II.
Communication and Collaboration

For the first hundred years of consumer communications, there were relatively few changes. Not until the late 1970s did the first commercial cellular networks come into being, and some of us still remember the plain, black rotary telephones that we rented from the phone company. Today, a cell phone is not just a phone; it is a mobile, multifunction device. The tendency of carriers to make strategic and exclusive alliances with phone manufacturers brought us a whole new world of subsidized smartphones. This business

model has been the single largest contributor to the popularization of the smartphone.

With respect to the relationship between today's job sites and websites, the question still is: How can we use these developments to do a better job of managing larger teams and keep everyone on the same page?

Synchronization

Not long ago most synchronization for a construction project ended when a reproduction company produced multiple sets of drawings and specifications, and delivered them to plan rooms and bidders. After that the process involved producing addenda and hammering out what was the design intent and what were "means and methods." It was an adversarial relationship. Today we have more negotiated contracts, teamwork, and better coordination. Drawings are now produced on modern CAD (computer aided design) platforms with state-of-the-art software. But plans, sections, elevations, and details are still plotted on paper at the office or by a reproduction company off-site and then delivered. The process can take days before the paper documents are finally distributed to all of the stakeholders. Paper is still the medium for communicating ideas, just as it has been for a long, long time. Recently we've seen online FTP (file transfer protocol) and FTH (file transaction hub) sites appear. PDF files are uploaded by the design firm and downloaded by the contractors and subcontractors. Teamwork has improved. But the directions in the field for getting a building built still

wind up on paper, along with all of the associated distribution and revision challenges.

When a change is made to one of the sheets, the original drawing file has to be revised electronically, and the process is repeated. This in itself is not difficult, but the work is re-rendered on paper once again, many times with delays and additional expense. Each revision is just as cumbersome to produce as the original drawing. And then even once the reproductions are made, each stakeholder needs to receive the document, file it and many times personalize it with comments. The use of 8½ x 11 supplemental drawings, sketches, and lists associated with that drawing are then attached. All of those additions stay with each stakeholder and are usually hand-written. Drawings are stuck in endless informal silos. The result is different stakeholders with different visions of the project.

The goal is to keep all of the changing documents in the hands of a growing number of team members. We long ago moved to the electronic production of documents with CAD software, and now it's time to take the next step and move to the electronic presentation, sharing, updating, and synchronization of that information. The old model of paper updates and paper distribution is obsolete. It's far more efficient to use mobile platforms in the field, and use easily sharable and editable electronic documents.

Some of the advantages of this approach are the following:

Eliminate the need to have each version of a document reproduced on paper either at the office or by a reproduction company

Ensure everyone on the project team has the same drawings, the same notes and the same version of the information

Share information and drawings quickly and easily with stakeholders, regardless of location

Improve the productivity and information flow of the construction process

Increasing the speed at which information is distributed, incidentally, does have one disadvantage. Producing complex structures requires thought and care. If information arrives so fast that we don't have time to consider its implications, the final product may wind up being "thoughtless." And if we are constantly bombarded with bits of information from different sources, how can we possibly keep track of it all? Contemporary file management systems and reasonable schedules that allow for quality workmanship are required.

For a technology to be truly significant, it must support our desire to produce more products of better quality, more economically. Just think of all of the time and material resources that could be saved if we eliminated the use of paper. We now produce documents in an electronic form in

the office. There is no reason why we can't keep this form of information in the field.

Modern mobile technology in the construction industry is moving us toward better synchronization of an ever growing number of construction team members. The smartphone is first and foremost a communications device. Its emphasis is on voice, but it can also help us communicate through pictures and drawings. The tablet is a drawing presentation platform that is a logical extension of our office-based drawing production platforms. The synchronization of drawings between stakeholders in a project currently occurs via FTP and FTH sites and service providers like Google Docs. The drawings are uploaded by the producers and downloaded by the users. But we now are moving toward the use of services and applications like Dropbox (free from Dropbox, Inc.) that automatically sync the contents of directories on office production platforms to the same directories on mobile platforms. Apple's new iCloud service will expand and refine this concept yet again. End users are thus able to receive drawing images as well as sketched changes to an image with notes, and then have those edits immediately pushed out to all stakeholders in all locations. Everyone has access to the latest information, the latest iteration of each drawing, and the latest notes and suggestions made by the construction team on the job site.

We have moved from the distribution of information via CDs and email to online FTP and FTH sites to services that make documents appear on our mobile devices out of thin air. Today's synchronization challenges need the best document

organization solutions possible. Different email accounts that are specifically named to send, receive and hold different types of information are the solution.

Construction in the "Cloud"

Cloud computing has had an impact on just about everything, but it is often misunderstood. The name alone confuses people. "Cloud" sounds like something that is hard to pin down, but in reality, it's very simple. Cloud computing is the storage of information or the providing of functionality at third-party servers which is delivered over the internet as a service. When you use Gmail or Hotmail, for example, the actual email client isn't in your computer on your desktop. It's on one of Google's or Microsoft's servers. You access your email over the internet, but the actual email-client software and the emails themselves are somewhere else. That's the cloud.

Cloud computing and SaaS have gained popularity in many consumer areas. Besides Hotmail and other free email platforms, consumers love to use sites like Flickr to store photographs. The online services and systems that are now in place to share pictures of the kids could just as easily be used to share images of drawings. Google has a complete set of SaaS applications that help you be more productive, without having the software or the files reside on your computer.

Cloud computing makes the use of mobile platforms even more attractive. When you are using a cloud application, you can access that application (and your data) from any computer

or handheld device with a browser, at any location. Whether you're at the office, at home, or at the job site, and whether you're using your work computer, your home laptop, or your smartphone, you can still get to the same information and do the same things, all without the need for massive hard disks.

Cloud computing provides more than just consumer convenience. The technology is robust, and the model is solid enough so that it has been embraced by small and large businesses all over the world.

The cloud is the ultimate mobile tool because it supports easy access to, and sharing of, information. Businesses have been taking on a much more global perspective ever since the dawn of the internet age, and today the infrastructure is in place for even a small company to have clients and partners in other countries. Cloud computing is a natural extension of this trend. If you're an American contractor, and you're bidding on a job in Saudi Arabia, you need to have an easy way to communicate and share data. Shipping paper documents back and forth between the home office and a job site on the other side of the world is just not practical. The combination of cloud computing and mobile technology is bringing the construction industry into the twenty first century, and it will be increasingly difficult for companies to compete and survive without it.

Teams Are Getting Bigger

One of the most important reasons why project teams are getting bigger is because of specialization. Of course, the

construction industry has always relied on consultants and subcontractors, but today with the increase in the complexity of materials, systems and regulations, we now have endless specialists for waterproofing, acoustics, interior design, ADA, and more. Specialization has even created the “design” firm category as opposed to the “general practice” firm. Many times, these different team members are in different geographic locations across town, across the country, or on the other side of the world.

There is another reason for the increasing number of specialists. It is called "liability shedding." Architects and designers often don't want to assume liability for various aspects of a building, so they bring in consultants who are knowledgeable in those specific areas, for example waterproofing. This helps to shield the architect from liability should something go wrong, while at the same time ensuring that certain critical aspects of the project are thought through by the most qualified person. The result is that the construction team expands.

But the increasing number of specialists and consultants involved in a project isn't just the result of a fear of litigation. It's also the result of the increasing complexity of materials, systems and designs. Architects and contractors are by nature generalists. They coordinate and manage the overall project and rely on subcontractors and specialists to manage individual aspects of the project.

With every construction project involving multiple team members, many of whom are independent professionals not employed directly by the design or construction firm, project

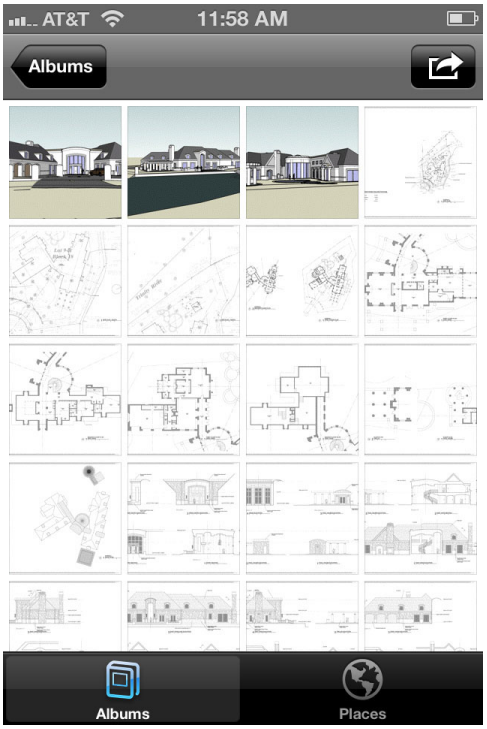
management becomes especially critical, especially under difficult time constraints. The project manager must make sure that everyone involved is in synch and informed. He must not allow the size of the team to bog down the process.

How Project Documentation Might Evolve

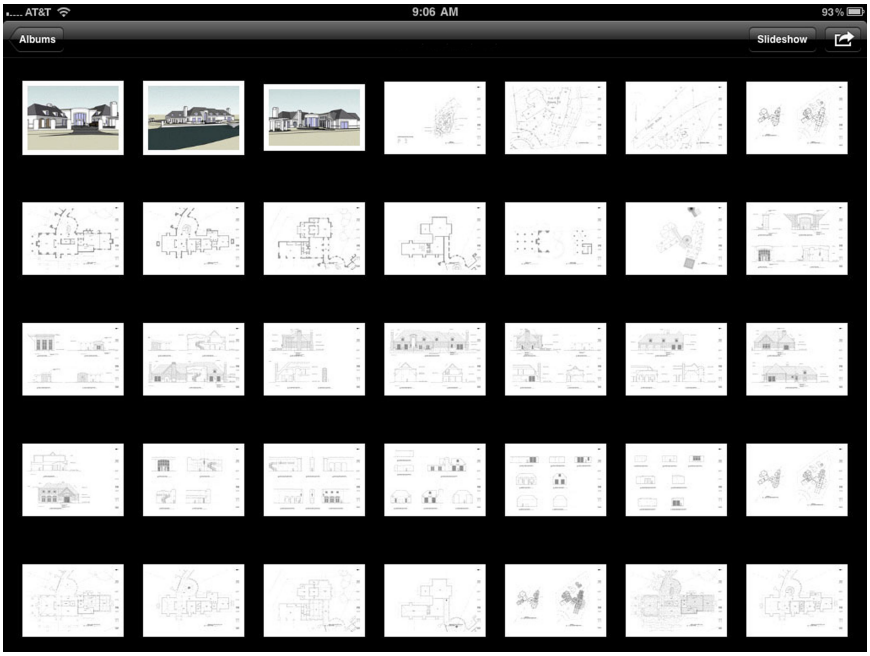
Not long ago we produced drawings based on the client's direction and then built the project. Design, Bid, Build projects seem so quaint these days. Now we produce documentation for different parts of the project, permit them and issue them to the field at different times. We "fast track" more and more projects. Each aspect of the work requires multiple specialists, often in different parts of the country or overseas. Project complexity is expanding, while project schedules are collapsing. As a result, construction requires increased sophistication with respect to management and coordination. This requires rethinking the way we communicate and coordinate our documents.

What might a contemporary work-flow be if we took full advantage of the systems that are now available to us? First, drawings and specifications could be issued, with proper degrees of security via cloud-based systems like Dropbox or iCloud. Those requiring that documents be printed could still download and print them. But those preferring to use mobile devices could have access to the document files and call them up on the screens of their smartphones or tablets at any time. The document directory could also be kept current, with revisions by the issuing firm simply by loading new files into

the cloud-based directory. Documents, if issued in a JPG format, could appear as thumbnails on mobile devices and searched easily for content. If the documents were issued as PDF files, images could be called to the screen of mobile devices, and screen captures could be produced as needed. These images could then be marked up using any of the many mobile applications that are now on the market. Specifications could also be issued as PDF files and loaded into the cloud-based directory. Documents can now be pushed directly from the systems of the issuing team member to the screens of the smartphones and tablets of team members in the field.



iPhone Photo Albums



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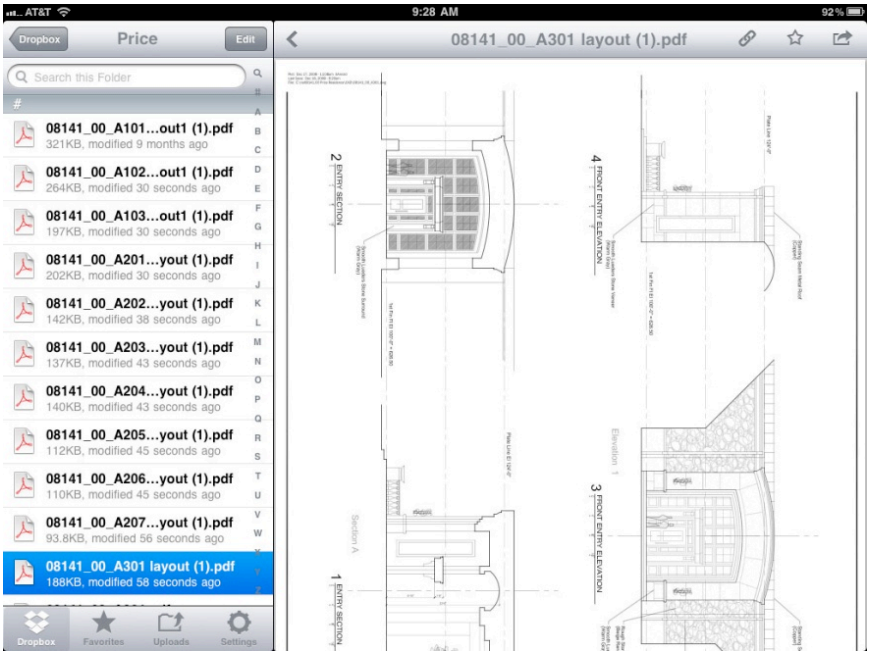

Dropbox on iPad