

Take Five

5D Integrated Process Part Of Changing Face Of Construction Industry

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The Master Builder of old knew how to construct the structure as he gathered all available resources together for successful completion of his work. Today's Master Builder is evolving project by project with the available tools, materials and resources dynamically changing the playing field where we build, each new project advancing the process.

Construction industry trends are integrating the supply chain, planning for the building life cycle and the dramatic technological change to support all of the building systems and data. What follows is a more efficient concentric process with integrated multi-tasking throughout the design, estimating and building process.

While these trends are fairly new to the AEC industry, these techniques are being perfected in aerospace, shipbuilding and automotive fields. Central databases of virtual model integrate the different facets of the business processes and lead to more efficient design and fabrication with faster delivery at less cost.

This brings us to the hot topic in the AEC industry and that is the 5D Integrated Process. 5D CAD is the use of a 1D program data, 2D documentation of the work, a 3D virtual model to digitally define the space, 4D construction simulation of the model with a schedule of the work, and the 5D date to derive cost and allocate resources.

NEW, BUT NOT SO NEW

The process is fairly new to mainstream AEC in the United States, but the Virtual Model or BIM-Building Information Model process approach is being used worldwide by many architects and builders. This process has matured in recent years and many buildings being built today use varying degrees of the 5D approach. Other countries that require building data to support the permit and construction process have advanced the process to being mainstream and the 2D linear process is no longer in use or competitive. Throughout the world, owners are taking advantage of the visualization and efficiencies in this process that saves time and money.

HOW WILL THE TREND TO 5D


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CHANGE THE BUSINESS OF AEC?

AEC tools are becoming integrated from the project programming phase through to the design, construction and eventual maintenance of the facility. A complete 5D process begins with data gathering and requirements management leading to design and analysis of the solution. This approach starts with the integration of the work flow process, and the initial program database begins to connect with the digital model. As the process integrates data and model information, this method reduces more risk through improved coordination.

BENEFITS OF 5D/BIM PROCESS

Many advantages of the BIM approach are realized due to central integration of the complete graphic and information database. Sharing a single data source allows greater focus on design (instead of documentation) for architects and reduces errors by improving collaboration and communication between the project team. The live connected model process also means that the documents are coordinated between plan, elevation, section and 3D views at all times. This reduces field notices and information requests. The design solutions are also of higher quality due to real time 3D interaction for the designer and fabricator.

SHORTER PROJECT DELIVERY CYCLE

The traditional project phasing process is very linear. The 5D BIM process speeds the work flow as more tasks can be performed together in combination with the 5D applications generating automatic views and reports. More time can be spent on design with the documentation process integrated as a byproduct. Energy and cost analysis can occur earlier in the process, code compliance and clash detection can be performed with model checking applications, and options or alternates can be quickly managed by the model/data process. The synchronization of design disciplines evolving into the construction process puts everyone on the same page.

PROFITABILITY GAINS ARE HIGHER WITH 5D

As the 5D process saves time with better output, owners, designers and builders are realizing the gain in profitability due to the applied methods. Designers are achieving 25-35 percent return on their investment in 5D, while contractors and owners look to reduce overall construction costs by 2-5 percent. This makes for an increase in profitability over the traditional 2D process, a very achievable expectation for the 5D method. The reduced timeline allows for cost savings due to contractors and engineers being able to review the project earlier and

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the interim cost of money being less with a shorter schedule.

MASTER PLANNING AND PROGRAMMING WITH 5D

A questionnaire given to the owner to document the program requirements. This data can seamlessly flow into the digital model and create a preliminary massing model from the criteria. Information is captured electronically about the building and quantifies ideas, constraints and relational requirements. Key requirements are quickly identified and tracked through the design process as this information is carried over to the 5D CAD model environment. In this stage the initial definition of the site and layout of the building begins the tracking of compliance against requirements. Baseline estimates of total space usage and

costs can be reported that reflect the initial requirements and are dynamically changing as the design develops.

With information connected to the 5D model, conflict and analysis reports let both the owner and designer know when design solutions are effective. Simple mass models and bubble diagram layouts are automatically generated with the programming/BIM applications.

DESIGN WITH 5D CAD

The model method allows for smooth communication between the architect and the design team. Sketch modeling programs are available that can take early design models into advanced 5D applications for development and documentation. Output can range from sketch renders, still views, animations and virtual reality objects and scenes. Curved surfaces and organic modeling allow for design freedom and analysis of complex solutions.

BUILDING SYSTEMS MODELING

Building subsystems or the structural, mechanical, electrical and plumbing components can be integrated into the architectural model for complete building design coordination. An open source computer code format has been developed for model information to be transferred from BIM applications to other analytical programs. This language IFC (Industry Foundation Classes) is not vendor specific, so applications that can read and write this format will support the seamless workflow of design and engineering. This open source format is also used as a means to transfer the digital model to applications for energy analysis, code review, clash detection and cost estimating.

DOCUMENTATION WITH 5D BIM


Automatic construction documentation from the design model does not consist of a magic red button for working drawings. However, many of the tasks can be directly derived from the model.

Dimensioning is both automatic and associative while intelligent objects are scale-sensitive and lead to enhanced drafting features. The model produces elevations, sections and schedules automatically and model views are directly linked to the drawing sheet layouts. This process reduces errors and redlining and also links drawing info such as sheet/drawing numbers to section and detail symbols.

GSA's (General Services Administration) Public Buildings Service is the largest public real estate organization in the country. For all major projects (prospectus-level) receiving design funding in fiscal year 2007 and beyond, GSA requires spatial program BIMs be the minimum requirements for submission to the Office of the Chief Architect for Final Concept approvals by the PBS Commissioner.

CONSTRUCTION PROCESS REDEFINED


Estimating, sequencing, procurement and site management are part of the data set for intelligent models. This integration of the data with the model is



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proving to be the preferred process for major projects with complex solutions and requirements. Pre-construction services provide for visualization, site logistics, estimates and scheduling using the data connected model. Construction models differ from architects models as the date must be associated properly with the digital model. Templates help to define the connection process and a new role of the construction modeler is emerging. Recipes are defined which establish the methods and resources to be used or allocating the cost.

These methods allow contractors to minimize downstream problems and have a much clearer idea of what's going to happen before any dirt is turned. Many 5D aspects aid in construction risk management, constructability analysis and planning and improved overall communications with the project team. Variance estimating and value engineering that consider design options can now be performed in a real-time environment as opposed to waiting for new information to be processed through traditional 2D take-offs.

COLLABORATION PLATFORM SHIFT

The use of 5D or BIM means a radical change in process and deliverables for architects along with the process shift for contractors and builders. The project team will have to adjust their understanding of collaboration as one occurring synchronously as opposed to staggering events. Architects will be sharing project models and data that had previously been limited to 2D output formats supporting the linear process.

Owners are requesting the 5D process

that saves time and money, and contractors are finding competitive edges with processes that deliver these savings to the owner. Insurance carriers will require or create incentives for firms to have quality assurance procedures in that include the use of Building Information Modeling. As these methods become mainstream, new contractual language, fee structures and project deliverables will emerge as the standard work practice.

THE FUTURE IS NOW

More projects are being completed with the 5D BIM process now than ever before. As this technology change is more significant than manual drafting to computer based drawing, early adopters will benefit greatly by gaining market share and new business. It is easy to consider the new opportunities many firms would have with a good 5D model of the current projects in design and construction. Those choosing these new methods are finding themselves leading their competitors while others are left behind caught up in traditional process and believing that change is not needed as they remain stuck in the slow lane.

Change is inevitable. The 5D process is not a fad, but is the future, and the future is now.

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Clark Construction Group is part of a team that has been awarded a \$186.9 million contract at the United States Navy's Recruit Training Command Center in Great Lakes. CBZG Design Builders, LLC – which includes Clark, Blinderman Construction Company, M+W Zander U.S. Operations and Graef, Anhalt, Schloemer & Assoc. – will rebuild the Camp Porter Barracks.

The Camp Porter Barracks project will complete \$787 million worth of changes by the Navy at what is now its only boot camp, which was opened in 1911. The project includes three recruit barracks, a visitors center, an arms marksmanship trainer, a parking structure and the demolition of 14 buildings. Target completion date is November, 2010.

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