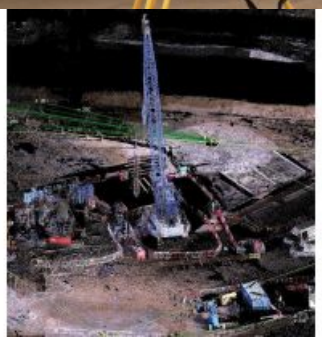
Adopting New Geospatial Technology for the A14 Cambridge to Huntingdon Project



New technologies are disrupting the geospatial industry, enhancing productivity and adding new dimensions to the value of geo-information. However, it is the implementation of this technology that often determines whether or not an initiative is successful. The A14 Cambridge to Huntingdon improvement scheme is providing a perfect example of balancing tried and tested technologies with new ways of working.

The £1.5bn project is Highways England's biggest scheme currently in construction and represents a significant investment for the government. The project will add capacity to the route and cut journey times by up to 20 minutes through the delivery of 19km of new bypass, the construction being supplemented by widening and improving the existing highway.

To undertake this project, Highways England has appointed joint venture (JV) contractors Skanska, Costain and Balfour Beatty.

The 34km site is open and flat, with over half the work away from the route of the current road and despite its scale, the topology of the site poses few distractions or significant challenges. The JV partners have substantial survey experience on road projects and for them, a site of this kind provides a perfect backdrop for both the consolidation of existing survey methods - regarded as highly innovative at the time - and the introduction of new methodologies to work alongside tried and tested workflows.

This project is an opportunity to draw on the extensive survey knowledge of the JV partners, who all have their own survey departments, to share knowledge and ideas and implement the best of them. Survey equipment decisions are based on reliability, productivity and commercial viability as opposed to habit or personal preference. The success of this approach depends upon the best use of existing instruments and the procurement of new ones. It would not be unusual to find a Trimble 2009 robotic total station with an upgraded logger working alongside a newly acquired SX10 scanning total station.

Tried and Tested

The selection of instruments must meet key criteria: an instrument must solve a problem or offer a significant advantage in efficiency or productivity over a previous method; it must operate reliably in all UK climates and sectors; it must have a sufficiently short learning curve for fast adoption; and it must be both upgradeable and sufficiently supported by the supplier. The diagram shows how Skanska has adopted new technology.

Monitoring Live Carriage Way

One instrument that delivers all these criteria is Trimble's SX10 Scanning Total Station which combines precision measurement, imaging and high-speed 3D scanning in a single instrument.

On the A14 Cambridge to Huntingdon scheme, Highways England was concerned that cross-drilling for utility ducts may cause parts of the live carriageway to settle and therefore required the survey team to monitor it regularly. Monitoring of the road would need to be carried out three times daily during drilling and once a day thereafter. Using a total station would involve inconvenience, danger and added expense of traffic management whereas laser scanning would be a more effective alternative. In this case, the SX10 was considered to be the perfect solution coming in at half the cost of a 3D laser scanner and providing greater flexibility for the engineering surveyor in charge who would also be equipped to respond to impromptu requests for any additional precise measurement work in the area using the SX10's functionality.

Responsible for this monitoring work is A14 IDT Senior Engineering Surveyor, Darren Perkins. With no previous scan experience, Darren reports that just 30 minutes was sufficient for him to understand the SX10 workflow and be carrying out successful scans. Already familiar with 'one man' robotic surveying and the Trimble Access field software that runs on the SX10's tablet, he was unfazed by the lack of eye piece and was quickly able to undertake the three baseline scans required for the monitoring work. Since then he has carried out all of the monitoring as required using up to three different locations each time. The other A14 IDT surveyors report that they have found the SX10's workflow equally straightforward.

Advantages in using the SX10 are that work is not restricted to monitoring within a 5m grid in the hope that the settlement falls in this area but instead can cover an area of around 30m in diameter which provides a far better picture. The Access software that powers the SX10 also allows variations in both the size and density of the scans thanks to a polygon tool that allows selection of an area of interest and provides an approximate survey time. Back at the office, registration is automatic, reducing processing time, which means we have the information that we need much faster than with any other method. Whilst the results are still output on spreadsheets, surface to surface comparisons can now be added using colour coding to highlight problem areas and in time the old method will be dropped. The SX10 can also be used to solve other problems such as monitoring bridge beams for deflection to ensure that they are performing to specification.

Making Style Sheets Work

Consistency of data is vital for any project and for the A14 IDT, it is Trimble Office Sync software which allows users to share and view the latest data and access project information from anywhere, at any time. This ensures that all the A14 engineers have access to the same consistent data. However, it is through the use of customised Trimble style sheets that the foundations for consistency of data are laid. The A14 project has proved the perfect test bed for the development of bespoke style sheets and top of the list is one for dipping the road. Style sheets ensure a better way of working by tackling the dual issues of quality and efficiency and enable engineers to work on any section of the project in the same way. For example, a stake out report gives confidence that the team is setting-out correctly across the board. Style sheets have been developed with Trimble's assistance for road dipping quality assurance works.

Smartphones and Accuracy

Whilst running the day to day surveying operations on the site, we also work alongside other contractors. These contractors are not involved in daily survey tasks such as setting out or topo work, but they still have a requirement for accurate positions to support their primary tasks. For example, those carrying out borehole testing or soil sampling require decimetre positions either to map a new point or navigate back to a previously recorded one. However, it would not be cost-effective to send a fully trained engineer with an R10 to carry out these tasks. A new way to provide the survey support that these contractors require is needed and a possible solution is Trimble's newly launched Catalyst, a subscription based software GNSS receiver that has been designed to run on Android phones and tablets. When used in conjunction with a small 'plug and play' low cost digital antenna, it turns these devices into cm accuracy data collection tools. It's available as an on-demand subscription service and offers a range of accuracies from 1m to centimetre level, priced accordingly. As part of this system, KOREC's K-Mobile data capture software would run on the contractor's smartphone. K-Mobile has fully customisable lists, drop down boxes, mandatory fields etc which again would bring consistency of data, this time to the attribute information collected. All of this collected data could be automatically bundled into a customised PDF report or output to a third party GIS software and then wirelessly sent to the office to provide a fast and accurate back up of all work undertaken.

Evolution of Deliverables

Common to all the new technologies and workflows on the A14 scheme is the quality of the deliverable and how best to present this information to the client. Consistency and repeatability of data, whether it be delivered through templates, stylesheets or K-Mobile's reports, along with the automation of these processes are driving factors. The survey industry is moving towards a more visual interpretation of data which ultimately can be understood by a broader user base. The adoption of technology doesn't stop in the field and extends to presentation of data to clients. The new colour coded surface to surface scans created from SX10 data are a great illustration of this approach. A long-term aim is to produce deliverables in the most useful format possible so that eventually clients will write that deliverable into the spec. We are constantly testing new delivery methods and as with any new technology it is our policy to introduce these changes alongside older tried and tested methods.

Requested from our designers for the next section of works, is that rather than extracting data from designs delivered in a standard format such as GENIO, they produce road box models for 3D machine control which means that the design is exactly what will end up in the cab. Our designers are understanding that designing for machines, not only engineers, can bring many benefits.

Over the years, the A14 IDT partners have witnessed and been a part of turning manual methods into electronic methods without any loss of quality. In fact, the quality of work has gone up, work is done more quickly and more efficiently and more data is provided. Results are presented in a more visual and intelligent way. The key is whether new technology or workflows will solve a problem and bring a significant improvement over a previous method. For this to succeed, communication is essential whether

that be between the JV partners, the engineers or the suppliers.

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