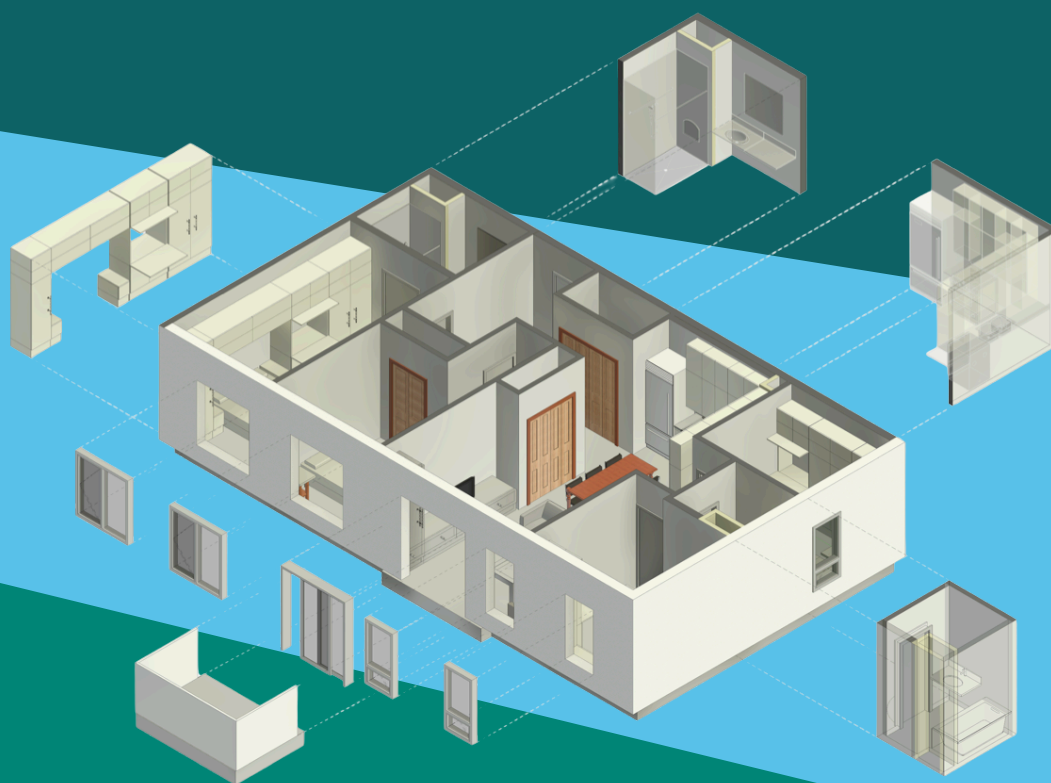


Digitally Accelerated Standardized Housing (DASH)



Tools and Site Selection Guidebook



BC HOUSING

For more information:

www.acceleratedhousing.ca

Common Language of DASH

Housing Type

High-level classification of housing within the spectrum that includes:

- Emergency shelters
- Supported housing
- Subsidized rental housing
- Co-operative housing
- Affordable home ownership options
- Housing for middle-income earners and students

It also categorizes housing from the perspective of funding streams (e.g., BC Housing’s supportive housing [SHF], women’s transition housing [WTHF], or community affordable housing [CHF]).

Structural Typology

An overarching “family-level” classification based on applicable code and structural system (e.g., Part 3 wood frame, 7+ storey mass timber, volumetric modular).

Blueprint

A preconfigured, repeatable design template built around a rules-based logic and associated kit of parts. Blueprints define layouts, unit mixes, and amenity/service space requirements for a particular use-case (e.g., BC Housing SHF 6-storey wood frame with a ground floor of services, small unit sizes, shared laundry, and centralized HVAC). They serve as a starting point for architects, who then adapt and modify them to suit the specific needs and constraints of each project. Each blueprint is a replicable format that can be applied and re-applied across projects. Multiple blueprints often exist within one typology (e.g., 3–6 storey wood frame with different accessibility ratios, CLT shear wall options, or program variants for youth vs. seniors housing).

Kit of Parts

A coordinated set of standardized building components and assemblies (wall panels, floor panels, bathrooms, service pods, etc.). It also includes defined configurations such as:

- Grid dimensions
- Floor-to-floor heights
- Structural options
- Accessibility ratios
- Suite layouts and mixes
- Performance standards
- connection details.

These components are interoperable across multiple blueprints, ensuring efficiency, scalability, and repeatability in both design and construction. The kit is the toolbox for assembling DASH blueprints.

Project-Specific DASH Design

A completed design generated by the architect from a DASH blueprint and its kit of parts that is both project-specific and standards-compliant so that it is optimized for DfMA and rapid site assembly. While tailored to site conditions, urban context and client needs, its underlying system logic and assemblies remain standardized, making it replicable for future projects.

DASH RECIPE

Digitally Accelerated Standardized Housing

A creative kit of parts for faster, more efficient, well-designed multi-family home construction projects up to 6 storeys.

APPLICABLE SITES

DASH Projects requires the following criteria:

1. The DASH team takes continuous learning seriously. We are actively engaging with project teams to understand their experiences with DASH so we can make the tools and processes more efficient and effective. We would like to support your use of DASH, and encourage you to reach out to us with any comments, questions, concerns, or suggestions regarding your experience using DASH.

Additionally, we are looking for project teams that would like to become involved in the research activities associated with DASH. We can work with you to develop a scope of that research so that it is not burdensome, but you are still able to contribute to the evolution of DASH. These activities may include:

- Periodic check-ins with you to understand your experience with DASH
- Data gathering so we can quantify how DASH has made your projects more efficient
- Allowing researchers to attend meetings with your team

In particular, we are interested in learning how DASH has been able to save you cost, time, and effort in the creation of better buildings. We may ask for information regarding cost savings, schedule reductions, approvals efficiencies, safety improvements, and other metrics that help us determine whether DASH is meeting its intended outcomes. In return, you can look to us to answer your questions, support your learning, and help your teams to become proficient in the use of DASH and modern methods of construction. We look forward to working with you to support DASH.

2. Slope & Topography: Elevation delta of not more than:
 - a. Max. 1.5m or 1/2 storey with parkade, over at least 18m but prefer site slope to be less than 5% at completion.

- b. Max. 1m without parkade, site slope to be less than 5% at completion.
3. Slope & drainage: Assumes finished grading will be fairly level. See Site Drainage.
 4. Services: known water, electricity, sewage.
 5. Existing trees: assume that all trees on the site are to be removed.
 6. Limiting Distance: Min. 100ft wide, length dependent on desired number units, etc.
 7. Street fronting: 1 Street – no panhandle, constricted lanes, etc.
 8. Foundations: Parkade walls to be foundations.
 - a. Optional: Basement and/or underground parkade is not required but is preferred.
 9. Structural simplicity - DASH buildings must be capable of being designed using simple “regular” structural systems (vertically stacked and regular structural members) as required by the BC Building Code’s new seismic requirements. This is not only required by Code, but it results in a more efficient, prefab-able and simple to erect superstructure.
(Lengthy and expensive dynamic/non-linear testing and independent review may be required by a P. Eng. as the current CLT balloon frame shearwall is not recognized in the Code at this moment)
 10. Site Class (BCBC 4.1.8.4.) Confirmed by Geotech:
 - a. A-C: Preferred
 - b. D: Acceptable – may require increased engineer foundation design.
 - c. D/E-F: Prepare for custom, increased engineer foundation design, possibly affecting DASH lateral design.
 11. Site Drainage:
 - a. Surface: Final grading to have no low spots (pooling), with drainage predictably away from built areas.
 - b. Drainage to be typical perimeter drainage, with some retention on-site and storm connections being fairly typical. See Services above.
 - c. Subsurface: no risk from high water table or risk of saturation under normal circumstances, with low-risk passive drainage sufficient for site.
 12. Site Logistics:
 - a. Crane operations: Site and ground conditions suitable for a crane to be set up for construction safely and without significant traffic, site, etc. hardships needed.
 - b. Crane clearances and conditions: Fewest crane locations possible for site, with sufficient swing/reach to minimize the need to move the crane. No temporary pads, etc. shall be necessary.
 - c. Laydown and hoarding: Sufficient room to allow for a reasonable amount of building components, consumables, etc. to be hoarded on-site during rapid site assembly.

***NOT EVERY PROJECT WILL BE SUITABLE FOR DASH**

DASH RECIPE STEPS

1 PRE-PROJECT SETUP & OPTIONING

OWNERS PROJECT REQUIREMENTS

- Unit mix
- Building typology
- Standards, guidelines & unique requirements

SELECT SITE OPTIONS

- List various sites

COLLECT SITE(S) INFORMATION

- Authority Having Jurisdiction (AHJ) planning zoning & regulations
- High level geotechnical, survey & topography
- Site records: civil & site services

AHJ INITIAL CONSULTATION

- How willing are they to work with DASH?

2 DASH ASSESSMENT (REPEATED AS NEEDED)

ENTER LOT IN ARCHISTAR - GENERATIVE BUILDING OPTIONS

- Is zoning coded?
 - If not: enter address in the local GIS system - is zoning policy available?
- Archistar mass modeling, download file.
 - Archistar not available in your region? feasibility for first pilot cohort provided by DASH team (Iredale - terms TBD)

CREATE REVIT MODEL: SITE & BUILDING BLOCKS FROM LIBRARY

Refer to DASH building information model requirements

Current manual process:

- Model site
- Use building information model blocks to build building - (pre-loaded, Pre-coordinated blocks from DASH library for that type of building)
- Rule of thumb: structural & mechanical
- Service in/out: is it simple?

UPLOAD TO KOPE

1. <https://www.kope.ai/dash-on-configurator>
2. KOPE provides a detailed take off (.csv file) for the prefabricated elements like exterior walls, interior walls and floor cassettes that can be used for estimation.
3. KOPE applies manufacturing-aligned exterior and interior wall panels for accurate estimation and improved manufacturing timelines.
4. further building systems, including floor and roof cassettes, shaft walls, ceilings and kit of part products, can also be applied.
5. K exports 3d ifc files for project coordination in any BIM software.
6. exports csv and excel bill of materials and bill of quantities for costing and estimating
7. imports into Revit and Tekla as native geometry with KOPE's plugins.

PROJECT PROFORMA

- high level class d estimate
- KOPE and building block building information model: provide useful outputs for rapid and low costs reports
- with historical data may not require quantity survey (repetition from standardization)

REVIEW PROJECT

- assess against owners project requirements
- assess site feasibility
- assess constructability
- verify project proforma
- repeat DASH assessment as needed for different iterations

PHYSICAL SITE INVESTIGATION AS NEEDED

- Site not owned, conditions & offer: potential cost: on-site geotechnical, survey, hazmat?

At the end of this stage, you will have:

1. BIM requirements for design & construction team
2. Massing Model
3. Class D cost estimate
4. Project pro forma

PROCEED OR NOT

Assume funding is in place - site acquisition and budget is informed by building information model/KOPE/take-off.

***PLEASE NOTE: NOT EVERY PROJECT WILL BE SUITABLE FOR DASH**

3 DESIGN PROCESS

- **ISSUE PUBLIC TENDER FOR DESIGN & CONSTRUCTION MANAGER SERVICES**
 - Design team with schematic BIM file
 - KOPE model
 - Details reports
 - Construction manager & manufacture secured
- **SCHEMATIC COMPLETED**
- **DESIGN DEVELOPMENT**
- **PRE CONSTRUCTION**

4 CONSTRUCTION

- **OFFSITE**
- **ONSITE**

5 OCCUPANCY

- **COMMISSIONING**
 - As built BIM for FM



DASH 1.0: User Guide – 4-6 LWF Residential Kit

Proof Of Concept - Blueprint Design For Rapid Housing Development

Version: Draft – Feb 2025

Authors: Iredale Architecture

Adopted: In-progress

Amended: Updated from Draft #1 (2024)

DASH 4-6 Storey Light Wood Frame Multi-unit Residential Unit

BCBC 2024: Group C 3.2.2.51

Levels: 4-6 Levels

Max. Building Height: 18m

Sprinklers: Yes

Fire Resistance Rating: 1hr (floors, load-bearing walls, roof)

Approx. Residential Units: 100



Area: < 1500m²

Construction: Light wood frame

Variants:

- Metro Vancouver, Climate Zone 4, Seismic Zone 4
- TBC - Capital Regional District, Climate Zone 4, Seismic Zone 5
- TBC – Interior & Central Regions, Climate Zone 5,6, Seismic Zone 3*¹

**Assumes populated settlements: Hope, Kelowna, Kamloops and/or Prince George*

DASH Objective

Develop a successful proof of concept of rapidly developed mid-rise Multi-unit Residential Buildings (MURB) utilizing generative, BIM-based design practices – the **DASH “Median” Reference Building**.

Project Background

The goal of this project is to scale system-level prefabrication solutions to make the process of providing more housing faster, easier, and more cost effective.

The project involves developing an open-source, BIM-based suite of multifamily housing designs, or “patterns.” These designs will use non-proprietary prefabricated elements or modules. The components will be “pre-qualified” by social housing providers, meaning they meet requirements for functionality, livability, sustainability, and resilience. They will also be designed for manufacturing by Canadian prefabricators using available best-practice technologies.

The project aims to digitally deliver prefabricated buildings, cutting the cost of new builds by up to 30 per cent, while speeding up construction by 20 to 50 per cent (metrics sourced from McKinsey).

The outcome of this project will be a fully digitized multifamily housing form. It will be designed to be efficient, affordable, and sustainable. Municipalities may ultimately consider it for “preapproval” to help reduce permit wait times.



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USER GUIDE

OVERVIEW

The Median Reference Building is a mid-rise (4-6 storey) Multi-unit Residential Buildings (MURB) design to utilize generative programs and BIM-based design practices. It requires a concise BIM Execution Plan (BIMx) to ensure efficient digital design to fabrication to construction workflow that minimizes errors and conforms to the constraints of the first version of the DASH Kit of Parts, for this specific typology.

BIM Technical Ability

DASH assumes full access to, and a high level of comfort utilizing BIM: Stage 1 utilized Autodesk's Revit 2024. This applies to all consultants, the construction manager and key trades and suppliers. Within the BIMx, software, version and procedures for information exchange will also need to be agreed upon.

BIM Project Milestones

The development of the DASH BIM template as a complimentary component to Metro Vancouver or similar planning regulations being piloted by AHJ's to streamline housing development. Using BIM as a coordinating tool for DASH aims to reduce variation and increase predictability, from owner's project feasibility, consultant design, to fabrication and construction. The BIM is the "single source of truth", made possible by DASH's kit of parts, developed in collaboration with shareholders across the MURB supply chain – from planners and owners, to architects and engineers, to fabricators and builders.

This can be broken into three key project milestones:

- A. Conceptual & Feasibility Phase: Site Validation & Planning Compliance**
- B. Design and Permit Phase: Digital Design & Design-construction Coordination**
- C. Contract Documentation Phase: Fabrication & Construction**

DASH is a Live, in-progress Innovation



The first DASH typology is an innovative housing delivery approach, collaboratively being developed by Government, Architects, Engineers, Builders, Fabricators, Trades, and Researchers. Therefore, this User Guide is considered a living document: updates are expected as innovations are developed and implemented. Lastly, while DASH 1.0 is the trail blazer, the principles and approaches described here are intended to be expanded to new MURB typologies as part of DASH.

DASH does not replace the Architects' and Engineers' professional: DASH provide digital design tools to assist, streamline and support their good judgement and professional experience. DASH digital design tools are coordinated with the regulatory, fabrication and construction tools and practices being developed collaboratively with professionals all along the building development supply chain.

Building Code requires life safety compliance assurances by Registered Professionals, demanding review, design and acceptance of responsibility by the professional of record, as well as complete review by the AHJ. The finer level of detailed design made possible early in a project's timeline, using standardized blocks and kits of parts, aims to reduce the repetitive design work common to all MURBs. This approach frees up more time for professionals to focus on life safety and high-quality design for specific DASH housing typologies. The goal is for professionals' time and fees to maximize value effort: safety, livability and constructability yields the best value for the owner, occupants and public good.



BIMx: What is needed for Design & Construction

The BIM template requires both a Project Charter defining the Owner’s Project Requirements (OPR’s) and Conditions of Satisfaction (CoS) to set project expectations and responsibilities, and a concise BIMx specifying what the Model will be used for:

BIM Model “Digital Twin”		
Building Elements	Key Requirements	Key Personnel
Building Massing (LOD 100)	<ul style="list-style-type: none"> • Site Topography • Building Form • Apartment Units • Access to Exits (corridors, halls, etc.) • Exit Stairs • Elevators • Service Room Locations 	<ul style="list-style-type: none"> • Architect • Structural Engineer • Civil Engineer • Geotechnical Engineer
Design & Coordinate Critical Path (LOD 200-300)	<ul style="list-style-type: none"> • Structural Walls, Floors and Roof (correct assemblies) • Site-specific structural foundations • Envelope Systems (walls, windows and doors (correct assemblies) • Fire Separations (correct assemblies) • HVAC Systems (M&E) • Services Runs (shafts, etc.) • Life Safety Systems (sprinklers system) • Kitchen & Bathroom Pods (correct service connections) 	<ul style="list-style-type: none"> • Regulatory Planning Permit • Building Permit • Mech. and Elec. Engineer • Energy Model Consultant • Building Science Consultant • Fabrication Supplier • Key Material Supplier • Key Suppliers and Trades
Maximizing livability and comfort (LOD 300)	<ul style="list-style-type: none"> • Interior, non-load-bearing walls (correct assemblies) • Modular millwork, fixtures and equipment • Special equipment & services • Finishes 	<ul style="list-style-type: none"> • AHJ Building Permit –to confirm accessibility/adaptability • Other suppliers and trades



Minor Building Use Elements	Furniture, features, etc.	<ul style="list-style-type: none"> • Other suppliers and trades
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Common Data Requirements	
Information Elements	Key Requirements
Site Assessment Reports	<ul style="list-style-type: none"> • Legal Description • Site Survey <ul style="list-style-type: none"> ○ Property Lines ○ Incoming/outgoing services ○ Easements, right of way, etc. • Climatic Data • Geotechnical & Seismic Data • Environmental/Hazmat
Details – Regional/Climate Zone specific Detail Libraries	<ul style="list-style-type: none"> • Structural/seismic performance • Architectural/envelope performance • Access: Canopies, balconies, features attached to building envelope (lighting, etc.) • Energy requirements
Details – Typical connections, etc.	<ul style="list-style-type: none"> • Incoming/outgoing services • M&E system connection • Adaptable/accessibility • Millwork & finishes
Details – Site-specific elements	<ul style="list-style-type: none"> • Civil & site: equipment/systems • Foundations
Specifications	<ul style="list-style-type: none"> • BIM Requirements • Project Delivery Requirements • Master Format Specifications

Project Delivery: Defining Collaboration in the Charter

BIM for DASH requires the owner, architects, engineers, construction managers, fabrication supplier, and other key suppliers (as well as AHJ’s) to be brought on much earlier than typical. DASH maybe ideally be paired with collaborative project delivery methods such as IPD. DASH requires teams to assess and make project decisions at the same speed possible with BIM-assisted, accelerated projects. DASH provides the means to mature a design quickly and can provide more information earlier. DASH projects cannot be held up by traditional project delivery or decision-making processes.



DASH CONCEPTUAL BIM WORKFLOW & TIMELINE

Requirements	Tasks	Items	Estimated Timeline (Month)
A. Conceptual & Feasibility Phase			
1. Site & Context	1. Legal & Survey	Legal Description: Establish easements, right of ways, impairments, etc.	0-1
		Survey of Property: Set property lines, setback, environmental areas, right of ways.	
		Existing Conditions: Review Civil/Geotech. reports, designate BC Hydro service, existing structures, etc.	
	2. DP Regulations Overlay (Pilot)	DP Parameters: Set setbacks, access requirements (vehicle/pedestrian)	
	3. AHJ Site & Building Requirements	Define requirements under 3 “Tiers” of complexity: <ol style="list-style-type: none"> 1. Tier 1: <ol style="list-style-type: none"> a. Code: Step Code 4, BCBC, Fire Code b. Hydro service/capacity c. Flood/Storm (tank?) d. Topography – flat-ish e. Access and traffic f. Offsite requirements set 2. Tier 2: <ol style="list-style-type: none"> a. Requirements unique to site, but not novel or specific to site. 3. Tier 3: <ol style="list-style-type: none"> a. Novel or specific to site, requiring custom solution. 	
2. Set Building Program	1. Owner’s Project Requirements (OPR’s)	1. Set Building Program: <ol style="list-style-type: none"> a. Area & building height b. Unit mix & sizes c. Required amenities d. Construction type (LWF) 	0-1



Requirements	Tasks	Items	Estimated Timeline (Month)
		2. Define Conditions of Satisfaction: <ol style="list-style-type: none"> Occupant accessibility & function O&M Building resilience & performance Budget & schedule Finishes, equipment Specialty items “Must haves” (e.g. meet BC Housing Design Guidelines)	
3. Set Viable Design	Option A: Generative Design	Software-assisted site layout and massing and layout. Key requirements for software: <ol style="list-style-type: none"> Generate solutions based on prefabrication. Kit of parts constraints to realize downstream design, fabrication and construction efficiencies Generate unit layouts and mixes according to owner requirements. Overlay massing and layouts on legal, site and existing conditions to confirm feasibility. 	1-2
	Class A Project Investment Decisions	Confirm high-level (elemental) feasibility - budget, timeline and project OPR's & CoS.	
B. Design & Permit Phase			
4. Rapid Schematic Design	1. Kit of Parts: Layout Blocks	Concurrently with Massing & Site Placement, the unit layouts can be designed efficiently and quickly.	2-3
	2. Menus of Components - Kit of Parts: Systems, Energy & Carbon Performance	Site, massing and form, building orientation, layout and size, design and selected. Kit of Parts achieves Building Code at a minimum . Detailed verification or tweaking occurs in 5. Design Development. <ol style="list-style-type: none"> Architecture, layout, accessibility and building safety Structural system M&E system design, energy performance (i.e. Energy Model) Site & Civil services design 	



Requirements	Tasks	Items	Estimated Timeline (Month)
		5. Set key design constraints: site, building access and accessibility, window/wall ratios, openings, etc.	
	3. Prefabrication Optimization	AI optimization of the prefabricated design of the building through centralized software with open market. Software should: <ol style="list-style-type: none"> 1. Integrate different fabricator suppliers' manufacturing preferences for walls, floors, roof and major structural elements. 2. Integrate "Best Practice" constraints based on coordination with manufacturers and builders. 3. Coordinate with the regions-based Detail Libraries. (See. 5.) 4. Include both costing and logistics factors (e.g. assist with planning transportation, etc.). 5. Allow multiple suppliers to bid to encourage competition and innovation. 	
	4. Class B Project Verification	Confirm budget, timeline and project OPR's & CoS based on Critical Path Elements & Equipment items.	
5. Planning Approval	1. 100% Schematic Design	"Set" Schematic Design: <ol style="list-style-type: none"> 1. BIM available for design 2. Drawing Package available for finance applications, AHJ submission and records, etc. 	3
	2. DP Verification & Approval	Submit to AHJ for regulation verification (pre-approval):	
		Option A: e-Permit submission, fully AI-based plan checking for compliance with regulations: <ol style="list-style-type: none"> 1. Kit of parts, compliant: Majority of projects will utilize the kit of parts will be 100% compliant. 	



Requirements	Tasks	Items	Estimated Timeline (Month)
		2. Kit of parts with options - requires limited review: Some projects will require limited human review of specific design responses to unique site conditions. For example, a concrete ground level podium can be added to manage heavily sloped sites. 3. Hybrid Kit of parts, review: Few projects may require elements to be “non-compliant” due to complex or difficult site conditions. Kit of parts can be used, but custom design responses will require the project to be reviewed and assessed by human planners.	
		Option B: e-Permit submission utilizing AI-assisted plan checking. Similar to the above option but requires an additional step to convert submitted digital files for ingestion into plan check software. This allows for traditional PDF’s, scanned drawings, etc.	
	3. Fabricator-ready Structural Package	Select Fabrication Supplier(s) based on “4.3 Prefabrication Optimization”, integrated into design team.	
6. Design Development & Coordination	1. Key Details & Prefabricated shop drawings	Select Detail Package (BIM) and Specifications (digital software): Select Detail Package and Specifications based on Region-based libraries: 1. Consultants design and review for sign-off: a. Architectural Details: Life safety, durability, overall performance, acoustics, etc. b. Civil & Geotech Modules: Site services and conditions	*4-6



Requirements	Tasks	Items	Estimated Timeline (Month)
		<ul style="list-style-type: none"> c. Structural Kit: Structural and seismic safety, including site specific foundation design. d. M&E + Bldg. Science Modules: Systems, energy, and performance. e. Fabrication Supplier: Design and issue Shop drawings for Structural Kit of Parts. 	
	2. Interior & Accessibility Design	Utilize BIM for interior design to meet occupant livability, enhance accessibility, utility and comfort.	
	3. Select: Finishes, millwork systems & equipment	Specify millwork systems and equipment related to livability, accessibility, utility, and comfort.	
	4. Class A Project Verification	Confirm budget, timeline, and project OPR's & CoS.	
7. Building Permit	BP Verification & Approval	Submit BIM, supporting documentation and letters of assurance to the AHJ for Building Permit: Option A: e-Permit submission, AI-based plan checking. Option B: e-Permit submission utilizing AI-assisted plan checking.	6-9
C. Contract Document Phase			
8. Issue for Tender	<ul style="list-style-type: none"> • Award PO's for successful critical path suppliers • Issue for market for bids for other suppliers 	<ul style="list-style-type: none"> • Issue Contracts Documents for market tender and selection of suppliers. • Owner confirms Contract: Division 0, 1 and supplementary conditions. 	9
9. Confirm Contract Documents	<ul style="list-style-type: none"> • Document based on Successful Tender • Issue Contract 	1. Review & verify availability of all tangible building elements.	10



Requirements	Tasks	Items	Estimated Timeline (Month)
		1. Approve prefabricated shop drawings to begin fabrication	
10. Issue for Construction		Issue 2D and 3D documentation for: 1. Issue for Tender (IFC) Bidding Documents 2. Fabrication Shop drawings Issued for Construction (IFC)	10-24



A. CONCEPTUAL & FEASIBILITY PHASE

Conceptual & Feasibility Phase Objective

- Rapid site feasibility assessment
- Define distinct site requirements & coordinate with AHJ
- DASH building massing and program
- Class A BIM-assisted elemental take-off
- High-level project schedule

SITE & MASSING DESIGN

The use of site-based generative design tools can quickly develop options for building massing, based on planning regulations, the DASH Kit of Parts, and Owner's Project Requirements (OPR's).

Massing with DASH streamlines the design process to submit for planning compliance much earlier. This allows for Design to start and finish much quicker once a viable design has planning approval.

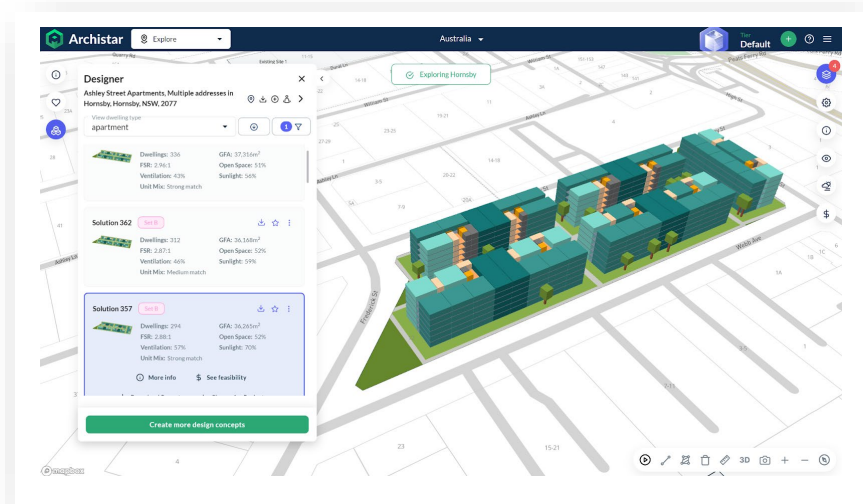
Other layers must be overlaid to show compliance with site-specific civil requirements such as:

1. Site legal requirements
2. Site-specific setbacks such as environmental
3. Existing incoming/outgoing services

With the more mature design possible with DASH and the BIM template, a project can assess and react to AHJ requirements sooner, cataloging the risks, requirements, and opportunities before the "go/no-go" investment decision is made, and design effort is expended.

With BIM and a digitally capable AHJ, building requirements can be resolved or flagged much earlier in a project's timeline. This includes:

- Sitting and massing

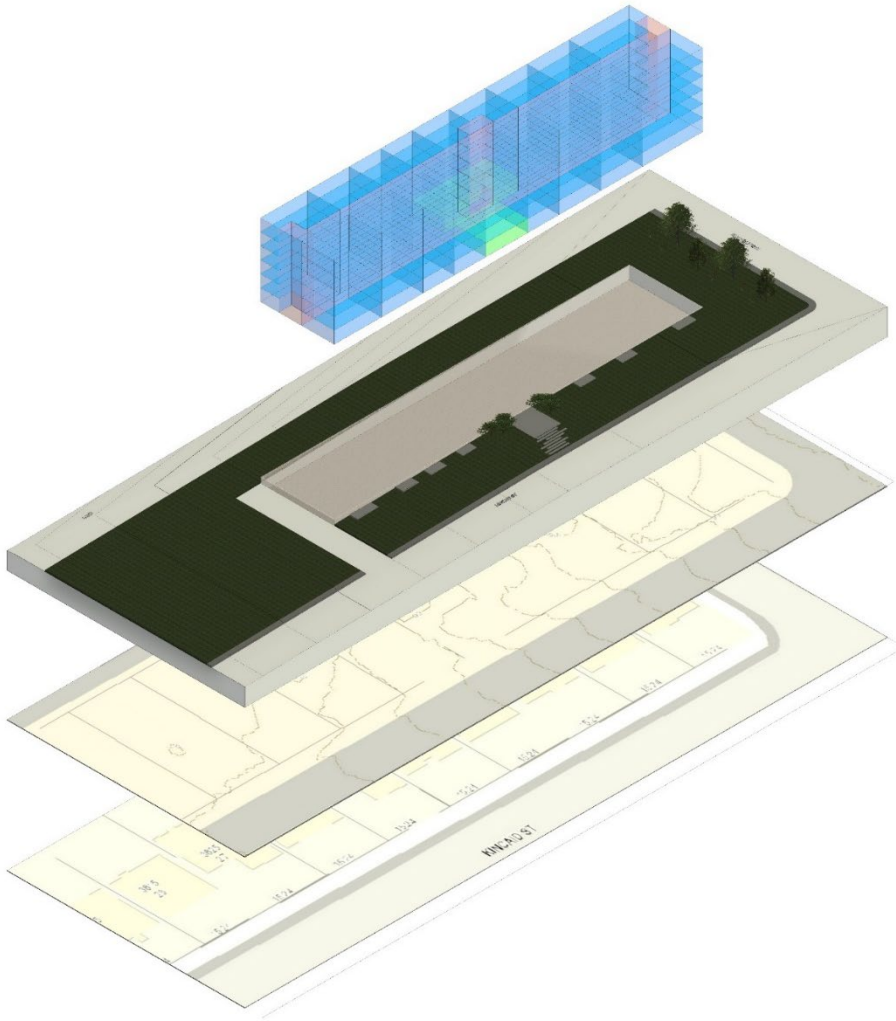




- Firefighting and rescue
- Rainwater management
- Incoming / out-going services.. The owner/developer can also test their Project Requirements and Conditions of Satisfaction (e.g. is the building site too sloped for seniors housing? etc.) on sites to assess any unique feasibility requirements.



BIM TASKS: CONCEPTUAL & FEASIBILITY PHASE



Generative Design:

Building Massing Imported from site-based generative software of choice, in IFCv4 format.

Ground Floor Level

Set based on site, AHJ or owner's requirements.

Site Survey Level

Imported from survey CAD files as 2D overlay to generate site topography. Site Survey also sets the BIM Survey Point.

Legal Level

Imported from Survey CAD files or drafted based on record data or from AHJ GIS data.

Site Design

Confirm form, facing, and site placement. Confirm site-specific energy analysis.



Civil & Site Requirements

Tier-based approach to site and civil servicing, coordinated with AHJ's, allows sites to be pre-vetted for suitability for DASH developments. The intention is not to exclude sites from DASH or “lock-in” sites for DASH developments, but to assess the general complexity of a site to allow owners to assess the commitment required to develop a site.

Tier 1: Commonly required and definable for all sites.

Tier 2: Specific requirements unique to site, but not novel or specific to site.

Tier 3: Specific and novel requirement for the site, requiring custom solution.

Some of the requirements that can be setup in tiers:

1. Code: Step Code 4, BCBC, Fire Code based on AHJ
2. BC Hydro service/capacity
3. Flood/Storm management
4. Topography
5. Ease of site access and traffic
6. Other AHJ site requirements

The Tier-based categorization also allows project teams to assess downstream design and construction requirements early on, reducing unknowns and providing a high level of understanding of the sites requirements and complexity.

Site-specific Energy Modelling

A site-specific energy model should also be completed to factor in site conditions and building massing specifics (facing, shape, etc.) to generate site-specific building parameters (window/wall ratio, size HVAC systems, etc.) for design.

Generative AI Site Assessment

Based on early coordination with Archistar, constraints and the DASH kit of parts can be setup within generative design software to rapidly generate options (“single click”) on a particular site or multiple sites across Metro Vancouver, assessing suitability for a DASH building.



B. DESIGN & PERMIT PHASE

Schematic Design Objectives

- Rapid Schematic Design
 - Site & Civil design, including intent and details
 - Architectural layout, life-safety design
 - Structural system design
 - M&E systems design
 - Energy Model confirmed
- Pilot Regulations or Development Permit Submission
- Class B BIM-assisted estimate, Class A budget goals set (target price)
- High-level construction schedule for project planning

SCHEMATIC DESIGN SUB-PHASE: BIM BLOCKS AND MODULES

The Kit of Parts is designed to quickly populate the massing model using pre-reviewed, digital apartment “blocks” and “sub-blocks”, as well as a standard “menu” of BIM components representing household fixtures, equipment, etc.

Accelerating schematic design by using standardized layouts and components common to similar MURB projects helps avoid reinventing the wheel each time. This reduces back-and-forth revisions, rework, and unnecessary variation. DASH’s use of digital twin institutionalized lessons-learned and evolutionary development of MURB’s through two BIM design elements:

1. **Blocks:** Pre-assembled apartment units using the pre-designed, reviewed, and approved design modules. The blocks can also be specific elements such as building ends with exit stairs, elevator cores or 90 Degree building angles. Ideally, the blocks that are favoured should be re-used on multiple projects to gain efficiency, reduce variation, derisk a portfolio of projects, and increase supplier familiarity.
2. **Sub-blocks:** Blocks are assembled are the pre-reviewed and approved elements within blocks, such as primary bedrooms (with ensuite bathroom), living, and secondary bedrooms/bathrooms. Modules also allow for the evolution of modules (and apartment blocks) over time to:
 - Improve efficiency
 - Incorporate construction lessons learned
 - Improve livability and adjust to different needs.

Modules are designed to be interchangeable.



Blocks and sub-blocks correspond to actual built building elements, systems, and features resulting from on-going DASH coordination and collaboration with consultants, builders, trades and suppliers. This is designed to streamline design and permitting, reduce variation, and support standardization for off-site fabrication and construction of “critical path” items, including:

1. Civil and Site requirements
2. Building Code (prescriptive requirements, or can included commonly accepted solutions to objective-based code requirements)
3. Unit sizes and layouts, including amenities
4. Accessibility within units and in common areas
5. Building exiting
6. Schematic Design of major systems and the building envelope
7. Prefabrication & delivery logistics
8. Select region-specific detail libraries
9. Aligned with DASH typology’s high-level energy model, and setup parameters for detailed design



BIM: DESIGNING LAYOUTS WITH BLOCKS



Example - blocks and modules constraints: 1 Bedroom and 2 Bedroom “slices”

Block and Sub-block Design

The unit blocks and modules are design to meet key constraints:

- Code & accessibility: Clearances and dimensions for safety, exiting and adaptability/accessibility. (BCBC 2024)
- Structural efficiency: Utilizes structural kit with no unique connections and simple spans for openings. (BCBC 2024 seismic code)
- System Efficiency: Mechanical systems are logically located, with vertical shafts to minimize runs.

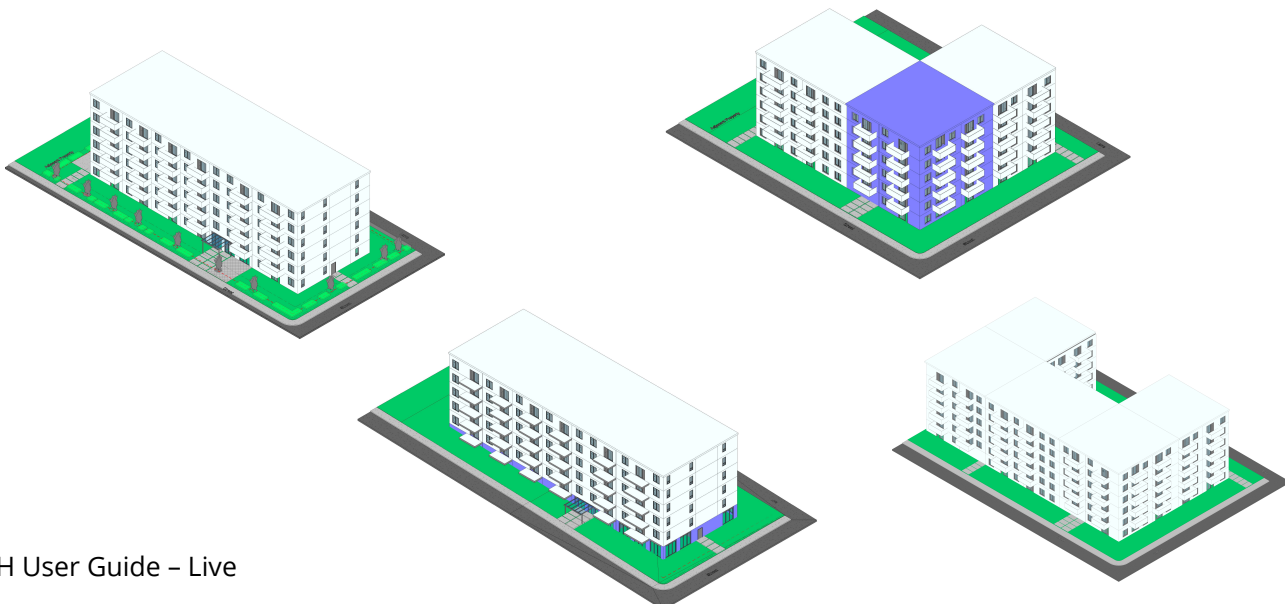


- Repeatability: Blocks are designed to be “modular” re-used to assemble different apartment sizes: 1-4 Bedroom and Studios, with only minor non-structural variations. (i.e. framed wall for closets, millwork, etc.)
- Utilize “menu” of standardized elements: Maximize the strategic use of standardized elements such as bathroom pods, mechanical service walls and HVAC systems.
- Fabricate-ability: The dimensions of module “bay” widths are whole unit increments, windows, doors and sized and located in easily fabricable locations. If dimensions need to be adjusted, it should occur in one location and be flagged. (i.e. Living Room sub-blocks are typically adjustable by approx. 1'-0" in width)
- Constructability: The form, elevation design, and other elements are design for prefabricators to manufacture and trades to rapidly assemble prefabricated panels on-site.

DASH BIM Template – Kit of Parts

The BIM template is setup for three building forms: Bar, L-shaped, and C-shaped. The guidelines in the template, together with “connector” blocks, are pre-loaded into the template to show how the DASH building is assembled. Units can be added to expand the building to accommodate sites, owner’s requirements, or other constraints.

The blocks and modules are assembled on Level 2 of the BIM Template, which is grouped to replicate the layout as typical floor plans for Levels 3-6. This replication is for both prefabrication efficiency as well as overall building efficiency. Structure and mechanical pods and service walls are all stacked. Assembling the typical floor plan drives the layout of the Ground Level and the below grade Parking Level.





Assemble DASH Blocks

Assemble the predesigned, pre-vetted blocks or design new ones to meet a project’s needs, utilizing the constraints flexibility and menu of parts.

Assemble Architectural Layout

Assemble the DASH building, validating the exiting, services, etc. of the building. This includes ground floor amenities and below grade parking layout.

Assemble Structural Design

Validate the structural layout: cores and the number and locations of the “1” shear assemblies. Confirm the nailing and assembly details for the exterior wall panels and framed shear walls.

Assemble M&E Systems Design

Assemble and validate the mechanical system will serve bathroom pods and mechanical service panels. Confirm size, location, and service requirements for the mechanical system.

Energy and Elevation Design

Place windows, doors, balcony systems, lighting, etc. Validate energy performance, select region-specific Detail library, confirm HVAC performance.



BIM Template – Menu of Components

The template is pre-loaded with families, groups, and types coordinated with the detail library – the “Toolbox”. Components in the Toolbox are standardized for all DASH building types and are the “building blocks” for all blocks and modules, as well as for elevation design, interior design, and other specialty components for specific requirements. The components include:

Types

1. Wall assemblies
 - a. Including mech. wet wall assemblies
2. Floor assemblies
3. Roof assemblies
4. **Structural (see text box)**

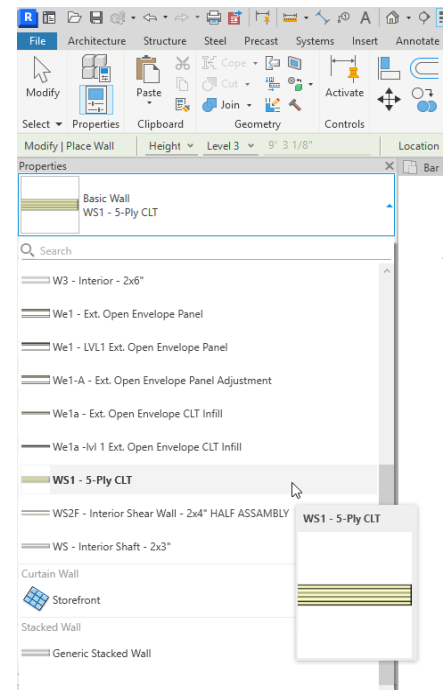
Groups

1. Unit Blocks
2. Unit Modules
3. Exit & Elevator Modules
4. Bathroom Pods
5. Mechanical Systems
6. Civil & Other Site Systems

Families

1. Standardized kitchen millwork
2. Mechanical Systems
3. Civil & Other Site Systems

See Design Development on the data, information, and perimeters embedded into the types, groups and families.





Structural Menu: Kit of Parts

The Toolbox ensures blocks and modules only use standardized components and are coordinated with consultants, fabricators, and suppliers (e.g. for design, specifications, take-off, etc.). Furniture, equipment and plumbing families are also nested into groups to support the rapid transition from schematic to design development to tender. It's expected that selection can be standardized by user groups, BC Housing, Metro Vancouver Housing, etc., and available for all project teams.



The DASH structural kit of parts is designed to scale to meet the building type, size, and site seismic zone. The “drop-in” system is designed with three main structural elements in the Model that when combined, creates a very simple code-compliant structure usable across Canada, which is easily fabricated and installed. The current design is suitable for Metro Vancouver seismic conditions. Note the colour designations for the structural elements are visual filters already set in the “VV/VG” options.

Exit stairs & Elevator Core: BIM Model Groups

WS1 CLT Wall Type, 5-ply CLT panels

The template contains 2 groups: a double elevator core and exit stair core. The approx. 60 lineal ft of 60' CLT panels. These help tie the superstructure to the foundations.

Drop-in “I” Shear Wall Assembly:

WS1 CLT Wall Type, Building Perimeter shear panel, 5-ply CLT panels

8' x 60' 5-ply CLT panels are a distinct wall type, and are located at each exterior and corridor walls, either side of the Shear Wall, double frame wall. The template contains 6 such “I” Shear assembly for a total of 6 panels.

WS2F Wall Type, designated Shear Wall, double 2x4 frame wall

Double 2x stud walls with plywood on 1-side (inside) of each wall. The wall type is modelled as two side-by-side walls dividing each apartment block and replaces the typical double partition wall



assemblies between apartments by assigning “Double shear wall” to the instance mark parameter. Note the shear wall and partition wall assemblies are very the same thickness.

Exterior Prefabricated Closed Envelope Wall Panels

We1 Exterior Panel Wall Type, 2x6 closed envelope panels

The closed panels are tied to the floor panels and CLT Shear Walls with nailing patterns at wall-to-wall connections, or through subfloor plywood to wall plates and nailing patterns at floor-to-panel connections around the perimeter exterior walls. The rigidity of the overall system allows for the elimination of plywood. However, plywood has been included in the current exterior wall type.

Foundation Connections – Core & I Shear Wall Assemblies

Conceptual Cast-in-place Concrete Details

Conceptually, the Core and I Assemblies are tied to slab band foundations, minimizing the likeliness for columns or other cast-in-place elements. However, the conceptual details are just a start point, as the specific foundation design will need to be completed by an engineer for regional and site-specific conditions.

Structural Design & Layout Diagram

Timber Engineering is leading the development, design, and testing of the DASH Structural Kit of Parts. Further models, drawings, and technical reporting will be provided in the near future.

Menus of Components

- Framework - Modules and blocks: The blocks are designed with 1’ increment “bays” to make the floor panels and exterior wall panels predictable and simple for fabrication suppliers. One living module can be designated an “adjustment bay” to meet different site sizes.
- Structural & Envelope Wall Types (Reference: Table 9.10.3.1.-B):

WS3-SW-H	Similar to W15a Wall Type - 2x4 interior, <u>half</u> of double shear wall assembly (i.e. 2 side by side is the complete shear wall assembly)	2x4 wood studs and plywood sheathing, ideal for prefabrication and rapid site assembly. Reducing the need for complex connections, hardware, rods, etc.
	Alt: W15b Wall Type	
We1 types	Closed 2x6 prefabricated envelope panels	Wall type coordinated with details for WRB/insulation continuity required to meet



		Step Code 4. Panel connections do not require special hardware or techniques.
W2, W3	Typical 2x4 and 2x6 interior walls, gravity bearing	2x stud walls between modules. Gravity-bearing wall carrying TJI floor joists.
W5	CLT, shear wall panels	5-ply CLT walls for 2 uses: <ul style="list-style-type: none"> • 8' x 60' shear panels for exterior walls and corridor walls. • 60' shear panels for exit stairs and elevator cores.
W6	8" thick cast-in-place concrete walls, conceptual for structural coordination	Conceptually, the concrete foundations will be 8" thick.

• Wall Types (Reference: Table 9.10.3.1.-B):

W1	W8a Wall Type - 2x4 studs staggered on 2x6 walls, corridor partition walls	Corridor walls provide greater sound separation with staggered wall assemblies.
W2, W3, W4	Typical 2x3, 2x4 and 2x6 interior walls, non-load bearing	Non-structural 2x walls for closets, millwork, etc. and other interior partitions. Adding new partitions requires review to meet accessibility/adaptability clearances within apartments.
W2F, W3F	2x3, 2x4 furring wall, with finish wall board on 1-side only	Furring walls for situations where a built-out wall is required for in-apartment services or features.
W2S-1, W3S-1, W3S-2, W4S-2	2x3, 2x4, 2x6 prefabricated. service panels, with wall finish on "-1" or "-2" sides.	Prefabricated. "wet walls" that can be sized and assembled to quickly connect plumbing, electrical, data, and other services, or act as horizontal ways to run services to vertical shafts.
W2-IS	2x3 interior shaft wall with shaft liner	Shaft walls for all vertical shafts for building service runs.
WS3-SW-H	W15a Wall Type - 2x4 interior, half of apartment unit partition assembly (i.e. 2 side by side is the complete partition wall)	2x4 wood studs and gypsum wall boards for fire and sound performance.
	Alt: W15b Wall Type	



- Floor Panels (Reference: Table 9.10.3.1.-B):

FA-1	F6d Floor Type - 11 7/8” TJI floor cassette with 5/8” T&G plywood subfloor, 1 ½” concrete topping.	Prefer concrete topping for fire and sound performance. Alternatives possible.
FA-2C	8” 8” thick cast-in-place concrete suspended slab, conceptual for structural coordination	Conceptually, the concrete suspended slab will be 8” thick, with 12” slab bands for stair and elevator cores and “I” assembly shear walls. Typical rectangular concrete columns and spread foots.

- Roof Panels:

RA-1	11 7/8” TJI roof cassettes, with insulated roof and membrane assembly	Conceptual prefabricated roof assembly similar to FA-1, except with roof slope package and membrane.
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- Windows: Within envelope panels, windows are coordinated with panel constructability – the windows and balcony doors are considered maximum sizes and ideal location for the current design. For installation, two options are being developed:
 - Installed off-site: Integrated window panels like window wall systems, where opaque and glazed panels are integrated at the fabrication supplier’s facility. (see: Brock Commons)
 - Installed on-site: Installation of the windows, either complete or partial assemblies, on-site. This typically is required to maintain the window installer’s warranty, who will not cover transportation, panel installation, etc. of installed windows.
- Balconies: Current balconies are the attached type, where structural elements are pre-installed in panels. An example would be like “Speed wall” type panelized products.
- Sequence of construction: The modules and bays’ panels are designed to be assembled level-by-level to allow for simple transportation, lifting, and installation. “Balloon” type wall panels spanning two or more levels are currently being investigated.



SITE-SPECIFIC DESIGN

Site and Civil Services

“Complexity Tiers” organizes technical items to support the development of standardized civil/site blocks or modules to address the majority of sites

However, some cases will still require human review, as site conditions can vary significantly. The intent is for lower-complexity tiers to be more common and require far less review than higher-complexity tiers, which are reserved for niche or unique site conditions.

For example:

- a. Fire Code – Fire Marshal review, site-specific response: Required review to determine firefighting and rescue requirements. DASH may allow for this review to occur much earlier with more certainty in the final design.
- b. Hydro service/capacity – Modules/Kit, coordination with BC Hydro: A suite of Hydro kits could be developed that capture most DASH building’s needs. They could be developed as “plug and play” elements in cooperation with BC Hydro.
- c. Flood/Storm – Modules/Kit, site-specific design: A suite of on-site water management kit parts can also be developed to streamline design. However, site drainage will need to be site-specific as hydraulic conditions and loads can vary widely and will require review during the pre-approval check.
- d. Topography – ground floor podium option: The DASH Kit of Parts includes the option for a concrete ground floor (“podium”) that can be utilized to manage site with significant sloping. However, this may mean portions of the ground floor will be custom designed and will require review.
- e. Access and traffic – AHJ review required: This will require site-specific considerations, design and review but is not expected to be a major hurdle.
- f. Offsite requirements set – defined by AHJ: Different sites in Metro Vancouver may require site-specific requirements. Ideally, these requirements will be identified and defined by the AHJ during site selection and factored into the complexity assessment of the site.



Foundations and Parkade

Foundation design requires geotechnical testing to determine a site's specific geotechnical conditions. This requires engineering foundation design for the specific conditions. Conceptual cast-in-place details will be designed as part of the detail libraries.

Parking in the single level of subsurface parking will also have a conceptual layout, which could be changed to accommodate any AHJ-specific parking requirements that may be included as part of their Regulations. The conceptual design will also provide some flexibility for locating services or occupant storage.

Menu: Mechanical, Electrical and Major Specialty Equipment

Mechanical systems, bathroom pods, and wet walls must be coordinated in the BIM. This ensures large critical operational equipment is integrated, and conflicts with prefabrication and envelope are resolved.

The development of building services menus is on-going. These kits of parts ensure these critical elements are coordinated and prefabrication-friendly as early as possible for the development of DASH Projects. The apartment blocks are created as vertical slices like sliced bread to ensure kitchen wet walls and bathroom pods are located at the back of the units (adjacent to the corridor), are vertically stacked. Blocks also include vertical shafts to coordinate service runs and operation and maintenance requirements of the standardized equipment of the Menu.

Limiting Distance & other site-specific parameters

The Kit of Parts Wall Types includes variants with non-combustible finishes to accommodate DASH designs very close to side property lines. In addition to Wall Types, the unit blocks at the "book ends" for the two types (bar and L) can be designed with no windows, or with small secondary windows for the bedrooms.

Access and exiting

Vehicle and pedestrian access, including specific site, accessibility, or privacy considerations, may require AHJ review.



BIM: EARLY DESIGN-CONSTRUCTION COORDINATION OF CRITICAL PATH

DASH's standardization and embedded elements provide sufficient information to coordinate design with construction much earlier. The BIM template is the “master” file that can be shared or exported in IFCv4 format for suppliers to coordinate their own fabrication, supply, and logistics software. The DASH template can also set parametric (if appropriate) within wall types, families and groups that correspond with key manufacturers' products, assemblies and elements.

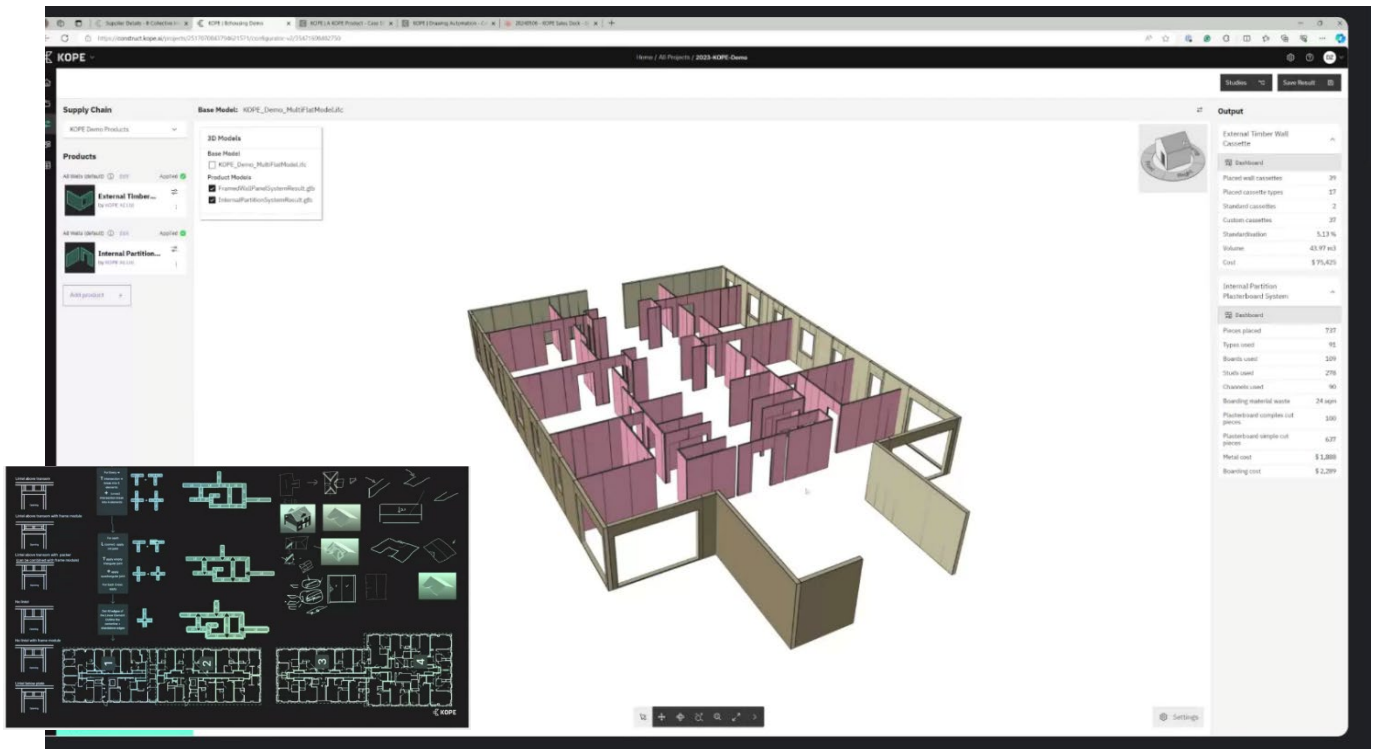
The BIM templates will be regularly coordinated with a steering group of fabrication suppliers, incorporating their experience and fabrication requirements as much as possible. The Critical Path elements that must be coordinated early:

1. Site & civil systems
2. Architectural form: life safety, accessibility, etc.
3. Structural system: Building and foundations
4. Mechanical and Electrical: Energy performance, envelope details, HVAC systems



SCHEMATIC DESIGN: FORM AND PROGRAM SET

Pre-planning or quick approval, combined with designing using standardized elements, “set in stone” the building form early in the project timeline. This enables more effective prefabrication



optimization and coordination, a significant advantage of DASH building. This is critical for yielding the greatest schedule and cost benefit from the DASH kit of parts. With the building form set, Design Development focuses on details, fit-out and coordination for fabrication and construction.

Kope.AI Prefabrication Optimization

After Schematic Design is set, **no major building changes should occur past this point.** Currently, Kope.AI has provided a proof of concept for integrating AI-based tools into DASH that assess the digital twin of a DASH MURB design to optimize for prefabrication (panelized construction). These tools draw on a “marketplace” of suppliers who are working to standardize their approach to prefabricated walls, floors and roofs. The panel constraints are based on fabrication suppliers’ parameters, allow for high-level costing to be automatically quoted, and allow for comparison with other subscribed fabrication suppliers within Kope.AI. The DASH template provides the wall assemblies setup to facilitate easy upload into Kope.AI:



1. Wall Types: The prescribed assemblies are created within Revit’s wall assembly tool, and interior, exterior and CLT wall types have digital parameter “type mark” designating their role.
2. Model: Wall types are distinct elements and not composites of different wall types. Filters are set up to assist software in isolating the wall types for AI assessment of panelization.
 - a. Note on other families and groups: Critical to Kope.AI and other software, families should be classified correctly to allow easy isolation of wall, floors, and roof in the BIM. This reduces the workload when the Model is uploaded to software for prefabrication optimization.
 - b. The model’s walls must be floor level to floor level to allow the Kope.AI to optimize
3. BIM format: Depending on the software and/or fabrication supplier, the BIM can be shared in its native RVT format or exported to IFCv4.

Note that the above guide is specially for Kope.AI as the proof-of-concept partner. Other options may require different parameters.

DESIGN DEVELOPMENT & COORDINATION SUB-PHASE

- Design Development:
 - Architectural details, exterior design, interior fit-out, specialty equipment
 - Structural details
 - Prefabricated Shop drawings
 - M&E details
 - Energy performance verified
- Building Permit Approval
- Class A Pre-tender Estimate
- Detailed construction schedule

Assembled Modules & Pods

The efficiency of the “vertical slices” provide more prefabricated options - pods, millwork, windows and balconies, that also leverages the BIM-based workflow and works within rapid site assembly practices.

Millwork

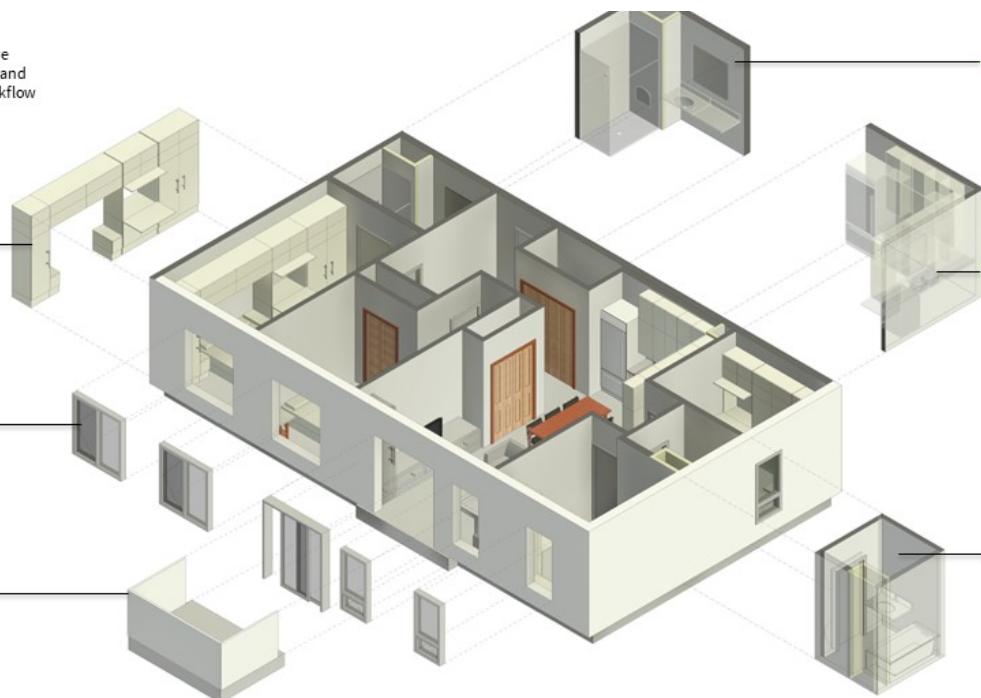
Millwork can be modular: adaptability, efficient layouts, changes over time, etc. Allows for “just in time” delivery, and rapid site assembly.

Exterior Opening

Windows and balcony doors can vary in size, shape and location – within the constraints of off-site manufacturing, transportation and crane installation requirements.

Balcony Options

Choice includes cantilevered, embedded and Juliet options, allow for access to outside air, as well as allow limited articulation for architectural expression.



Pod Option: Panelized Kits

Kitchens and bathrooms can be “flat-packed” packages complete with mechanical and electrical rough-ins, ready to be delivered and assembled.

Pod Option: Drop-in Service Panels

Drop-in service panels, roughed in for plumbing and electrical, can be standardized based on kitchen pods. They can be rapidly assembled for mechanical and electrical trades to allow earlier installation of services.

Pod Option: Pre-fabricated Units

Bathrooms can be completely fabricated and assembled off-site, and delivered as “plug and play” units that only require service connection after installation.

BIM TASKS: DESIGN DEVELOPMENT SUB-PHASE

Diagram of the menus of elements that make up each digital blocks and apartments.

Elevation Design

Design the DASH building’s elevation with the windows, doors, balconies, sunshades, etc. components, balancing access to daylight, good elevation design, and energy performance.

Layout Coordination

Review bathroom pods and service panels for coordination with HVAC and plumbing systems. Review modular millwork and furniture layouts to ensure interior design meets Owner’s requirements (occupant use, accessibility, etc.).

Verify Details

Confirm elevation design and energy performance aligns with the correct region-specific envelope details. Confirm Mechanical details are coordinated with structural details and interior design.

Professional Assurance Review

Consultant review of DASH design for professional assurances. Owner confirms design meets OPR’s and CoS as defined in the Project Charter.

Details, Fit-out & Coordination

Design Development focuses on detailing and fit-out once the building form, size, layout, configuration is optimized for prefabrication.



1. Exterior - Wall types, shop drawings and finishes: Determines the correct detail library and complimentary specification package.
 - a. The panels allow for a limited number of finish options built on the standardized panel, which is currently completed on-site to maximize quality with today's supply and skill context. In the future, panels complete with exterior finishes will be developed to take advantage of off-site fabrication and speed up on-site completion of the envelope.
2. Exterior – Doors, windows and balconies: Selection of doors, windows and balconies, including envelope and structural connection details.
3. Interior fit-out: Selection of modular kitchen and bathroom millwork, with connections to the mechanical/plumbing pods and wet walls set during Schematic Design.
 - a. Interior Design - finishes & features
 - b. Accessibility and adaptability enhancements
 - c. Specialty equipment (small)

Prefabrication & Construction Coordination

Simultaneously during consultant Design Development, the fabrication supplier selected through the Prefabrication Optimization process (Kope.AI) will coordinate their prefabricated shop drawings for all wall, panel and roof panels in coordination with the consultant team.

Parallel, coordinated development of structural and envelope details is designed to reduce rework and errors. It also helps expedite and streamline the issuance of tender (IFC), fabrication (shop drawings), and construction (IFC) contract documents.

Region-specific DASH Templates, Menus of components, Detail Library

As DASH typologies are developed, different region-specific kits of parts will be developed. These kits should also evolve over time as codes, requirements, and preferences change.



BUILDING PERMIT SUBMISSION

The Schematic Design Package is designed to facilitate the development of the documentation required for Building Permit applications. Typically, the remaining outstanding items are developed during Design Development, with additional details and information being added to DASH. This detailed information will allow the Coordinating Professional and Consultants to streamline Design Development and Construction Documentation, allowing them to focus on their professional responsibility for public safety, public good, and good design:

1. Appropriate region-based detail library to confirm Step Code 4 compliance.
2. Site-specific design details for foundations, together with the Site and Civil modules and details developed earlier.
3. Inform site reports and documentation backing up the design, as required for Building Codes, AHJ regulations and professional responsibility.
4. Professionals to complete the design to their satisfaction issue letter's of assurance.

The DASH BIM workflow uses standardized blocks and menus of standardized, kits of parts to minimize the need for “custom every time” design. The assumption is that standardization will cover 80% of a DASH building's requirements, with 20% being site-specific design. The goal is to develop the Kit of Parts (and Toolkit) to provide a range of blocks and modules to streamline the site-specific design as much as possible.

DASH does not replace the Architects' and Engineers' professional: DASH provide digital design tools to assist, streamline and support their good judgement and professional experience. DASH digital design tools are coordinated with the regulatory, fabrication and construction tools and practices being developed collaboratively with professionals all along the building development supply chain.

Building Code requires life safety compliance assurances by Registered Professionals, demanding review, design, and acceptance of responsibility by the professional of record, as well as complete review by the AHJ. The finer resolution of detailed design possible early on in a project's timeline using standardized blocks and menus of kits of parts aims to reduce the repetitive design commonly required for all MURBs. This opens up more time for professionals to focus on life-safety and good design for specific DASH housing typologies.

The goal is to focus professional time and fees on high-value efforts such as safety, livability, and constructability. These priorities deliver the greatest benefit to owners, occupants, and the public good.



Lastly, AHJ submission can be through traditional 2D means such as printed and sealed package generated from the BIM, or the BIM digitally submitted for e-permit review in the near future. The BIM template will evolve in consideration of the range of e-permit software currently being piloted and adopted in BC.



DASH FIT-OUT: MENUS OF FIT-OUT ELEMENTS

DASH intends to develop a library of BIM elements in coordination with a broad range of suppliers and fabricators, incorporating their products parameters, data, etc. DASH menus of BIM components are how data and requirements are coordinated, not just for the creation of a Model. The integration of “Information” in BIM will vary depending on the product being included.

Therefore, collaboration with suppliers standardized elements will also be needed. For example, window performance must meet CSA and NAFS Standards, while prefabricated mechanical pods will need to be designed to meet several standards covering plumbing, prefabrication and safety. For example:

- Wall Type - Wet Wall / drop-in service panel: Fabricated by project - consultant design, supplier supplied.
- Window Family – windows, balcony/patio doors: Supplier standardization of standard product ranges - supplier supplied.
- Casework Family - Modular Millwork: DASH standardized design, supplier supplied, meeting AWMAC and other standards.
- Model Groups - Bathroom Pods: New, DASH standardized design, supplier supplied, meeting CSA and other standards.
- Model Groups - Balcony Systems, attached: Supplier standardization of standard product ranges - supplier supplied, meeting safety standards.

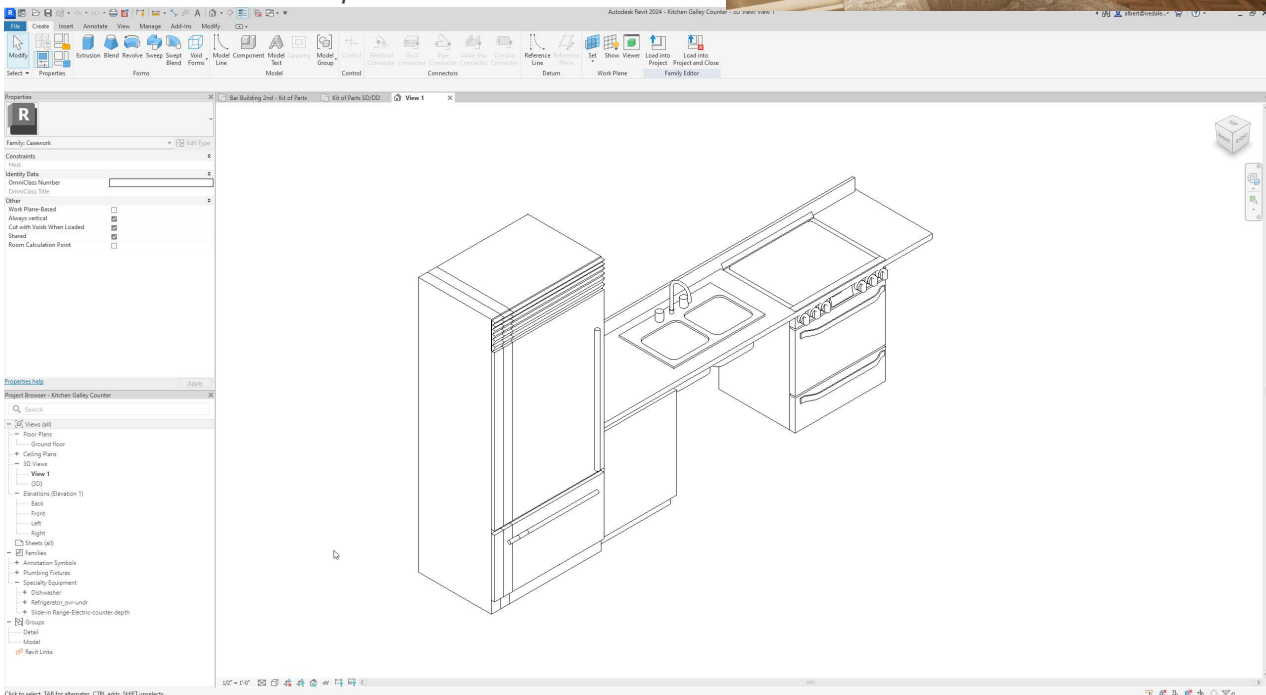
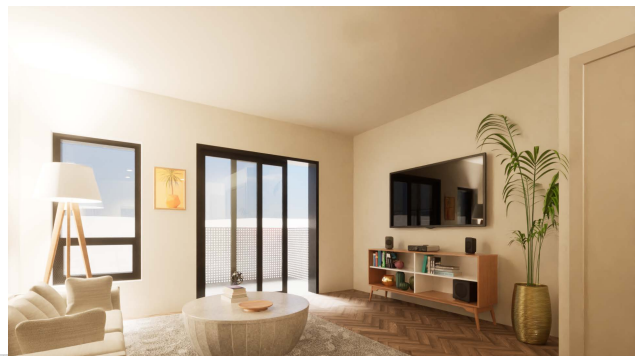




Fit out example: Modular Millwork for Efficiency & Accessibility

Adaptability is required in BCBC 2024 and to access funding such as those offered by CMHC. The Toolbox includes standardized modular millwork developed in coordination with suppliers. This approach can maximize space efficiency, particularly in studio or one-bedroom units. It also allows typical units to be converted into accessible units simply by swapping out the millwork, minimizing the need for extensive in-suite renovations.

Images Right: With the building form set and validated, interior design and occupant specific consideration can be completed.



Kitchen modular millwork family to be developed with suppliers, allowing for different cabinets to be swapped in depending desired finishes or accessibility requirements.



Fit out Example: BIM-assisted take-off

The DASH template is set up to generate schedules that quantify elements to assist with take-off for the pr-tender Class A estimate. However, this requires consultants to have strict procedures defined in the BIMx for using families and groups (as well as creating new ones) to ensure accurate categories, quantities, and schedules can “live” in the BIM file.

<Wall Schedule>				
A	B	C	D	E
Type	Type Mark	Cost	Count	Area
Cast in Place Concrete			4	7065 SF
Storefront			9	768 SF
W1 - Staggered Corridor - 2x4" on 2x6" Plate	W1 Interior		294	20894 SF
W1-A - Staggered Corridor - 2x4" on 2x6" Plate Adjustment	W1-A Interior		232	14686 SF
W2 - Interior - 2x3"	W2 Interior		68	551 SF
W2 - Interior - 2x4"	W2 Interior		1404	75518 SF
W2-Kin - Interior - 2x4"	W2-Kin		68	5106 SF
W2F - Interior - 2x3"	W2 Interior		141	5844 SF
W2F - Interior - 2x4"	W2 Interior		472	10964 SF
W3 - Interior - 2x6"	W3 Interior		313	16925 SF
We1 - Ext. Open Envelope Panel	We1		288	32640 SF
We1 - LVL1 Ext. Open Envelope Panel	We1		50	4259 SF
We1-A - Ext. Open Envelope Panel Adjustment	We1-A		117	9426 SF
We1a - Ext. Open Envelope CLT Infill	We1		21	3259 SF
We1a -lvl 1 Ext. Open Envelope CLT Infill	We1		2	310 SF
W51 - 5-Ply CLT	W13 - CLT		225	25264 SF
W52F - Interior Shear Wall - 2x4" HALF ASSAMBLY	W5		277	56399 SF
W5 - Interior Shaft - 2x3"	W2 Interior		128	1980 SF

<Plumbing Fixture Schedule>			
A	B	C	D
Family	Model	Cost	Count
22 Shower - BF			154
Bath-Alcove-KOHLER-Underscore-K-20201	K-20201-LA-0		90
Faucet-Lavatory-KOHLER-Components-K-77958	K-77958-4A-CP		244
Shower_Head_on_hose_7023			154
Sink Kitchen-Double			158
Sink-Under_Mount-Lavatory-KOHLER-Rhythm-K-2602	K-2602-SU-NA		244
Toilet-Floor_Mount-KOHLER-Veil-K-1381	<varies>		222
Toilet-Wall_Mount-KOHLER-Veil-K-31539	K-31539-7		22
Grand total:			1288

Above: Examples of BIM Schedules for elements that can assist with Class A estimates.



Other Components

Other critical elements from Civil, Mechanical, Electrical and Structural will also be developed as part of DASH's streamlined design, allowing for earlier coordination down to the detail and specifications level where possible.

The Menu will also include elevation elements where possible, such as balconies, sunshades, or exterior light fixtures, because these elements need to be coordinated. If not accounted for, they can interfere with critical-path items related to structure, envelope, and systems, or impact prefabrication and the construction sequence.

These items will be further developed as DASH grows.

USE OF MENUS OF KITS OF PARTS FOR FIT-OUT

Standardized apartment blocks and the use of menus of pre-vetted elements as standardized BIM components will streamline high-occupant-value design tasks, such as interior design, adaptability, and amenity spaces. This allows critical-path items to remain the primary focus of DASH. Design consultants can spend more time these high-value designs for occupant livability.

Other important tasks can also be made easier or faster through the use of BIM. This is effective when proper BIM practices are implemented, defined in the BIMx, and committed to in the project's Charter.

For example:

- Specifications: Simplify the drafting of specification packages by defining the relevant specification sections in the families and scheduling the sections. When integrated into software such as NBS Chorus or similar, the consultant or owner's standard specifications can quickly reference the schedule to populate the project's specification book.
- QS Estimating, take-offs: Proper categorization and organization of BIM elements can assist with take-off estimates (i.e. piece count).
- Portfolio metrics: Similarly, standardized blocks and menus can be leveraged to provide per apartment unit estimates that may be useful for feasibility assessments on future projects. This is the case if DASH kit of parts is used over sequential projects, where the data set can grow to provide detailed pricing data or provide insight into price trends.



Modifying Menus: Families, Groups and Types

The open-source nature of DASH kit of parts (within specific constraints) is designed to evolve or be modified to suit different owners, or evolve with changing building codes or standards:

1. Coordination with planning regulations: The template specifically aligns with Metro Vancouver’s Pilot Regulations requirements, theoretically allowing for quick planning approval, and/or the use of e-permit and generative software like Archistar or Test Fit. However, if Regulations are modified by AHJ’s for adoption, DASH can also evolve within the constraints detailed in this guide and the kit of parts.
 - a. Coordination with Design Guidelines: DASH is coordinated with BC Housing’s design standards and can easily yield related versions that apply to other standards.
2. Design efficiency and Integrated Design: The use of blocks as DASH’s constrained building form allows for the rapid BIM development of prefabricated 4-6 storey residential buildings. The principles are designed to accommodate other off-site delivery methods such as volumetric modular or mass timber, or any other methods that may grow in popularity such as robotic manufacturing.
3. Other Design Software: The accelerated BIM-based design possible with DASH may also allow other critical path design tasks to happen sooner, where important decisions can be made “at the right time”. For example, energy tools can ingest the digital twin of the DASH building to assess its energy performance, including factors such as orientation, facings, and shadows. They can then suggest adjustments to window-to-wall ratios and system performance to optimize energy and carbon efficiency. The tools can confirm the appropriate envelope detail library and specifications.
4. Industry prefab-ability: Pre-designed and coordinated bathroom pods, mechanical service panels (wet walls), standardized modular millwork, and integrated window and door wall panels may significantly speed up design and construction—what is often called the “Lego effect.” They can also improve quality by moving more construction into factory settings.
5. In the medium term, this could also mean economies of scale cost efficiency. DASH is actively developing (and expanding) probability, looking to engage with more suppliers to maximize panel and modular elements for DASH.
6. Accessibility and adaptability: Importantly, the flexibility offered by DASH kit of modular millwork in the Toolbox is to achieve true adaptability or universal accessibility. They can be designed to easily fit into any DASH building without the need for custom design and be easily modifiable while in-service to accommodate occupant needs.
 - a. Universal Accessibility: Like modular millwork, the development of apartment blocks specifically for the broader spectrum of accessibility requirements, including aging-friendly or other universal accessibility requirements, can be included into DASH to



- better reflect diverse populations. For example, modules can be assembled to allow for double occupancy for two tenants requiring wheelchairs.
7. Other Amenities: DASH can also include new DASH typologies that can be developed for complimentary amenities. For example, one supplier currently has a modular Early Childhood Education product.



C. CONTRACT DOCUMENTATION: FABRICATION & CONSTRUCTION

Contract Documentation Phase Objectives

- Issue document for prefabrication and construction:
 - Architectural details, exterior design, interior fit-out, specialty equipment
 - Structural details
 - Prefabricated shop drawings
 - M&E systems details
- Building Permit Approval
- Issue contracts
- Set project construction schedule

CONTRACT DOCUMENTS: IFT & IFC

The development of DASH streamlines the development of housing from feasibility, design, permitting, fabrication and construction, using BIM as the “single source of information truth”, and as a coordinating design tool to reduce variation and increase predictability. DASH’s BIM template provides the framework for information continuity required to organize and coordinate a government, private industry, and NGO response to housing. While not explored in depth during Stage 1, BIM has been used for 2D and 3D documentation for Virtual Design and Construction, Fabrication and Construction:

1. Issue for Tender (IFC) Bidding Documents
2. Fabrication Shop drawings
3. Construction planning and rehearsal
4. Issued for Construction (IFC)

The use of BIM is critical for both prefabrication and collaborative delivery methods. Both should be considered essential for the success of DASH building development.