<u>Using Mobile Technology for Managing Construction Projects</u>

David Dylan John

11/14/2014

Building Information Modelling (BIM)

TCM – 2333& 4433

Georgia Southern University

1

Abstract

The construction industry is beginning to understand the utilization of mobile technology in construction projects in order to improve work flow, save time and reduce cost under tight budgets. There are many mobile devices and software applications that can be used at various phases of the construction project - from early design to final punch list. This essay is focusing on three primary phases of construction, highlighting the different mobile technologies that can be utilized by project managers for better project outcomes and more efficient site management.

Introduction

Mobile technology is rapidly transforming our world in its applications and has given us the ability to communicate more effectively and significantly improve the efficiency in industry. The continuous development of technologies based on industry user feedback, coupled with research and development has resulted in reduced cost of devices and an increase in software, functionality and usability, all in a relatively short period of time. Furthermore, these technologies have been developed with mobility and accessibility in mind which has enabled better utilization on construction sites. My study on mobile technology for managing construction projects focusses on three major phases of a construction project: project design, project planning and site construction while aiming on the proposition that mobile technology is reducing costs, streamlining communication and improves quality of the work to perform.

Project Design Stage

During the project design stages, there are many software platforms such as Graphisoft ArchiCAD, Bentley Navigator, Tekla Structures and Autodesk Revit that are available to the construction industry as useful Building Information Modeling (BIM) tools and can be operated on most new laptops. These software packages may create a stage for collaboration among construction professionals such as the Architect, Engineer, Trade Contractors and General Contractor enabling streamlined communication. This will reduce the time spent on going back and forth on clarifications during the architectural and structural design processes. The accessibility and transferring ease of the information on these models are supported by the public's growing interest in mobile technology devices such as laptop computers which has increased by 34% since 2005 to 2013

(Dugan). This increase in device availability and accessibility is an enabler for further enhanced streamlining in the communication channels during the design stage, as key players in the design process can access the 3D model, make changes and discuss details of the designed model from any location without being tied down to any singular location. One example, from many available in the industry is Tekla BIMsight which since its launch in 2011, is being used by over 100,000 construction professionals from 160 countries worldwide.

Autodesk's 360 platforms has enhanced mobile device application in the design process and enables the stakeholders of the design process to perform analytical functions such as Autodesk 360 rendering, optimization, energy analysis, and structural analysis in a cloud environment. These functions used through powerful cloud computing capabilities allow for stakeholders to combine the different models together, allowing for better understanding of the design and the changes that may need to be done in the early stages during site construction. This effectively helps prevent a waste of time that could be caused by on-site troubleshooting and saves money on the project as the job task could be performed with minimal to no errors and smoother workflow.

Another resource that can be used effectively in the design process is the clash detection feature in programs such as BIM 360 Glue and Navisworks Manage, which enables designers to foresee collision challenges that may
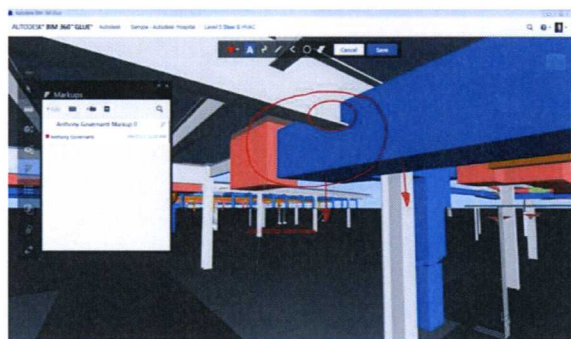

Figure 1 (Smith)

occur on the project and provide better cost engineering services to the client, saving

money and valuable time. The image in Figure 1 (Smith), above is the visualization of a clash detection test on BIM 360 Glue and as illustrated, it is also possible for design collaborators on the cloud to mark up and make relevant notes for other members of the team to access.

In line with the observation made earlier that these mobile technologies are becoming more accessible, factors such as the release of BIM 360 Glue with 30-day free trial with global availability and accessibility, shows the understanding of mobile technology application developers of the need to keep these software and applications easily accessible in terms of cost and availability and the added need of focusing on allowing people to try the software out and experience it so that they can get a hands on with its user friendly attributes. The fact that many of these applications can be easily downloaded directly through application stores onto I-phones, I-pads and Android devices make it so much easier to access and use.

If I were in the position of a project manager of a complex project and had the opportunity to utilize certain mobile technologies for the preconstruction phase of my project, I would start the project off by acknowledging the value quotient of mobile technology towards the project and communicate it with my team. I would then encourage the architectural and engineering design teams to create a Building Information Model, so that we can collaborate and effectively conduct analysis of the building in the preconstruction stage and also conduct related collision testing to avoid any unforeseen constructability challenges in the project construction phase. Project delays due to unforeseen challenges are a prevailing problem in projects which depend heavily on paper documentation as reference materials on site as opposed to devices such

as I-pads, I-phones or androids which can help conduct some of these simulations and tests on design components and also store and track information for recording purposes. Most importantly, I would ensure that my project team has updated laptops and I-pads or similar mobile device with Revit, Navisworks and BIM 360 Glue to enable streamlined and efficient communication within the project team, regardless of time constraints and location of the individual team members.

Project Planning Stage

Project planning and scheduling is a very important component of a construction project. Regardless of how effective and accurately a bid went through, if the planning and scheduling fails, the project can cause severe losses to stakeholders. This typically happens because of errors such as inaccurate material quantity take-offs and scheduling delays, these errors result in having to expend more resources wastefully and increases pressure on project budget constraints which potentially could turn the project into a loss. These negative effects can be avoided with the effective use of mobile technology and programs such as FieldCollaborate Mobile (Computer Presentation Systems) to efficiently plan and manage the schedule.

Pre-planning of projects can also be done collaboratively by using mobile technologies such as video conferencing through Skype which can be used to conduct meetings with the use of mobile devices. In Lean construction, trades contractors and the general contractor work collaboratively prior to the project in order to lay out the plan of action for the construction project. This is done, using methodology such as the Last Planner system and Pull-planning which are strategies of pulling inputs from the different trade's foreman so that their input can help create better accuracy on the schedule of the

project. This information can then be translated into a program like FieldCollaborate Mobile (Computer Presentation Systems) so that all members of the project team can remotely access the details of the plan and schedule and make any necessary communication notes on the program. This streamline of communication on projects through programs such as Field Collaborate may help reduce time wastage on projects and has also shown increments in the streamline of project communication and collaboration.

When laying out the planning and scheduling logistics we can make use of Lean construction to create a more efficient job environment that reduces waste related cost and further enhances productivity, Use of mobile technologies may also complement the implementation of the construction methods available to deploy for project specific activities. This could range from on-site mobile communication for speedier and easier communication within the project team and could include devices such as tablet PC's and PDA's that would allow crews to make record of objects being constructed and their workflow. An example would be: if a worker had to use a certain set of tools for a job task on site and went to a truck to collect the tools but, did not collect them all as he had not clearly recorded or could not remember the necessity of a certain set of tools. PDA's and tablet PC's could help in tracking the requirements of the job task and thereby save time on the worker having to leave again to collect the tools he needed. These may be considered small savings of time on an instance basis. But, on a complex project with the possibility of having thousands of tasks, the small savings add up very quickly to a very significant amount of time saved overall.

Planning also requires a more accurate analysis of the material requirements for the site in order to plan better and keep costs low by avoiding purchase of material and supplies in excess. Mobile technology allows us to analyze detailed building information models and thereby take quantity take-offs and schedules in order to obtain an accurate reading of the material quantities and their specifications. This fact allows for faster analysis coupled with higher accuracy which in turn reduces the time spent on quantity take off and schedule compilations to help lower cost during the planning phase of the project.

For planning to be carried out effectively, it must have good communication and understanding. Mobile devices such as I-pads with the usage of increasingly popular software applications such as Tekla BIMsight (Tekla BIMsight) will help us become better builders as we are now able to employ a user-friendly, technology-based platform with high accuracy and the ability to share vital project information with stakeholders from multiple locations.

<u>Site Construction</u>

There are powerful software applications that can be used on mobile devices for the development and maintenance of a project schedule such as Primavera P6 Team Member mobile app for I-pads. This app allows project team members to review and update the schedule as it progresses. "By optimizing project communications, P6 Team Member for iPhone and P6 Team Member Web Interface help organizations focus on managing the project delivery and eliminating the time typically required to track down project status updates." (Oracle).

When construction on a site begins, it is very important to manage the three main resource components which are labor, material and equipment and effectively communicate these to the project team so everyone is aware of the trades on site. Applications such as E-sub Fieldworks app (Esub) allow for us to use our existing mobile hardware device with a very user friendly format that anyone can easily follow. The project manager can set the schedule, allocate the necessary resources to various tasks and share it with the entire project team who can easily refer their smart phones or I-pads to learn about the latest updates or changes to schedules and resource allocations.

Protecting the material and equipment on site, especially during transport and storage is vitally important to smooth progress of the construction project. Lost or misplaced tools, material and equipment can cause severe inconveniences to the project teams and could also result in delays. To avoid these, it is possible to use RFID (Radio Frequency Identification) tagging on materials and equipment so that all these items and components can be tracked through RFID scanners and readers such as the Winmate E430T (Winmate). Using this technology will help expedite the process of building on site as it would be easier to plan the logistics of material delivery, equipment management and prevent any delays that may occur as a result of not having certain materials and equipment on site and at the right time.

Summary of Benefits

The usage of Mobile Technology has many benefits at every stage in a construction project from initial design to planning and also during the actual building process. Many of the technologies may be used during specific stages. However, they would be typically used through the entire lifecycle of the project after it has been introduced to the project

as the design and schedule is constantly updated and changed with the progress of the work.

The key benefit of using mobile technology on a construction site is that it allows for streamlined communication which leads to better workflow and significantly reduces the amount of time wasted on clarifications. This process can be made in real time by using communication tools through the various mobile applications described in this paper. As noted, collaborators are able to make notes on the digital document itself which in turn allows for greater interaction and faster response to constructability issues.

Using mobile technologies to communicate and discuss details of the construction-project, project team leadership is able to keep track of all suggestions and changes on the collaborating platforms which allow for reduced discrepancies as it is all recorded methodically. Also, it can provide easy access when compared to a written paper trail of the actions and changes pertaining to the project.

If mobile technology is effectively employed on a project, it significantly increases the opportunities to reduce the budgetary pressure on the project. This would occur as a result of the time savings due to better collaboration and communication between project team members. It will further help reduce cost through accuracy of information available to the project team that will lead to better management of materials purchasing, logistics planning and distribution of resources in the project. While mobile technology does not change traditional project management procedures, it can be viewed as a resource that can be integrated to help improve and streamline traditional project management.

Conclusion

In conclusion, I am fortunate to be a student at Georgia Southern University and be exposed to many of these unique mobile devices and applications that are transforming our industry. Through my Building Information Modeling and Project Planning & Scheduling Classes, I have been given the opportunity to interact with industry guest speaker presentations and webinars and also have hands on practice on many of these software and applications combined with site visits to see for myself how some of the construction projects utilize various mobile technology for better project management.

Many technologies are usually deemed expensive and as a result, the technologies are only held between a few larger organizations that have the money to invest in the research and development of such applications. However, we have seen that the mobile technology applications pertaining to the construction industry are relatively cheaper and more accessible, allowing for wider access and usage. Mobile Technology is the way forward for effective construction project management and is growing in importance as a realized enabler for cost and time saving in construction projects.

Bibliography

BlueBeam. *BlueBeam Revu iPad*. n.d. 12 November 2014.
        <http://www.bluebeam.com/us/products/revu/ipad.asp>.

Computer Presentation Systems. *Web Browser Home Builder Construction Scheduling Software*.
        n.d. Web Site. 10 11 2014. <Web Browser Home Builder Construction Scheduling
        Software >.

Dugan, Andrew. *American's Tech Tastes Change With Times*. 6 January 2014. Internet. 11
        November 2014. <http://www.gallup.com/poll/166745/americans-tech-tastes-change-
        times.aspx>.

Esub . *Esub Construction Software - Field Works App*. n.d. Internet. 12 November 2014.
        <http://info.esubinc.com/MTC_Common/mtcURLSrv.aspx?ID=18967&Key=8AA189E8-
        FCBD-4B70-873B-EC0D564CDB57&URLID=22248>.

Newforma. *Newforma Project Center*. n.d. Internet. 12 November 2014.
        <http://www.newforma.com/products-services/newforma-project-center/>.

Oracle. *Oracle Introduces Mobile PPM with Oracle's Primavera P6 Team Member for iPhone and
        Oracle's Primavera P6 Team Member Web Interface*. 28 February 2012. Internet. 11
        November 2014. <http://www.oracle.com/us/corporate/press/1534327>.

Smith, Susan. *New version of Autodesk BIM 360 Glue provides greater access to project
        information*. 16 May 2013. 11 November 2014.
        <http://www10.aeccafe.com/blogs/aeccafevoice/2013/05/16/new-version-of-
        autodesk-bim-360-glue-provides-greater-access-to-project-information/>.

Tekla BIMsight. *Tekla BIMsight*. n.d. Internet. 12 November 2014.
        <http://www.teklabimsight.com/>.

Winmate. *Winmate Industrial PDA with RFID*. 28 September 2012. Internet. 12 November 2014.
        <http://www.winmate.com.tw/newsletter/Newsletter20120928.htm >.