MiTek®

BIM BEST PRACTICES

CONTENTS

[1.00] INTRODUCTION

This document serves as a guide to anyone who is first getting started or transitioning into Building Information Modeling (BIM). It explores what BIM is, BIM's relevance to modern building practices, and potential challenges to BIM. It also offers a roadmap for successful BIM implementation and BIM best practices. It introduces the Integrated Project Delivery (IPD) approach where key stakeholders are involved early in the design process and how IPD integrates with BIM to provide a comprehensive process for the design and construction of dwellings.

This document also explores how MiTek can make BIM more accessible to those wanting to transition into BIM. The Innovation Build-Digital Asset Team (IBDAT) was created within MiTek to explore how to best work within an IPD process for BIM and what tools would work best. It is required to review the Process Guide for IPD Projects and BIM Project Execution Plan Template created by IBDAT in conjunction with this document. They explain specifics for project expectations, software best practices, and guidelines for team collaboration based on IBDAT's collective experiences from working on BIM projects.

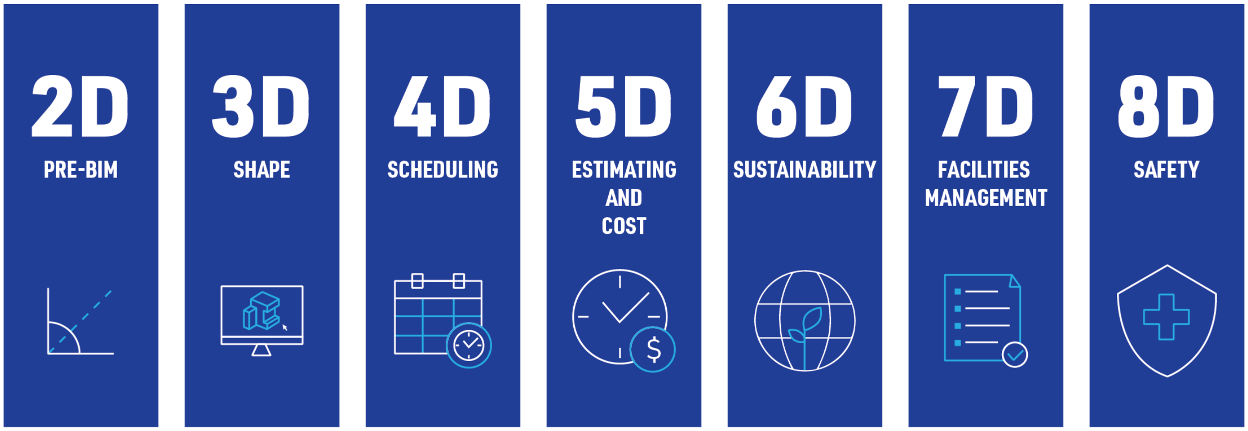
[2.00] WHAT IS BIM?

Building Information Modeling (BIM) is the process of creating a digital representation of a built asset where every detail can be openly explored, analyzed, and optimized by everyone involved before construction. Objects in a BIM model have coordinated and integrated, multi-disciplinary data (height, length, volume, etc.) associated with it to inform how it can be constructed in the real world. This data is leveraged to reinforce accuracy and consistency across the entire project lifecycle. BIM facilitates collaboration from all stakeholders involved to create a better, finished product.

BIM is a term that can mean:

1. Building Information Model—a digital representation of a structure.
2. Building Information Modeling—a process to create the intelligent model of a structure.
3. Building Information Management—a way to consistently achieve desired results during the modeling process.

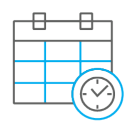
There are 7 recognized dimensions of BIM representing added levels of data integration that projects can undertake. As teams progress through these levels, the use of BIM tools allows for increased efficiency, better communication, and improved project outcomes. Each stage introduces more data and collaboration that helps reduce errors and improve decision-making in the final building. Ultimately, it is up to project teams how far they want to take a project.



→ 2D: Pre-BIM—Traditional 2D drafting with minimal digital tools and no data sharing. A project for a house at this stage is a simple drawing using either paper or simple 2D software. A door or window may be shown, but it is just part of a drawing with no real information attached.

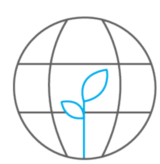
→ 3D BIM: Shape—3D BIM models with some data integration and improved collaboration across disciplines. A 3D house model now has information integrated. The doors and windows can have data attached such as dimensions, materials, and possibly manufacturers. Other team members on the project can also view and use this data if needed.

→ 4D BIM: Scheduling (Time)—The project model accounts for the timeline of the construction process. Depending on how detailed teams want to take BIM, elements such as doors and windows can have scheduled information to include a timeline of when they should be installed and track how long it may take.



→ 5D BIM: Estimating and Cost—Cost data is added to the model, enabling better budgeting and financial management. Along with time, you can add cost data to elements. Using our example doors and windows, the price and installation costs are included, helping to keep track of the budget as a house is designed.

→ 6D BIM: Sustainability—Sustainability and energy performance data are integrated, allowing for environmental impact analysis. Projects at this stage can assess element or system energy efficiency, carbon footprint calculations, and overall environmental impact. For instance, doors and windows can be simulated to see how well they are insulated and how it contributes to the house's overall sustainability.



→ 7D BIM: Facilities Management—The model includes all necessary data for long-term facility management and maintenance. After a project is finished, all the data of all elements is stored in the model. This can include details such as maintenance schedules and replacement timelines to manage the life of a building post-occupancy.

→ 8D BIM: Safety—This refers to the health and safety concerns of jobsites. With appropriate data, teams can identify potential hazards and simulate risks attributed to the construction process.

These 7 dimensions guide project teams through increasing depths of BIM, allowing for more comprehensive design, construction, and lifecycle management. As BIM continues to evolve, adaptations of its principles shape the future of what BIM should be, both in commercial and residential construction.

[3.00] WHY BIM?

BIM itself is rooted in commercial construction where large-scale projects benefit from BIM's ability to streamline complex workflows, enhance collaboration, and manage large amounts of data. However, BIM's principles and tools are adaptable to residential construction. This makes BIM a valuable process even on smaller scales as proven by projects completed by MiTek's IBDAT. By using BIM, residential projects can also achieve benefits similar to commercial projects from improved design accuracy, better coordination between disciplines, and more efficient project management.

BIM's key feature is the ability to openly visualize and contextualize a model in 3D to solve construction assemblies means that potential design issues are less likely to be hidden. Issues can be fixed in the model now without incurring significant costs later in the field.

BIM under an Integrated Project Delivery (IPD) approach offers projects a higher chance to succeed by having key collaborators brought together earlier in the design process. This approach seeks to improve the original product design by having multiple disciplines provide effective design input where changes will least affect a project's budget. When all disciplines collaborate and coordinate early for the creation of a digital building, BIM achieves several benefits.

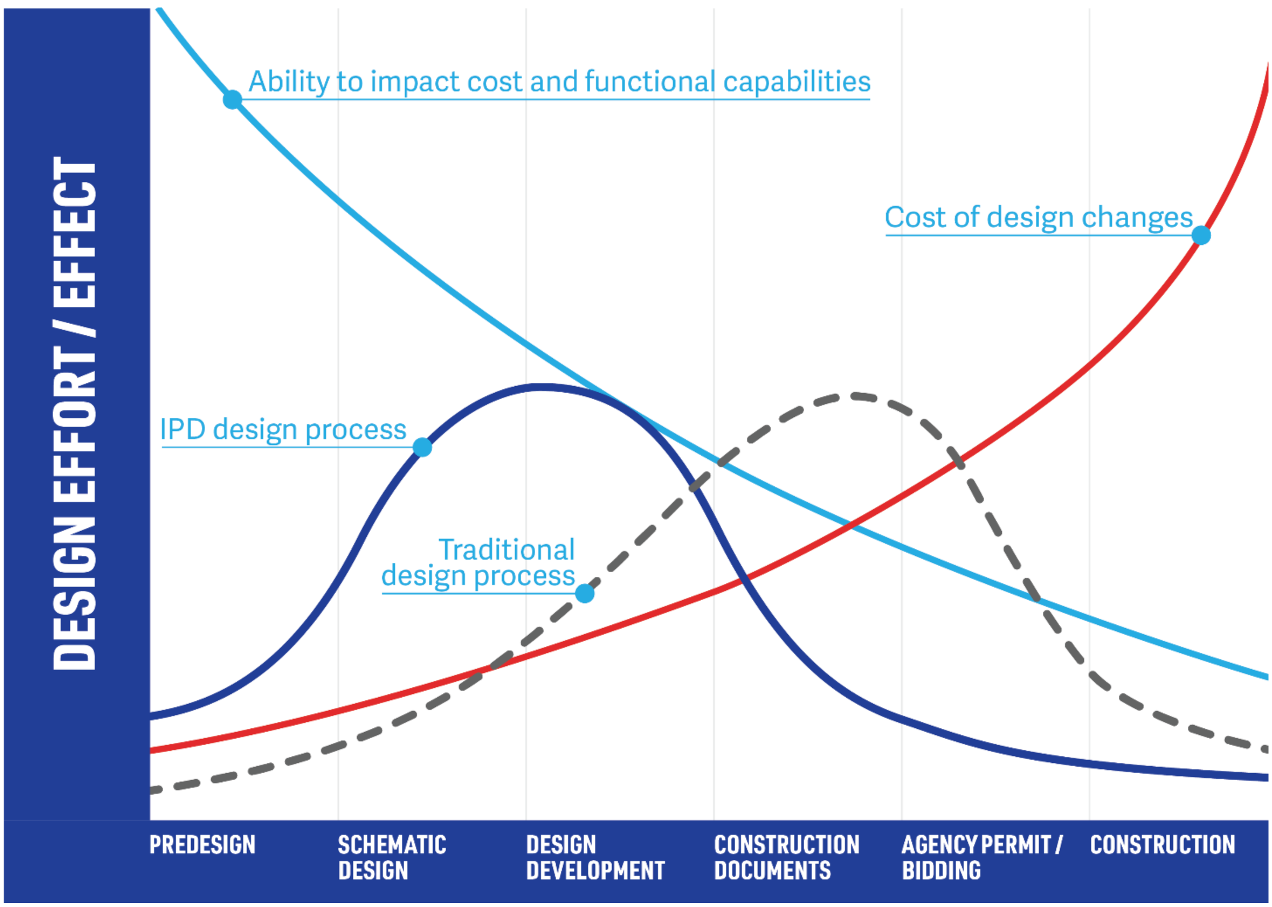
1. Reduces the chance of costly mistakes through visualizing building systems virtually to reduce errors and conflicts in design before construction.

2. Enhances collaboration/coordination by engaging all involved disciplines to work with a unified, single source of truth model.

3. Improves quality by enabling more informed, collective decision-making as the project life cycle continues.

4. Facilitates sustainability through digital analysis and optimization of building systems to enhance design and assess performance early in the design phase.

5. Actively tracks progress across a building's entire life cycle from inception to post-construction when needed.

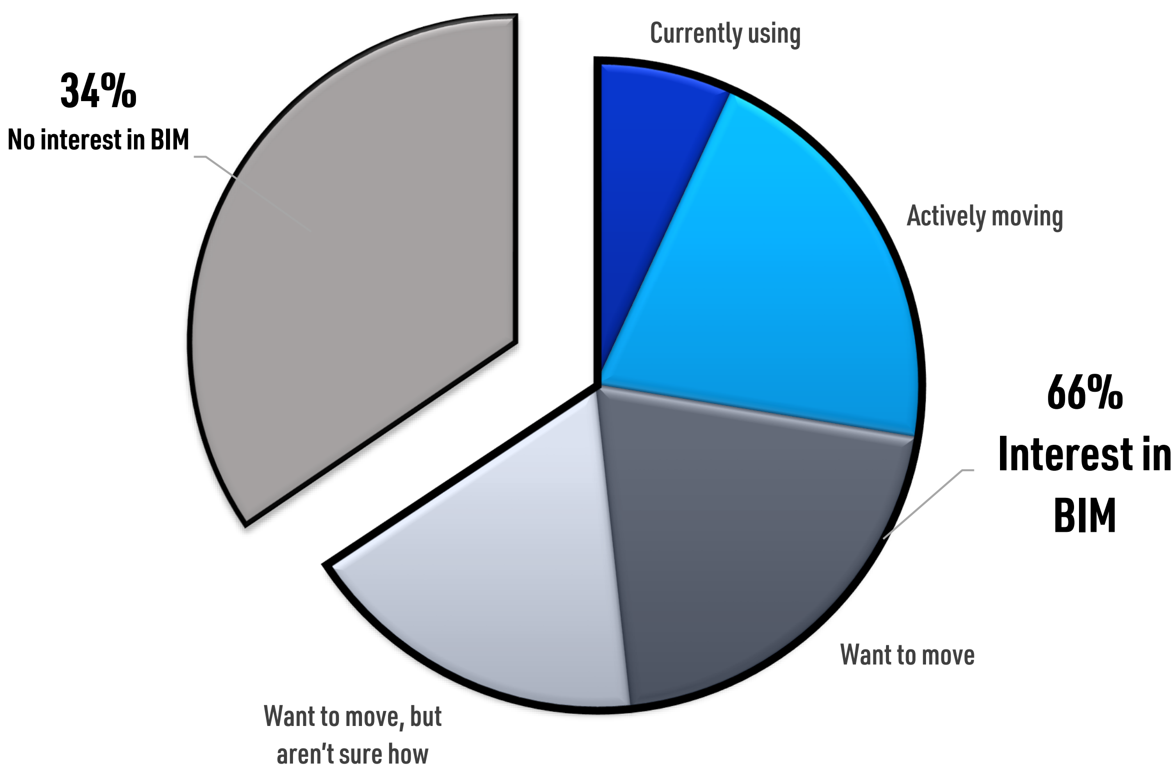


MacLeamy Curve from DYNAMIC ENERGY SIMULATION TOWARD INTEGRATED DESIGN OF NON-RESIDENTIAL BUILDINGS Model description simplifications and their impact on simulation results.

The beginning of any project is the most important as it sets the stage for everything to come and IPD in BIM is often the ideal. However, not all BIM projects need to follow IPD, nor should it be expected. This document proposes that projects can achieve successful results as long as projects have an effective plan implemented, effort is placed earlier in design, and projects follow high-quality modeling standards to ensure accurate information can be extracted from a model.

[4.00] CHALLENGES TO BIM

Despite its benefits, there are several pervasive challenges to overcome for anyone still outside of BIM. Effective implementation of BIM practices is not as simple as just buying the right tools. MiTek conducted a home builder survey in 2022 that took a snapshot of current strategies and technological trends, including BIM's influence in businesses. MiTek's survey was sent over to 17,000 builders across the United States for feedback and over 150 builders of varying sizes responded. While the results of 150 builders do not represent the majority of the market, there are insights to be gained from the results. It is encouraged to review MiTek's 2022 Builder Survey for the full responses and information.



BIM Interest pie chart from the 2022 Builder Survey conducted by MiTek.

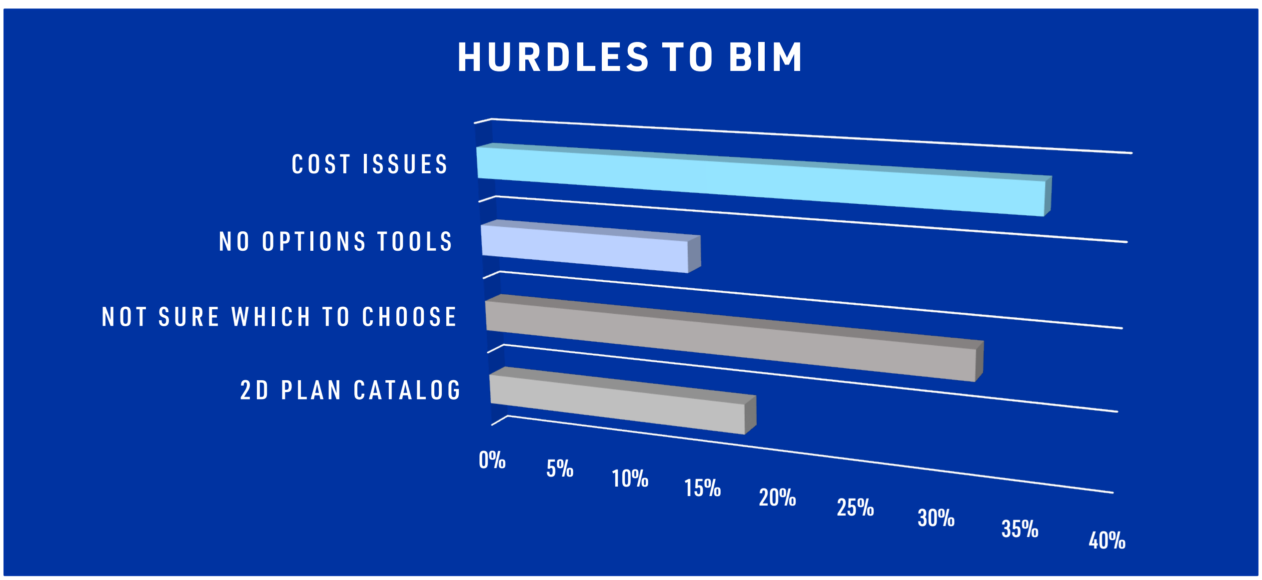
The survey found that of the builders who responded, 34% expressed no interest in BIM while 66% did have varying interest in BIM. The conclusion from the survey is that BIM has become more prevalent in Residential Construction, but there are several hurdles to BIM adoption—including perceived costs, fighting against established practices, and a lack of guidance.

Where MiTek can effectively participate to foster BIM includes:

1. Teaching and advocating customers the benefits of BIM.
2. Provide training opportunities on how to use BIM and its best practices.
3. Converting existing 2D project libraries to BIM models.
4. Acting as the BIM company for a customer to coordinate and manage BIM projects.
5. Authoring BIM best practices specific to individual customers.
6. Developing tools and processes that promote BIM, such as MiTek's Array plugin for Autodesk Revit®.

[4.10] COST ISSUES

The most significant hurdle to adopting BIM is the cost associated with buying, training, and implementing BIM. The perceived monetary and time costs often outweigh the benefits offered by BIM. For customers, it is important to note that the transition to BIM does not need to happen all at once. MiTek has the opportunity to guide customers from their unique position into the next stage of their process.



Hurdles to BIM bar chart from the 2022 Builder Survey conducted by MiTek.

[4.11] Existing 2D Plan Catalogs

Customers that have an existing library of plans may be reluctant to transition when a large body of work is still in 2D. The time and cost required for plan conversions can be prohibitive.

Plan conversions can often be seen as the first step before opening possibilities for BIM implementation. MiTek Services has the capacity to manage plan conversions and new projects while facilitating a transition process for customers to learn and adopt BIM.

[4.12] Learning Curve

For anyone still using 2D drafting, the shift to 3D modeling can be a significant challenge. Professionals will need to learn new software, new processes, and understand what it means to think in terms of 3D space. Structural components, MEP systems, and their interactions with the wall and floor systems will be more apparent in 3D because 3D demands careful attention to detail.

Adoption of BIM will require the effort to train others and that effort can come in the form of MiTek offering direct training services or partnering with a training provider.

[4.13] Implementation

The cost to implementing BIM can vary depending on the scale required and specific customer goals. Software licensing, hardware investments, training, data storage, process development, and ongoing maintenance all contribute as barriers to entry to BIM. Committing to any one solution can mean a significant change in a work process later.

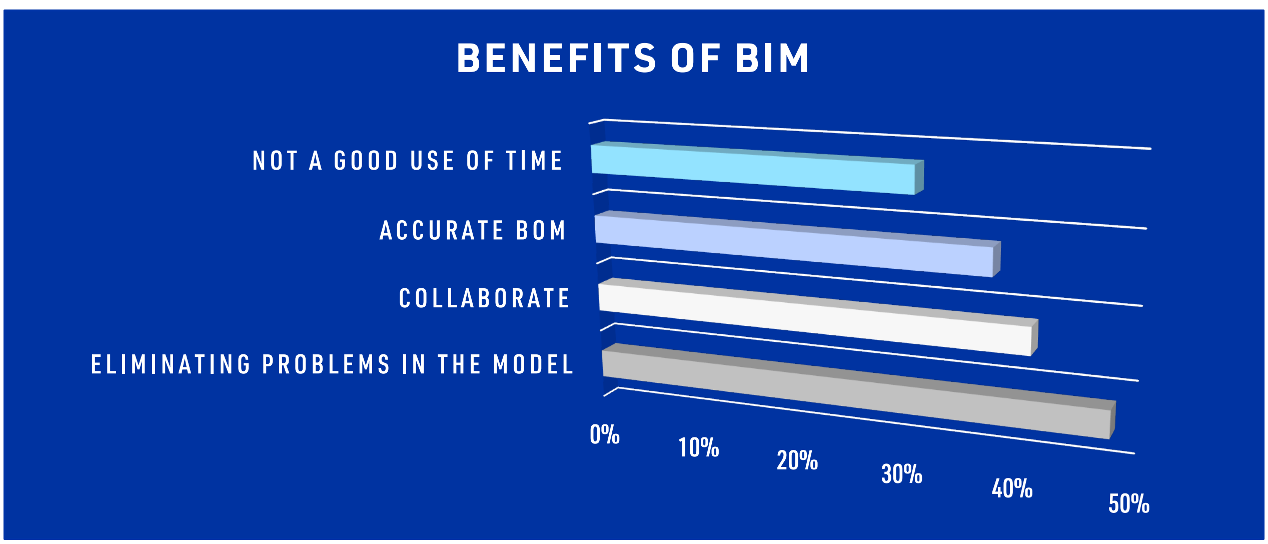
Depending on where a customer is on their process to implement BIM, they may require:

1. Consulting with MiTek in developing systems and processes for their business step-by-step.

2. Focusing on the front-end of their business while partnering with MiTek to take on the brunt of the implementation costs as exemplified by MiTek Services.

[4.20] LACKING GUIDANCE

If customers are comfortable with existing workflows, how can concerns about adopting a BIM approach be addressed? Reluctancy to transition can stem from inadequate information about BIM and a lack of guidance towards establishing effective BIM practices.



Benefits of BIM bar chart from the 2022 Builder Survey conducted by MiTek.

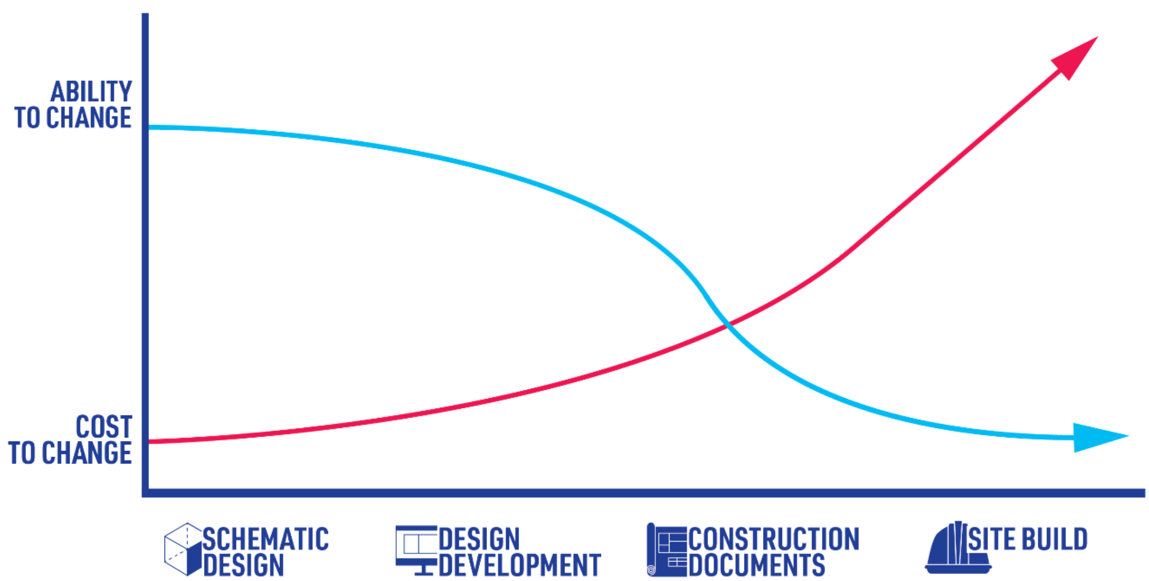
[4.21] Unaware of Benefits

Those uninterested in BIM may not understand its potential savings and benefit for future growth. Relevant and effective data needs to be demonstrated that shows why adopting BIM is beneficial.

MiTek's IBDAT has an encompassing body of work to highlight what those material benefits are and how to achieve them.

[4.22] Collaboration Hurdles

The traditional siloed approach is common for projects to fall into. The siloed approach is where a design is created and finished independently before disciplines further into a project's life cycle even see the design. This approach is the basis for costly changes later during construction.



BIM requires effective collaboration that puts more of the work upfront to reduce downstream workload. Customers may be offput by the shift. With clear guidance and approachable methods to foster open communication, early collaboration should be made the new norm.

MiTek's IBDAT's BIM Project Execution Plan Template and Process Guide for IPD Projects provide guidelines and a defined framework to achieve successful BIM implementation for projects.

[4.23] BIM Package Selection

Customers starting a transition to BIM can be overwhelmed by the wide range of software.

The prevalence of multiple software that accomplish the same task also means that there are ways to transfer information between software. It is important to note that regardless of the BIM software chosen, the benefits outweigh staying with traditional 2D.

Customers can adopt MiTek's preferred software packages or explore other options for themselves. MiTek's IBDAT has explored over 50 different software and settled on a list presented in their documents and here.

[5.00] BEST PRACTICES

There is not necessarily one best approach that should be advocated for, but there are commonalities between projects that can be referenced and built upon. What this means is that each project will present individual challenges, but an adaptable framework and protocol can lessen the initial burden in new projects.

Having an open framework that can be adjusted per project means that effort can be focused on making successful projects instead of having to redefine the framework entirely for each new project. Any developed best practices should be treated as living documents by improving them as new software or effective processes are discovered.

[5.10] PROJECT OVERVIEW

Traditional BIM collaboration is commonly referenced to start at project inception and carries through construction into operation and maintenance of a building. This section reviews the possible integration points for BIM collaboration and uses the concept of Level of Detail (LOD) that defines the quantity and types of data expected in a BIM model at stages of a project's life cycle. Level of Detail will be explained in the Milestones and Level of Detail section but can be thought of as the information expected per design phase.

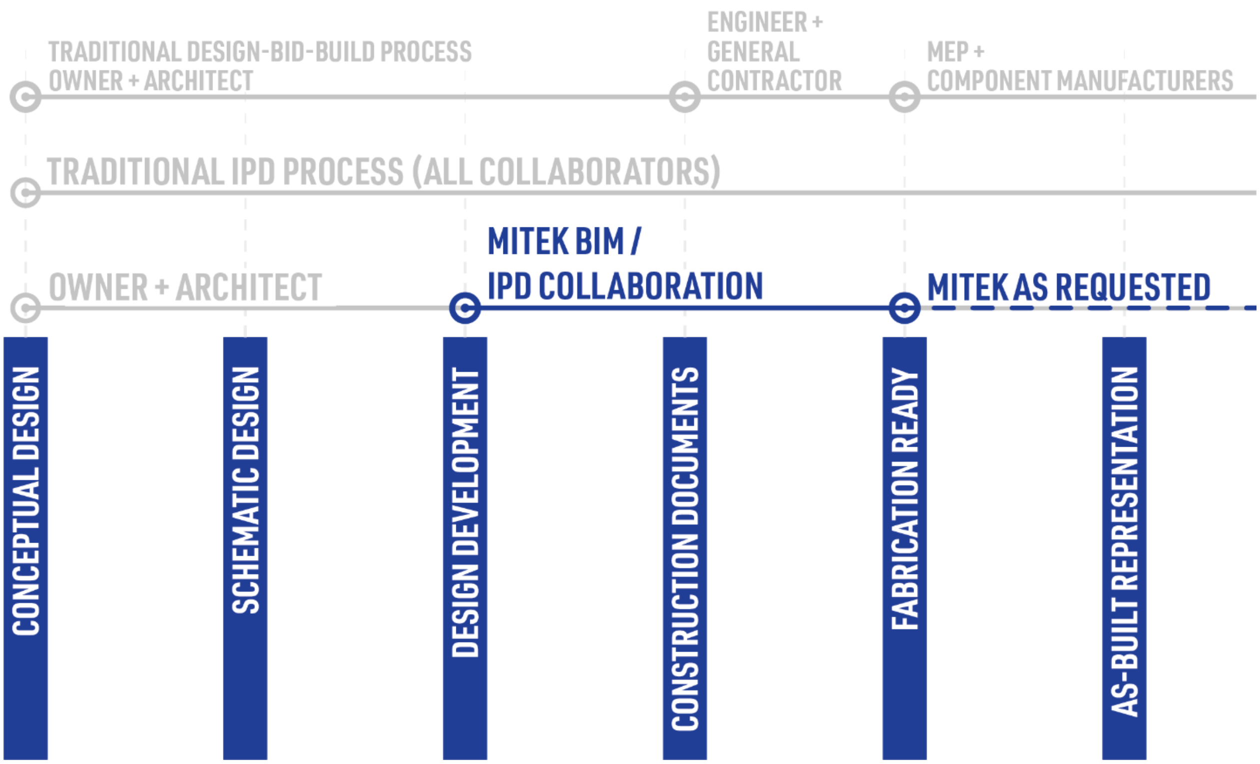
The IPD approach intends to make meaningful changes at the earliest point of a project's life cycle, but it is not required for a project to be successful. MiTek proposes a Hybrid approach for BIM that coordinates only the information needed. Depending on a project's scope, a tiered system can be applied to use BIM only where a customer requests.

A project can decide to use a full IPD collaborative approach, the traditional siloed approach, or a Hybrid approach as a middle-ground between the two. The end result is to have a building model that is consistent with computable information for construction.

[5.11] IPD Approach

A traditional IPD approach will try to bring all relevant collaborators as early as possible in a project life cycle. Starting further into a project's life cycle means less opportunity for design changes that negate costly mistakes. MiTek can still effectively facilitate BIM starting at the Design Development phase or Level of Detail 200 where approximate locations of modeled elements have been established. This is a good phase to start because it is early enough to make impactful, cost-effective design changes. Collaboration starting at this phase means that each discipline can integrate their ideas while still having room to be flexible with the building layout.

PROJECT MILESTONES



Key collaborators that should be included:

1. Owner
2. Builder / General Contractor
3. Architectural Designer
4. Structural Designer
5. MEP Systems Designer
6. Component Designer

A BIM Execution Plan should be established per project to determine the overall goals, what is expected of each participant, and the processes to achieve a finished project. It is recommended to define the coordination requirements between participants, including the Level of Detail expected for modeled elements that satisfies project requirements (see Milestones section for more information).

The plan agreed upon by collaborators for a BIM Execution Plan is the most realistic to achieving a project. Setting unrealistic expectations is counterproductive and leads to people ignoring the plan. MiTek can function as an agent to create all modeled elements as needed per project. If a dedicated customer team is unfeasible, MiTek Services can assist on a project-work basis to fill any gaps to complete projects.

As elements are modeled, collaborators should regularly review a federated model for clash detection and note any design issues to be fixed for the next model review. It is encouraged for online model reviews to be conducted with Virtual Reality (VR), which immerses users through a headset in simulated environments that enable interactive experiences with the model. In-person collaboration may consider Augmented Reality (AR) with mobile devices or tablets where a digital model can be visually superimposed over any space, including the real-world site. Both methods leverage the digital model by enabling real-time visualization and interaction at full scale.

When all modeled elements are finalized as agreed upon by the BIM Execution Plan for each respective discipline's model, the IPD process is complete at LOD 350, and construction can begin. A full Bill of Materials (BOM) will be generated that will contain a comprehensive list of materials, components, and parts required to construct the building.

[5.12] Hybrid Approach

BIM collaboration on a project can still be successful through a Hybrid approach where only selected collaborators participate, and a limited model scope is defined. A Hybrid approach should still establish a BIM Execution Plan to define a project's individual scope.

The success of a project will be dependent on what goals are set and the accuracy of its architectural model. The architectural BIM model must follow the same rigorous standards expected of the IPD approach where all necessary, constructed elements are modeled accurately to the real-world conditions. The quality of all subsequent work is dependent on the architectural model.

The following outlines levels of BIM where a higher tier includes work from the previous tiers:

→ BIM Level 0 – Traditional / Minimal BIM (LOD 300–350)

  → Little to no BIM information. At most, accurate door, window, and area schedules.
  → 3D models that satisfy 2D construction documentation, but not accurate enough for material estimation.
  → Collaboration mostly limited to sharing 2D drawings and the 3D model.

- BIM Level 1 – Architectural BIM (LOD 350)
    - Construction-accurate, architectural 3D model.
    - Complete visualizations can be completed from model.
    - Accurate architectural elements schedules.
    - 3D model collaboration with Owner / Architect. VR/AR preferred.
- BIM Level 2 – Selected MEP BIM (LOD 350+)
    - Construction-accurate, architectural 3D model with structure + selected MEP systems modeled (or none).
    - Accurate architectural with structure* + selected MEP systems estimation.
    - Federated 3D model collaboration with Owner, Architect, and selected MEP-systems designers. VR/AR preferred.
- BIM Level 3 – Full BIM / IPD Approach (LOD 350+)
    - Construction-accurate, architectural with structure* + MEP model.
    - Accurate, full Bill of Materials (BOM)
    - All key collaborators in regular VR and/or AR meetings with federated 3D model.

The intention of the Hybrid approach is to open up the common barriers to entry for BIM implementation and adoption. By taking smaller steps, customers gain the following:

- Starting with lower BIM levels contributes to gaining experience with BIM procedures and requirements. This opens the potential to build a BIM plan library now that can be adapted to higher levels in the future.

- The freedom to select which parts of BIM to employ gives way to focusing only on BIM practices that make the most impact for a customer while acknowledging that existing solutions for the remaining parts of a project are still viable.

*All structural integration will be in partnership with a Component Manufacturer or Lumberyard. MiTek will not create the structural model independently.

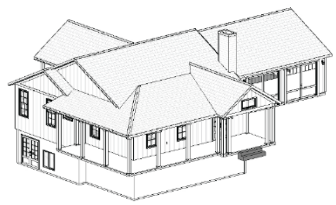
HYBRID BIM LEVELS

	MODEL INFORMATION	COLLABORATION	ESTIMATION

LEVEL 0
MINIMUM BIM

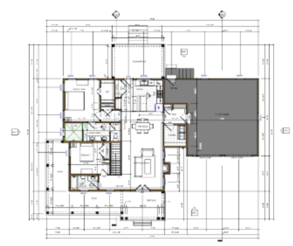
LOD 300-350
ARCHITECTURE

MINIMUM 3D ARCHITECTURE



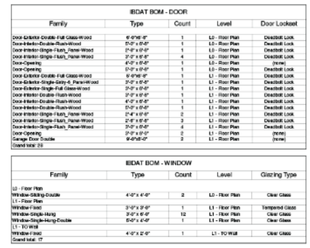
Minimum Architectural model for construction documentation

CONSTRUCTION DOCUMENTS



Limited to sharing 2D drawings and images of 3D model

LIMITED SCHEDULES

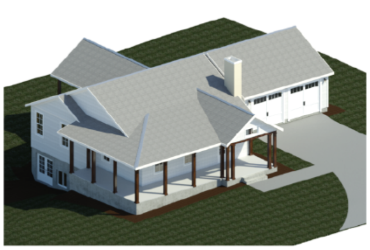


Minimum scheduled information—Doors + Windows + Areas

LEVEL 1
ARCHITECTURAL BIM

LOD 350
ARCHITECTURE

COMPLETE 3D ARCHITECTURE



Accurate Architectural model

3D MODEL WALKTHROUGHS

3D model walkthrough with Owner / Architect—VR/AR encouraged

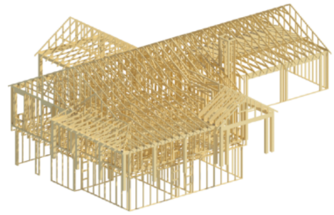
VISUALIZATIONS

Bill of Materials limited to only Architectural model

LEVEL 2
SELECTED MEP BIM

LOD 350-500
ARCHITECTURE
STRUCTURE*
SELECTED MEP

STRUCTURE*



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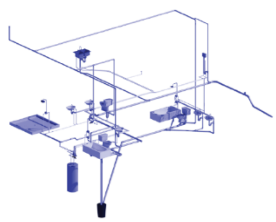
Accurate Architectural model + selected MEP / Structural* modeled

PLUMBING



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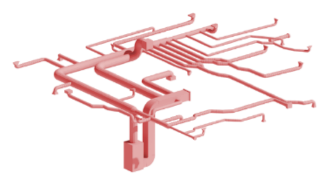
Federated 3D model walkthrough with designers—VR/AR encouraged

HVAC

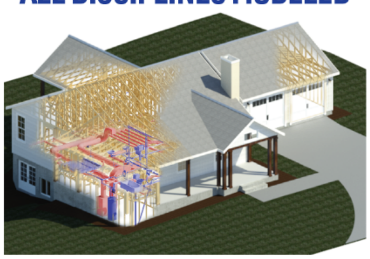


Bill of Materials complete up to selected MEP systems

LEVEL 3
FULL BIM / IPD

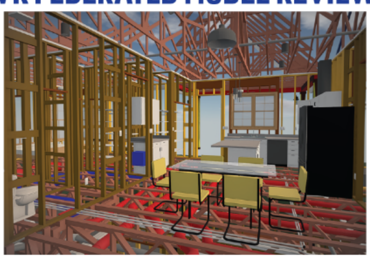
LOD 350-500
ARCHITECTURE
STRUCTURE*
ALL MEP

ALL DISCIPLINES MODELED



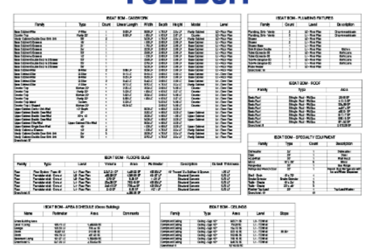
Accurate Architectural + Structural* + MEP systems model

VR FEDERATED MODEL REVIEW



IPD with VR/AR using federated 3D model with all key collaborators

FULL BOM



Accurate, full Bill of Materials

* All structural integration will be in partnership with a Component Manufacturer or Lumberyard. MiTek will not create the structural model independently.

[5.20] MILESTONES AND LEVEL OF DETAIL

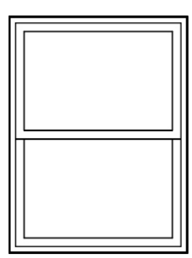
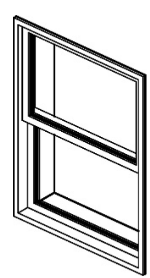
Of the various standards that track project progress, Level of Detail (LOD) defines the quantity and types of data in a BIM model at various stages of a project's life cycle. LOD divisions can be considered an extension of the traditional design phases. MiTek has opportunities to encourage BIM in the start of the Design Development phase or LOD 200 and onward by ensuring BIM practices are incorporated early in the model.

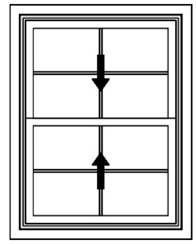
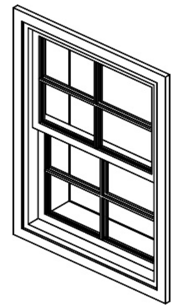
Earlier design phases such as Concept (LOD 0–100) and Schematic Design (LOD 100–200) involve fewer model elements while focusing on general location, overall aesthetics, and relationships between model elements. In Design Development (LOD 200–300) the project starts specifying exact functions, locations, sizes, and quantity. When all necessary data is met for construction, a project is considered in Construction Documents (LOD 300–350). By Fabrication (LOD 400), data such as assembly instructions and detailing are expected.

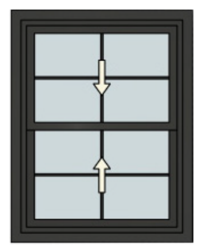
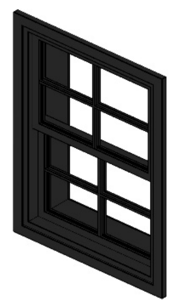
Graphical representation in a BIM model is dependent on the expected goals of a project. Be sure to consider the impacts and value of becoming more detailed than necessary. It is possible to represent exact manufacturer doors in a model with correct frame profiles and glazing. This can look great for visualizations, but the added geometry multiplied by the number of other same doors will increase file sizes and reduce overall speed.

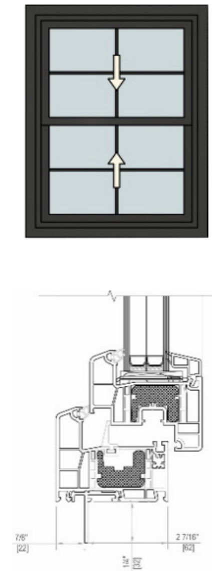
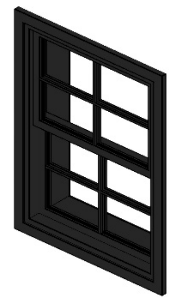
In general, only model what is necessary. If higher-end 3D visualizations are required, it should be managed separately in software designed for visualizations.

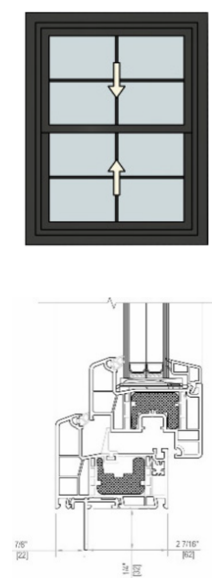
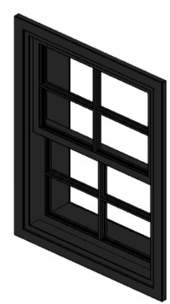
Below is an example of requirements for window model elements by the end of each phase. This can be part of a BIM Execution Plan to explicitly define the detail expected for each model element.

Model Element [Exterior Window]				
LOD	Project Phase	Description	2D Representation	3D Representation
100	CONCEPTUAL DESIGN	→ No windows considered or approximate location	None or simple openings in model	None or simple openings in model
200	SCHEMATIC DESIGN	→ Approximate location → Approximate size → Approximate count → Approximate type → Simple representation → Operation subject to change		

300	DESIGN DEVELOPMENT	→ Specific location
		→ Specific nominal size
		→ Modeled generic frame elements, color and glazing representation
		→ Operation and function indicated
		→ Non-graphic documentation:
		    → Performance characteristics
		    → Finishes
		    → Glazing type
				

350	CONSTRUCTION DOCUMENTS	→ Specific location
		→ Rough opening dimensions
		→ Additional non-graphic documentation present in element:
		    → Manufacturer
		    → Attachment method to structure
		→ Same model graphic representation as 300 or more detailed if desired
				

400	FABRICATION	→ Recommended to be managed outside of the model itself
		→ Shop drawing level with frame profiles and components
		→ All 2D graphic details can be included in the model
		→ Additional non-graphic documentation finalized:
		    → Hardware specifications
		    → Warranty
		    → Installation details
		    → Maintenance requirements
		→ Same model graphic representation as 300/350 for computer performance but can be more detailed if desired
				

500	AS-BUILT	→ All final construction, non-graphic documentation is included → All final construction 2D graphic details are included → Model graphic representation can remain the same as 300/350 for computer performance but can be more detailed if desired		

PROJECT MILESTONES + LEVEL OF DETAIL

TRADITIONAL DESIGN-BID-BUILD PROCESS
OWNER + ARCHITECT

ENGINEER +
GENERAL CONTRACTOR

MEP +
COMPONENT MANUFACTURERS

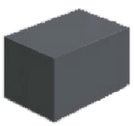
TRADITIONAL IPD PROCESS (ALL COLLABORATORS)

OWNER + ARCHITECT

MITEK BIM / IPD COLLABORATION

MITEK AS REQUESTED

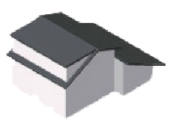
CONCEPTUAL DESIGN



LOD 100

The Model Element may be graphically represented in the Model with a symbol or generic representation. Information related to the Model Element can be derived from other Model Elements. Any information derived from LOD 100 elements must be considered approximate.

SCHEMATIC DESIGN



LOD 200

Generic systems, approximate shape and sizes where the Model Element is graphically represented in the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Any information that is to be derived from LOD 200 elements must be considered approximate.

DESIGN DEVELOPMENT

LOD 300

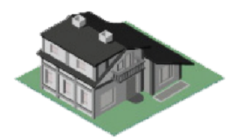
Specific systems, accurate shape, size and locations where the Model Element is graphically represented in the Model as a specific system, object or assembly in terms of its quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element. The project origin is defined and the element is located accurately with respect to the project origin.

CONSTRUCTION DOCUMENTS

LOD 350

Accurate shapes, sizes, locations and any supporting 2D Documentation to build the product—the Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, location, orientation, and interfaces with other building systems. Any non-graphic information may also be attached to the Model Element.

FABRICATION READY



LOD 400

The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly, and possible installation information. Non-graphic information may also be attached to the Model Element.

AS-BUILT REPRESENTATION

LOD 500

The Model Element is field-verified and given accurate representation in terms of element size, shape, location, quantity, and orientation. Any necessary non-graphic information like manufacturer names and data may also be attached to the Model Elements.

[5.30] PROJECT START

Refer to the project start-up and initial coordination section in MiTek's IBDAT's Process Guide for IPD Projects for specific information.

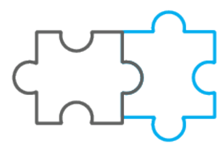
Regardless of using either an IPD or Hybrid approach, the start of any project needs to establish necessary background information. The initial coordination meeting should define the entire process to carry a project into completion. This information should be codified by all collaborators into a BIM Execution Plan that can be referenced.

[5.40] BIM EXECUTION PLANS

Refer to the BIM Execution Plan Template document by MiTek's IBDAT.

A BIM Execution Plan is a document that outlines how a BIM project will be executed, managed, and delivered as agreed upon by all collaborators. The plan can be recreated or adjusted on a per project basis. There are several recommended topics to be defined in plans:

1. Project Goals, Expectations, and Deliverables
2. Project Team and Contact Information
3. Roles and Responsibilities of each member or discipline (with Responsibility Assignment Matrix or RACI chart)
4. Meeting Protocols
5. Coordination Process
6. Software Used
7. File Sharing Practices
8. Naming Conventions
9. Milestones (determined by Project Phase, Level of Detail, Level of Development, etc.)
10. Terminology



It is important to define and agree upon by all collaborators what is in a project's BIM Model. A BIM Model can be an architectural, structural, and MEP models linked in a single Revit file or a single Navisworks file that is a federation of all models. There should be no confusion by anyone as to which model is being referenced for design changes.

It is better for BIM Execution Plans to be kept simple and define what is required. Being over-defined will discourage its use and invite mistakes.

It is also encouraged that each collaborator develops their own in-house BIM guidelines. By developing realistic, initial expectations and practices, they can be incorporated in any future BIM projects or BIM Execution Plans with future teams.

[5.50] TECHNOLOGY

Computers and software can come in a daunting range of specifications. If someone is to start working with BIM, what would they need? Unfortunately, there is no hard answer to this question. The technological landscape is constantly changing and what may be the best now might not be the best a year from now.

This section provides guidelines regarding technology.

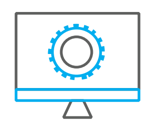
[5.51] Computer Hardware

Computer hardware is constantly changing and due to the rapid pace, individual parts cannot be named in this document. There is a balance that should be considered for improved productivity and speed in exchange for cost to upgrade every couple of years.

You can expect high-end computers to satisfy all current and most future needs for 5+ years to come. You can expect a computer at minimum–to–low specifications to meet current needs, but potentially struggle with future demands and require upgrading every couple of years. How should someone choose?

There are several questions to keep in mind when deciding on a computer:

1. What are you planning to use the computer for? Be specific.
2. What software will you need now and potentially in the future?
3. What operating systems do the software run on?
4. What is your budget?



Most BIM software is based on the Windows operating system. The most intensive, required tasks should be the driving factor for deciding on a computer. It is highly recommended to reference the system requirements from each chosen software's website and discover what the minimum and recommended computer configurations are.

In general, the most demanding computer tasks fall under visualization, modeling, and graphical editing software. Web-based software does not require anything more than the ability to access an internet browser, so even mobile devices will be useable.

Desktops offer the option for upgrading components in the future compared to laptops which has little to no upgradeability. Upgrading individual parts generally costs less than replacing an entire machine.

File storage is an important consideration. Files can be managed either locally on physical storage drives and network systems or using cloud-based services where third party remote servers host files for a subscription. File sharing for collaboration will generally be held using a cloud-based service because of ease of accessibility, scalability for large projects, and file management features like version control that prevent accidental file deletion or overwriting.

<table>
<tr><th colspan="2">General Computer Recommendations</th></tr>
<tr><td>CPU</td><td>→ Use the latest generation released for a CPU (Central Processing Unit)
→ CPUs generally fall under two groups—higher core count with slower speed and lower core count with higher speed. Generally, go for a higher core count, but balance with speed if cost is prohibitive.
→ Some software like Revit and 3ds Max® are multi-threaded, which means they will utilize multiple cores for a task and benefit from higher core counts. However, these same programs will also have single-threaded tasks that will rely on the speed of a single core.</td></tr>
<tr><td>GPU / VIDEO CARD</td><td>→ Use a dedicated GPU (Graphics Processing Unit) for visualization software or for GPU-accelerated functions in software.
→ Check your chosen rendering software's computer specifications web page for specific information and recommendations. (Example for Lumion® requirements here)
→ For visualization software, higher VRAM is important for complex rendering tasks for speed.
→ Most CPU (Central Processing Unit) come with integrated graphics built-in that gives the ability to use visualization software but provides an overall worse user experience compared to a dedicated GPU.</td></tr>
<tr><td>STORAGE DEVICES</td><td>→ A combination of different storage mediums will be more cost effective.
→ Fast storage mediums should be used for main drives while slower storage mediums with increased capacities can be used to archive files.
→ Separate personal or company servers may also be set-up if costs allow.
→ Cloud-based storage will only require internet access, no special physical components.
→ HDDs (Hard Disk Drives) should be avoided for main drives due to much lower speeds.
→ The following list is in order of greatest speed to slowest speed:
    → M.2 NVMe SSD (Non-Volatile Memory Express Solid-state Drive)
    → M.2 SATA SSD (Serial AT Attachment Solid-state Drive)
    → SSD (Solid-state Drive)
    → HDD</td></tr>
<tr><td>RAM</td><td>→ Minimum 16 GB of RAM (Random Access Memory), but 32+ GB preferred.
→ RAM capacity takes precedence over RAM speed if costs are prohibitive.</td></tr>
<tr><td>MONITOR</td><td>→ 2+ monitors (and/or wide screen monitors) for productivity to be able to reference information and work simultaneously.
→ Larger screens such as 4K resolution can replace multiple smaller monitors.</td></tr>
</table>

	→ If visualizations are a key part of a computer's use, color accuracy may need to be considered.
POWER SUPPLY	→ PSU (Power Supply Units) will depend on the total power consumption (in watts) of all critical components above. → It is advisable to add an additional 30% buffer to the total power consumption calculated. → Higher efficiency PSUs are more efficient and generate less heat. → A higher-end workstation can easily reach power consumption of 650W to 850W.

[5.52] MiTek BIM Software

This section lists relevant software to enable effective BIM implementation. This is not an exhaustive list. The list can be adapted and improved upon as software changes over time that better suits listed roles.

MiTek's IBDAT team has evaluated over 50 different pieces of software and settled on the following per role in a project.

BIM Software Per Role		
Role	**IBDAT Software Used**	**Computer Specifications**
ARCHITECTURE	Autodesk Revit®	Revit Link
STRUCTURAL LAYOUT AND DESIGN	MiTek Structure	
HAVC LAYOUT AND DESIGN	MiTek WrightSoft RSU and Right CAD	
PLUMBING LAYOUT AND DESIGN	Revit® MEP Tools	Autodesk Link
VR WALKTHROUGHS AND REDLINES	Prospect®	IrisVR® Link
2D REDLINES AND 2D COMMUNICATION	Autodesk Design Review	Autodesk Link
MEETINGS	Microsoft Teams®	Microsoft Link
SCHEDULING AND COORDINATION	Smartsheet®	Web-based
VISUALIZATION	Autodesk 3ds Max®	Autodesk Link
FEDERATION OF MODELS	Autodesk Navisworks®	Autodesk Link
BOM ITEM EXTRACTION	MiTek Array - Data Extractor	
CARBON FOOT PRINTING	OneClick LCA®	

Revit is part of the Autodesk Architecture, Engineering, and Construction collection of software that encompasses the majority of the market share for BIM authoring software. It is more likely to encounter other professionals using the same collection. Having a larger portion of the community using the same software results in more help documentation and tools being developed.

Designers should have a solid understanding of their chosen software, especially the potential limitations of their software. It is generally possible to achieve the similar goals across software of the same category, but there are different learning curves. Opportunities also change as each software is developed over time.

Regardless of the BIM software chosen, interoperability between different software is possible by exporting to commonly accepted file types. The Industry Foundation Classes (IFC) file format is one that establishes international standards to import and export 3D building objects with their properties still attached so that model data can be shared across various software.

[5.60] BIM SOFTWARE MODELING STANDARDS

Successful BIM projects utilize project templates as part of a living, BIM documentation process. Software template creation and process standards enable faster project times, reduce inconsistencies between modeled elements, and be scalable for future projects.

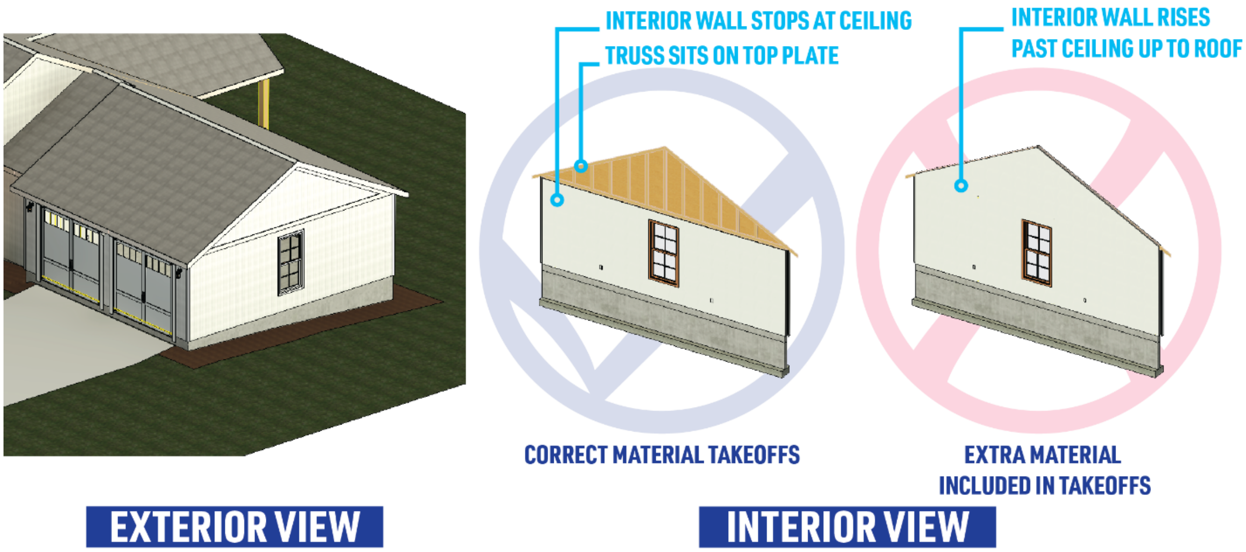
There should be agreed upon modeling standards from all collaborators (framer, component manufacturer, HVAC designer, plumber, etc.) that can be referenced within a BIM Execution Plan. A BIM model should only have the information that a BIM Execution Plan defines it to satisfy the requirements of the project. Over-modeling and creating analyses outside of the scope is generally wasted time.

This section observes the important modeling practices shared between projects. These practices are relevant to all BIM software and not necessarily for specific software.

[5.61] Architectural Model

The architectural model should be accurately modeled to mimic real-world construction techniques, assemblies, and products. High-quality modeling standards need to be followed to ensure necessary data for construction is accurate and complete. This model will be used in renderings, takeoffs, construction documentation, and more.

Careless modeling will add extra materials during takeoffs and contribute to increased file sizes. For instance, a gable-end truss wall can mistakenly be modeled to have gypsum wall board and studs on the interior when it should be unfinished with no studs visible. It can be easy to fall back on faster modeling methods, but attention to detail is required for BIM.



MiTek's IBDAT uses Revit to create architectural models, but any other BIM authoring software can work. Customers using Revit are encouraged to use IBDAT's Revit template and adjust as necessary to fit customer-specific standards and processes.

Standardizing common modeling practices, schedules, and family libraries leads to efficiency by spending less time adjusting projects and more time on impactful decision making. The template and documented standards should continuously be updated to better suit new software or processes that are more efficient and lead to better results for projects.

Refer to Revit best practices set by MiTek's IBDAT's Process Guide for IPD Projects.

[5.62] Model Elements and Materials

Following the requirement that architectural models need to mimic real-world construction techniques, all modeled elements should reflect accurate dimensions when possible. For instance, an accurately modeled wall should reflect correct plate heights (e.g., 9'-1 1/8" instead of 9' flat). Templates should have these common assemblies and materials built into it that cut down time from having to recreate it for future projects.

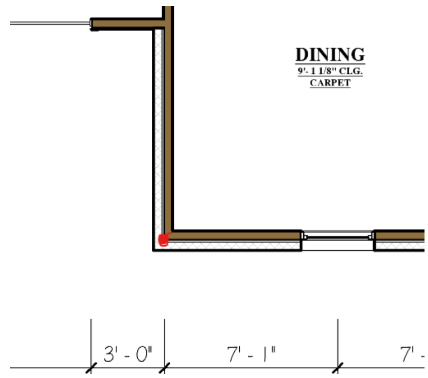
Software limitations may be present at any point in the process. There could be forced, temporary workarounds or processes for an architectural model. For instance, corner roof returns may cause problems when exporting as an IFC into structural software. Issues and their solutions should be documented. In general, modeled elements should be simple where possible to reduce issues.

Each discipline may use naming schemes for objects and materials that fit their individual company standards as long as it can be communicated easily. Individual company standards can be referenced in a BIM Execution Plan if needed for other collaborators in the project.

It is recommended that any project looking to use simulation and carbon footprint-tracking software be aware of any limitations that can arise from certain naming conventions (e.g., concrete being mistaken as CMU during data import). It is recommended to use MiTek's IBDAT Revit template where elements and materials are created for the OneClick LCA platform or to adjust the template as needed for other tools.

[5.63] Origin / Shared Coordinate System

Defining a project origin is paramount for BIM to ensure that all modeled elements are aligned as intended. The origin can be thought of as 0,0,0 in some software packages. Model federation will be easier when using a common point.



Generally, choose the bottom-left corner of the first-floor wood structural wall (as depicted by the red dot in the example image), not a porch or covered patio. Keep the established rule consistent between projects.

[5.64] File Naming

File structures and models to be shared between collaborators should have an agreed upon naming scheme that can easily identify its function within the overall project (e.g., 00-project-ARCH.rvt, 00-project-STRUC.rvt, and 02-project-HVAC.rvt). Naming standards should be part of the BIM Execution Plan and leave no room for interpretation of what is the latest model.

Refer to file storage and naming best practices set by MiTek's IBDAT's Process Guide for IPD Projects and the BIM Execution Plan.

[5.65] Visualizations

It is possible to use the BIM model as the visualization model for simple or preliminary renderings if needed. However, projects that require higher-end visualizations beyond the capabilities of the software used to generate an architectural model will likely need to export the model into software best suited for photo-realistic rendering. It is better to start any marketing visualizations after the main structure is finalized to reduce time needed for editing a second visualization model.

There can be limitations from directly importing an architectural model (e.g., from Revit) into rendering software such as Twinmotion and Lumion. Specific material adjustments (e.g., accent walls, roof planes, or material direction) may need to have materials mapped differently than what is normally built into an architectural BIM model. For this reason, it may be necessary to maintain a separate model for visualizations only.

A BIM model will also have to consider the amount of detail to be shown between what is necessary for construction and what is desired for visualizations. A window in a BIM model may use a simple rectangular cross-section for its frame. For visualizations, the window can be swapped out with an accurate frame profile if needed, but this can slow a computer down considerably depending on the detail, number of windows in a project, and computer hardware. In general, BIM models should only need to have a minimum amount of detail required to complete construction documents to save space and keep computer performance optimized.

MiTek IBDAT's Modern Farmhouse interior visualization.

To save time and direct energy towards more impactful decisions, decide what parts of a model require detail and what can remain simple. Visual changes like the previous window frame profile example offer little to no impact to visualizations. It is more important to consider the overall composition and framing of images or videos than smaller details.

[5.66] File Interoperability

In BIM projects, it is possible to model all necessary components from each discipline using a single BIM authoring software such as Revit or Archicad. However, this is not always practical or expected, especially in projects with multiple collaborators. Different team members may use varying software packages that are best suited to their specific needs. MiTek's IBDAT's list of software by role is an example.

It is important to understand the capabilities and limitations of each chosen software. Effective collaboration depends on each team member's awareness of the file types and specific data required when sharing information. Common file formats like .DWG, .IFC, and .PDF can be exported to transfer essential 2D and 3D information between different software. There could be specific modeling requirements or procedures so that necessary information can be extracted. For example, some software might need roof elements to be modeled as separate elements instead of a single roof element in order to get the necessary information from structural software.

For projects to manage these differences and limitations, a BIM Execution Plan should clearly outline procedures for data and information transfer. The plan itself can include standardized practices for exporting data to ensure software compatibility. This plan should be referenced so that every collaborator can work efficiently with their specific tools.

Refer to best practices set by MiTek's IBDAT's Process Guide for IPD Projects for importing and exporting into the different software IBDAT uses.

[5.67] Building Analyses

BIM software like Revit offer built-in tools or allow plugins that offer energy, lighting, solar analyses, and carbon tracking. Revit's cloud-based analysis feature is connected to Autodesk Insight that can assess the energy cost per area per year and give visualizations of key performance indicators.

Both energy analysis and carbon-tracking will inform physical building design, system selection, and material selection. Any project intending to use analysis tools should start using the tools early and be revisited multiple times as the design process evolves to inform better design decisions.

MATERIAL CARBON EMISSIONS BY SECTION		
Footings & Slabs	9,434	kg CO_2e
Foundation Walls	10,944	kg CO_2e
Structural Elements	107	kg CO_2e
Exterior Walls	977	kg CO_2e
Party Walls	0	kg CO_2e
Exterior Wall Cladding	1,263	kg CO_2e
Windows	1,518	kg CO_2e
Interior Walls	2,189	kg CO_2e
Floors	2,693	kg CO_2e
Ceilings	690	kg CO_2e
Roof	7,661	kg CO_2e
Garage	7,505	kg CO_2e
NET TOTAL	**44,981**	kg CO_2e

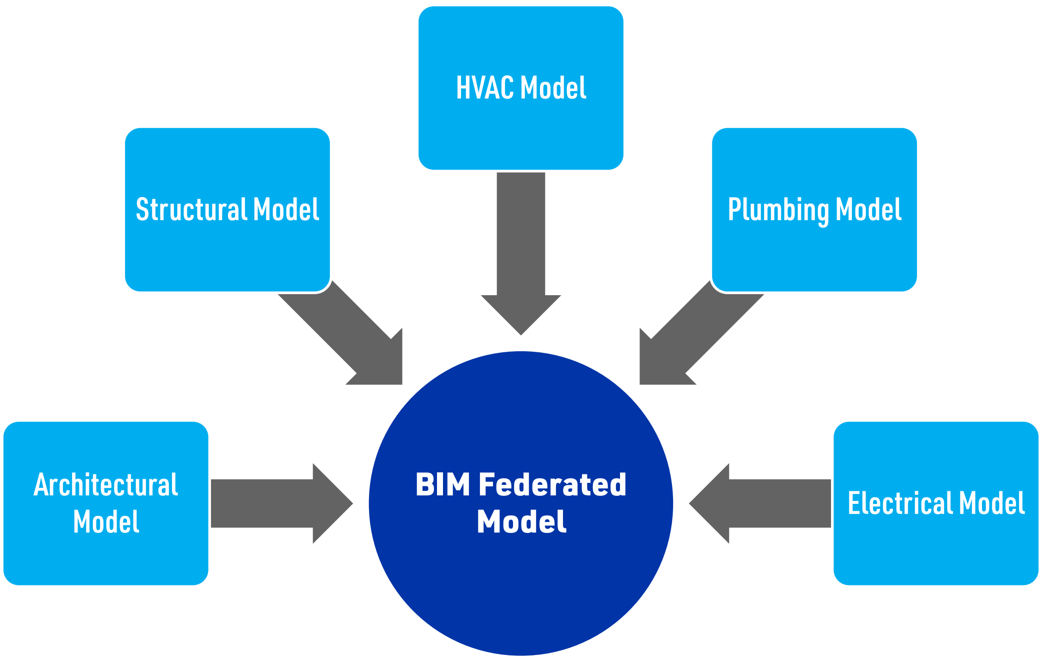
0 MCE (kg CO_2e) 15,000

MiTek IBDAT's Modern Farmhouse Material Carbon Emissions Report using the BEAM platform.

Refer to BEAM and Building Transparency's EC3 reviewed by MiTek's IBDAT for accessible, homebuilder carbon-tracking tools in the Process Guide for IPD Projects document. OneClick LCA is a recent addition to the software list that is currently being evaluated.

[5.68] Model Federation

Model federation in BIM is the process of integrating and managing multiple sub-models from different disciplines into a single, coordinated project model. Each discipline maintains its own model, and these are then linked into a central, federated model. This allows each team to work independently while ensuring alignment with the overall project.



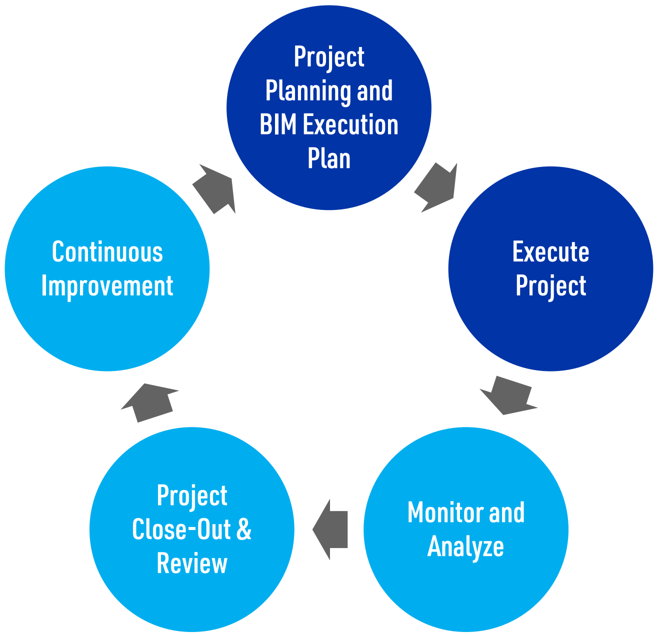
MiTek has settled on Navisworks for its ease of use, file type support, and ease of access to supporting documentation.

Cloud-based file sharing and storage will be the most efficient method to distributing information or models for teams. A BIM Execution Plan should outline how file storage should be organized so there is no confusion about which is the current model.

Refer to best practices set by MiTek's IBDAT's Process Guide for IPD Projects and the BIM Execution Plan for using Navisworks.

[5.70] REVIEW AND IMPROVE

After each project, collaborators should review and document any lessons learned. Any BIM best practices, BIM Execution Plans, and templates should be considered living documents that can be improved upon for future projects.



The following list is neither exhaustive, nor a list where collaborators are expected to try and answer everything. The list is meant to be an introduction to possible review points of a BIM project.

Process and Workflow Improvements

1. What best practices have we learned from this project that can be standardized for future projects?
2. Were there any areas where BIM provided unexpected benefits or drawbacks?
3. Was there anything about the BIM process that hindered the project?
4. Were there any discrepancies between the BIM model and the completed construction? If so, what caused the discrepancies?
5. Were there any discoveries that could help future projects?
6. Were there any unnecessary design decisions?
7. Did the BIM execution plan cover all necessary aspects of the project? Did it fall short?
8. How can we improve any training programs to better prepare team members for BIM projects?
9. How accurate and reliable were the cost estimations generated from the BIM model?
10. What strategies can be adopted to ensure all project collaborators are proficient in using BIM tools and workflows?

Software and Tool Evaluation

1. Were there any specific software issues? How were they resolved?
2. Which BIM tools and software templates worked well, and which did not? Why?
3. Were energy, water, and carbon analyses accurate to what was built?
4. What specific BIM capabilities would users like to see enhanced or added in the future?
5. How can we improve interoperability between different BIM software used by various collaborators?

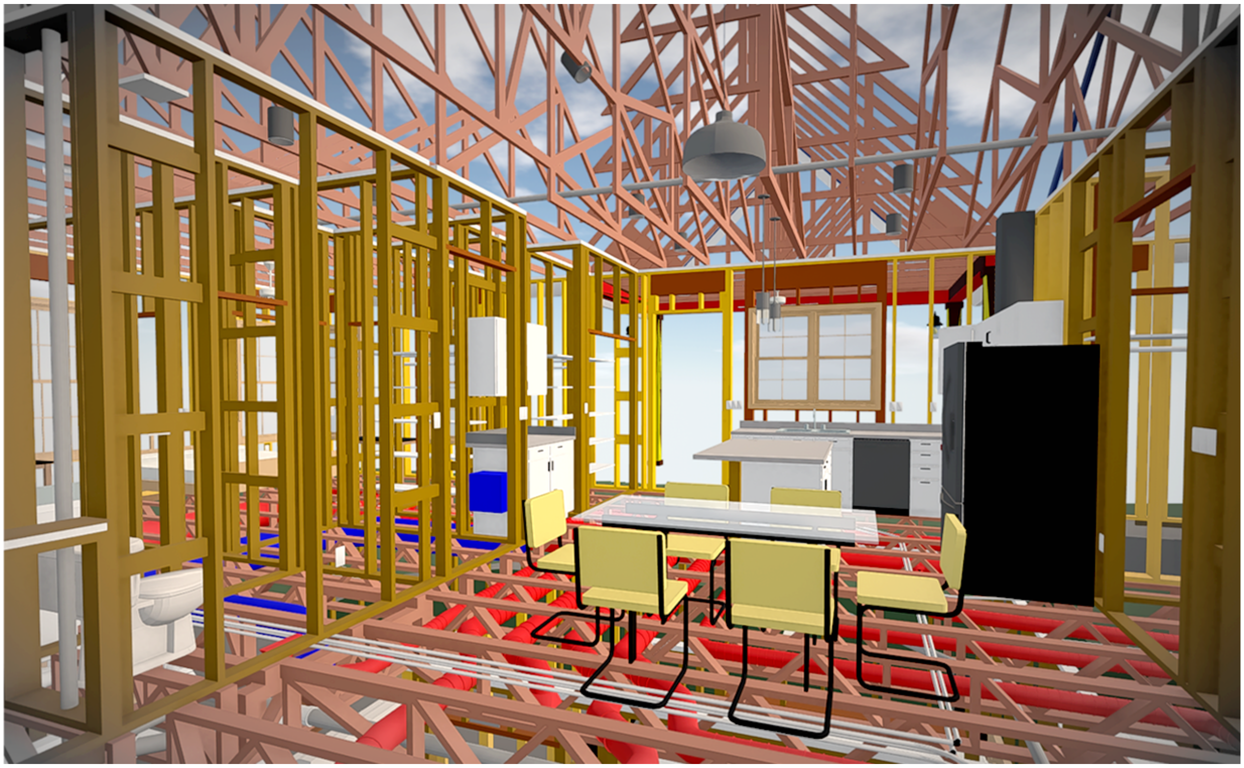
Collaboration and Communication

1. How effective was the communication among collaborators? Did each collaborator have equal say in the project?
2. What feedback do collaborators have about the BIM process?
3. How can we better integrate feedback from non-technical collaborators into the process?
4. How were conflicts between collaborators managed and resolved during the project?

[6.00] BIM FOR RESIDENTIAL

BIM has its roots in the commercial sector where the size and complexity of projects can readily leverage BIM's benefits. Hesitancy to adopt BIM for residential is common and often thought to be more of a burden for architects where only teams that are downstream in a project's lifecycle will benefit. This misconception is primarily due to projects being reliant on accurate architectural models. BIM does require accuracy and the architectural model is the general starting point. However, BIM is contingent on the quality of the team collaboration and a rearranged workflow that invests more time upfront for significant savings later.

It is important to understand the benefits BIM brings as a whole in addition to how individual steps in the process specifically benefits architects. MiTek has undertaken a role to define what BIM for residential means and how it can be viable to designers on smaller-scale projects. MITek's IBDAT has already proven how BIM's process is beneficial for designers and residential projects. For BIM to work well, there needs to be a shift in expectations of the perceived workflow and an understanding of the tangible benefits that BIM allows.



MiTek IBDAT's Modern Farmhouse federated model with structural, HVAC, and plumbing displayed in Navisworks.

[6.10] ARCHITECTURAL

BIM is transforming the architectural design process, making it more efficient, accurate, and collaborative. While some may perceive BIM as adding more work for architects, this is not necessarily the case. BIM tools like Revit will font-load much of the effort, helping architects create detailed, coordinated models from the start. This ultimately reduces errors and saves time overall of a project. By streamlining the workflow, BIM ensures that architectural designs are more precise and consistent, preventing issues that might arise later during construction. The upfront investment of time and effort ultimately leads to smoother project execution and fewer costly mistakes.

[6.11] Traditional 2D vs 3D BIM

Traditional 2D drafting can be labor-intensive and prone to mistakes. Architects must manually update different views such as plans, sections, and elevations each time the design changes. This fragmented process increases the risk of inconsistencies between drawings and potentially leads to errors that may only be discovered during construction. What kinds of opportunities does 3D BIM provide designers?

- Improved Visualization—3D BIM models offer realistic, detailed views of the project for design teams and customers to visualize the final building. This is especially helpful for non-technical customers who may struggle to understand an abstract, 2D plan.

- → Automatic Updates—Changes to BIM models are automatically reflected across all related views such as plans, sections, elevations, and even schedules. If a window is removed in one view, then it is removed from the whole model, including schedules. This ensures all documentation remains consistent and up-to-date.
- → Detailed Documentation—BIM provides a comprehensive project documentation linked to the model to ensure accuracy. BIM can automatically generate accurate schedules, quantities, and material lists that saves time from manual updates.
- → Clash Detection—BIM software can automatically detect potential clashes between elements prior to construction, such as any intersections between mechanical, and structural elements.
- → Data Integration—Object properties, material properties, costs, and more are incorporated into BIM elements. This allows for comprehensive tracking and evaluation for more informed decision-making across projects.
- → Collaboration in Real-Time—Multiple teams can collaborate simultaneously with real-time updates on the same working model. This reduces the risk of miscommunication and ensures all teams are working with the latest information.
- → Cost and Time Savings—Project timelines are more efficient due to earlier issue detection and better coordination among teams. There is a reduced need for rework or delays.
- → Energy and Sustainability Analysis—BIM software can simulate energy performance so that designers can optimize building orientation, materials, and systems for sustainability live.
- → Future Renovations—BIM models provide a comprehensive digital record or snapshot of a project and be kept for making future renovations or expansions.
- → Error Reduction—Precise 3D models help avoid errors that are common in manual 2D drafting, such as incorrect dimensions or misinterpretations. With 3D, it is easier to coordinate between elements to minimize design conflicts. For example, it is easier to spot a portion of the second floor intersecting a cathedral ceiling or an engineer may place a structural column in an area due to loads but was not visually intended to be there in the architectural design.

- Enhanced Design Flexibility and Drafting—3D BIM allows for easy modifications and a quick exploration of design alternatives that are instantly reflected throughout the model. With BIM, teams draw with components like wall assemblies, doors, and windows instead of lines.

The BIM process and its tools are an effective visual communicator that utilizes 3D to visualize elements and entire systems in projects. For designers, BIM can be an invaluable cornerstone for producing higher quality projects that ultimately save time, money, and future headaches by leveraging the capabilities of 3D.

[6.12] Visualization and Renderings

Architects using BIM will create a 3D model by default of the process that not only helps them design and communicate those designs more effectively, but also provides opportunities for high-quality renderings and visualizations. The initial effort in building the 3D model pays off by reducing time spent on presentations and client revisions by taking advantage of the visual opportunities 3D offers.

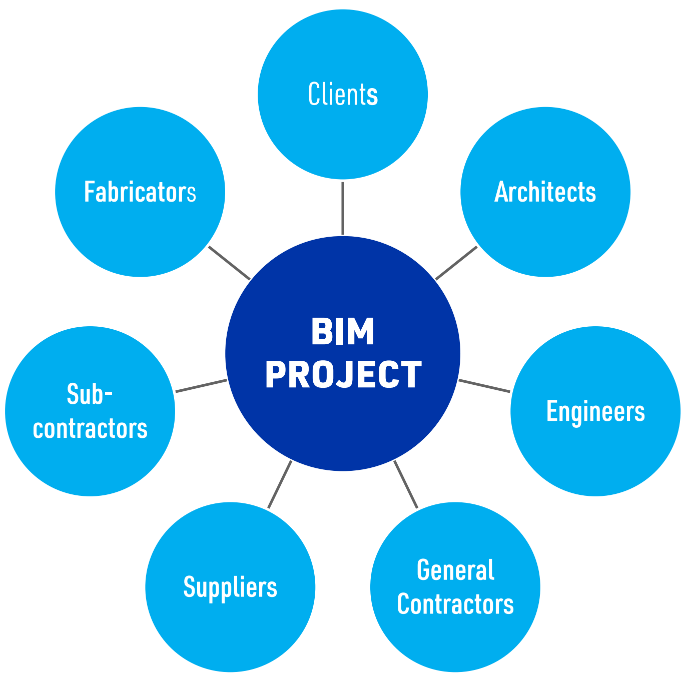
MiTek IBDAT's Modern Farmhouse exterior visualization.

Walkthroughs and renderings can be generated directly from BIM software like Revit. This allows designers to use their design tool live in customer meetings for customers to visually explore projects. As augmented reality and virtual reality becomes more integrated into the design process, it will be even easier to visually communicate potential design changes and their impacts.

If higher quality renderings are required, then the same 3D model can be imported and detailed in separate, more advanced visualization software. Photo-realistic images can be quickly generated as developed software has lowered the knowledge gap needed to create photorealism. The impact of Artificial Intelligence (AI) in visualization is already making another shift by allowing image content to be generated more easily than ever before.

[6.13] Collaboration and Coordination

A common refrain is that BIM increases the overall workload for architects. However, BIM's collaborative nature benefits all parties and reduces the overall burden on architects further into a project by shifting the investment of time to the beginning. BIM projects often resemble the Prisoner's Dilemma theory in that if all participants (architects, engineers, contractors, and all other key members) work together, the entire project benefits. However, if one party prioritizes their own interests and withholds information, it can lead to inefficiencies and conflicts, making the process difficult for everyone. BIM fosters teamwork by encouraging real-time collaboration and data sharing so that all disciplines are on the same page from the start.



While architects may have more work upfront in setting the foundation for the project, the coordination with other disciplines from the beginning reduces the need for rework later in the project. In a typical BIM workflow, architects develop a central model that serves as the foundation for other disciplines. Engineers and contractors can then work on their own drawings, such as structural, mechanical, plumbing, and electrical systems that tie into a federated BIM model. Each discipline is responsible on their own components and drawings, but since all data is linked back to the architect's model, conflicts and errors are identified early through tools like clash detection.

[6.20] MITEK AS INNOVATOR

MiTek is at the forefront of residential construction BIM implementation by defining how BIM can be implemented at the scale of individual houses. MiTek's IBDAT has pioneered and documented its IPD process for BIM that teams can adopt and improvise for their projects. When taking a look behind the BIM scene at the tools available, MiTek has taken the initiative to develop software that proves how BIM for residential construction is both possible and viable.

[6.21] MiTek Structure

MiTek Structure with Integrated Truss Design is built for component manufacturers that delivers the most powerful structural modeling, editing, and estimating platform in the industry. In addition to laying out the trusses for a project, Structure designs trusses and wall panels for production. These elements are 3D modeled with accurate loading and these elements can be individually or group edited live in the software. BIM integration starts with an accurate architectural model that can be exported to the IFC file format which brings in the necessary floor, wall, and roof systems to begin the structural design. When the structural design is finished, a traceable, verifiable BOM can be produced. Each designed member can be visually traced back to an element in the structural model.

[6.22] MiTek Supply

MiTek Supply is a one-stop software solution for whole-house estimating, engineered wood products (EWP), and lumber design. Supply allows precise layout of all framing members in 3D to eliminate guess work and includes a pre-loaded with products from industry-leading EWP manufacturers and MiTek's USP structural connectors. Custom databases can be set-up to include any category of product to be estimated. The final result is an accurate BOM where each item can be traced back to a completely framed 3D model for verification. With the accompanying MiTek Viewer, customers can identify and resolve potential design issues before construction, confirm the model for estimating, and empowers framers at the job site.

[6.23] MiTek Array

MiTek Array is the premier Revit plugin that allows production builders to effectively create and manage their library of options, models, sheets, and materials. Array expands on the versioning and options concept by allowing automation and advanced assembly of model options to produce lot-specific or site-specific project files. A centralized repository of options enables standardization and naming consistency between projects. Enhanced option capabilities allow individual elements to have property modifications that provide greater control and reduce overall project complexity. Automated exterior dimensioning to save time and effort in drafting and a Data Extractor tool that harvests Revit element data to be exported to Excel to efficiently price by options rounds out Array's capabilities.

MiTek®
ARRAY™

[7.00] CONCLUSION

For those new to Building Information Modeling, it is crucial to recognize its reliability and the positive impact it can have on projects. The increasing adoption of BIM practices and tools highlights the construction industry's shift towards more efficient and cost-effective methods of design and construction. This document emphasizes that while full BIM implementation is a worthwhile goal, the key to successful BIM lies in professionals adapting BIM to fit their specific needs. By grounding BIM in a set of best practices to follow and a flexible framework to build from, BIM can be made accessible and beneficial for everyone involved in the building process.

MiTek has a role to be the trusted expert in residential BIM, guiding professionals by attentively listening to their needs and addressing specific challenges to BIM adoption. Through an in-depth understanding of the construction process, MiTek is continually refining its services and tools like Structure, Supply, and Array to comprehensively address real-world problems that designers, engineers, component manufacturers, and builders face. MiTek's offered services, expertise, and tools make BIM not only more accessible, but also practical and beneficial for all.

[7.10] COPYRIGHT AND TRADEMARK INFORMATION