

## Drawing distribution and usage

|                       |                            |
|-----------------------|----------------------------|
| <b>Users</b>          | Site engineer & operatives |
| <b>Location</b>       | Design office & on site    |
| <b>Solutions</b>      | Several                    |
| <b>User benefits</b>  | Medium                     |
| <b>Org. benefits</b>  | Medium                     |
| <b>Implementation</b> | Easy                       |



### Process description

Consultants' drawings are received at the head office of the contractor responsible for the project. The document controller dates them when received, keeps the originals and issues copies to the site office. Here they will be logged, copied and distributed to the drawing racks kept on site. As new versions are issued superseded drawings will be removed from the racks and filed.

When work is to be carried out, photocopies of the drawings are given to the operatives and foremen by the site engineers. It is up to the site engineer to ensure that everyone is using the latest versions and that no-one is working to out of date drawings.

Once the structure is complete the latest version of the drawings are used to create the as-built drawings by surveying actual measurements on site.

### Background

The drawing distribution and usage cycle is critical to the success of a project. This process consists of three primary sub-processes;

- Drawing distribution from designer to contractor
- Drawing distribution on site
- Usage of drawings on site

The formal approval and distribution process involves many different parties at many locations. Each location has to log and record the arrival of drawings and ensure that everyone is aware when drawings are updated. These problems have become more pronounced with the advent of design and build contracts whereby the design is still being completed after construction has commenced.

The complexity of this process has been recognised and the advent of web based collaboration systems goes some way towards automating drawing distribution. However, these systems are not yet in common use in the field e.g. by foremen and site engineers. The flow of electronic information comes to an abrupt halt when it reaches the construction site, only reaching selected personnel in the site office, and

thus many of the efficiency and knowledge-based benefits of collaboration tools are lost.

The administration of drawings on site is still a very paper based process and requires vigilant control of versions and knowledge of who has which drawing at any one time.

### Current issues

The following issues have been raised for this process:

- Drawings can be received informally directly at site however the contractor is then working at risk until the drawing has been approved through the formal route.
- Delays in the issue of approved drawings can have a serious impact of project progress.
- Site operatives are closely managed by site engineers to ensure that they are using the latest drawings. This requires the site engineers to be constantly aware of who is using which drawings and if they has been a revision.

- Although it is rare that structures will be built using out of date drawings, the consequences if this occurs are severe. The costs involved in rectifying the situation can be very high, and the time lost on site through undertaking rework will adversely affect progress on the project.

### **Mobile solutions**

There are three distinct areas in this process that mobile technologies can be used to address; the delivery of drawings to the field, notification of revisions to drawings and capture of as-built information.

#### ***Delivery of drawings to site***

It is possible for electronic drawings to be delivered directly to the field. Although there are several packages available for use on a PDA (e.g. PocketCAD) it is thought that the form factor of a PDA is not suitable for viewing drawings which are designed to be read at a minimum of A3 size.

There are rugged Tablet PCs available that provide larger screens to view drawings effectively. Drawings could then be downloaded onto the Tablet PC for use in the field or ideally a WLAN would be set up on site such that the drawings can be downloaded as and when required. If the project is using a collaboration tool, the drawings could be accessed from here, ensuring that it is the latest version being used.

File size is an issue for the delivery of drawings using a WLAN, however compression technologies such as DocRocket could be utilised to provide smaller files without losing the resolution.

In the near future ePaper will become available. This has many of the qualities of paper, is relatively inexpensive, requires minimal battery power and is able to download enables images via WLAN.

As construction moves towards a more data-centric approach, it may be possible to deliver the data required to site rather than the entire drawing e.g. the depth required for the drainage pipe.

#### ***Notification of revisions to drawings***

A simpler and potentially cheaper step to take would be to provide a mechanism to alert users of the drawings that there has been a revision.

A central store of drawing numbers could be kept and the operative using the drawing could SMS the drawing number he has currently and then receive an SMS to say "OK" or "Out of date". This requires the operative to remember to check.

Alternatively a record of who uses which drawing could be collated either through a log on the collaboration tool (if used) or by providing each drawing and person with an ID. People would be required to check out the drawing when they take a copy using their ID (could be a barcode on their mobile phone). They will then be alerted automatically via SMS when a new revision of the drawing they are using has arrived.

#### ***Capture of as-built information***

PocketCAD on a PDA can be used to provide the drawing to the surveyor. This can be connected directly to a laser measuring device to input the as-built data onto the drawing. This is currently is use by M.H. Surveys.

### **Benefits of mobilisation**

The mobile solutions illustrated above ensure that the operative is always using the latest drawing. It eliminates the reliance on the site engineer being aware of who is using which drawings when.

By collating distribution lists automatically this removes a time-consuming and tedious task. In addition by providing the information direct to the field it eliminates some of the time spent travelling to and fro from the site office to collect or check you have the latest information. On a large project this time can be significant and in the order of a 1 hour round trip.

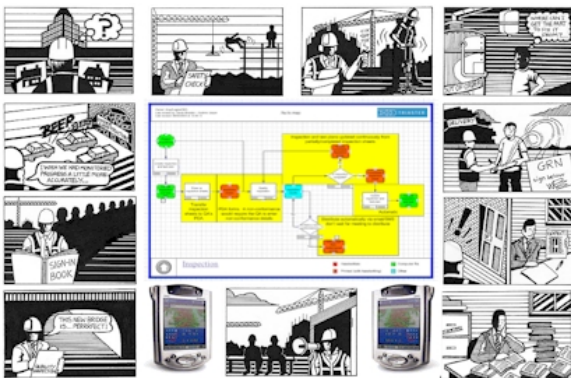
### **Ease of implementation**

Many of the technologies required for the mobile solutions outlined above are currently available. If the simple approach of notification of revisions to drawings was taken then you could assume that everyone already has a mobile phone and that they are comfortable in using them to send and receive SMS messages. Therefore there would not be a new technology barrier to overcome; it would simply be instigating a new procedure for checking in and out drawings.

## Process improvement through the introduction of Mobile IT

**Accompanies** To-Be map  
As-Is map  
Narrative

**Available from** [www.comitproject.org.uk](http://www.comitproject.org.uk)



### Summary

The construction industry's drive towards utilising IT to enhance communication both within a company and between clients, consultants, suppliers, subcontractors and contractors has, to date, ignored the need to deliver information effectively to mobile personnel e.g. whilst on site or attending a client meeting.

The advent of suitable devices and software solutions will go some way to correct this. However, simply because the technology is now available we should not be indiscriminate in choosing the processes to apply it to.

This report documents the activities undertaken to better understand which construction processes would derive most benefit from the application of mobile information and communication technologies.

### Introduction

An initial review of existing research and applications of mobile IT in construction was undertaken; The Current Status of Mobile IT. You can download this report from [www.comitproject.org.uk](http://www.comitproject.org.uk).

The COMIT community, 30 representatives from the construction and technology industries, were then presented with a list, derived from previous research, of processes that Mobile IT could improve.

Ten processes were chosen to look at in detail in order to determine which processes would benefit from the introduction of Mobile IT. These were:

- Drawing distribution and usage
- Monitoring progress
- Monitoring health and safety on site
- Quality inspections
- Task allocation
- Goods received notes
- Site design problem resolution
- Site diaries
- Onsite accounting of operatives/visitors
- Maintenance inspections

In addition, one of the partners requested that monitoring of hazardous activities was also researched as new legislation, recently introduced by the HSE, has brought about a new requirement to monitor and record this process.

### Generating the process maps

Process maps were produced to show how the processes occur currently; the "As-Is" maps.

Companies from within the COMIT community and relevant external contacts were asked to provide any material they had relating to each process; this included project procedures, existing forms, and QA documentation. This was supplemented with a literature review of research carried out in this area.

Material was received from 25 companies including most of the major contractors. This was then used to produce generic "As-Is" process maps for each of the 11 processes.

Using the "As-Is" process maps, activities were identified which could be improved through the use of Mobile IT. These areas are annotated and highlighted in yellow on the maps.

Five of the COMIT companies attended a workshop to ratify the "As-Is" process maps and the areas highlighted for improvement.

Once the "As-Is" maps were finalised these were taken as a basis for the "To-Be" process maps which illustrate how the processes could be enhanced using Mobile IT.

Through the use of Mobile IT, data can be collected electronically at the point-of-activity. This results in many of the highlighted activities being automated, thus reducing substantially the time spent producing reports and transferring information.

Additionally the quality of information collected and hence produced is increased due to the lack re-keying and data entry errors.

**The narratives**

A narrative has been produced to accompany each set of process maps. This provides an overview of the process, the issues that are present with the current approach, ideas for mobile solutions, details of the benefits that they bring and an assessment of how easy the solutions would be to implement.

These have also been ratified by the COMIT community.

**Mobilisation "scores"**

A subjective assessment has been made of the how widely relevant solutions are available today, the benefits to the end-user, the benefits to the organisation and the ease of implementation.

These "scores" (red, orange, green) are given at the top of each process narrative to provide information at a glance and help you to decide which processes should be considered for the implementation of Mobile IT.

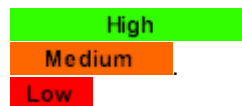
**Solutions**

An assessment of available solutions is made in accordance with how many solutions are available, their affordability, and are they in current use in the construction industry and/or will they require customisation to suit the particular process under consideration. The scores given are:



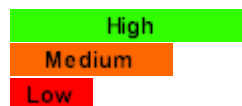
**User benefits**

For any mobile solution to succeed it must deliver benefits that are directly apparent and of value to the end-user. This will encourage the adoption of the solution and hence help to deliver the organisational benefits. The scores given are:



**Org. benefits**

The user benefits will result in benefits to the organisation. In addition benefits will be derived through the collection of more accurate information, the reduction of information transfer time and the ability to search and utilise the electronic information subsequently. The scores given are:



**Implementation**

The ease of implementation is assessed in accordance with whether the solutions are already in use on construction or similar industries, the readiness of the users to take up the technology and the current extent of electronic information in the process. Hence a judgement can be made on the length of time and the effort that would be involved in the implementation. The scores given are:

