

Case Study

Customer:
A14 Integrated Delivery Team

Project:
A14 Improvement Scheme

Solution:
Full range of Trimble technology including the SX10



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

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Mark Lawton
A14 IDT

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.

Responsible for fitting the pieces

of the puzzle together is Mark Lawton, Survey Manager for the A14 Integrated Delivery team (IDT). For Mark, this 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. With survey teams comprising members from each of the partners, Mark's approach is very much one of building for the benefit of UK Plc with strictly 'no company hats'. This ensures that 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.

Successful implementation of technology on the A14 Improvement Scheme

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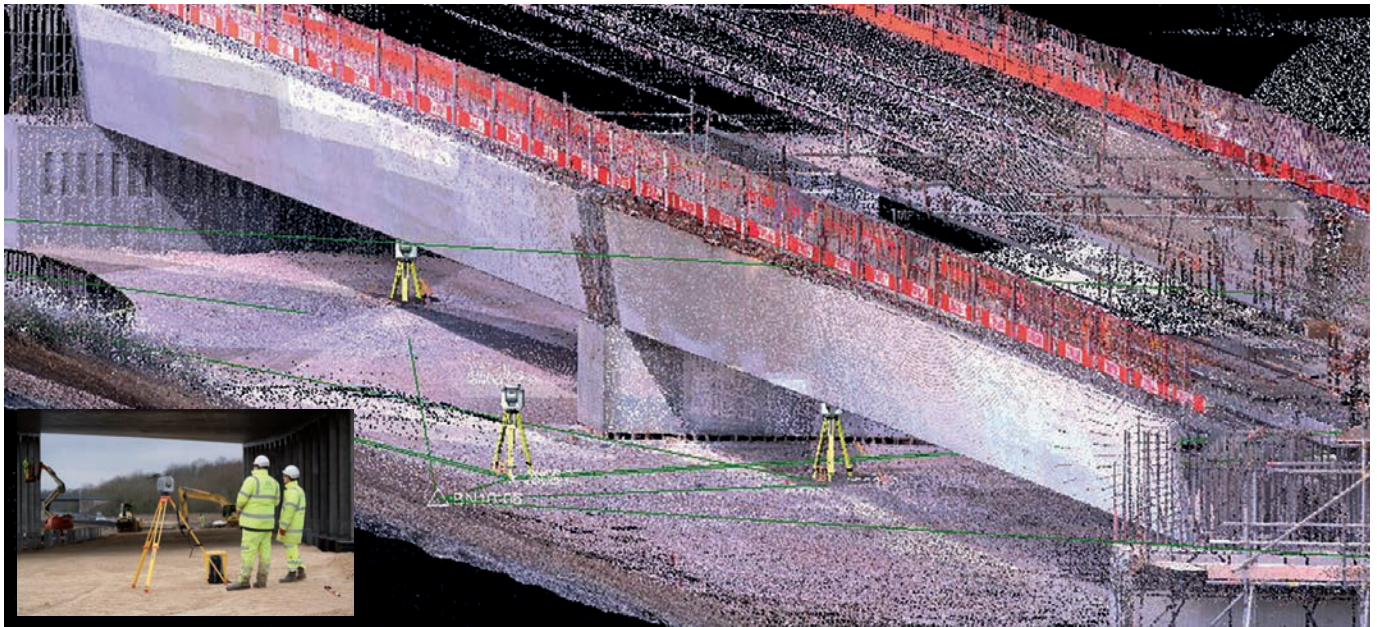
The £1.5bn project is Highways England's biggest scheme currently in construction and represents a significant investment for the government. The project will add capacity to the route and cut journey times by up to twenty minutes through the

delivery of twelve miles 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 21-mile (34km) site is open and flat, with over half the work away from the route

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
														Trimble SX10
														Trimble R10 GNSS
														Trimble VX Spatial Station
														Trimble VRS Now real-time correction service
														Trimble R8 GNSS
														Trimble 5800 GPS
Geodimeter/TSC1														Trimble S-Series RTS/TSC3/Access software
Trimble Link (integrated site and office workflow)														

▲ Showing Skanska technology adoption



▲ SX10 scanning under the bridge and capturing all the beams, even the hidden ones

Tried and tested

Mark's policy has always been to run a new workflow alongside a tried and tested method until the new practice is proven to deliver the better result and subsequently becomes an accepted alternative. This approach has been very much in evidence over the last decade:

The 2008 Highways England M25 road widening project saw the Skanska Balfour Beatty JV working with earthworks contractor McArdle. On this project, 2D machine guidance was established and then used as a stepping stone for the introduction of 3D machine control for more complex tasks as the project progressed. The M25 project also saw Mark trialling Trimble's then newly launched VRS Now real-time correction service.

Six years later, on the M1 improvement scheme near Rugby, Trimble VRS Now is the backbone to the site operations and Mark has introduced a single newly

developed Trimble R10 GNSS (combining several new technologies) to work alongside the proven S6 robotic total stations and R8 GNSS already on the site.

Fast forward to 2017 and the A14 IDT. Trimble 3D machine control is in evidence across the site, the VRS Now license has been ported over and nearly half of the GNSS systems are R10s.

For Mark, whilst the technology may change, the principles remain the same. If an instrument is to become part of the project fleet it must meet key criteria; it 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; it must be upgradeable and it must be sufficiently supported by the supplier.

Monitoring live carriage way

One instrument that delivers all these criteria is Trimble's new 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. Mark wished to avoid the inconvenience, danger and added expense of traffic management that using a total station would entail and knew that 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 total station functionality.

Responsible for this monitoring work is A14 IDT Senior Engineering Surveyor, Darren Perkins. With no previous scan experience, Darren reports that just thirty 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.

"Without doubt the SX10 is delivering exactly what we need for the safe monitoring of this stretch of carriageway," explains Darren. "I'm 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 me to make decisions on both the size and density of the scans I wish to undertake thanks to a polygon tool that allows me to select 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 far faster than with any other method. Whilst we will output the results on spreadsheets as previously, we are now also adding in



▲ The Trimble R10, first adopted on the M1 improvement scheme in Rugby and now used daily on the A14 site

surface to surface comparisons using colour coding to highlight problem areas and in time, we will drop the old method. For me, scanning is now 'business as usual' and consequently we're using the SX10 to solve other problems. For example, we need to monitor bridge beams for deflection to ensure that they are performing to spec. We can now do this with the SX10 scanning under the bridge and capturing all the beams, even the hidden ones. For me, the SX10 has introduced me to scanning and brought integrated surveying into the topo world."

Making stylesheets work

Consistency of data is vital for any project and for 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. For Mark, 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. Mark explains, "We've always used style sheets. They force us into a better way of working by tackling the dual issues of quality and efficiency and enable our engineers to work on any section of the project in the same way. For example, a stake out report means that I can be confident that the team is setting-out correctly across the board. These style sheets work well and I've been showing agents and managers how useful the quality aspect is. This led us to ask how can we push stylesheets for further gains? The latest one that we have developed with Trimble's assistance has been exceptionally useful for our road dipping quality assurance works. Trimble has worked closely with us on these stylesheets and we are very appreciative of the 'added value' that being a Trimble and KOREC customer has brought us."

Smartphones and accuracy

Whilst running the day to day surveying operations on the site, Mark also works 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-



▲ Catalyst is a subscription based software GNSS receiver

effective to send a fully trained engineer with an R10 to carry out these tasks. Mark has therefore been looking for a new way to provide the survey support these contractors require. One of his solutions has been to test Trimble's newly launched Catalyst. Catalyst is 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 accurate 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 outputted 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 that Mark and his team have sought to bring to the A14 scheme is the quality of the deliverable and how best to present this information to the client. Again, for Mark 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. He explains,

"The survey industry is moving towards a more visual interpretation of data which ultimately can be understood by a broader user base. Our adoption of technology doesn't stop in the field and if we can find a better way to present data to clients then that's what we'll do. The new colour coded surface to surface scans we've been creating from SX10 data are a great illustration of this approach. Our 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. Also for the first time on the A14, rather than extracting data from designs delivered in a standard format such as GENIO, the designers are producing road box models for 3D machine control which means the design is exactly what will end up in the cab of the 3D machine control.

"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, we work quicker, we provide more data, more efficiently and we present it in a more visual and intelligent way. For us, the thinking behind the introduction of new technology or workflows, whether it be back in 2008 on the M25 or today on the A14, remain the same. We ask will it solve a problem and will it bring a significant improvement over a previous method?"

Mark concludes, "The reliability of Trimble equipment, along with the support of our ideas from the Trimble team backed up by our longstanding relationship with KOREC, have allowed us to adopt new technology, push older technology in new ways and in some cases create entirely new workflows. For any of this to succeed, communication is key whether that be between the JV partners, our engineers or our suppliers."

**Many thanks to
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Contact us:

Please do get in touch for further information on any of the products or services mentioned in this case study, a demonstration, support or just a chat about your requirements.

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