BUILDER INSIGHT

BC HOUSING

FACTS AND FIGURES

Construction timeline: November 2023 –June 2026
Construction budget: $54.9 M
Residential Units: 123
Site Area: 2,968 m^2, 31,945 ft^2
Total Gross Floor Area: 13,039 m^2, 140,334 ft^2
Net Floor Area: 10,446 m^2, 112,433 ft^2
Building Height: 22.64 m, 74.29 ft
Volume of Mass Timber: 1,194.67 m^3 of CLT
Annualized Whole Life Carbon Emissions: 7.8 kgCO2e/m^2/year
Total Energy Use Intensity: 49 kWh/ m^2/year

PROJECT TEAM

Owner: More Than A Roof Housing Society
Land: Non-Market Housing Development & Operations
Architect: PUBLIC Architecture
General Contractor: Kindred Construction Ltd.
Owners BIM Consultant: Summit BIM
Design BIM Consultant: BIMOne
Construction BIM Consultant: Modelo Tech Studio
Structural Engineering: Wicke Herfst Maver Consulting Inc.
Mechanical and Electrical: Introba
Fire Suppression: Introba
Energy Modeling: Introba
Passive House Consultant: Introba
Embodied Carbon Modeling: Introba
Civil: Core Group Civil Consultants Ltd.
Landscape: Matthew Thomson Design Ltd.
Building Code: GHL Consultants Ltd.
Building Envelope: Stantec
Acoustical: BKL Consultants Ltd.
Passive House Certification: Steven Winter Associates, Inc.
Elevator: GUNN Consultants
Project Management: CPA Development
Research Management: Scius

KEY STAKEHOLDERS

City of Vancouver
BC Housing
City of Vienna
Rüdiger Lainer + Partner

Bulletin No 9 | Vienna House

BIM Lessons Learned

Vienna House is a National Housing Strategy project and a Mass Timber Demonstration Project that demonstrates sustainability and innovation in construction. The project will be Passive House certified. It is the first non-market multi-family housing project in B.C. to use Building Information Management (BIM) through all stages of design, construction, and facility management. BIM implementation can improve construction efficiencies and achieve cost savings.

The seven-storey mass timber and lightwood frame hybrid building will provide 123 units ranging from studio to four bedrooms. It is an efficient mid-rise building type, with the potential for it to be replicated in B.C. and across Canada. The project has a counterpart housing project in the City of Vienna, Austria called Vancouver House. This provides a unique opportunity to share knowledge and best practices in housing design.

Figure 1. Rendering of Vienna House from Stainsbury Ave. (source: PUBLIC Architecture).

Using BIM for Housing

Digitizing project delivery using BIM is one way that BC Housing is attempting to increase productivity in construction of its housing projects and speed delivery to address the housing crisis. BIM has been used on other types of buildings in B.C., including hospitals, high-rise residential, educational, and large commercial buildings. Buildings aiming for BC Energy Step Code compliance often use BIM for performance analysis and energy modeling. It is not a process that is new to many architects and engineers in the province, but it is new to many housing developers.

Facility Management and Operations (FMO) costs over the life of a multi-family residential building can account for a significant portion of lifecycle costs. Investing in BIM processes during design can save some of those costs by increasing efficiency of maintenance and operations tasks. The data can be used to quickly identify replacement parts or locations of faulty equipment and streamline development of maintenance schedules. Preventative maintenance plans can be developed early, providing all the necessary information to the FMO team from day one.

To take advantage of the benefits BIM can provide, its use and purpose on a project must be well-defined in procurement documents. Owners must have a clear understanding of the information that should be shared in the BIM process, enough to make it useful, but not so much as to overwhelm the team. The level of information need (LOIN) that is required for different components of the model, the responsible party and the timing of when it is required is important to define early. This ensures that an appropriate amount of time is allocated to these tasks in preparation of proposals. Feedback from consultants on Vienna House indicated that little weight was given in the proposal evaluation for the BIM experience of the team and it was not clear how the BIM Requirements would be enforced. They felt that adding extra fees to properly implement BIM would have made them unlikely to win the contract.

Owners of multi-family housing projects may include government authorities, not-for-profit agencies or independent developers. They must be sufficiently familiar with the requirements for BIM implementation to request the appropriate amount of detail and collaboration and to enforce its use. If they do not have this capability, BIM consultants are available to educate them, to help them be well prepared by implementing the proper workflows and to potentially accompany them on their first projects. However, that should not change the common roles and responsibilities on a project.

> For an overview of BIM see the Vienna House Builder Insight: Digital Project Delivery and BIM

BIM is fundamentally a powerful approach to enhance collaboration and support collective efforts throughout the design and construction phases. For example, the design consultants are responsible for coordinating the model during the design phase. Their BIM Manager is usually responsible for orchestrating the clash runs, as well as tracking and assigning responsibility for resolution between the various design consultants. Once it moves to construction, the responsibility for refining coordination moves to the construction team in collaboration with the design team when needed. Owners must remain engaged in the process to ensure workflows are followed to achieve their goals.

If BIM processes are followed as intended, the data can aid teams to

- resolve construction issues during planning phases,
- coordinate prefabrication of components, and
- optimize maintenance and operations information before building handover.

Figure 2. Vienna House under construction, April 2026 (photo: Bright Future Studios)

Goals for BC Housing

BC Housing is implementing a BIM process for Capital Construction Contracts and Facilities Management to obtain accurate 3D models containing structured and consistent digital data to be used throughout the entire life cycle of their facilities.

Our stated goals can be summarized as follows:

- **Improved Data Management** - Capture inherent data generated by technology designed to improve communication and collaboration. This enables BC Housing and its partners to better visualize projects, monitor progress and support decision making, including resolving issues early. This results in a facility that is easier to maintain and operate throughout its life cycle.
  This high-level objective can be broken down into more specific goals:
  - Supporting estimating workflows leading to more accurate costing and reduced design rework.
  - Identification of assets and their required classification to support the digital handover to the facilities team.
  - Identification of asset parent/child (asset hierarchy) relationships and systems from the model data sets, to support the needs of maintenance and operations.
  - Collection and access to asset information before handover supports the development of preventative maintenance plans required for facility management. It also provides room and space data along with systems and asset information for ongoing maintenance and operations.
  - Reduced handover timeline + data exchange to enable the non-profit operator to maintain the facility with the required information from day one.
- **Improved Quality** – Use of defined and agreed protocols, processes, workflows, and strategies focused on mitigating the overall risk to BC Housing in undertaking design and construction projects. These measures generate a consistent data set and provide a common understanding of the work being undertaken by the different parties.

  Such a common understanding supports improved communication and collaboration among the different parties. Information exchange may be based on 3D visualization, walk throughs to understand the building form and spaces, or on schedules to ensure that spaces and areas meet the facility program.
  This high-level objective can be broken down into more specific goals:
  - Better project management through access to the data which supports improved communication and collaboration between all parties to the project.
  - Improved design quality and accuracy using a database driven software solution which supports the concept of 'One Version of the Truth'. The use of these database solutions enables 3D visualization of spaces, issues, and design intent, including quality control and facility program compliance.
  - Use of the underlying data to support design visualization and energy analysis.

Figure 3. Vienna House under construction, September 2024 (photo: Scius)

- **Risk Mitigation** – Establishment of a controlled BIM process, using BIM enabled software tools and following agreed specifications to generate a robust data set that can be used by all parties to drive efficiencies and reduce risk. A virtual coordination process, aligned with improved communication and collaboration helps identify and resolve issues that could potentially impact construction and require rework or re-design. Resolution of such issues prior to construction supports the long-term quality of the project by mitigating construction rework and maintaining access for ease of maintenance. The involvement of construction expertise, through a construction manager, reduces the likelihood of redesign by trades after tender.
  This high-level objective can be broken down into more specific goals:
  - Improved risk assessment and mitigation throughout design and construction by adhering to virtual coordination processes to identify coordination issues including maintaining space for maintenance and operations access.
  - Construction analysis through 4D simulations to maximize construction schedule, on-time delivery, site utilization, and maximizing opportunity for prefabrication.
  - Generation of an asset registry at issued for construction (IFC) documents, providing access for uploading of all required facility information during construction, and supporting development of preventative maintenance plans.
  - Identification of asset hierarchies during design to support handover and development of preventative maintenance plans.
  - Updating of record models in alignment with agreed accuracy criteria to reflect the built facility, reducing time to handover of all required information in an interlinked digital format.

Figure 4. attaching balconies to Vienna House (photo: Kindred Construction)

Big Picture Lessons Learned from BIM Implementation

Vienna House was the first non-market multifamily housing project to use BIM in British Columbia for design, construction, and facilities management. For any project using new approaches, a learning curve is expected. Normal processes and customary workflows are disrupted. Change sometimes requires incremental improvement to be successful. This report reviews the lessons learned and the recommended approaches moving forward. In some cases, changes to contract structure or responsibility and liability issues may be required to fully implement the changes.

The use of BIM processes on the Vienna House project contributed to a lower number of change orders and facilitated prefabrication of the components, however misunderstandings and lack of clarity limited the impact of its implementation. Significant benefits were achieved through collaboration in a common data environment. The project team successfully coordinated the plans for a non-standard shape in a challenging location. At 82% completion, the building had required only 42 change orders totaling less than 0.95% of the contract value, with 93% of contingency funds remaining.

Lack of clarity of expectations and lack of familiarity with BIM contributed to challenges with BIM implementation on this project. The quality, efficiency, and level of collaboration of BIM implementation is referred to as BIM maturity. One of the primary lessons learned is that to take advantage of the benefits of BIM, industry expertise with its processes and tools must improve. This applies to everyone who is affected by it, including the building owners.

Traditional workflows rely solely on 2D drawings, "typical unit" modeling and design intent, leaving many of the coordination details between systems to be worked out as the building is constructed. As the housing industry transitions to higher performance buildings that are prefabricated and may use mass timber, that workflow must be replaced by one that fully models the building in 3D to identify penetrations and clashes. Coordination of steel, lightwood frame panels, mass timber, and mechanical, electrical, and plumbing (MEP) systems must be developed digitally to ensure the components will fit together before anything is constructed. For Vienna House, coordination began during design but because the prefabrication vendor was not confirmed until after tender, panel details had to be approximated. Construction coordination with the chosen panel design did not begin until after the design and tender were completed, causing delays and frustration and increasing costs.

Earlier engagement with the trades and manufacturers has been recommended by many members of the Vienna House project team. As in a conventional project, all trades were tendered at the same time. This prevented the design team from adding detail in the model for the designs for the prefabricated wall system since each manufacturer has a slightly different approach. Thus, coordination of the walls with other systems could not occur until after the tender was awarded. If prefabricated walls and steel are tendered earlier, for example, the design can be finalized based on what those vendors can provide and the BIM model can be more detailed at an earlier stage. Another solution is to design panels that can be fabricated by any manufacturer.

Figure 5. Prefabricated wall panels and CLT floor/ceiling. (photo: Scius)

Owners must understand how BIM can be used and explicitly state the purposes that are expected. If design coordination within the 3D model for export to 2D is expected, they must clarify that in the requirements. If assets will be tracked for operations, extra data entry will be required and should also be confirmed to be a part of proposals. Requiring a detailed BIM Execution Plan with proposals is recommended by ISO 19650 to provide confidence that expected tasks and costs are aligned and understood by the delivery teams.

The experience of using BIM processes on Vienna House has educated the owners and consultants about the possibilities and potential of this approach and informed their interest in using it again on other projects. As it is used on more projects, the workflows and familiarity with the tools and approaches to communication will have a more significant impact on the process.

BC Housing chose to use BIM for Vienna House to deliver on the objectives of Passive House performance and off-site prefabrication while exploring opportunities to accelerate the development and construction process. We brought in consultants to develop the BIM Requirements Specification, train and assist BC Housing and the design team on how to use it effectively, and assist in the development of an asset database for use in FMO.

The primary lessons learned from the Vienna House project include:

- **Ensure Direct Owner Involvement**. While BIM consultants provide necessary technical expertise, they cannot fulfill the owner's role entirely. Owners must be proactively involved from the start to establish project goals, secure proper resource allocation for budget and schedule, and define BIM requirements as contractual deliverables. FMO needs to be involved before design starts, both in the development of the BIM requirements and to request the data they need in a form that is useful for their day-to-day operation.
- **Recognize BIM as an investment in project efficiency.** BIM requires upfront planning and coordination effort, but this investment supports improved coordination, reduced rework, and more predictable project outcomes. As workflows continue to evolve and mature, the benefits become increasingly evident across design, construction, and operations.

Figure 6. Plumbing in a Vienna House washroom. (photo: Scius)

- **Clarify how models will be used**. BIM processes clarify goals, facilitate collaboration, and provide a common source of project data. With different teams producing different data that all needs to work together, the Project Execution Plan (PEP) must be developed to clarify how the data created and the combined effort will produce the stated goals. For example, the Vienna House PEP clarified the responsibilities of the architectural and structural models and improved collaboration of those elements. It clarified expectations from the beginning.

  A well-coordinated federated model that combines different compatible data sets will help the team identify potential clashes and provide a strong basis for a model that is used for prefabrication and construction. However, design models that show intent but not accurate locations are difficult to merge. Clarification of how data will be used enables the determination of required accuracy and level of development. For example, if MEP data is required to inform openings in prefabricated wall panels or CLT, accurate locations of the assets are necessary.

- **Align BIM Uses with Practical Value**. New BIM processes should not be imposed without understanding current workflows, as this can hinder rather than improve productivity. Value is only fully realized when the end-users (contractors, manufacturers, facility operators) have the intent and capability to use the delivered data. Therefore, involving them in defining requirements is crucial. Depending on how the data will be used, different levels of detail, different organization of data, or different timelines for delivery of that data may be required.
- **Prioritize BIM Maturity in Team Selection**. Team proponents must demonstrate experience using BIM for housing or other complex projects. The RFP process must provide weight to the evaluation of BIM expertise, and make expectations of its application clear from the outset. Failure to do so can lead to confusion and misalignment of resources.
- **Adopt International Standards**. Utilizing international frameworks like ISO 19650 helps address the lack of consistency in how information is produced and shared. Following these standardized approaches facilitates better collaboration and more predictable project outcomes.

Figure 7. Details from the architectural and structural models were coordinated for the CLT elevator shaft. (photo: Scius)

BIM Standard

CSA-ISO 19650 became a Canadian standard in 2024, after design activities for Vienna House were completed. The standard is not referenced in contract documents. However, many of the principles of the standard are reflected in the BIM Requirements Specification that BC Housing included in the Requests for Proposals (RFPs) for both design and construction services.

As with any new methodology, taking the time to properly implement it can be transformative. The standard comes in six parts. These parts define a framework for information management across an asset's lifecycle, focusing on collaboration, common data environments (CDE), roles, and standardized processes for better project outcomes.

1. **Concepts and principles** - Establishes the foundation, outlining core ideas for managing information using BIM, applicable to all project stages.
2. **Delivery phase of the assets** - Focuses on the design, construction, and handover stages, detailing how information is managed during the project's delivery.
3. **Operational Phase of the Assets** - Guides information management for the long-term operation, maintenance, and eventual disposal of built assets.
4. **Information Exchange** - Provides guidance on exchanging information, ensuring consistency, and interoperability between different systems and parties.
5. **Security-Minded Approach to Information Management** - Addresses security considerations, protecting sensitive information throughout its lifecycle.
6. **Health and Safety Information** - Specifies concepts and principles for classifying, sharing and delivering health and safety information collaboratively, to secure economic, environmental, and social benefits.

Lessons Learned from BIM Implementation During Design

Public Architecture led the design phase of Vienna House. Consultants from Introba developed the MEP design and WHM Structural Engineers provided the structural design. BIM support was provided by consultants from BIM One, AEOS and Summit BIM. The BIM Requirements Specifications were included in the RFP for the design team along with assurances that consultant assistance would be available for teams who were less experienced using BIM. Since this was a first for BC Housing, there are lessons learned in implementation of those requirements for everyone involved.

- **Clarify strategic goals and why BIM is desired for new purposes**. Requesting workflow improvements can be difficult for any organization. It becomes even more challenging when the goals of the changes and the reasons for implementing them in a specific way are not clearly communicated. Sharing information about why change is happening and why specific tasks are being requested is vital to buy-in for that change. Requirements that describe the change to building and team performance, how data will be used, and the intent for collaboration may yield better results than those that are too prescriptive technically without clear explanation. Teams have developed workflows that work for them in other situations and may resist altering their approaches without justification.

  For example, for unit designs that were repeated on higher floors, the design workflow was to make all changes to a “typical” floor and then copy the data to other floors. This ensures that the changes were completed before being copied across multiple floors and then are more likely to be consistent. This approach ensures that errors are not introduced through omission and limits the repetitive work of copying and adjusting data fields. However, floors are similar but rarely identical. If the data is to be used for cost or energy use estimating, it will be required on all floors before the design is completed. If cost or energy estimation are part of the project goals, that must be clarified so that appropriate time can be allocated to this change in workflow.

A learning curve is expected. Owners and operators may not be familiar with the data that can be provided and how it can increase productivity. As more projects have BIM data available, owners and operators will be better able to specify their goals and requirements.

- **Allocate extra resources to new processes early**. BIM is relatively new to many people involved in residential construction. Therefore, extra time must be allocated for new approaches to design, new tools, and new requirements for data entry. Owners should dedicate personnel to follow up with consultants, confirm understanding of requirements, and implement them. This extra upfront effort to implement BIM workflows is in addition to the efforts described in the McLeamy graphic (Figure 7) which presents how upfront efforts and costs to implement BIM will replace efforts and costs traditionally experienced later in the construction process. The digital process pushes the work effort forward, ensuring that changes to the design occur early enough that the work is still in a digital format and the cost of change is relatively low. Since these early efforts involve digital files and training, they can be enhanced with each new project. But effort and cost will likely be higher on the first project. During the initial design phases of Vienna House, AEOS and BIM One provided technical support to the design team. They demonstrated how to establish a robust PEP, how to set up the models, and implement best practices for model sharing, model exchange, and virtual coordination. In addition, Summit BIM provided guidance on establishing best practices for data management and structure within the model data set.
- **Clarify workflow processes and align expectations**. Each member of a project team will likely base their workflows and expectations on previous projects and with different clients and consultants. It is essential that everyone has a common understanding of how the data will be used, responsibility of each party, how collaboration will be coordinated, and the timelines for major deliverables. If everyone's expectations are clearly stated, fewer misunderstandings may arise. When issues do arise from conflicts of expectations and workflow, it will save time and effort to quickly identify what is different and how to resolve the conflict rather than to have it persist. In some cases, owners may need to insist upon compliance to achieve their goals, which may come at an additional cost.

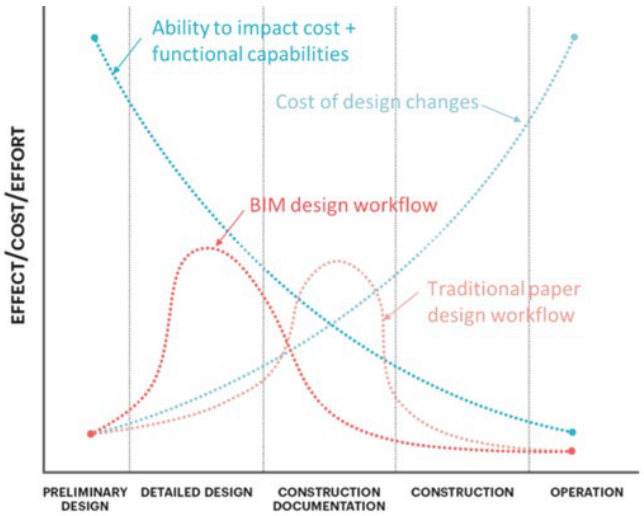

Figure 8. The McLeamy graphic applied to BIM (source: Summit BIM)

- **Clarify modeling requirements and expectations**. Design models are extremely valuable for coordination, but their effectiveness depends on consistency in geometry accuracy, element placement, and modeling conventions. Establishing clear expectations for model reliability, including the size, location, and completeness of elements, helps ensure the models can be efficiently used and built upon during construction. This reduces the need for rework and increases confidence in the coordination process.
- **Set modeling approach and naming and classification conventions**. Consistent naming of assets and components facilitates ease of searches and automation. This is a more prescriptive approach, but will have long term benefits for everyone. The requirements should be set as required by the project so as not to become burdensome. Names can be specified to make it easier to extract information for costing takeoffs or for automated processes that extract information from the model for permit evaluations. Relationships between components should be set up as either a hierarchy or collection of items (such as in a mechanical system loop).

- **Create a 'Single Source of Truth'**. Software used in BIM processes should facilitate collaboration and provide a central repository for other information that can be generated. Data other than the model itself can be included in the BIM file. If all data is regularly updated so that interaction between different building systems is clear, and there is prioritization of common geometry based on its source, clash detection can be resolved as components become better defined. Development of construction drawings can be based on outputs of the BIM model data. Takeoffs and sequencing efforts can all be based on the same dataset. Any exceptions to inclusion of data should be clearly stated. Clear communication and collaboration help to prevent duplication of work and incomplete data.

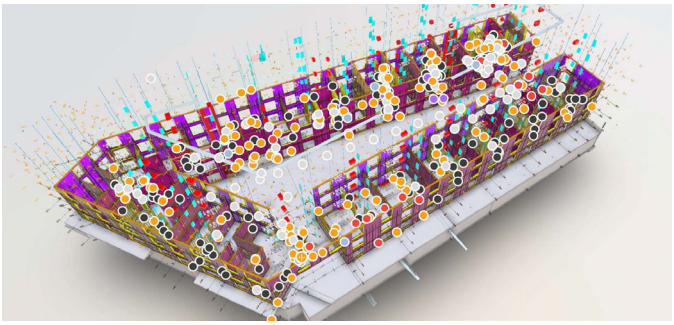

Figure 9. BIM model clash detection during model coordination (source: Public Architecture)

- **Confirm constructability**. Involving the general contractor and manufacturers in the design to confirm its constructability can provide significant savings in cost and schedule. Some procurement contracts are better suited to accommodate this than others. For example, pipes and ducts may be modeled as simple structures that bend and end without much detail. Including connection details, bending radii and firestopping allowances will inform wall space requirements. This information is usually provided by the trades. Constructability for Vienna House was not thoroughly coordinated until later in the process, when it was identified that there was limited space and clearance for building systems. Drop ceilings were adjusted to accommodate them in the kitchens and bathrooms.

Figure 10. Vienna House under construction, January 2026 (photo: Scius)

- **Engage the Construction BIM Team early**. Engaging the construction BIM coordinator earlier, before the later stages of design, allows sufficient time to develop coordinated models, integrate fabrication input, and support prefabrication workflows. When coordination begins after construction activities are already underway, additional effort is required to reconcile design intent, fabrication requirements, and site realities. Models can be better aligned with construction and prefabrication needs. This alignment improves continuity between design and construction, enhances model usability, and strengthens collaboration across project teams.

CSA-ISO 7817 was published in 2025 by the Canadian Standards Association. It specifies concepts and principles to establish a methodology for specifying level of information need and information deliveries in a consistent way when using BIM. It ensures all project stakeholders (architects, engineers, project managers, etc.) have a common understanding of the required information at various project stages, reducing ambiguity and improving collaboration.

The standard specifies different characteristics used to define the information, including geometrical information and alphanumerical information such as identification and information content. It also includes documentation such as reports, manuals, sketches, and signed documents.

The principles are applicable to the whole life cycle of any built asset and can be used for general information exchange, collaborative work processes, and specific contractual information deliveries.

Lessons Learned from BIM Implementation During Construction

Kindred Construction Ltd. was the general contractor for Vienna House. They hired BIM consultants from Modelo Tech Studio to develop a BIM model for construction based on input from the design team.

As with the design process, clear communication of goals among the team is crucial to an efficient and worthwhile use of BIM during construction.

- **Procure contractor early or as "design assist"**. Early involvement by the contractor, trades and their BIM team aids in an efficient transfer of data and clarity about constructability and where increased levels of detail will be required for construction. Involvement during design also provides time for adjustments where needed. It allows drawings for prefabrication to be completed to optimize the schedule. It also requires a healthy and collaborative relationship among the team. Feedback from the Vienna House team members is to incorporate input from the contractor and trades before the 50% Construction Documents (CD) milestone, with some putting it at the beginning of CD.
- **Allocate time and budget for fabrication coordination**. On Vienna House, consultants identified that there was a phase of work that was not well defined after design was completed and construction was due to begin. During this time, the fabrication models were being developed and clashes were being identified. Fabricators were working with the contractor to resolve issues to develop fabrication models. This highly administrative phase was not allocated time in the schedule or funds in the budget, posing challenges for those involved.
- **Clarify the role of BIM model data for construction**. Contract documents are expected to continue to require 2D drawings as the official representation of what is to be constructed. What role does the BIM model play during construction if that is the case? If the 2D drawings are created from the 3D BIM model, it can aid in visualization of the data or provide additional information. The 3D model can also be used to optimize sequencing and plan on-site activities. Prefabrication manufacturers for Vienna House were interested in using the 3D model to inform their processes. It was made available for reference but not considered an official document.
- **Verify what is built matches the plan as you go**. The value of BIM coordination depends on the model accurately reflecting what is constructed. Establishing reality capture methods to verify installed work against the model can help identify issues early. Methods such as laser scanning, photogrammetry, or immersive 360° imaging allow for quick comparisons to check for misalignment and prevent downstream conflicts. This is particularly important on projects involving prefabrication, where dimensional accuracy is critical. This was not done on Vienna House, but may have aided installation of the ground floor panels.
- **Use BIM to provide value to quality control workflows.** When integrated into construction verification processes, BIM can help identify potential conflicts or deviations early, before they impact schedule or require corrective work. This proactive use of BIM strengthens coordination outcomes and enhances overall project efficiency.
- **Clarify timelines for asset information**. Once shop drawings are completed for different assets, information about those assets can be entered into the database for facilities maintenance. Traditionally, this information was often provided at the end of construction and was more difficult to gather. If BIM data is to be used for FMO, much of the data can be recorded digitally once shop drawings are completed. Model numbers, locations, and user manuals, for example, can be entered into a spreadsheet or uploaded to a database. This can greatly reduce the workload of maintenance teams once operations begin, since the information is already available.

  The timeline for data entry must be emphasized and compliance measures identified, otherwise data entry activities can be neglected in the hustle to complete construction. A suggestion to make data entry easier is to have an application for a phone or tablet that

allows data entry by trades as installation occurs. Data entry for Vienna House has not been completed along the preferred timeline despite being stated in the BIM Requirements Specification.

- **Confirm final model data expectations**. Record models are delivered to owners to provide design intent. These models are a representation of what has been built and do not have the accuracy required for fabrication or construction. Record models are not a digital twin of the building. However, they remain valuable for many owner uses, such as sharing with fire departments, serving as a basis for space management or supporting future renovations.

The contractor on Vienna House hired an experienced BIM Consultant, Modelo Tech Studio, to coordinate the construction BIM model to use for construction and prefabrication. This model incorporates data from the design phase work completed by the architectural, mechanical and structural teams. It is the model that was used to detect clashes and to confirm that the prefabricated wall panels and mass timber floors could be built in their respective factories and then assembled on-site with limited issues.

BIM for Asset Management in Maintenance and Operations

More Than a Roof Housing Society will be maintaining and operating Vienna House once it is completed. The BIM process is intended to provide them with a detailed account of the assets in the building, including model numbers, locations, and maintenance information. This information can then be transferred to their Computerized Maintenance Management System (CMMS) software. Specifics about assets are to be input into the Facilities Maintenance Information (BIMFMi©) database by the contractor and trades. From there it can be collected and organized into a format that is useful to the operator and output to a spreadsheet that can be read by CMMS so that it is available at handover.

A lesson learned for data collection for asset management is to more clearly state the requirements to the appropriate parties at the signing of contract documents. This helps ensure the contractor and trades understand that timely data entry regarding assets is part of their scope and that

Figure 11. Steel, Prefab Walls and CLT were coordinated for construction of the amenity room (photo: Scius)

means to enforce compliance are included in the contract documents.

Information about assets and equipment in a building has historically been provided as paper documents that contain:

- asset locations
- manufacturers
- model numbers
- serial numbers
- warranty IDs
- shop drawings
- maintenance manuals

that are kept in sets of binders. Organizing this data into a searchable database that can be accessed from a laptop computer or tablet makes this information more accessible and useful. By supporting proactive maintenance practices, it can inform maintenance management systems, maintenance schedule updates, and ordering of replacement parts, and make it more likely for equipment to be repaired in a timely manner.

When determining which data to include for FMO, an owner needs to identify:

- common maintenance operations
- the data needed to perform those operations
- the level of detail within that data
- estimates of the maintenance cost savings in both labour and materials provided by the data
- the estimated cost or level of effort required to include that data in the BIM dataset.

For many items, data that can easily be gathered will provide a significant time savings for maintenance if it is readily available.

The asset database can be created using the data in a BIM dataset, identifying which assets should be tracked and which trade has the relevant information to be entered. As the first project for this owner/operator, it was challenging to identify which assets and which data about those assets to include. The asset list for Vienna House was compiled from the BIM data by the BIM Consultant and owner/operator. The list contains 1,665 items in 61 categories including mechanical and electrical equipment, safety equipment, doors, windows, appliances, and other items that may require maintenance. As shop drawings are completed and equipment is installed, the information is being entered into the database to facilitate access for asset management and replacement. The data that is being collected for Vienna House should be reviewed to ensure that information that is being collected is required for FMO and identify if fewer assets or less data can be collected on future projects to reduce the effort required.

As this is a new workflow for most of the trades, there have been challenges in timely entry of the data. The intent is that the data is entered regularly, a little at a time during construction, so that it is not a large burden at the end of the project. It may be more difficult at that stage to access information about what was installed in each unit, including model and serial numbers. Workers may be prioritizing completion of construction of the project and are not focusing on data collection and entry. This is an area where change of workflow can improve the process.

One suggestion is to request a shared parameters data file from the manufacturers that allows necessary data to be easily uploaded into the asset database. Information about serial numbers and locations of equipment in the building would still need to be entered as it is installed.

Final Thoughts

Implementation of BIM processes for multi-family residential buildings has the potential to improve quality and schedules, reduce costs, and streamline data transfer for prefabrication. The data can be used for cost estimating, energy use projections, circularity, and to help automate permitting processes. It is unreasonable to try to do everything in the first project, just as it is unreasonable to require housing projects to pursue the level of detail that might be required for a hospital. We can, however begin to adjust our workflows and gradually adopt these tools and resources.

In an ideal situation, data that is provided by architectural, structural and MEP design teams through their respective models would be coordinated using a federated design model. These models would then be completed or refined by the trades with additional input regarding where studs would be placed, and where pipes and ducts would be routed to create a federated construction model. Construction drawings in 2D could be created from the 3D BIM models and the federated construction model would also inform the fabrication models. The models could be used for quantity takeoffs for costing, energy efficiency modeling, automation of permitting and as input for the asset database for FMO.

This idealized process and data flow is shown in Figure 7. Legal and contractual barriers, liability, and responsibility for data are amongst the issues that must be addressed to make BIM more commonly used in housing. However, beginning to structure data and workflows to move to a process like the one described will move us closer to this idealized state.

BC Housing has identified BIM as a required element to pursue the Digitally Accelerated Standardized Housing (DASH) project. DASH provides standardized panels and layouts to create buildings that are appropriate for sites and communities across British Columbia.

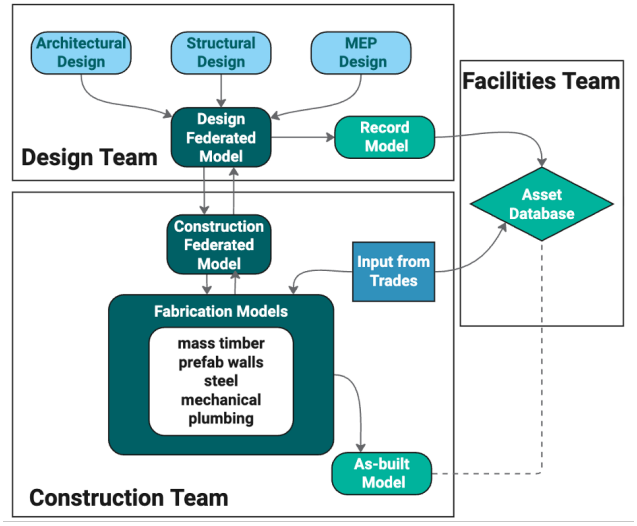

Figure 12. Ideal flow of BIM data

BC Housing requires BIM deployment on its projects to enable effective coordination, transparency, improved logistics and fast delivery, clash detection, easy access to offsite production processes, and documentation to facilitate operations and management. Leveraging these advantages will enable BC Housing to expedite the provision of affordable, high-quality housing and to:

- Achieve a high-level of design resolution and coordination to minimize uncertainty in construction. This objective requires well-coordinated three-dimensional models and corresponding two-dimensional Construction Documents.
- Achieve an efficient and straightforward BIM workflow that doesn't require intensive management on the part of BC Housing, the Design Team, or the Construction Team.
- Support the Optimized Design and Construction Process in the context of the DASH demonstration projects.

Standardization supports expansion of prefabrication. It also speeds permitting as municipalities become familiar with the panels and layouts. BIM provides the data source and collaboration tools to efficiently assemble the components into more homes.

BIM comes at a cost, but it should be considered an investment, not an expense. It requires different tasks to be carried out and greater involvement from all stakeholders to deliver better projects in more effective ways. By leveraging the current momentum and providing the right level of leadership and support, everyone can gain efficiency and maturity. Workflows and expectations will evolve. New approaches to financing may be required but there is potential to dramatically improve productivity in construction as BIM processes become a common means to create housing. As we become more familiar with its features, we can expand how it is applied.

BC MASS TIMBER Demonstration Program

Since 2020, the Province of British Columbia (B.C.) and Forestry Innovation Investment have invested over $11.1 million through B.C.'s Mass Timber Demonstration Program (MTDP) to help with the incremental costs associated with the design and construction of 22 building projects and 8 research projects that demonstrate emerging or new mass timber or mass timber hybrid building systems and construction processes.

NATIONAL HOUSING STRATEGY

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BC Housing's Research Centre collaborates with industry, non-profit, and public sector partners to foster excellence, innovation, and affordability in British Columbia's housing sector. We share leading-edge research, advance science and technologies to encourage best practices, and provide data analysis to understand and find solutions to housing issues across the province. The Research Centre identifies and bridges research gaps in the following topic areas: populations & communities, built environment & design, sustainable & resilient housing, housing assistance & policy, housing & wellbeing. Mobilizing knowledge and research expertise accelerates innovation and facilitates the adoption of new housing models, building methods, and standards. Housing studies and program evaluations drive policy changes and support access to affordable housing in British Columbia. Sign up to receive the latest news and updates from BC Housing's Research Centre at www.bchousing.org/subscribe.

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