



Finding a way around the underground service maze

In an ideal world, every service that runs underground – water, gas, waste water, electricity, fibre, cable TV – would be clearly mapped and easy to find on-site. In an ideal world, up-to-date records would exist of all work that has been carried out. In an ideal world, when a contractor, utility engineer or surveyor opened up a hole, they would know exactly what to expect beneath.

Unfortunately, this 'ideal world' does not yet exist. Although records are kept, these are frequently inaccurate and out-of-date. Does this matter? It certainly should do, because inaccurate underground records lead to higher costs and project delays, and can even raise health-and-safety concerns. Valuable time can be wasted trying to find a specific cable, pipe or fault, but the industry has - until recently - found it difficult to deal with the challenges involved. However, that situation is now changing, with new technology making accurate, even 'real time' underground location both feasible and affordable.

The situation today

Before looking at these new developments, it is important to understand why they are so needed. The ground beneath our feet is becoming increasingly congested, with many services crammed into the same space. This can make it extremely difficult for any contractor, engineer or surveyor working in that area, because the risk of inadvertently damaging the pipes or cables of another organisation is a very real risk, one that can cost money, bring streets to a complete standstill while repair work is being carried out and, in some cases, carries a safety risk.

Most utility companies, as well as railroads and similar organisations, do maintain underground records, but with even the best will in the world, it is difficult to ensure their accuracy. Many underground services date back many years, to a time when accurate records were not always kept (early 20th century for some power cables, and even the Victorian era for certain water pipes).

In addition, it is very easy for records to become out of date quickly. Imagine a situation where a water pipe was running along the side of a wide country road for years, clearly signalled by above-ground markers. Then the district council allows a housing estate to be built on the site. Suddenly, the water pipe is under a pavement and the above ground marker is no longer in situ, because it was ripped out of the way by a digger. Now, if the pipe has a fault, the utility engineer will have only a vague clue where to look.

Much of the developed worlds' infrastructure is deteriorating fast, meaning that there will continue to be considerable rehabilitation work for many years. This is in addition to repair work and any new-build projects. In other words,



the volume of ground digging that is currently carried out by – or on behalf of – utilities is unlikely to decrease. Digging holes is an expensive and time-consuming business: a typical hole in a street in the UK can cost £1,000 upwards.

Furthermore, utilities are under increasing pressure from local councils and government to minimise the amount of time spent on 'streetworks', with the threat of heavy penalties. In the UK the Transport Management Act has brought this whole area into sharp focus, because whether rightly or wrongly, it attributes a relatively high percentage of road disruption to streetworks carried out by utilities.

In a new development, from mid 2012, the ownership of utility connections from the street into properties has been passed from the property owner to the utility. This creates an extra burden on the Utility, by requiring them to know where each connection is buried.

What needs to be done, and why hasn't it happened already?

Clearly, there is a strong case for accurate underground location, so why has this issue languished on the industry's back-burner for so long? The reason is simple: accurate underground location has traditionally meant time and money that the industry was not prepared to spend. Until recently, underground location technologies were fairly basic and relied on a lot of effort and manual input from people all along the chain to make it worthwhile, from on-site staff to the team maintaining the utility's CAD records.

The situation is not getting any better, according to Simon Robertson, Ex Thames Water, "Records are getting more inaccurate each day, not less." The sheer volume of work, as well as the range of services sharing underground space, has in some areas resulted in a cat's cradle of pipes and cables, sometimes in precariously close proximity.

In recent years, there has been call for a more co-ordinated approach to utility management in the UK, with the formation of the HAUC (Highway Authorities and Utilities Committee), NUAG (National Underground Assets Group), and NJUG (National Joint Utilities Group). Initiatives such as these are to be applauded, but unfortunately, fight against the fact that many utilities have little option but to focus on immediate priorities. That said, there is a strong argument that short-term measures cost more over time. Says Simon Robertson, "Short term rehabilitation techniques can cost more in the long term. If rehabilitation projects were dictated by a 50 year design life, then that would make it more of a cost issue."

Given that many cables and pipes being put into the ground today are expected to be there for several decades or more, then it would certainly seem to make sense to take a longer-term view of costs. The argument becomes even stronger when factoring in other, less predictable costs, such



as power or water supply failures, fines and repair work that could take days to complete.

If accurate underground location was easier to achieve, then it is likely it would move higher up the agenda. Techniques for recording and finding underground services have been around for years, but have all had their limitations. Starting at the least 'high tech' end of the range, there are the good old-fashioned above ground markers that we are all used to seeing: cheap and visible, but basic and easy to move.

Underground location techniques

Rather more sophisticated are the range of radio frequency-based Technologies that have become prevalent over the past few years and broadly fall into two categories: passive and active mode detection. Passive mode is based on the knowledge that any metallic pipe or cable naturally picks up and re-radiates a signal, so it is sometimes easy to track an existing pipe along its course. The drawbacks are that it depends on metal content and a sufficiently strong signal, which is not always the case. Fibre optic and CATV services are notoriously difficult to find. Moreover, this approach depends on knowing roughly where the cable or pipe is located and does not provide any means to record more detailed information once found.

Active mode detection involves applying a transmitter unit on to a pipe or cable, or stood on the point where it is expected to be. Someone then walks along holding a receiver, which detects the signal and emits a beeping sound that increases in relation to the signal's strength, or proximity to the cable or pipe. This system is relatively straightforward, but has its limitations, not least of which is the fact that it may detect any other pipes or cables in the immediate area, potentially creating confusion. Again, it depends on knowing the approximate whereabouts of the pipe or cable and does not provide a simple mechanism for recording location data.

Even more sophisticated is the electronic marker location method, which can be found in many countries. This is a completely different approach, because it does not depend on the pipe or cable to emit a signal. Instead, small markers are attached to the pipe or cable during the installation process, whether at regular intervals or simply at key junctions. The markers are usually ball-shaped, but can take other forms and some contain a fluid that ensures the marker is always horizontal and optimally positioned to respond to an electronic signal. This information is then recorded on as built drawings which are then used on future occasions to find the pipe or cable. Markers can be allocated different colours and radio frequencies, to distinguish between kinds of services.



Enter the next generation

All the techniques described so far have their place, but still have their limitations, not least of which is the fact that they focus on finding cables and pipes, rather than helping utilities to build up accurate, detailed records in the first place. Now, however, Key2iD, have developed a complete, end-to-end solution, from the contractor working on-site to the utilities' head office systems.

The first link in the chain is the advent of intelligent tag marker systems, which are an extension to the existing concept of passive electronic location, but with added 'intelligence'. Each iD marker ball contains an ASIC (application specific integrated circuit) and is used in conjunction with more advanced devices, including Tablets and Smartphones. Before the ball is placed into the trench, the camera on the tablet or smartphone is used to scan a barcode of the balls' unique 10 digit serial number. The ball is then placed into the trench, affixed to the asset being recorded. Next, details of the assets and trench conditions are captured, including photographs, and these are used to create a record for the marker. This serial number then becomes the unique "Key" to the identity of the location, and the underground assets therein

The next stage is to get that data into a central database. Either sending the records over the 3G/4G network, via a Wireless network, or connecting the device to a laptop achieves this, at which point the data is automatically transferred into the database. Also, the tablets/smartphones can utilise their onboard GPS systems, so that the approximate co-ordinates of each marker ball, and assets, are correctly recorded. The GPS systems may, in turn, be connected to databases and CAD drawings held by the contractor/utility. Thus, over time, a set of detail-rich records can be created.

When future work needs to be carried out, the information is simply accessed direct from the tablet/smartphone. Once the information is found, a locator is used to communicate with the marker ball and confirm exact location.

As Pete Hardy Ex Thames Water says, "Accurate asset location – located right first time, every time – is important. It means that there is no need to do an initial reconnaissance visit. For example, it reduces the risk of going on site, finding that you don't have the right parts and having to come back another time. With this approach, we can avoid this happening. We can also use the system to upload completed records to the asset database."

There is a small additional amount of effort required by the Contractor/Utilities' staff, but this is minimal and if the utility company mandates accurate location, then it will happen. Moreover, some of the more innovative contractors could view this as a means to differentiate themselves in a very competitive market. As Simon Robertson says, "The opportunity is there every time a hole is dug.



The information is staring us in the face.” Certainly, the reasons for not having accurate underground location are running out fast and as some utilities are already discovering, the benefits are very clear.

Introducing Site-Track™

Key2iD has developed a solution for capturing details of buried assets on construction sites by the placing of RFID Markers adjacent to each critical asset, and then using the Site-Track™ software application, the asset data is captured and stored for later transfer to GIS applications. The solution is pictured below:

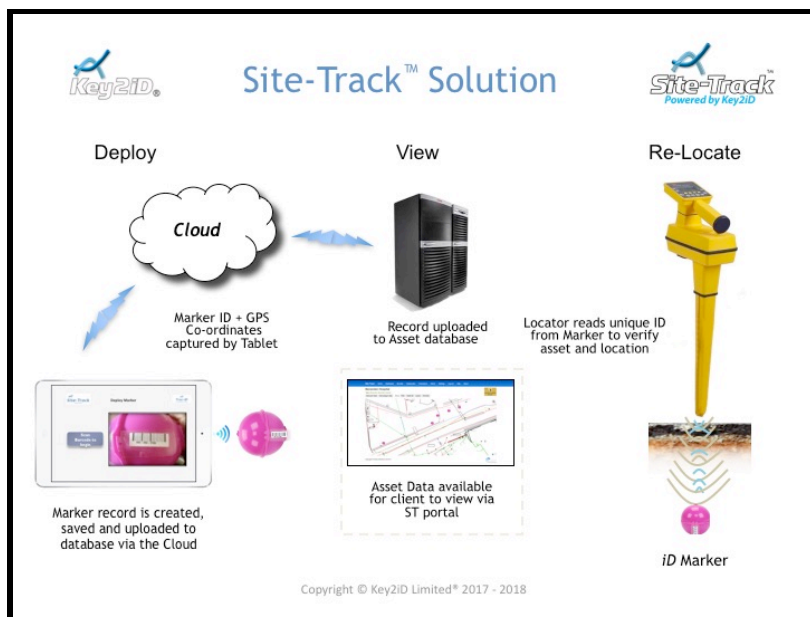


Figure 1 Site-Track Solution 2018

About Key2iD

Key2iD specialises in the design and development of Asset Management solutions. The key to the success of Key2iD is the range and depth of the technologies available within the company. Site-Track™ is one of a range of unique Asset Management Technologies developed by Key2iD to satisfy Regulatory and Health & Safety requirements within a number of specific market segments.

For full details about Site-Track, contact Key2iD Limited:

Website: www.key2id.com
Telephone: (0118) 380 1646
Email: info@key2id.com