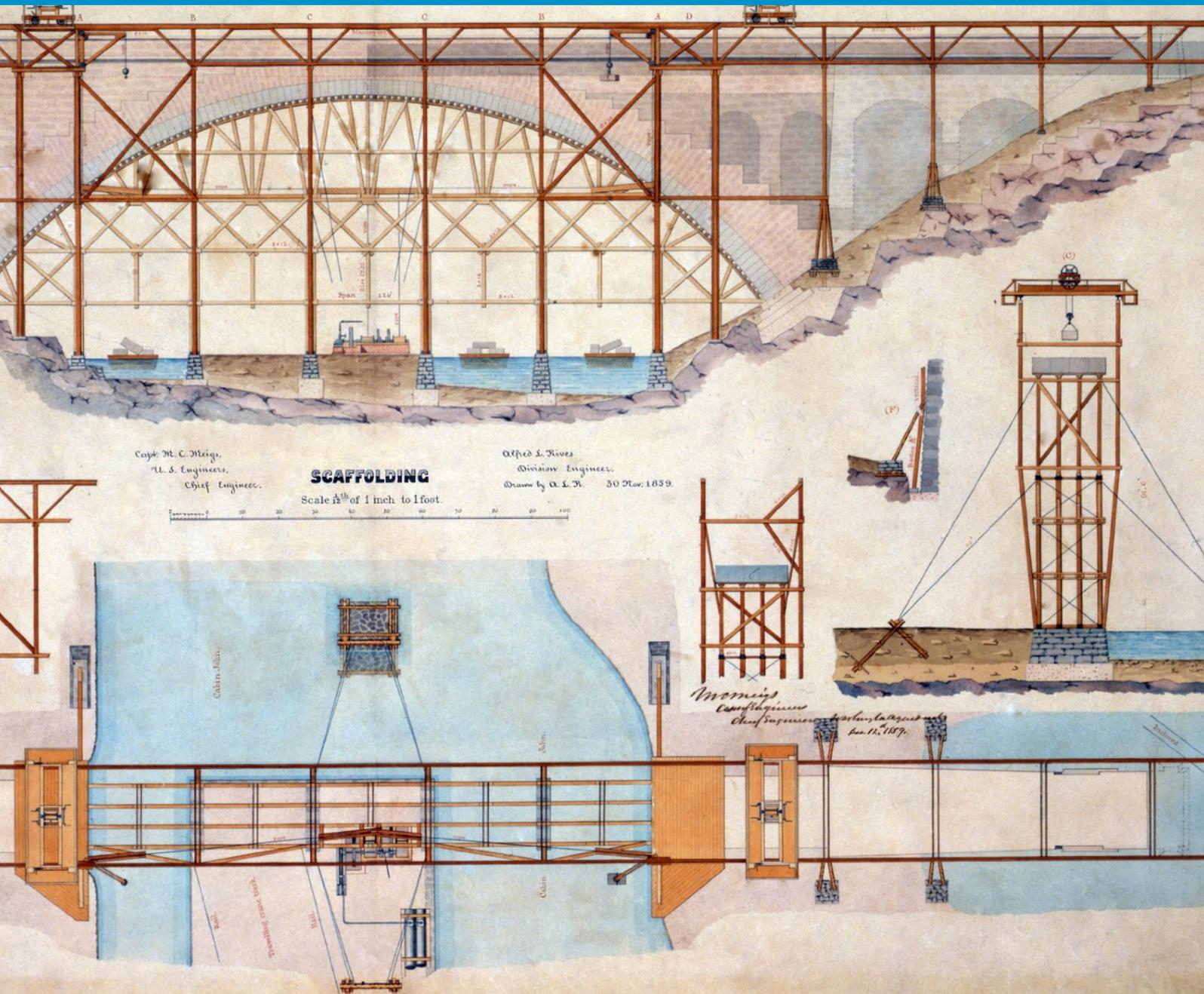


# A Guide to the Adoption of Digital Quality Tools in Construction



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**The construction industry is experiencing significant change as it attempts to embrace digital transformation. Arguably, the introduction of BIM has forced our hand as Central Government nudged us to start the journey by embracing level 2.**

**Consequently we are told that rolls of drawings and archives full of lever arch files, all suffering water damage, could be thing of the past.**

**We are told we are now creating a digital asset as well as a physical building!**

**The biggest impact of digital transformation will be felt in the field. It is here on the site, that the majority of the records that we need are created. The clipboard, the duplicate book and the A4 diary are about to become a thing of the past. Such items will be replaced by phones, tablets and laptops that can capture, share and archive a record in an instant.**

**So how can this new technology help the industry address one of its current key challenges – improving Site Quality?**

First, we need to differentiate between the two main uses for recording quality and issues on site:

1. The on-site quality inspection – this is an inspection that follows a predefined list of quality check and hold points, through the course of each trade's work on site. The checks and who is responsible for them have been agreed previously and are incorporated into an 'Inspection and Test' plan, which in turn reflects the potential risk and impact of poor quality at each stage.
2. The snagging list – is this unique to construction? We supposedly finish something and then rely on someone else to tell us what is wrong with it! This is a list produced prior to the handover of a trade, stage or indeed the whole project that highlights any work that is incomplete, damaged or that does not accord with the contract documents.

For the purpose of this guide we will concentrate on the first mechanism, the on-site quality inspection, as the hope is that if this is carried out efficiently, the snagging list should be significantly reduced (even if it does not disappear entirely).

As with any software, the old adage 'People – Process – Technology' is equally true when looking at quality inspections. A separate paper could be written on each of these, but for now the key considerations for each are as follows.

# People, Process and Technology

## People

Do the people that we are asking to carry out this vital role?

- Know how critical it is and what the true cost of poor quality on site is to the industry?
- Understand what 'good' looks like? Do they have previous experience of the trade they are inspecting and knowledge of the standards required by the specific contract?
- Have the necessary support from the senior management in the business, always to apply robust quality management procedures, rather than let the programme dictate the level of quality.
- Have access to the supporting resources at their fingertips, when they encounter issues in the field?
- Have regular training in changes to the materials, methods and technologies used on the modern construction site?

## Process

Is the quality management process on site clearly defined?

- Are the roles and responsibilities of the parties involved in the process clear?
- Are the forms and tools required readily available and up to date?
- Do the checks reflect the specific requirements of the project being delivered

Only after we have run a health check on the first 2 elements can we then start to look at what we want from the technologies available. The aim should always be to find a technology that fits with your people and process and not to have to modify either of these to suit the technology available. That said, we always need to be open to the power of the technology to shine a light on an inefficient paper-based process.

*“...find a technology that fits with your people...”*



## Technology

The technology in this case is a combination of the software and the hardware it runs on.

Let's start with the software, as in many cases it is the software that dictates the hardware required.

# The Software

Firstly the software needs to enable us to create an electronic form or template that then allows us to collect the same information we collected on the paper version.

The difference now is that, rather than store the records in lever arch files on site, they will probably be stored in the cloud from where they can be accessed by the whole team at any time. So, anyone who has been granted permissions will be able to see any record the minute it is created and synced, without even having to visit the site, let alone search for the file!

When considering software it is always beneficial to speak to current users of the software in similar-sized businesses to your own. They will hopefully share their experience, “warts and all” and don’t have a vested interest in selling the product.

If the vendor of the software cannot provide suitable references for this purpose, the first alarm bells should start to ring.

*“...alarm bells should start to ring...”*

## Data Capture

Some initial questions to ask of the software supplier:

- 1.Can we create our own forms or does the supplier of the software have to create them for us?
- 2.If the Supplier has to create them, how much does this cost and how long does it take?
- 3.How much training do staff members need in order to be able to create the business/site specific forms?
- 4.Can we create hold points in the form, such that the check points that follow a hold point are not accessible to enter data into until the hold point has been signed off?
- 5.How can we protect areas of the form by setting permissions? Are we happy to have any user be able to change any data entry?
- 6.Can we also print the forms created, if the supply chain can’t receive them electronically?
- 7.The records we are collecting through the use of these templates are now actually electronic data, so where is it stored (is it secure?), how can we access it and how do we archive it at the end of the project?
- 8.Does the system work offline?
- 9.Does the system allow set up at business level enabling streamlining of a suite of forms?
- 10.Does the system allow revisions, meaning all users are using the correct revision of a form at all times?
- 11.Is there a data limit?

# The Software (cont'd)

## Added Value Data Capture

So our initial drive is to capture the same information we had previously collected with pen and paper, but now we have it in an electronic format, there are potentially numerous new opportunities for additional records and workflows.

So further questions include:

- Can we take photographs and attach them to the appropriate electronic record?
- Can we mark up and annotate the photographs?
- Can we pinpoint the location of each observation on a plan? Do we need to?
- Can we distribute (by email or an alert from the website) the records to the people we want to action them?
- Can the people that need to carry out the actions raised confirm that they have done so, either through their phone, tablet and /or desktop?
- Can we define the status for each item, or are these predefined (i.e. open/complete/closed or compliant/non-compliant)?
- Can we raise a task from within a form (i.e. if we are carrying out a quality inspection can we raise a nonconformity report from within the inspection form)?
- Is the nonconformity report the software supplier's own form, or can we bespoke it to reflect our existing 9001 certified form?



# The Software (cont'd)



## Data Analysis

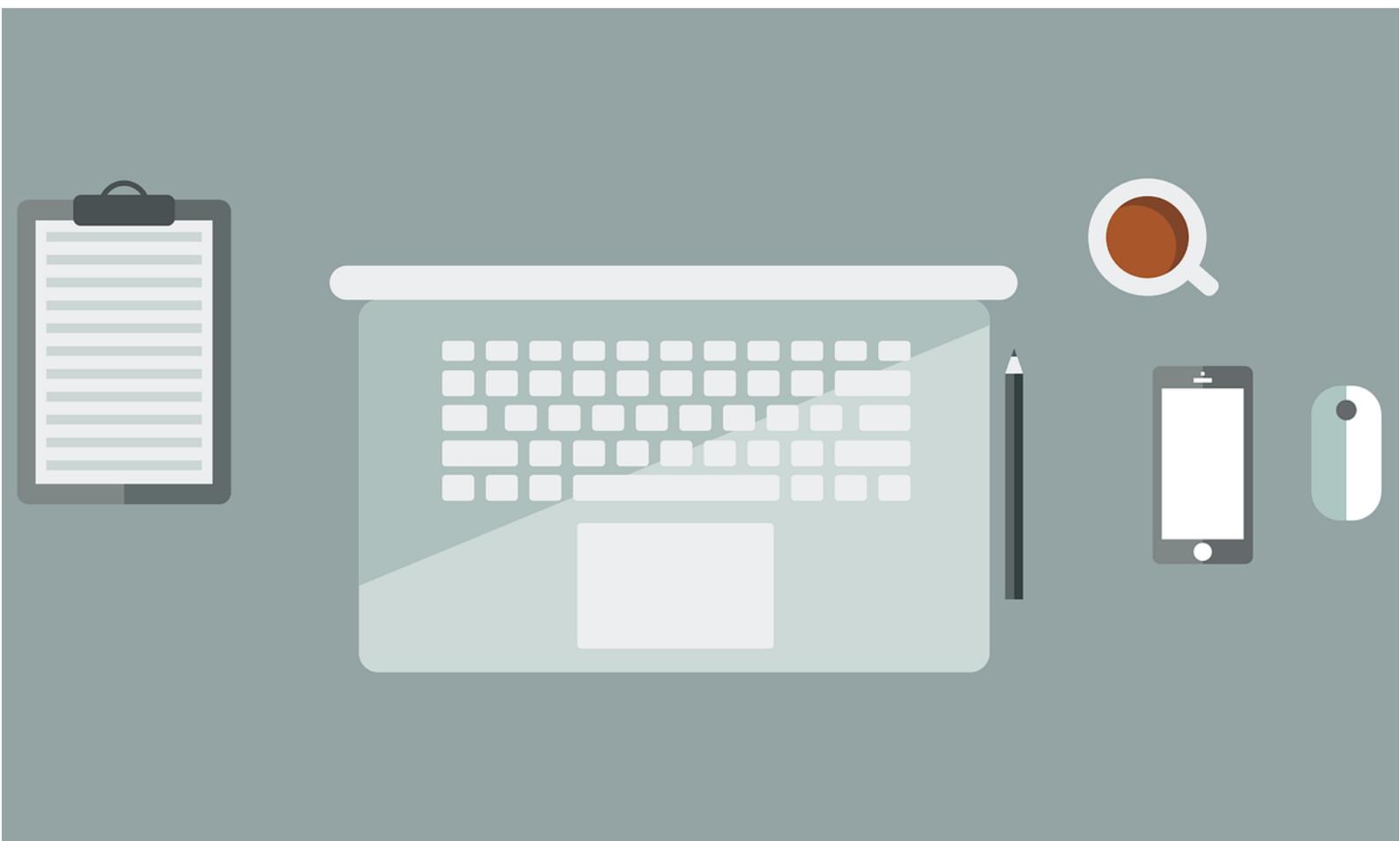
Now we have our field-based quality information in an electronic format, we want to be able to view it in a way that drives improvement.

To understand our options we should ask:

- Are there any “standard reports” available as part of the software?
- Can we view reports on a project, a business unit, a region and country-wide levels?
- Can we create bespoke reports?
- Are there standard charts available to represent the reports (pie charts, bar graphs etc.)?
- Is there an application protocol interface (API) available to allow us to extract the information we want from the database that the supplier holds? Do we have the capability to do this within the business?
- Can we set alerts when thresholds are breached or response times exceeded?
- Can our Supply Chain and Client view the information either on a mobile device or desktop, if we grant them permission?

# The Hardware

The software supplier will guide you on this, but in an ideal world we are looking for software that is cross platform (windows/iOS/android) and runs on mobile phones and tablets along with desktop. From a user's point of view, it is also desirable to have a similar appearance irrespective of the operating system you are using. It is also worth checking that the functionality is the same across all operating systems as sometimes some are at a more advanced stage than others, depending on the platform the software was originally launched on.



*“...ideally we are looking for software that is cross platform..”*

If a tablet is the preferred device, these are available in a variety of sizes ranging from 5” to 13” through various increments depending on the manufacturer. The trade-off here is ease of use based on screen size, as against size of device in terms of portability. Remember this is going to be used on a construction site, so something that slips into the patch pocket on a typical high-viz jacket is useful.

# The Hardware (cont'd)

Unfortunately, tablets are not generally built for construction sites, so some sort of robust case is also required that is built to protect it from the dust and knocks on site, whilst still allowing the user to operate it, often whilst wearing gloves.

The other consideration is “How are we going sync this data we have collected up to the cloud?”

Basically, there are 2 options to consider:

- wireless only devices, or
- devices that can take a SIM card and connect to a mobile network.

In terms of the initial purchase cost of the tablet, it is more expensive to buy a mobile network enabled device than a wireless only device. In addition, there will be the data usage cost for the mobile network, which will vary significantly depending on the number of observations made and the photographs attached. If you can utilise an existing wireless network on the project, you are unlikely to attract any additional data costs; but this may be restricted to the areas on-site where you can perform a sync.

Either way, there are likely to be occasions when neither the wireless nor the mobile network is available. Under these circumstances the device will not be able to sync, it is therefore essential that the software has the ability to work offline until the network connection can be re-established. In the past, where network connections have not been available or too slow on site, this has resulted with users having to take their tablets home to sync them!



# The Cost

## **The key commercial question is “What will it cost?”**

In terms of the software there are many cost models out there; some are based on a project-by-project cost which is often calculated on project value, project duration and number of users. Alternatively, suppliers may offer larger businesses an Enterprise Agreement that works out more economically across all of their projects; but again this calculated on bands of turnover and number of users and are often commitments for 3 or 5 year duration. Sometimes this can be negotiated on a stepped basis over the period, as increasing numbers of projects take on the new technology, so the cost steps up over time.

In terms of hardware, the cost will vary with both the size of the tablet and the operating network (wireless or mobile) as outlined above. However, in addition to the initial capital cost we need to also make a cost allowance for the device management – initial set up, training and ongoing support. A business decision needs to be made in terms of the financial management of the device; will we allocate them to individuals or projects and are they assets or consumables? Each business will have their own protocols to manage this, but it needs consideration from the start.

# The Business Case

**Once the costs are established, but before the business invests, they will want to know what the business case is that justifies this additional expenditure.**

The research we carried out suggested that recording both quality inspections and snagging digitally achieved time savings of between 80% and 90% in carrying out the task, when compared to the traditional paper based approach. The real saving on each business will therefore vary depending on the time currently spent operating their on-site quality process.

*“...the whole team can focus on quality management...”*

The benefits of this time saving technology are numerous:

- When we save time, we become more efficient.
- We free up the site management admin time, to allow them to concentrate on planning and preparation of future activities.
- This allows time to walk the site and see what is actually going on.
- When we save their time, we get immediate “buy in” from the users.
- Instant communication to our stakeholders, staff and Supply Chain.
- It is the way Generation Y will do business.

However, the benefits are certainly not limited to time saving. The whole construction industry has recognised the challenge we have in improving the quality of our product. The use of a digital quality tool on site creates real time visibility of:

- What has been checked and what hasn't been checked.
- Who it was checked by and when.
- What issues are still outstanding and who is responsible for closing them.
- How long it is taking to close issues.
- Who creates the majority of our issues by trade and name of Supply Chain Member.
- Where the majority of our issues occur on site.

This new-found exposure means that the whole team can focus on quality management; from the package manager with the tablet on-site, to the Business Unit MD who can view the projects performance anywhere at any time.

In our experience, once a project team has operated a digital quality tool, they will never give it up to return to the “old” paper based system. In an industry that is traditionally resistant to change and technology, this is testament indeed to the benefits of the tool.

# Implementation

## **We would recommend a phased approach into the use of the software, following something like:**

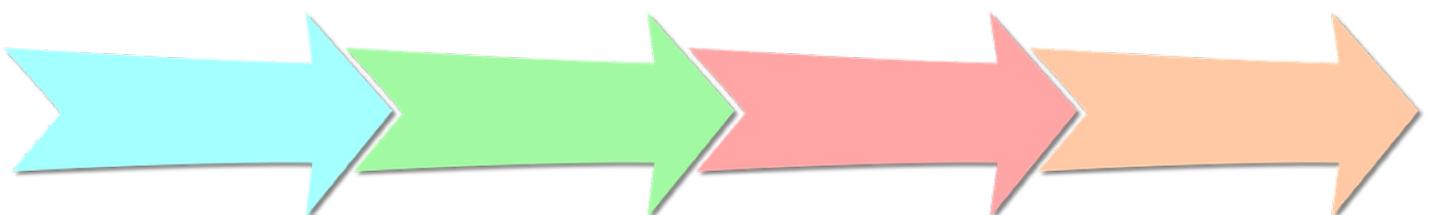
1. Trial the software on 2 or 3 projects initially and approach the potential supplier to see if they will offer these trials free of charge as a proof of concept. Where possible, the trial sites should reflect the variety of projects and users that exist in the business generally. This way the feedback received should be typical of the rest of the business.

2. If the feedback is not encouraging, the process will need to be repeated with an alternative software until an acceptable solution is found. Note – there is a need to work closely with your Management Systems team throughout the course of any trials, to ensure that any current 9001 certifications are not put at risk as a result.

*“...if the feedback is not encouraging, the process will need to be repeated with an alternative software...”*

3. Once a suitable software is identified and a suitable (stepped?) Enterprise Agreement is signed off, we would recommend a phased introduction to projects rather than a “big bang” approach. Typically the new software, following training, would be introduced on all new projects and maybe also those that are yet to commence superstructure activities. Rather than have 2 methods deployed on the same contract, we would suggest that the remaining current projects are left to run out on the existing system. It is inevitable that there will be an interim period where the old and new technology will be running across the business.

4. This phased adoption is likely to run for anything between 1 and 2 years depending on the duration of projects being delivered. Note – a similar crossover period should be borne in mind if and when you consider changing software provider



**As with any new technology or process in a business, training and support are essential ingredients for its successful adoption. We would propose a training programme along the following lines:**

1. Initial general awareness training to all construction staff covering the digital transformation in the construction industry generally and the benefits of a digital quality tool specifically. It is important to establish an understanding of the benefits to both those that collect the data (e.g. Package Manager) and those that can use the data (Project Lead and Commercial team).

2. To reduce costs and provide additional flexibility, we would encourage a “train the trainer” approach from the software supplier to the trainers within the business. This also accelerates the deployment of the new software. The importance of the careful selection of suitable “trainers” cannot be overstated. Here, we are looking for an unusual combination of people who embrace technology, have the enthusiasm to share it, understand the construction process and have the patience to train staff from a wide variety of backgrounds.

3. Hands-on use of the tool training is best delivered face to face to the actual users. In an ideal world, this would be on a one to one basis to ensure it is tailored to the individual needs. In reality this will rarely be possible; it is more likely to be delivered in small groups of 5 to 10 staff. The key here is to create a learning environment where everyone is comfortable to ask questions, as this is key to our learning; there is no such thing as a stupid question.

4. Once the initial training has been delivered, there will be a need to provide an ongoing support network. One approach is to establish Project Admins and Super Users or Product Champions. The nominated Project Admin staff assist with project setup, training of supply chain partners, setting up of tablets and the provision of some initial 1<sup>st</sup> line support to project users. This could amount to 0.5–1 day per week. Super Users/ Champions could provide additional FV support to their projects and regions. They would also attend user group meetings quarterly to discuss issues, suggest improvements and share best practice in the use of the tool. This is more likely to amount to an average of 1 day per month.

5. It would also be the role of the Super Users/Champions to keep up to date with the software and its developments and share these with the rest of the business. Where updates are significant, further training maybe required for all users and the training delivery team would be advised accordingly.

6. A library of “bite sized” video training modules will provide a useful backbone resource and first “port of call” for new starters and refresher training.

# Procurement

Although there are benefits to be gained by the main contractor using digital quality tools in isolation, the real benefits are achieved when the whole project team adopts the technology. To avoid any confusion and disagreement once on site, we would recommend that the use of this collaborative technology is written into the Appointment Documents for the Consultants and the Sub-Contract Conditions for the Supply Chain.

*“...the real benefits are achieved when the whole project team adopts the technology.”*

The exact requirements will probably vary from Contractor to Contractor and from project to project.

However, as a minimum we would expect the Consultants to commit to:

1. Providing email addresses for their team that will be using the software.
2. Using the tablet-based software to identify and share any quality issues they might observe whilst on site.
3. Respond within the software (desktop version) to any proposed corrections to nonconformities identified (if the digital is used to manage NCRs).

In terms of the Supply Chain we would expect a commitment to:

1. Provide email addresses and standard signature templates for their team that will be using the software.
2. Respond within the software to any quality issues, NCRs etc. identified and follow the predefined workflow to close out the issue.
3. Provide evidence of their own quality inspections (if not carried out in the Contractor's software) in a paper format for the Contractor to photograph/scan into the software as a record of compliance.

The above are purely examples, but the detailed obligations will vary depending on Contractor, form of contract and software used.

## Governance and Steering Groups.

To provide governance and maximise the benefits of the software we would recommend that a couple of Groups are established:

### Steering Group

#### Purpose

- Manage the initial roll out of the software
- Provide due governance and compliance with 9001 accreditation
- Agree the ongoing development strategy
- Provide guidance to the User Group

#### Members

- Information Systems Manager
- Management Systems Manager
- Quality Manager
- Production Director(s)
- Managers from other departments that will be using the system

#### Meeting Frequency

- Monthly during the first 12 months thereafter quarterly

### User Group

#### Purpose

- To share best practice
- Provide feedback to the steering group on any software or hardware issues

#### Members

- Super users/Champions
- Other users' team members seconded as appropriate

#### Meeting Frequency

- Monthly during the first 12 months thereafter quarterly



# Future Developments

## Future Developments

Although this guide is written to address the fundamental issues around selecting and deploying a Digital Quality Management tool, such tools can typically be used for Health and Safety, Environment and programme management.

A similar suite of tools/forms can be created for Health and Safety and Environmental teams to carry out their own site inspections.

In terms of programme, there is an undeniable link between the specified quality being achieved and a stage of the works being completed. By extracting the sign-off dates for quality, we are also capturing the progress sign off for that particular element by default. In its most basic form, this will be a table of dates.

The more sophisticated field based programme management software goes way beyond this; allowing the contractor's programme to be imported into the field-based software. The actual completion dates are then compared the planned dates and the variances identified. This information can then be displayed in a tabular format with different colours representing the various trades' completion status in the various areas. This can equally be displayed on coloured-up plans or elevations, all fed via a live link to the reporting software in the field.

# Conclusion

There are undeniable benefits in deploying digital tools into the field for on-site quality management. Just try taking back the tablet and software from a site team that have been using it for a year and suggest they go back to pen and paper!

However, there are currently a multitude of tools to choose from and their numbers are growing almost daily. It is therefore important to get the best fit for your business and this guide will hopefully help you better understand what your actual business needs are in this area.

Experience suggests that the smaller the business is that is providing the software, the more flexible they will be in accommodating your needs. The larger businesses that provide software have achieved their growth by serving a multitude of customers and, whilst they will continue to develop their software, it is more aligned to the needs of the majority of their customer base not individual business needs.

This is fine in most cases and is a good means of sharing and capturing best practice in the use of the software. However, you are unlikely to get a major software supplier to introduce a development to suit your specific business needs. If you do, it will be at a significant cost!

## About the Author.

Steve Green is the Head of Knowledge Sharing at Bouygues UK, who utilises knowledge from both within and outside of the business to drive collaboration, innovation and productivity across the group.

Before taking on the role of Knowledge Manager, Steve's career started in Quantity Surveying, then moved into Design Management, before broadening into Strategic Procurement and Business Improvement.

For the past 3 years Steve's focus has been on improving the "as built" quality both in Bouygues UK and across the UK Construction industry generally.

Steve is an active member of CE Midlands and the Hereford & Worcester CE Club along with the Construction SIG (Consig) of the CQI.

