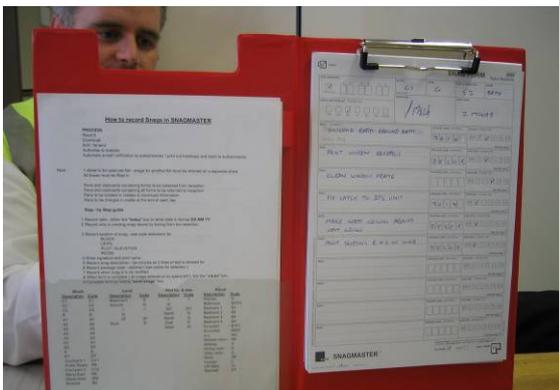


**Taylor Woodrow**

<b>Process</b>	Snagging
<b>Users</b>	Any work inspector
<b>Hardware</b>	Digital Pen and Paper
<b>Software</b>	Sysnet Snagmaster
<b>Location</b>	Glasgow Harbour, UK
<b>Cost</b>	£10,400
<b>ROI</b>	During first project



**Business Problem**

Snagging data was received and processed by sub-contractors days after the snags had originally been identified and recorded on-site. This was due to identified snags having to be typed up and then issued to sub-contractors in writing. This was causing delays to projects at a vital time – i.e. at the end of the project, when most snags are found and rectified. It is widely acknowledged that delays to contracts when handover is due can be very costly.

**Business Solution**

Capturing data using Digital Pen and Paper and processing that data using an associated web-based Snag Management System. Using this solution means that sub-contractors are in receipt of relevant snags almost immediately. Part of the reason that this solution is accepted so readily is that the recorder of the snags is just using pen and paper, as they usually would.

**Background**

Like other contractors, Taylor Woodrow has noted that too much time is spent rectifying snags. Snagging is estimated to account for the last 1% of a project. Prompt rectification of snags is particularly critical at the final stages of a project, where delays can affect final project handover dates, and ultimately, payment of contractors.

Snagging can be a particularly difficult issue on large sites, such as the Glasgow Harbour project – a major regeneration project on the waterfront in Glasgow, comprising retail, leisure and commercial developments, along with the construction of 2,000 to 3,000 homes.

**Process**

Snagmaster allows snags to be identified, actioned and checked efficiently. The snagging process previously involved the typing up of all snags identified, and then these forms would be photocopied and sent to the relevant sub-contractors.

**Solution**

Taylor Woodrow and Sysnet have re-designed and improved the forms that record the data. Snags are

noted as before, but using Digital Pen and Paper. The data is captured in a web-based application, designed by Sysnet, which is accessible via secure login. The data can then be interrogated, reports produced and snags issued to sub-contractors electronically.

**Costs**

The total implementation cost for Snagmaster at Glasgow Harbour was £4,375, including running costs for the first year, the total is £10,375. Key areas of expenditure were:

- Customisation of forms and website;
- Printing of forms;
- Software Licence.

**Benefits**

Previously, the time elapsed between recording snags and notifying the relevant sub-contractor(s) was between a few days and a week. Using Snagmaster, it is now just a few hours. The new system improves confidence, speeds up the process and enables data interrogation and the whole process to be better managed.

## Business Benefits

### Cost

The costs saved in this project are largely a result of the time saved to input the information into the computer systems. There is also time saved on site and when reporting. One of the savings that is not measured is the value of telling the sub-contractor about their snags a few days sooner than they are used to. There can also be a large saving if there is a legal appeal and records of snags are required by the courts.

### Time

Time is saved whenever data is needed about snags. The forms have been re-structured to accurately populate the database with as little human checking as possible. The forms are now simpler and have a stricter format; this means that they can now be filled in by a client or by the main contractor. The main contractor will follow the client around the site for the first visit. After that, the digital pen and paper is given to the client. This saves half a day of the contractor's time by not having to shadow the client.

Time is saved by not having to manually enter the contents of forms into a database. Printing off and sending the entire list to each sub-contractor no longer happens, since one page is printed or e-mailed for each specific sub-contractor. This also makes the reporting of snags to the sub-contractor much faster and thus much more likely to be resolved quickly without disruption to any other work packages.

When tribunals take place regarding works undertaken, all snagging information is requested. The information is usually needed within two days. With the old paper system, some of the information was likely to be missing and it took site staff considerable time to find all the related files.

Now a simple query within the database will find all the related files and this has already helped significantly. One sub-contractor has even bought the system for this sole reason after seeing how easy it is to retrieve all the information.

### Quality

Since the snags are sorted and notified to the sub-contractors much faster, they are much more inclined to complete the job properly instead of thinking that

they are reading a snag noted last week and that it will be forgotten.

Since the database is so user-friendly, sub-contractors only see snags specifically notified to them, rather than a long list of snags for everyone. This means that they are less likely to miss any snags.

### Return on Investment

Taylor Woodrow's large projects commonly use temporary office staff to handle the snagging information. With the new system, the time saving means that one fewer full-time temporary staff member is needed. The time saving for Taylor Woodrow site staff can be equated to over £20,000 per annum. With licence and support costs at about £6,000 per annum, there is a large saving just on administrative time.

The major benefit is the speed with which snags are rectified. This is one of the reasons that the Glasgow Harbour project is on schedule.

### Champion

Taylor Woodrow has an ethos of continuous improvement. The company had been working with software developer Sysnet (developers of Snagmaster) elsewhere. Sysnet introduced Taylor Woodrow to Digital Pen and Paper technology as a possible solution to helping speed up the snagging process – the first time such an application has been used for this purpose in the UK. Iain McNabb is the site manager responsible for piloting the use of the digital pens on Glasgow Harbour.

### Implementation Team

The team consisted of Iain McNabb and Alasdair Ross (Business Development Manager, Sysnet), with help from the Taylor Woodrow IT staff. A close working relationship between the two brought the construction and IT knowledge together.

### Training

A simple written process, provided to each pen user, is all that is required, rather than any structured training. This again reduces the cost of implementation.

The digital pens come with easy to install software for the local PCs. However, no software needs to be installed when used with mobile phones. The website is available via an internet connection.

## Technology Usage



### Team tasks

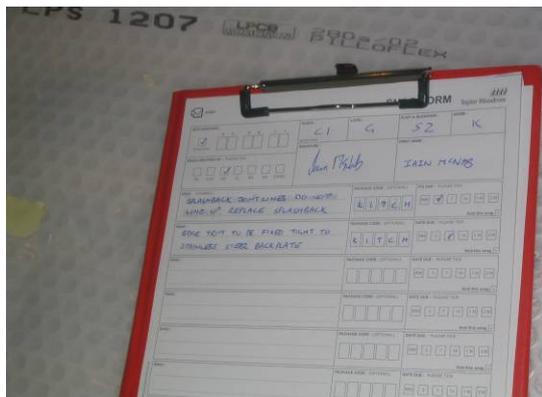
A member of the team takes a Snag Pad and a digital pen round the site. On the pad, they note any snags that they identify.

Back at the site office, the information is uploaded to the database and the snagging reports are e-mailed / faxed or printed and handed to the sub-contractors.



### Technology usage

The snagging process described above is carried out as it was before, using pen and paper. However, the pen-strokes are now stored in the memory of the pen and uploaded seamlessly to the on-line database. This means that the data can be issued to sub-contractors more rapidly than before. Interrogating the data and creating reports are now simple tasks, instead of taking hours of manual effort.



### Why employ this technology?

The pen can automatically record the date and time; the software changes the handwriting into text and also saves the signatures of the author. An image of completed forms will always be stored in the system. Signatures are stored on the original form and recorded in digital format. The technology is almost hidden, which greatly reduces the human barrier to change.

### Implementation Costs

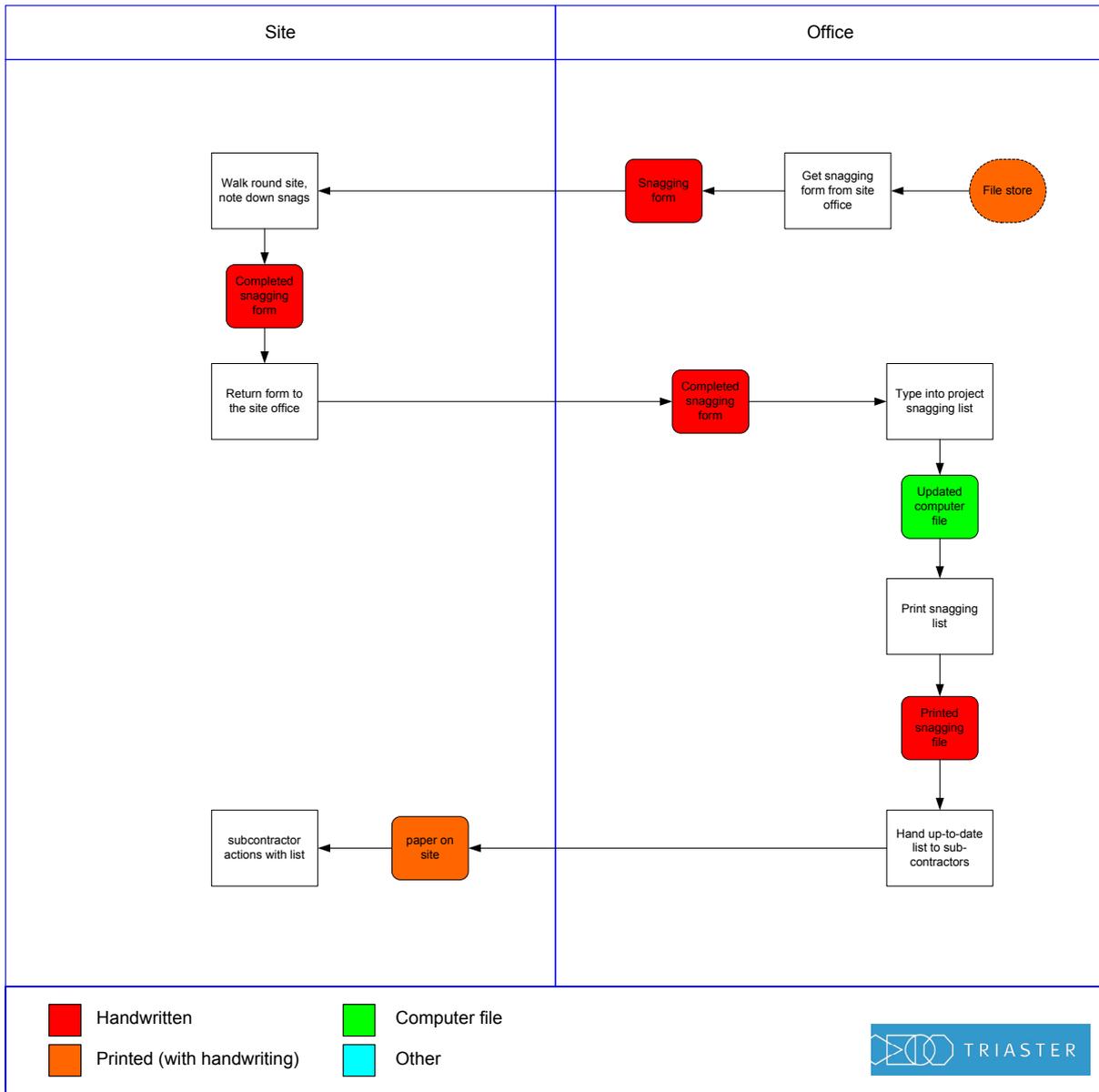
How much did it cost to implement this solution?

Description	Notes	Cost
<b>Up front investigation costs</b>	A few days introduction on how to use the system and get permission from TW IT.	£700 (time)
<b>The mobile computing devices</b>	Digital Pen @ £115 per pen (includes cradle); and £20 per pen for software.	£675
<b>The software application</b>	Licence and customisations to adopt TW corporate style	£1,500
<b>The communications infrastructure</b>	Printing of Digital Paper Forms (2,000, enough for 20,000 snags)	£1,530 (inc. 2000 Snag Forms, 2000 Action Forms and 2,000 Approval Forms)
<b>The data storage system</b>	Stored and maintained on website on Sysnet server.	£500 per month, including hosting and Helpdesk support.
<b>Consultancy service costs</b>	Included in Software application costs above.	£0
<b>Site installation costs</b>	None	£0
<b>Personnel training costs</b>	Demonstration from Sysnet, 2 hours to three site staff	£200 (time)
<b>Staff costs</b>	Time from IT manager, site staff, Taylor Woodrow decision makers	£Not available
<b>Support costs</b>	Included in Data Storage System above.	
<b>Other costs</b>	On-going paper costs. IT department time to enable site staff to get on web through firewall.	New clip-board!
<b>Total</b>		£4,400 plus £6,000 annually

### Implementation Timescale

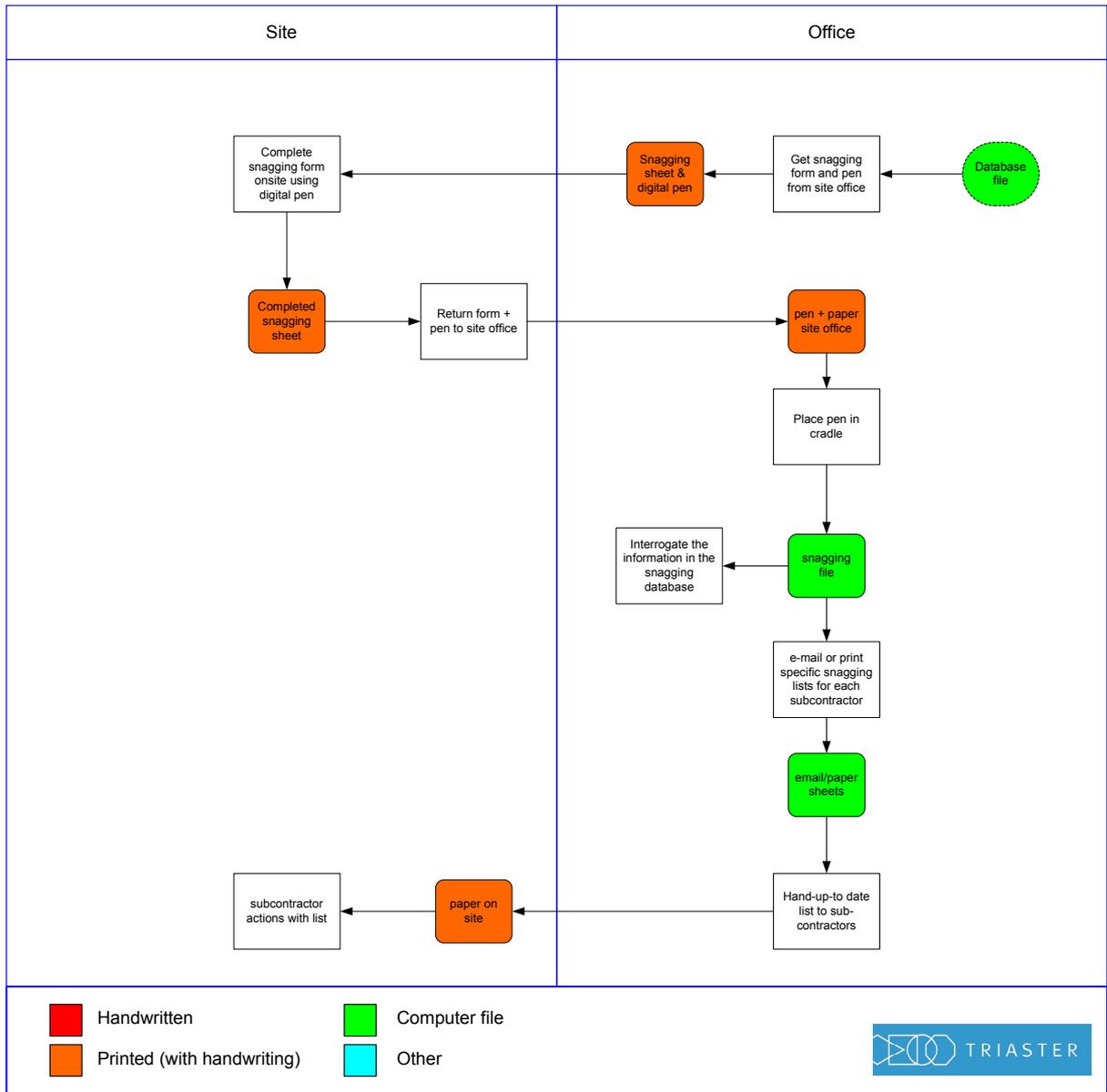
From the start the pilot was ready in six months. The initial demonstration to senior staff and the formal proposal took a few weeks. It was a month until authorisation was given. Talks between Alasdair and Iain for the forms design and web site design, software development and access protocol took most of the time.

Snagmaster is now commercially available as an on the shelf product. From receipt of a Purchase Order, Snagmaster can be implemented and in use within 4 weeks.



### Original Business Process

Snags were listed on a sheet of A4 paper, with a column on the right showing the sub-contractor responsible for fixing the snag. When the forms had been filled in on site, they were left in the office to be typed into the computer system. When the snags had been typed up, they were passed back to the site staff to check and then the list was printed out and handed to all the sub-contractors. This process could often take nearly a week. The sub-contractors then had to find their snags on the list and rectify them. These could often be out of date.



### New Business Process

The Taylor Woodrow site staff (or client management staff) sign out the digital pen and the folder which contains the digital paper forms. Whilst walking round the site, they fill in the forms with details of the snags and their location. Staff have to remember to tick the 'start' and 'send' boxes at the top and bottom of the forms. When the pen is given back to the site office and put in its charging dock, it will upload the saved information to the Sysnet server which will process and publish the data to Snagmaster. The Snags can then be issued to relevant sub-contractors at the click of a button.

This method means that there is a copy of a signature whether it is digital or on paper.

## Lessons Learnt

### People

The construction team have learnt that the software more easily recognises clear handwriting or writing in capitals. The software will encounter problems reading rapidly written, unclear handwriting.

The new technology prompted the project team to improve the structure of the snagging questionnaire and to make questions more clearly structured / easy to answer. This has not only enabled the software to more easily interpret the information given in the questionnaire, but has also helped users with completing the forms. This, in turn, means that more contractors (not just Taylor Woodrow team members) can more easily complete the snagging forms.

### Process

The recording of snags can be carried out by the contractor or by the client.

### Technology

The software allows the site staff to look at the recently submitted forms and edit the words in case the handwriting software has not been accurate.

The handwriting recognition is easier for capitals and neat handwriting.

There are two ways of sending the information to the database. This can be either via the pen's 'cradle', which is now being used by Taylor Woodrow, or by mobile phone that sends the information via Bluetooth technology to the software. Taylor Woodrow is considering this for other projects that do not have a considerable site office so that the information can be at head office or with the client before the site manager can get back to a computer with internet access.

## What Next?

Taylor Woodrow is evaluating the system and may extend its use to other projects.

The FM division of Taylor Woodrow may look at the technology for inspection of premises and remote working applications. Sites without a permanent office will send information via mobile phone to the database.

Sysnet is looking to possibly extend the software to enable it to be used for site diaries, which are mainly used by Site Managers. The software could enable the site diaries to be more readily accessed by other team members.

Sub-contractors may also use it, which will facilitate them becoming preferred supply chain members to Taylor Woodrow.

## Details for further investigation

### User:

Iain McNab, Taylor Woodrow  
[iain.mcnab@uk.taylorwoodrow.com]

### Software and Hardware Provider:

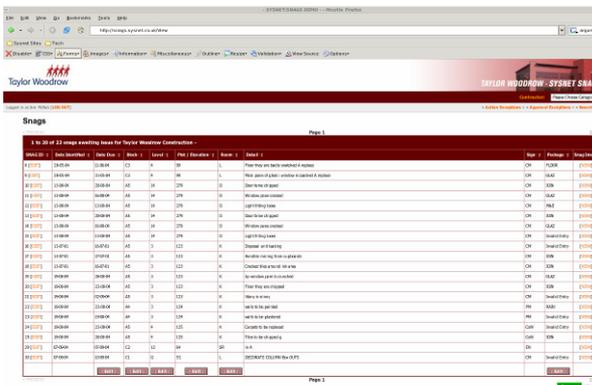
Alasdair Ross, Sysnet  
[arr@sysnet.co.uk, www.sysnet.co.uk]

**Technology Overview**



**Mobile computing device**

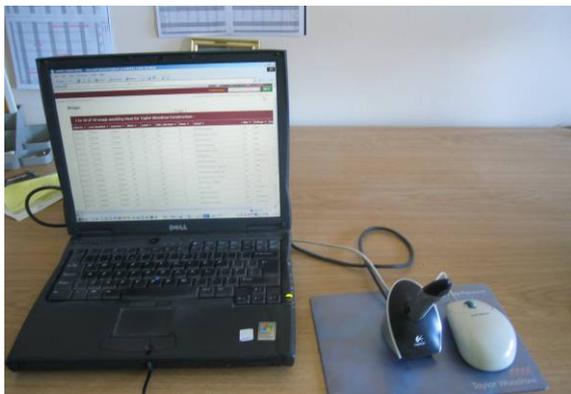
Logitech iO pen. The pen writes like any normal ballpoint (using replaceable ink cartridges), and stores everything that is written when used with digital paper. The pen can carry about 500 snags in its memory before needing to be cradled.



**Software application**

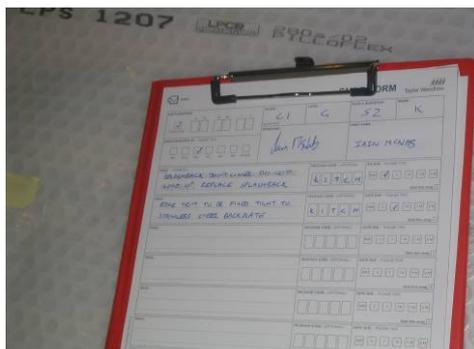
The Snagmaster database is a web-based application hosted by Sysnet. This is paid for only when it is being used. Sub-contractors and managers are notified automatically of snags.

Sub-contractor codes, site locations and trade packages are user definable to be flexible to most projects. This provides information for a wide variety of reports and benchmarks.



**Communications infrastructure**

This project has been using the cradle for the pen to send the information through the PC to the Snagmaster application hosted at Sysnet. This can also be achieved in the same way by using a mobile phone to send the information instead of a cradle.



**Data storage system**

The data is recorded on the forms and then uploaded to Snagmaster, which is a web-based application hosted on a server at Sysnet. Anyone with a web browser and valid login/password details can access the data.

## The COMIT Project

COMIT, Construction Opportunities for Mobile IT, is a two-year research and development project part-funded by the Department of Trade and Industry. Led by Arup, in partnership with BSRIA and Loughborough University, the project brings together representatives from construction, technology, research and dissemination organisations to facilitate the realisation of business benefits from the adoption of mobile information and communication technologies.

### Key Objectives

- Creation and running of the COMIT community.
- Mapping of information and communication needs of point-of-activity workers.
- Production of case study material, including detailed factual business benefits and implementation guidance.
- Implementation of mobile IT on two demonstration projects, in order to evaluate the benefits and barriers successes and failures.
- Continuation of the development of community activities in conjunction with the ITCF.

## COMIT Case Studies

This report provides an overview of the use of mobile communication technologies on a construction project. It is one of a series of case studies that have been conducted as part of the COMIT project to show real examples of implemented applications.

The case studies illustrate several mobile technologies and how the companies have improved work processes. An overview is given of vital information such as who championed the changes, how much they cost and what business improvements were gained. To gain a full insight, both the staff using the technologies and their managers were interviewed.

## How do I find out more?

In addition to the contact details provided in this case study you can use the **Information hub** available on the COMIT website ([www.comitproject.org.uk](http://www.comitproject.org.uk)). The relevant details can be found by selecting:

<b>Process</b>	Snagging
<b>User</b>	Project team
<b>Software</b>	Data Capture
<b>Hardware</b>	Digital Pen
<b>Infrastructure</b>	Synchronisation

## Disclaimer

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Produced in association with:



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