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The Impacts of 3D Technologies on the Planning and Design Process

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How 3D Design and Integrated Technologies are influencing the way that we conduct business

Today's AE firms are facing significant challenges due to a myriad of changes that are occurring within the marketplace. Projects are drifting to a design-build arrangement, while the design process itself has become increasingly complex. The introduction of 3D Design and Integrated processes such as Building Information Modeling (BIM), Integrated Project Delivery (IPD), Virtual Design and Construction (VDC) and Virtual Reality based 3D Design (VR3D), all are influencing how projects are planned, designed and constructed.

How can AE firms' best prepare for these changes? When should they start to be implemented? What are the costs? Where can they go for assistance? These and many more questions need to be answered before firms can respond most effectively to the exciting developments in our industry. However, one thing is for certain, change is imminent, and in some cases already here. What is your organization's plan to address these changes?

Over the past few years, our industry has experienced technology advancements at a pace never before seen. During the industrial revolution, tradesmen relied on tools such as drafting tables, T-squares, compasses and french curves. Widespread changes to the design process were historically slow to implement. Some 25 years ago, we traded in those tools for Computer Aided Drafting (CAD)

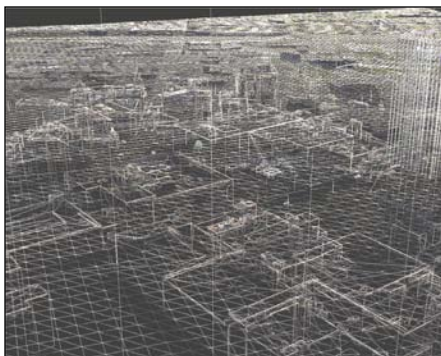
technologies to improve and modernize the design process. Today, we are once again trading in our tools for new, smarter, more advanced technologies. The emergence of 3D Design and Integrated Technologies is analogous to when our industry evolved from the drafting table to CAD. Essentially, CAD applications were developed to replace and improve upon the drafting pencil. Since the tradesman had to focus on learning just one new technology application, implementing CAD was somewhat easier to grasp. Today, we have multiple applications to consider for every discipline within our industry. There are also hundreds of applications that can integrate and interoperate with these applications. Further, the landscape is made even more complex for those designing within the 3rd dimension.

Why must we change? Well, quite simply, there are countless benefits associated with these technologies that make the time and effort more than worth it. The emergence of designing in 3D has increased the quality of our end product by improving communication between the owner, designer and constructor. For those who struggled with understanding 2D design plans, they can now much more easily interpret and conceptualize what *will be* built. Bergmann Associates utilized 3DVR technologies for the Florida Department of Transportation (FDOT) on the Central Broward Transit Corridor project. The 3D model enabled

designers to identify significant design flaws that normally would not have been detected easily with traditional 2D CAD tools. By identifying these flaws early in the preliminary pre-design phase of the project, FDOT was able to improve the quality of the design while achieving indirect project savings. Scott Seeburger, FDOT Project Manager stated ***"The visualizations provided clear perspectives on how the system and station areas could be designed."*** Integrating a 3D model within a construction schedule can assist in visualizing and identifying impacts between all the trades. Issues such as clash detection and interferences become apparent, which has the potential to reduce overall design and construction costs, while increasing the probability of a satisfied owner.

One tough question to answer is: when should my firm make the investment in 3D Design and integrated technologies? That question can be more easily answered by identifying the level of commitment from the ownership and management teams within an AE firm. Without the financial and managerial commitment, 3D technology enhancements will fail.

So how would you implement 3D Design and Integrated Technologies at your company? You take it on just as you would for any other integral part of your business, through careful planning,



City of Rochester - baseline 3D model



City of Rochester - Existing Conditions



City of Rochester - Proposed Alternative



FDOT - Existing Conditions



FDOT - Alternative-01



FDOT - Alternative-02

commitment and a well executed model. However, it's not all about investing significant amounts of capital into the technology. To be successful, firms need to be proactive in their approach to implementing these technologies. A reactive approach most certainly will lead to production problems, budget overruns and potentially, jeopardize a client relationship. Projects become extremely complex when 3D based programs are introduced. Project Managers now have to manage and coordinate the design process from both a client-team perspective and from a technological perspective.

A New Project Approach

One factor to keep in mind when implementing 3D Design and Integrated Technologies is how it affects your planning and design processes. Issues such as; how you write contracts, the sharing of electronic data and project staffing, will all be impacted. So much so, that the management processes of our projects will need to be altered. In particular, it is advisable that a key person is identified to exclusively manage the technology side of projects.

The advent of the need of a "BIM Manager" within our industry is a perfect example. Not only do you have to have a person manage your overall technology services, but you also have to have someone manage each and every project from the technical side. Can your firm afford this position? 3D Design and Integrated Technologies is making it tougher on project design teams due to applications becoming more complex than ever before. In the past, a designer could have a successful career only knowing 20 to 25 CAD software commands, a basic understanding of geometry, and artistic craftsman's flair to make the drawings look presentable. Now, the same designer has to be conscience

of the third dimension and astute at integration with other applications. Both require the learning of thousands of new commands and a commitment on the part of both employee and employer. You now truly have to think "outside the box" to design complex pieces of the project. BIM Managers have to develop content that's unique to each project. To learn and become proficient at this new role and process takes a significant amount of time and effort. With 3D Design and Integrated Technologies; construction documentation is now combined with other information about the project creating a powerful tool for the entire project team to leverage. Again, to address this issue, BIM Managers need to develop unique tutorials and applications for each project. They are needed by the project design team to assist in effectively managing and structuring how the 3D Design and Integrated Technology is being used and created throughout the lifecycle of a project. A significant loss in productivity will be realized if this vital function is not in place from the onset of a project that utilizes 3D Design and Integrated Technologies.

Emerging from the Technology

One of the by-products of 3D Design and Integrated Technologies is the approach to sharing data between disciplines. In the past, applications were developed as general design packages. Today, we have design applications tailored specifically for Architecture, Mechanical and Electrical Engineering, as well as Civil and Site design, etc. This approach opens up opportunities for all elements and phases of a project to be harmonized. 3D models can be combined from all of these disciplines to create a more complete and sound design. It provides the designers a mechanism to virtually see how their projects are going to be successfully completed.

Another example of this revolutionary approach, is the merging of BIM and GIS. GIS analysts now can insert BIM applications into their platforms to conduct much higher detailed analytics. Disciplines that once had difficulty communicating and collaborating with each other, can now seamlessly interact. For example, designers at Bergmann Associates are utilizing Autodesk's Revit to design new buildings for our college and university clients. Once completed, Revit information is imported into ESRI's ArcGIS 10 application. GIS analysts are then able to integrate GIS based data with the new design. This new project approach allows planners at institutions to make more informed decisions. At Bergmann, it allows our planners and designers to more effectively collaborate and design while providing the client/owner with a utility that can be effectively used for operations. This is a true project lifecycle approach.

Conclusion

Similar to the advent of CAD, 3D Design and Integrated Technologies has the potential to revolutionize and improve the planning, design, construction and operational phases of our projects. If these technology tools are not utilized properly or ignored, then you run the risk of jeopardizing your firms' future planning and design capabilities. Utilizing the technology correctly will yield improved productivity, quality and project economics.

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