HEXAGON

White Paper

Accurate 5D BIM

How 5D BIM is Creating Better Outcomes on Construction Projects

Contents

5D BIM

5D BIM is a five-dimensional way of showing the physical and functional aspects of any project. 5D adds the element of cost to the already existing time management and Common Data Environment (CDE) components of information sharing in construction. When performed correctly, 5D BIM can optimize a project, impact schedule and cost, and ultimately save margins.

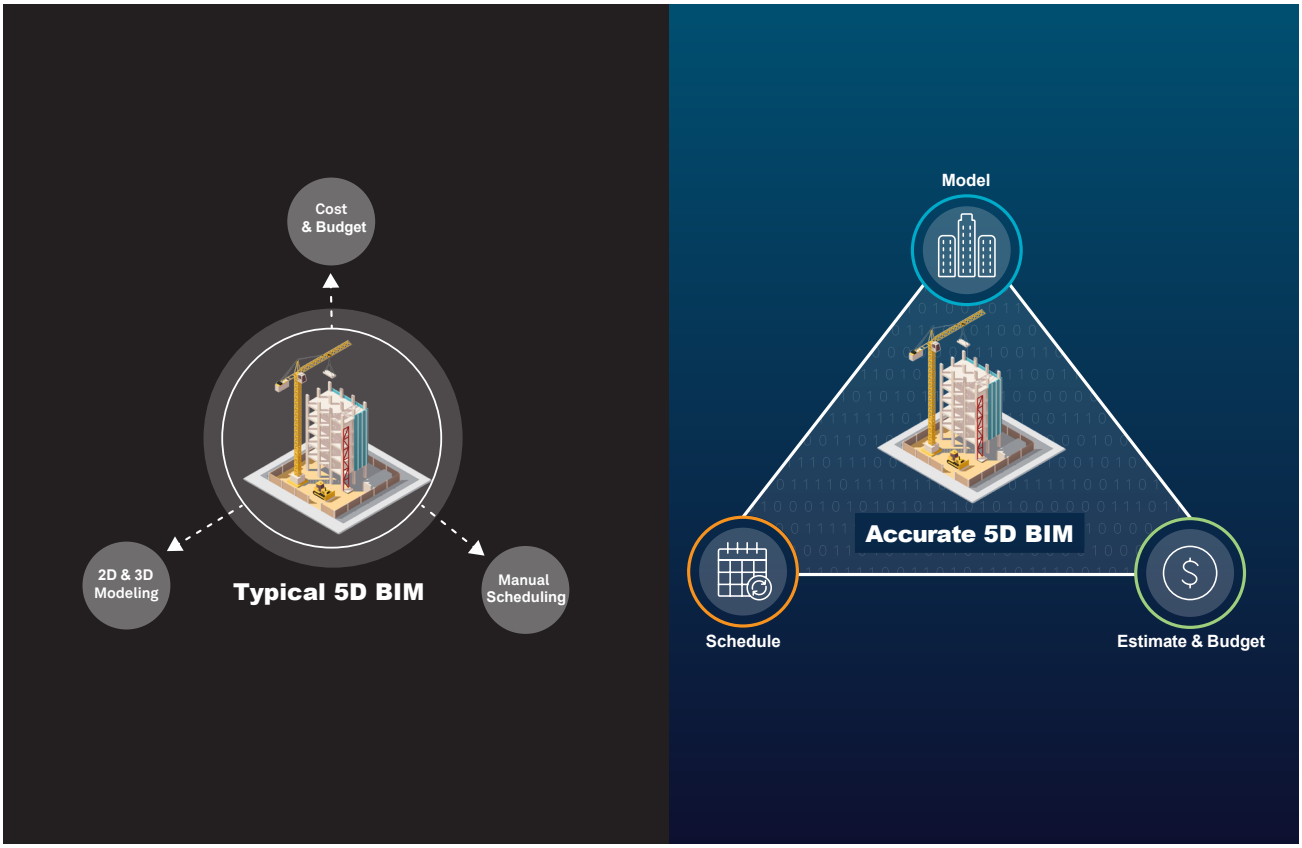
However, most solutions today are not purpose-built for 5D, and instead are a collection of data and solutions that only give a snapshot of scheduling, cost and ultimately a fake representation of reality. This is in part why more than 90% of construction projects continue to be delivered over budget and past deadline.

Accurate 5D BIM

Accurate 5D maintains model integrity and allows more people to be involved in the conversation from the onset instead of working in isolation, waiting to provide information about their piece of the project when it is time. This technology also enables automation of quantities to be processed quickly, provides more accurate data and allows the estimator to explore new ways of providing efficient designs, performance and costs.

This contrasts most 5D workflows and processes today, ones that are laden with data translation, outdated information and a lack of real-time estimating. Accurate 5D BIM aids in all aspects of the construction industry, but the ones who get the most benefit of this extra dimension are the project managers, estimators, general contractors and ultimately the owner. They all are in a unique position to drive greater project integrity and decision making by providing insights into the project scheduling and cost. More owners are looking to achieve this level of delivery from their general contractors because of its benefits, and it is simply smart business.

So, it follows that many projects are using a “traditional” 5D BIM workflow. They are typically a conglomerate of model-based data, estimating spreadsheets and field updates (blueprints) taken at intermittent times during a project lifecycle.



Accurate 5D BIM relies on a CDE where all different project agents can collaborate and exchange valuable feedback. In that sense, 5D BIM software can have a powerful impact on the construction management process when it comes to cost-related information. More analytically, thanks to 5D BIM, data connected to cost are continuously updated as the project progresses.

This means that cost is dynamically evolved and readjusted instead of solely being denied at the beginning of the project, or intermittent project audits.

It's a revolutionary approach that makes it easier for the project managers to monitor changes while keeping the project running within the agreed budget. In the long run, this can improve cost predictability and resource management. On top of that, establishing a good connection between the construction site and the office will prevent teams from working in silos and will pave the way for better decision making.

Of course, digital adoption plays a decisive role in the successful use of accurate 5D BIM software.

And as more construction companies embrace digital transformation, they become capable of achieving accurate 5D BIM. Otherwise, the new project data will never make it to the BIM model. Once this barrier is down, everyone can be sure that they are working on the latest and up-to-date project version.

> **One of the most time-taking and error-prone activities ... is literally the process of taking off measurements and quantities from a set of drawings. Generally, this process has involved physical blueprints or, today, digital versions of those blueprints."**
>
> **Walter Davis, Estimating Market Manager**

Additional Benefits of Accurate 5D BIM

Accurate Cost Estimating & Forecasting

5D BIM implementation enables contractors to create accurate cost estimates as the quantities of building components are accurately identified from 3D models. This helps project stakeholders to develop a reliable cost estimate for the entire project, right from the beginning. When the cost estimates are accurate, there are fewer chances of risks and losses due to mismanagement and miscommunications.

Detailed Quantity Take-Offs

According to industry surveys, estimators spend most of their time in creating quantity takeoffs. A 5D BIM implementation paves the way for automation of the development of quantity takeoffs. This helps in saving time on Bill of Quantity (BOQ) generation and at the same time eliminates chances of error due to manual reasons. When the BOQ development process is automated, estimators can spend saved time on critical aspects like accessing financial risks and generating pricing models. With 5D BIM, all the cost information is linked to a 3D model which makes it easier to deal with the problem of liquidity in construction projects. As the financial estimates are linked to the work and time, the resource quantification process becomes faster, leading to a reduction in on-site issues due to finances or frequent changes.

Real-time Changes to Quantity Take-offs as per Design Modifications

Every change in any component or design impacts the cost of the project. With 5D BIM, the change in cost gets automatically reflected in the BIM model. As the take-offs and measurements are directly calculated from the BIM model, the information stays consistent throughout the project lifecycle. Also, the changes made to quantity take-offs are updated in all associated documents, schedules and other measurements used by an estimator.

Faster Decision Making

When cost estimation and budgeting is quick, it becomes easier for project stakeholders and other key decision-makers to make better and informed decisions quickly. Be it a contractor, sub-contractor or owner, every decision is transparent, which boosts the speed of project development and completion.

Improved Collaboration Among Stakeholders

BIM is an advanced technology that allows all the stakeholders to work on a single model from various locations and devices. This means that all stakeholders can work simultaneously and make changes together to augment the collaboration process. When everything is being reviewed and changed in real-time, the prospects of collaboration broadens, and everyone in the team stays onboard the changes made to the central BIM model.

Challenges to Accurate 5D BIM Implementation

Despite several advantages of 5D BIM implementation, the adoption process is slower, owing to several unique challenges and barriers. These barriers make the process of accurate 5D BIM adoption challenging for a real-life project.

Lack of Single Software Solution for 5D BIM Implementation

At present, few software vendors have a single solution that delivers accurate 5D BIM using a single platform. Or, they leverage proprietary formats coupled with a cloud environment, locking your data away. In fact, most vendors deliver a "traditional" 5D BIM solution due to a portfolio that is largely created through acquisitions leading to time-consuming data aggregation techniques for the customer, instead of a purpose-built solution that provides an integrated solution for 5D.

Traditional or Typical BIM Workflows

BIM Phrases and Terminology from the last decade still have gaps that require manual processes to move data between each phase of a project. A recent poll conducted during a Hexagon "5D BIM with HxGN Smart Build™" Webinar concluded that 60% of respondents cite that they identified with either terminology of Hollywood or Lonely BIM in application as opposed to accurate 5D BIM where Smart Integrations connect 3D + 4D + 5D BIM elements giving insight into Schedule and Cost and unlike some of the commonly used BIM phrases (as mentioned in a BIM Services article, *Enrich your knowledge about BIM terminology*) are below:

Hollywood BIM

When Building Information Models are used only to communicate the concept of BIM in 3D and are not used in building projects to enhance its productivity it is known as 'Hollywood BIM.' This kind of BIM is used by contractors to simply win jobs. This concept of BIM is no where utilized in building projects to make them efficient.

Lonely BIM

When BIM is optimized by an individual firm to execute a project but is restricted from sharing to other organizations involved in project execution, then it is known as 'Lonely BIM.' To make this concept a little clearer, for example, if in case a design firm optimizes BIM to execute certain services demanded by clients but does no share BIM models designed by it with other teams or organizations involved in the execution of same project it is considered as lonely BIM. Instead of sharing the model with other teams they just end up in providing 2D CAD drawings to them.

Social BIM

However, social BIM can be considered as a more collaborative approach. In this approach BIM models generated for construction purpose are shared between architects, engineers, contractors, subcontractors and as well as with owners. The project productivity is achieved highest in this kind of collaborative approach. All the stake holders anyway associated with building project can have access to information-rich building models.

Intimate BIM

Intimate BIM is a very different concept in which the fruits and risks involving the project are contractually shared between contractors, design team and owners. In other words, all the risks and rewards related to the project are shared between them.

Challenges to Accurate 5D BIM Implementation

High Cost of Implementation

5D BIM requires contributions from key personnel on a project including all stakeholders. This takes an enormous amount of time initially, as everyone must be brought on to the same page. The longer it takes for a project to initialize, the higher the cost. Also, 5D adds another step during initial planning, increasing the time window again. When project management sees an increase in time and cost, they are opposed to the idea of 5D BIM adoption.

Change Management

The biggest challenge is to prepare teams for a changed workflow, convincing them to adopt the change. Many humans are averse to change, in general. Incorporating 5D BIM through new software tools requires existing team members to learn new skills and work on an entirely new domain, which makes them wary of future implications.

At the same time, most software tools that have 5D BIM implementation options require a high degree of expertise to master for real-life implementation. This requires teams to learn new things and be trained from scratch, making the 5D BIM implementation process harder.

Increased Risk Exposure

Using 5D BIM models increases the risk of all the stakeholders. There is a massive debate on legal issues such as the ownership of the BIM models, the right to accessing information in BIM models and who is in control of the information. Moreover, the accountability of a stakeholder in case of error is diluted in a collaborative environment such as 5D BIM. This increases the risk of a stakeholder concerning the damages, in case they occur, which discourages companies to use 5D BIM.

Incompatibility with Industry Standard Cost Planning Formats

There is a huge gap between the available 5D BIM practices and the industry standards for cost planning in several countries around the globe. The industry recognized cost planning format is not entirely compatible with 5D BIM practices. Generally, BIM models are prone to design errors and omission of important information, which makes the cost estimates inaccurate.

Who Benefits from Accurate 5D BIM?

Accurate 5D maintains model integrity and allows more people to be involved in the conversation from the onset instead of working in isolation, waiting to provide information about their piece of the project when it is time. This technology also enables automation of quantities to be processed quickly, provides more accurate data and allows the estimator to explore new ways of providing efficient designs, performance and costs.

What Does Accurate 5D BIM Mean to Cost Managers?

Currently, cost managers might produce an indicative cost plan at the outset of a project and then update it once or twice as a project develops. They only cost complete designs at the end of a long iterative chain when their project team has finished designing. In a BIM process, cost managers are engaged right from the outset and are equal players in the project team. What does 5D BIM mean for cost managers? Accurate 5D BIM represents less work for them, but it's less work done more often.

In total, it's the same amount of work, and their contribution is more highly valued by their colleagues and project team peers. If anything, cost managers are likely to become more valuable as a result of the 5D BIM process. Their time is freed up from painstaking manual take-offs in the later stages and used in faster, more accurate cost reporting up front at a much more influential stage. They effectively maintain a "living cost plan" and become invaluable in helping their teams design to budget.

Accurate 5D BIM can be a game-changer for cost managers, as well. In general, it adds much more flexibility to their work and improves considerably their decision-making process. Simply put, through accurate 5D BIM, cost managers have full control over a project's budget, as any alteration or update on the design reflects directly on the budget.

Based on the available data, cost managers can quickly access price estimations and provide project teams with instant feedback on executing or developing a task, or even an entire stage of a project, within the agreed budget. Furthermore, by connecting cost to planning, there is a more accurate ordering process. Cost managers know with great precision when items are needed on site, and they can plan their orders accordingly.

In that scenario, project teams avoid having materials or equipment sitting unused on site for long periods, and they are also in a position to plan ahead and submit orders for long-wait items in advance so they arrive at the right time.

Of course, digital adoption plays a decisive role in the successful use of accurate 5D BIM software.

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Benefits of 5D BIM for cost estimation:

- Quickly estimate and provide project teams with instant cost information
- More frequent cost analysis helps maintain project margins over the project lifecycle
- Provide better project output due to enhanced scheduling of activities based on current and available building materials

What Does Accurate 5D BIM Mean for General Contractors?

It is not much of a surprise that accurate 5D BIM information with rich intelligent models and real-time estimates are appreciated by contractors. The fourth dimension “Time” and 5th dimension “cost estimation” play a vital role for general contractors in winning the bid for any project.

BIM for general contractors equipped with intelligent and information rich 4D and 5D models have direct as well as indirect benefits for the work managed by a contractor:

- Accurate estimation helps win trust with the owner and winning more bids
- Generate fast and accurate cost reporting allows better financial decision-making
- Owner confidence is increased through more accurate reporting and estimating over the span of the project

What Does Accurate 5D BIM Mean for Estimators?

Accurate 5D BIM implies that the costing software used by an estimator has access to the data contained in a 3D model. One of the most time-consuming and error-prone activities performed by estimators is a process called takeoff. This is literally the process of taking off measurements and quantities from a set of drawings. This process involves physical blueprints or digital versions of those blueprints.

Access this information in a 3D model without manually measuring or counting everything in the project can multiply an estimator’s productivity by an order of magnitude.

- Data confidence means not having to inject a buffer on your estimates
- Estimates become available faster and provide accurate information throughout the project
- Alternatives and versions of a project are easily evaluated due to real-time data analytics

Resources

https://www.letsbuild.com/blog/5d-bim-in-construction

https://consultleopard.com/5d-building-information-modeling-bim-and-cost-analysis/

https://www.united-bim.com/barriers-benefits-of-5d-bim-implementation-in-the-construction-industry/

https://www.clouda2k.com/post/entering-the-5th-dimension-3d-bim-to-5d-bim

https://www.bimservicesindia.com/blog/4d-and-5d-bim-modelling-an-overview/

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Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous — ensuring a scalable, sustainable future.

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