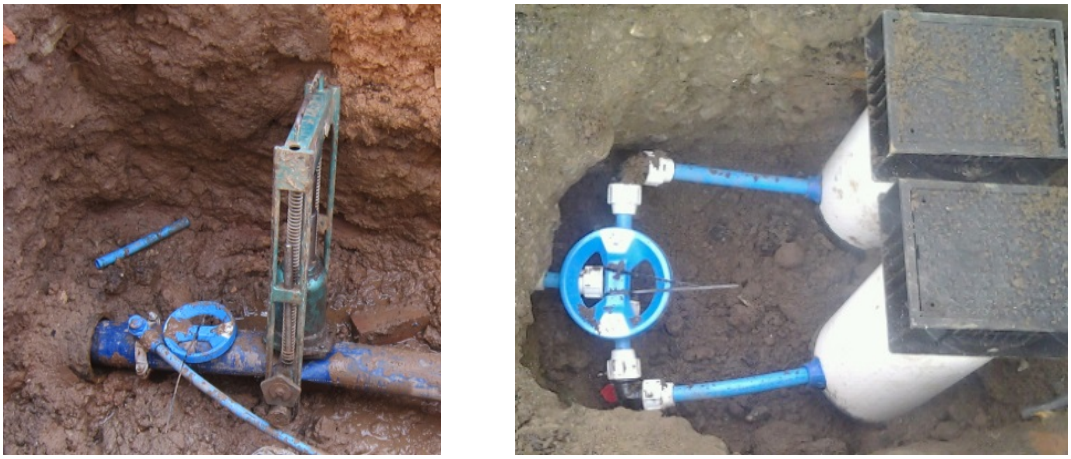
The valves, ferules or joints and other features are the points where new targeted intervention techniques could be used. But that's impossible without knowing with absolute precision where the asset point is. For point-specific interventions crews need point-specific information. And that demands something new.

STRAIGHT TO THE POINT

It is not just a matter of tracing the track and depth of a buried asset. That's helpful but, on its own, not sufficient. Why? Because most issues occur at specific points on those assets – joints, junctions, valves and so. And those are the points where new targeted intervention techniques can be used *... but only if there can be certainty about the position.*

As we know from school physics, velocity has two components: speed and direction. Go as fast as you like but, if it's in the wrong direction, you will never reach your destination!

Similarly, underground asset management is a vector issue dependent upon two components: the general pathway of an asset *and* data about specific points on the asset.



The left image shows a tagged ferrule & squeeze-off point, whilst the right image shows a tagged split on a customer pipe - a potential point for future background leakage due to the excessive use of push-fit joints

Which is to say, the general pathway mapping enabled by any GIS is valuable but not sufficient.

For point-specific interventions, point-specific identification is a must-have requirement. And it demands something different.

Enter tagging. Tagging marks specific points on assets. And to overcome the inevitable fluctuations in positional readings from outside sources, it enables pinpoint identification by placing a physical tag at the point of interest.

Put it another way. To provide totally accurate guidance, a virtual map has to be 'anchored' to the real world. That's what tags do. They are the real, physical markers that provide absolute 'lock on' to specific points of interest.

VIRTUAL + REAL = ABSOLUTE PRECISION + UNLIMITED DATA

When tags are attached to buried assets, the requirement of any GPS system is made easier because it has simply to get close to a target asset (within say a couple of metres) rather than absolutely 'on it'.

Then the detector part of the physical tag detection system takes over, easily enabling utterly reliable, absolute location of the tag.

This means, of course, that there are cost savings on the GPS, because the more precise the GPS, the greater its cost.

In addition, physical tags enable vastly more accurate data input and recall about specific points of interest than is possible with a virtual system alone.

The OXEMS system uses passive tags (i.e. the tags have no on-board power sources or silicon, so there is nothing to go wrong) that are easily associated with any amount of data, including:

- Photographs showing the layout and orientation of specific points of interest on an asset …
- Where appropriate, photographs showing the positional relationship of tags to above ground features
- The date and time of any and all interventions …
- The contractors and work teams involved
- Even the invoices to which interventions relate …
- Additional data that may help the asset management, quality assurance and training purposes of any utility or contractor.

Yes, we now all live in a world transformed by digital technologies. Yes, we are all now able to communicate with one another as never before. And yes, the new digitally-enabled capabilities are set to go on transforming our lives.

BUT … a joint or valve on a polyethylene gas or water pipe buried beneath our feet can be as invisible and difficult to locate as it ever was.

Unless, of course, the joint or valve is fitted with a real tag. Then, its precise position and associated data are accessible with ease.

GIS, GPS, GLONASS, GNSS, SBAS and more!

A GIS (Geographic Information System) is designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.

Two satellite-based positioning systems are currently fully operable. GPS (Global Positioning System), created and owned by the U.S. Department of Defense, and managed by the USAF. And the Russian GLONASS (GLObal NAvigation Satellite System). The generic term for both is GNSS (Global Navigation Satellite System). In development are China's Beidou system (estimated completion date 2020), the EU's Galileo system (2019) and more. RTK (Real Time Kinematic) technology can be used to enhance the performance of any of these systems.

Currently, manufacturers are claiming "sub-metre" accuracy for enhanced systems. For example, the **Leica Zeno GG02 plus GNSS/GIS SmartAntenna** claims a horizontal real-time accuracy of <1.2 metres with SBAS (Satellite Based Augmentation System) and a vertical real-time accuracy of <2cm.

However, the small print indicates some limitations. For horizontal accuracy: "Measurement precision, accuracy and reliability depends upon various factors including number of available sat, geometry proximity to base station, multipath effects, ionospheric conditions etc." And the vertical accuracy: "May vary due to atmospheric conditions, multipath, obstructions, signal geometry and number of tracked satellites."

According to a Trimble Navigation Limited report the real-time accuracy of GPS is 10 – 15 metres. This can be improved, using SBAS (Satellite Based Augmentation System), to 2 – 5 metres. The real-time accuracy of GLONASS is 4.5 – 8.5 metres.

None of this is to imply that these systems are anything other than remarkable. However, on their own, they are not sufficiently accurate to reliably enable the use of Core 'n' Vac or other keyhole excavation technologies. And there are other limitations. So, on their own, these technologies are not sufficient to solve the inaccuracies associated with blind digging to find particular buried assets.

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