

Application Report

Customer:
Project:
Solution:

National Grid
Survey of As-Laid and Abandoned Gas Pipelines
Trimble R8 RTK GPS + FastMap Tablet
'As-Laid' + Trimble VRS Now

How GPS proved a cost-effective solution for the survey of As-Laid and Abandoned Gas Pipelines

National Grid is responsible for the safety, development and maintenance of the UK's largest gas distribution system and also operates the National Gas Emergency Service. This involves gas distribution to 10.7 million homes and businesses via 133,000km of pipes in the North West, West Midlands, East of England and North London.

An on going gas mains replacement programme covering 1820 km of pipeline in 2007/8 is currently underway implemented by National Grid's Alliance Partners' in each of the four regions.

The accurate capture of pipeline location is integral to the construction, operation and proper maintenance of pipelines in projects like this. Whilst RTK GPS would seem to be the obvious solution, up until very recently it has not been practical in the utilities market for 'everyday' use due to the complexities associated with setting up a GPS base station coupled with on site software limitations.

Closely in contact with Ordnance Survey, National Grid was aware of developments with OSNet – Ordnance Survey's own GPS correction network providing instant access to RTK (real time kinematic) corrections throughout Great Britain – and were keen to investigate how this technology could help them to achieve cm positional accuracy in the field. They also had previous knowledge of Trimble's GPS mapping systems and their UK distributor and specialists in mapping software development, KOREC. These advances in RTK GPS technology combined with KOREC's software development capability all pointed to the advent of a viable and cost effective cm accuracy mapping solution. Consequently a three-way consultation process between National Grid, their Gas Alliance Partner in the North West, Balfour Beatty Utilities (BBUL) and KOREC began with the view to setting up a pilot project.

The Challenge

The National Grid team had a set of clear aims in mind that any new system would have to meet before a pilot project in the North West could get underway. The primary aim being to find a new way of surveying As-Laid and Abandoned gas pipelines using GPS, which would bring benefits such as reduced process cycle times and be more accurate than existing manual methods using paper maps. The current survey process requires a BBUL surveyor to take a paper drawing on-site, showing Existing Assets relative to an Ordnance Survey map. The Engineer would then begin his survey using a tape



Making cm precision GIS a viable option for the utilities market

measure or roadwheel to record relative offsets to the map every 10m along the new pipeline. This requires two manual tape measurements to fix each position and the information was recorded as dimension lines on the paper plan. The annotated paper plan was then returned to the BBUL drawing office and the survey redrawn onto a digital map using CAD before being re-checked by the original surveyor. A hard copy of the final version would then be printed and included in the 'Project Pack' and submitted to the National Grid Hub to be reviewed and digitised for use in their corporate ESRI GIS.

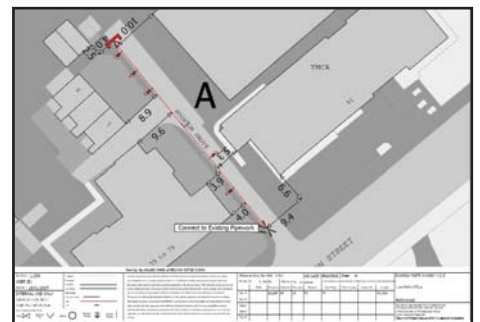
The As Laid surveys are thoroughly checked by National Grid at this stage. If the data did not fit the map correctly, it could be rejected resulting in time consuming rework.

National Grid's challenge was therefore to find a cost-effective solution that would replicate existing workflow procedures but produce results that would reduce the time taken and the number of steps involved. Any system would also have to be easy to use by the field engineers and provide consistent cm accurate data that could be easily imported into their corporate GIS as

well as providing a good fit onto OS MasterMap digital maps. This data would also need to be captured in 3D as recommended by industry bodies VISTA and NUAG and the Street Works Act.

Finding the Solution

Following extensive consultation, National Grid and BBUL decided to trial a Trimble R8 RTK GPS system capable of delivering real time cm accuracy. This level of accuracy could be achieved by subscribing to Trimble's VRS Now service providing instant access to real time GPS corrections in the field powered by OSNet. A subscription to VRS Now would not only eliminate the need and expense of a GPS Base Station but also the time consuming complexities associated with setting it up.



BBUL Measurement Engineers can verify and issue completed survey drawings such as this on-site.



The pole mounted system also had to be reliable, robust and work in any weather conditions

A Panasonic Toughbook CF-18 Tablet computer was selected for its large clear screen, ruggedness and ability to be converted from a Tablet PC in the field to a Notebook PC in the van where a mouse could be used for more accurate editing of data.

Existing GIS data capture software on the market did not provide the correct functionality to suit National Grid's requirements. The KOREC Software Development Team therefore designed the precise solution to suit National Grid and developed a software enhancement of their existing FastMap Tablet Software. The end result is FastMap Tablet 'As-Laid', a solution that allows the digital display of existing pipeline asset data against an OS MasterMap background whilst offering extensive features for recording cm accurate GPS positions of As-Laid and abandoned pipes with attribute data.

Specialist Software Functionality

Peter Lloyd, KOREC's GIS/Mapping Director expands on the functionality, "For the first time BBUL engineers can verify and issue the completed survey drawing on-site. Drawings can be annotated there and then with information such as dimensions and labels whilst Title Blocks are placed around areas of interest to scale and automatically populated with data from the As-Laid and Abandoned pipes."

"Engineers can survey new pipe positions and record attributes in a managed customised form and also identify and draw abandoned pipes on a separate overlay. 'Duplicate Points' are recorded along the pipe to ensure data integrity of features such as valves and service connections where points coincide. The 'adjust to map' tool fits GPS positions relative to OS MasterMap whilst still retaining both sets of GPS and Map co-ordinates."

"When the drawing is finished it can be printed to PDF ready for easy transfer to the drawing office for printing, and the original As-Laid survey data is used to output digital data as ESRI Shape files ready for importing into National Grid's corporate GIS."

Pilot Project

In December 2006 a pilot project got underway in the North West.

On-site there has been a clear reduction in the time needed to carry out the survey alone and additional data can now be captured that was previously deemed too onerous when using manual methods. BBUL Measurement Engineers have found the system straightforward to use and now 'own' the data from initial capture through to the completed drawing.

There have also been significant time-savings back at the office. Rework has been reduced because the data has been captured and verified on site whilst the system replicates the existing paper

based processes, as required, enabling a finished drawing to be included in the 'Project Pack' ready for submission to the National Grid Hub as previously.

As the pilot is extended it is expected that the National Grid Hub will also benefit. As-laid and abandoned drawings will arrive faster and be more accurate and consistent. Fewer drawings are expected to be returned to the Alliance Partner for rework and their easy availability is expected reduce GIS data processing and input time at the Hub. 3D GIS Data will have enhanced quality which is anticipated will be in keeping with future requirements of VISTA, NUAG and the Street Works Act.

Conclusion

Highly accurate GPS positioning means a reduction in unnecessary trial-holes and excavations and has the potential to increase the performance of techniques like 'Key Hole Surgery' on the Gas Network, which means shorter job times, less damage to the environment and reduced traffic disruption. In conclusion, National Grid reports that the Pilot Project has been successful delivering the increased accuracy and time savings required.

The system is now being used in the North West region by BBUL and was short listed for both the Pipeline Industries Guild (PIG) award for significant contribution to utility pipeline technology and the Gas Industry Innovation Award.