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

Blueprint Design: Digitally Accelerated Standardized Housing - DASH
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: < 1500m^2 (greater with firewalls)
Construction: Light wood frame

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Variants:

- Current: Metro Vancouver, Climate Zone 4, Seismic Zone 4
- In-progress, TBD - other BC regions and jurisdictions
- In-progress, TBD – other Canadian region and jurisdictions

DASH Objective – Mobilization at Scale

Implement rapidly buildable mid-rise Multi-unit Residential Buildings (MURB) utilizing Building Information Modelling (BIM) based design practices that "digitize" standardization and coordination across government, the building industry and housing operators.

Note: the DASH 1.0 project team will act as "Pathfinders", offering support to other teams to develop similar digital design practices and standardized housing for different regions in BC and Canada.

Project Background

This project mobilizes at scale, system-level prefabrication solutions utilizing a digital process – Building Information Model (BIM), to make the process of providing more housing faster, easier, and more cost effective. This guide provides a user guide for the fully digitized, efficient, affordable and sustainable delivery of the multifamily. **DASH is intended to be open-source to all industry to assist in the industry's coordinated response to address today's housing need.**

The project involves developing an open-source BIM-based suite of multifamily housing blueprint designs comprising non-proprietary prefabricated elements or modules that are "pre-qualified" by social housing providers (meet functionality, livability, sustainability and resilience requirements, etc.) and can be manufactured by Canadian prefabricators using available best practice and technologies.

The project aims to digitally deliver prefabricated buildings to reduce costs of new housing builds as much as possible and speed up construction by 30 percent or greater. Digitization is also being coordinated with regulatory changes and digital permitting at the municipal and provincial level to address permitting time frames.

Contents

USER GUIDE

OVERVIEW

DASH 1.0 is the first standardized Multi-unit Residential Buildings (MURB) design to utilize generative programs and BIM-based design practices, in-coordination with government, consultants, builders, trades and suppliers, from the start. Within design and construction teams, DASH requires a concise BIM Execution Plan (BIMx) to ensure efficient digital design to fabrcation, to construction, workflow (commonly known as DfMA) that minimizes errors and leverages DASH "Kit of Parts" successfully. This "live" user guide will document and disseminate best practices, complimentary tools and other parallel innovations currently being developed to help DASH adopters to achieve the best outcomes with DASH.

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. Note the BIM Template is currently in Revit 2024 format.

BIM Project Milestones

The development of the DASH BIM template as a design and coordinating tool for DASH to reduce variation and increase predictability in DASH typology MURB's: 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. For example, DASH compliments Metro Vancouver's RHB Regulations Guide (as well as similar planning regulations), and is being developed with awareness of e-permit platforms being piloted by AHJ's in BC, to streamline permitting.

The utilization of the DASH BIM template 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: Fabrcation & 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, tested 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 is a Tool, complimenting and enhancing Building Industry Professionals

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 to deliver specific forms of housing. DASH digital design tools are coordinated with the regulatory, fabrcation 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, requiring review, good design and acceptance of responsibility by the professional of record, as well as complete review by the Authority Having Jurisdiction staff (AHJ – permitting). The finer resolution of detailed design possible early on in a project's timeline using DASH's BIM-based standardized blocks and menus of parts aims to standardize the repetitive design elements commonly required for all MURBs, opening up more time for professionals to focus on life-safety and good 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)	• Site Topography • Building Form • Apartment Unit "Blocks" • Access to Exits (corridors, halls, etc.) • Exit Stairs • Elevators • Service Room Locations	• Architect • Structural Engineer • Civil Engineer • *Geotechnical Engineer – Site Investigation Reports
Design & Coordinate Critical Path (LOD 200-300)	• Structural Walls, Floors and Roof (correct assemblies) • Sire-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)	• AHJ – Planning Staff • AHJ - Building Permit Staff • 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)	• Interior, non-load-bearing walls (correct assemblies) • Modular millwork, fixtures and equipment • Special equipment & services • Finishes	• *Future AHJ Building e-Permit platforms (TBC) to review accessibility/adaptability • Other suppliers and trades
Minor Building Use Elements	Furniture, features, etc.	• Other suppliers and trades

Common Data Requirements	
Information Elements	Key Requirements

Site Assessment Reports	• Legal Description
	• Site Survey
	  ○ Property Lines
	  ○ Incoming/outgoing services

	○ Easements, right of way, etc. • Climatic Data • Geotechnical & Seismic Data • Environmental/Hazmat
Details – Regional/Climate Zone specific Detail Libraries	• Structural/seismic performance • Architectural/envelope performance • Access: Canopies, balconies, features attached to building envelope (lighting, etc.) • Energy requirements
Details – Typical connections, etc.	• Incoming/outgoing services • M&E system connection • Adaptable/accessibility • Millwork & finishes
Details – Site-specific elements	• Civil & site: equipment/systems • Foundations
Specifications	• 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, fabrcation 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. 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. RHB and DP Regulations Overlay	RHB & DP Parameters: Set setbacks, access requirements (vehicle/pedestrian)	
	3. AHJ Site & Building Requirements	Define requirements under 3 "Tiers" of complexity: 1. Tier 1: 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: a. Requirements unique to site, but not novel or specific to site. 3. Tier 3: a. Novel or specific to site, requiring custom solution.	
2. Set Building Program	1. Owner's Project Requirements (OPR's)	1. Set Building Program: a. Area & building height b. Unit mix & sizes c. Required amenities d. Construction type (LWF) 2. Define Conditions of Satisfaction (CoS): a. Occupant accessibility & function b. O&M c. Building resilience & performance d. Budget & schedule e. Finishes, equipment f. Specialty items	0-1

Requirements	Tasks	Items	Estimated Timeline (Month)
		g. "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: 1. Utilize RHB Regulations "Rule Set" to ensure compliance. 2. Generate solutions based on prefab. Kit of parts constraints to realize downstream design, fabrication and construction efficiencies 3. Generate unit layouts and mixes according to owner requirements. 4. 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. 1. Architecture, layout, accessibility and building safety 2. Structural system 3. M&E system design, energy performance (i.e. Energy Model) 4. Site & Civil services design 5. Set key design constraints: site, building access and accessibility, window/wall ratios, openings, etc.	
	3. Prefab. Optimization	AI optimization of the prefab. design of the building through centralized software with open market. Software should: 1. Integrate different fabricator suppliers' manufacturing preferences for walls, floors, roof and major structural elements.	

Requirements	Tasks	Items	Estimated Timeline (Month)
		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. RHB Verification / Planning Approval	1. 100% Schematic Design	"Set" Schematic Design: 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 RHB regulation verification (pre-approval):	
		Option A: e-Permit submission, fully AI-based plan checking for compliance with RHB regulations: 1. Kit of parts, compliant: Majority of projects will utilize the kit of parts will be 100% compliant. 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.	

Requirements	Tasks	Items	Estimated Timeline (Month)
	3. Fabricator-ready Structural Package	Select Fabrication Supplier(s) based on "4.3 Prefab. Optimization", integrated into design team.	
6. Design Development & Coordination	1. Key Details & Prefab. 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 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.	*4-6
	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	• Award PO's for successful critical path suppliers • Issue for market for bids for other	• Issue Contracts Documents for market tender and selection of suppliers. • Owner confirms Contract: Division 0, 1 and supplementary conditions.	9

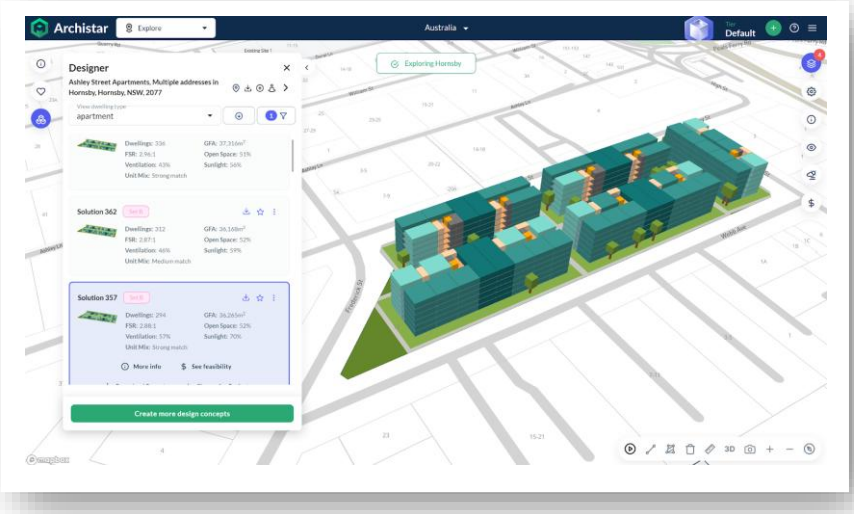
Requirements	Tasks	Items	Estimated Timeline (Month)
	suppliers		
9. Confirm Contract Documents	• Document based on Successful Tender • Issue Contract	1. Review & verify availability of all tangible building elements.	10
		1. Approve prefab. shop drawings to begin fabrication	
10. Issue for Construction		Issue 2D and 3D documentation for: 1. Issue for Tender (IFC) Bidding Documents 2. Fabrcation 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 blueprint designs, and Owner's Project Requirements (OPR's).

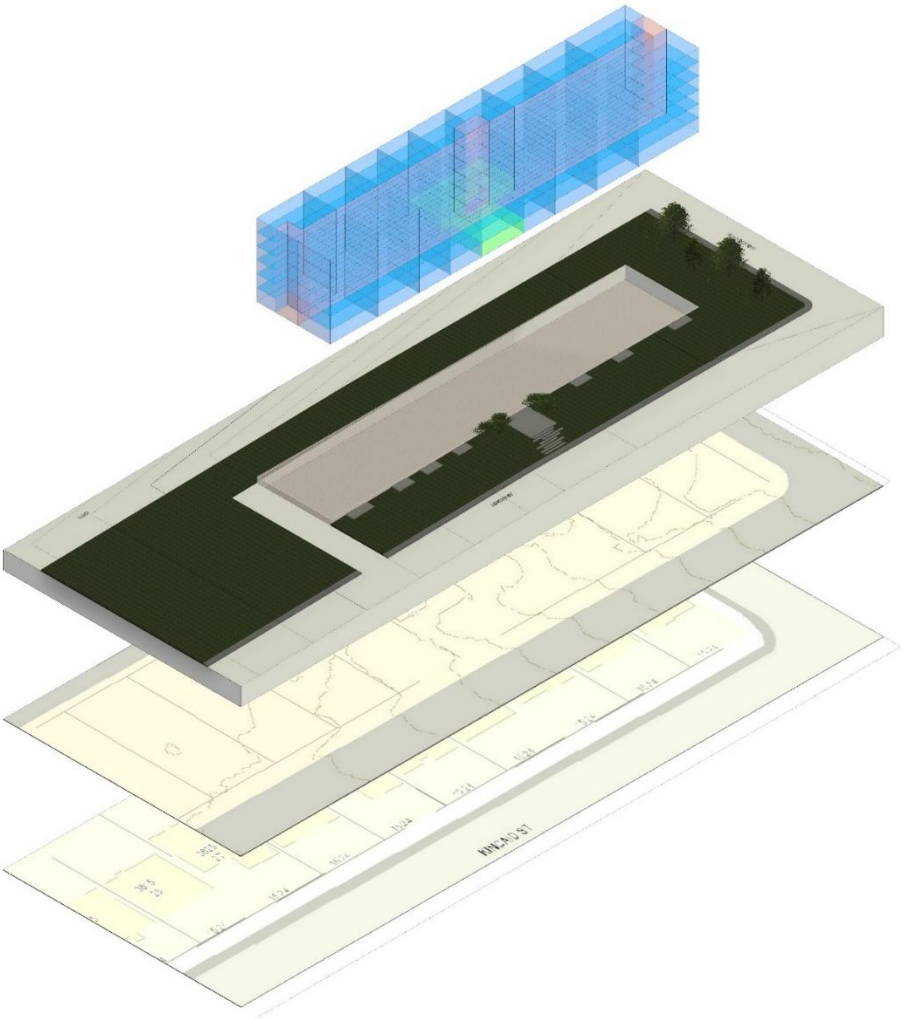
Massing with DASH streamlines the design process to submit for AHJ planning review and compliance much earlier, allowing for design to start and finish much quicker once a viable design has planning approval.

Other layers must be overlayed 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 this 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's e-permit system, requirements such as sitting and massing, firefighting and rescue, rainwater management, incoming / out-going services, can be resolved or flagged much earlier in a project's timeline. The owner/developer can also test their Project Requirements and Conditions of Satisfaction (e.g. is the building site too sloped for assisted living?) 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

Currently, a Tier-based approach to site and civil servicing is being developed. In coordination with AHJ's, this may mean sites are -re-assessed or 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 an order of magnitude understanding of the site's 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 pilot with one generative design program Archistar, constraints like the RHB Planning Regulations and DASH 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.

However, site-based generative design cannot capture AHJ or Owner specific requirements. Therefore, AHJ's must also assess and pre-define their requirements, and owners must "set" their requirements in the Project Charter to ensure generative software actually speed up development.

The BIM template for DASH is also designed to start with manual planning exercises common to architects as well. While generative software can provide options, it may be optimal for the architect and owner to complete a sketch exercise with the manual block and modules to develop and define preferences for building programming without the added logistics of digital tools that may require specialist training.

BIM schematic sketch exercise possible by hand or on digital tools like Muro Boards.
[Link]

SITE FEASABILITY: INVESTMENT DECISION

DASH's BIM provides a more mature design as "digital twin" of the proposed MURB building to allow owners to assess if their requirements are address and assess the optimal unit mix, program and configuration early on during the project – where information can be utilized to make good decisions for the most benefit.

PLANNING APPROVAL: RHB PILOT REGULATION EXAMPLE

The BIM Workflow and BIMx will be aligned with e-permit systems and practices currently being developed and adopted by some BC AHJ's as part of Metro Vancouver's RHB Regulations Guide being published specially for rapidly developed housing. For example, the LOD 200-300 BIM is designed to generate 2D or 3D information to cover most required information for both traditional (i.e. generate PDF and hard copies) and digital permit applications. The intent is to allow a more streamline workflow to produce models and drawing packages for Development Permit and AHJ reviews without separate, dedicated tasks. DASH's BIM is designed to be the "single source of truth" for DASH MURB's from development, to design, to construction and fabrication, and operations.

Example: Simplified DASH buildings compliant with Metro Vancouver's RHB Pilot Regulations Guide

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
- RHB 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

DASH's BIM template is designed to quickly populate the massing model using pre-vetted, digital apartment "blocks" and "sub-blocks" (referred to as blocks), as well as a standard "menu of parts" (referred to as menus) of BIM components representing household fixtures, HVAC equipment, prefabricated service walls, etc.

Accelerating Schematic Design by leveraging standardized designs and menus of common parts for specific, common typologies of MURB developments minimizes the "re-inventing the wheel every time", minimizing the back-and-forth re-work and 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 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 sub-blocks: 1 Bedroom and 2 Bedroom "slices"

Block and Sub-block Design

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

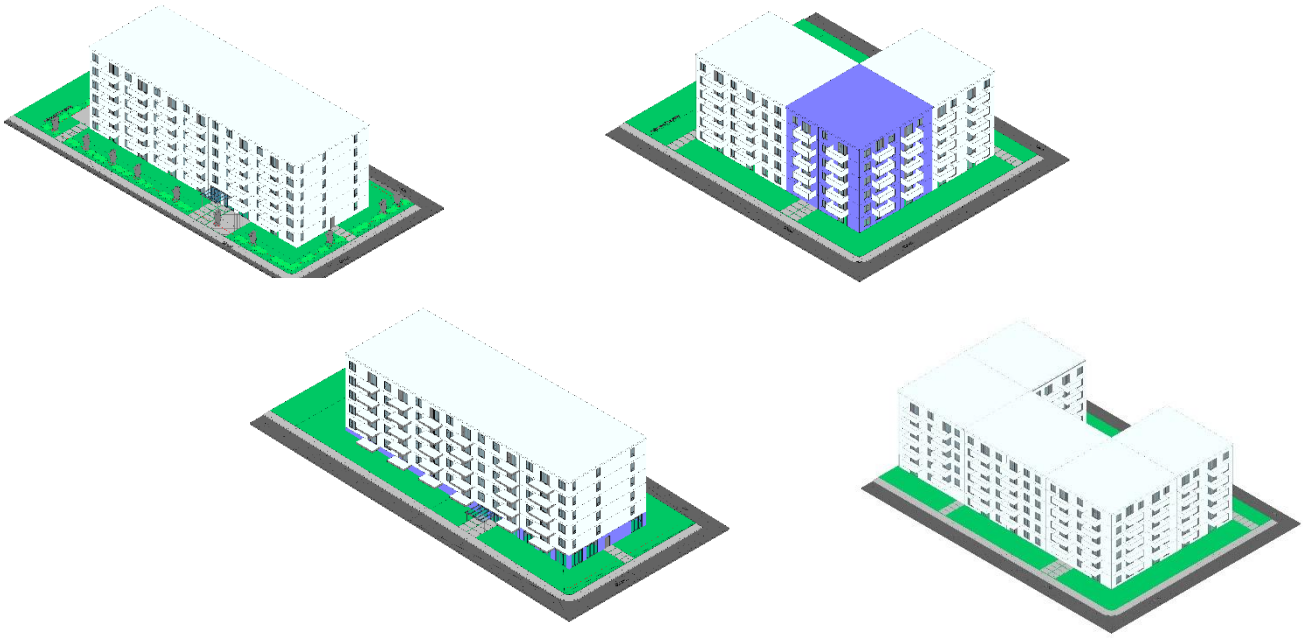
- Code & accessibility: Clearances and dimensions for safety, exiting and adaptability/accessibility. (BCBC 2024)
- Structural efficiency: Utilizes structural kit with no unique connections and simple spans for openings. (BCBC 2024 seismic code)
- System Efficiency: Mechanical systems are logically located,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

DASH BIM Revit Template – Blueprint Designs as “Kits”

The example BIM template is currently setup in Revit 2024 for three building forms: Bar and L-shaped and C-shaped. Other BIM programs will be incorporated as DASH develops further. 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 are pre-loaded and 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 prefab. 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 an owner or project's specific needs, utilizing DASH's coordinated constraints for prefabrication and menu of parts.

Assemble Architectural Layout
Assemble the DASH building, validating the exiting, services, etc. of the building. Including ground floor amenities and below grade parking layout.

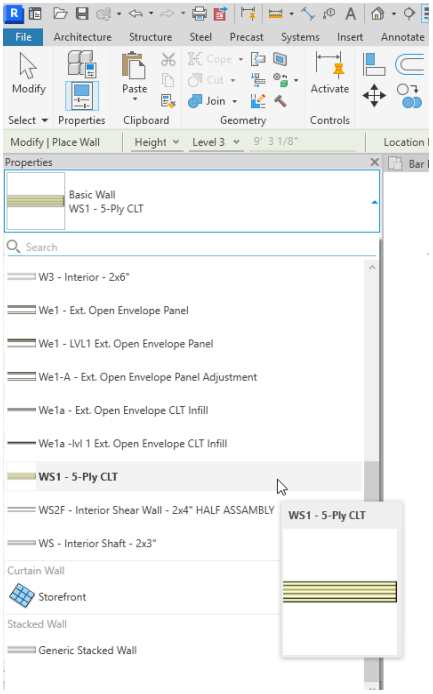
Assemble Structural Design
Validate the structural layout: cores and the number and locations of the "I" shear assemblies. Confirm the nailing and assembly details for the exterior wall panels and framed shear walls.

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.

Revit BIM Template Toolbox: The digital Menus of Components

The template is pre-loaded with Revit families, groups and types coordinated with the detail library – the "Toolbox" setup within the Revit Template, which will be added to as DASH 1.0 concept matures. Components in the Toolbox are standardized for all DASH building types and are the components for designing all standardized apartment blocks, 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 that can be embedded into Revit's 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 Prefab. 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 fabrcation 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, half 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 prefab. 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: • 8' x 60' shear panels for exterior walls and corridor walls. • 60' shear panels for exit stairs and elevator cores.
W6	8" think 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 prefab. service panels, with wall finish on "-1" or "-2" sides.	Prefab. "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" think 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 prefab. roof assembly similar to FA-1, except with roof slope package and membrane.

- 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 fabrcation supplier's facility. (see: Brock Commons)

    - Installed on-site: Installation of the windows, wither 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

Civil "Complexity Tiers" (see early section "Civil & Site Requirements") currently being developed organizes technical items to support the development of standardized civil/site blocks to address typical sites requirements. However, some will require human review as site conditions vary greatly: the intent is for lower complexity tiers to have standardized approaches available, while higher-complexity tiers that are specific to niche or unique site situations can be address by the civil and geotechnical professional's experience and expertise when required. 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 RHB 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 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 and 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 a structural engineer's expertise for 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 RHB Regulations. The conceptual design will also provide some flexibility for locating services or occupant storage.

Menus: Mechanical, Electrical and Major Specialty Equipment

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

The development of building services in on-going – including Mechanical and Electrical menus. The development of these menus of components ensures these critical elements are coordinated and prefabrication-friendly as early as possible with the help of BIM, ensuring the development of DASH Projects are as streamline as possible without compromising safety or quality. The apartment blocks are designed as stacked 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. This DASH constraint allows blocks to include pre-coordinated vertical shafts for service runs, as well as coordinate operation and maintenance requirements of the standardized equipment within the menus of components.

Limiting Distance & other site-specific parameters

The menu of Wall Types will include 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

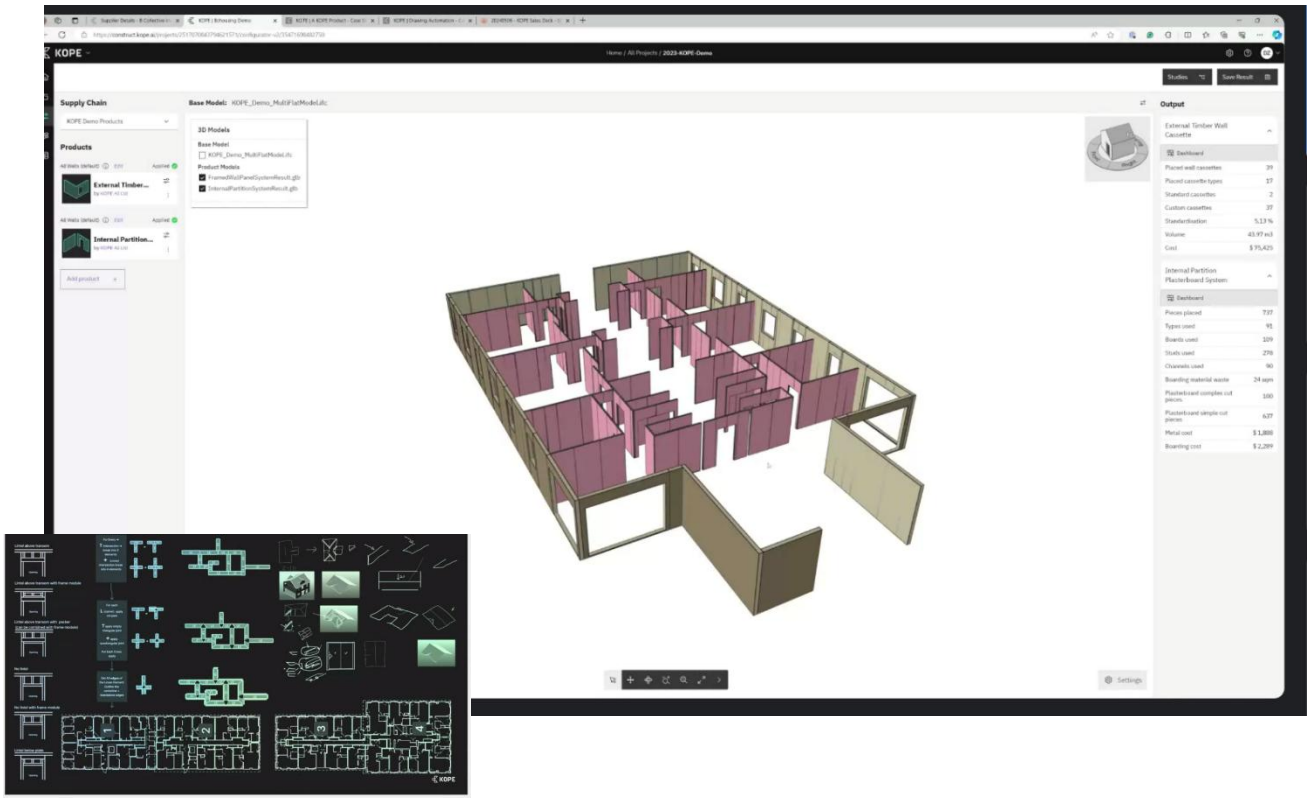
DASH's standardization and embedded elements provides sufficient information to coordinate design with construction much earlier. The BIM template is the "master" file that can be shared or exported in IFCv4 format for suppliers to coordinate their own fabrcation, supply and logistics software. The DASH 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 fabrcation suppliers, incorporating their experience and fabrcation 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

Rapid planning approval process being developed like Metro Vancouver's RHB regulations guide can leverage standard ion. Schematic design "sets in stone" the form for both planning approvals and downstream prefab. optimization and coordination early on during a project's timeline – a significant



advantage with DASH building. This is critical for yielding the greatest schedule (and cost) benefit from the DASH standardization. With the building form set, Design Development focuses on details, fit-out and coordination for fabrication and construction.

Kope.AI Prefab. Optimization

After Schematic Design is set, **no major building changes should occur past this point.** Currently, Kope.AI has provided proof of concept for the Integration of AI-based tools as part of DASH that assess the digital twin of the DASH MURB design to optimizes for prefabrication (panelized construction), based on a "marketplace" of suppliers who are currently working to standardizing their approach to prefab. Walls, floors and roofs (11 prefab. Suppliers are assisting in the development of DASH). 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 the AI program to assess and optimize wall panelization.
    a. The model's walls must be floor level to floor level and continuous at each wall segment (i.e. from corner to corner).
    b. 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 prefab. optimization.
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 (in-development)
    - Structural details (in-development)
    - Prefab. Shop drawings (project-specific supplier responsibly)
    - M&E details (in-development)
    - Energy performance verification (site-specific supplier responsibly)
- Building permit approval
- Class A Pre-tender estimate
- Detailed construction schedule

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 prefab.

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 the 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 Prefab. Optimization process (Kope.AI) will coordinate their prefab. 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, and expedite and streamline the issuing of Tender (IFC), Fabrcation (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 letters 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, fabrcation 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, opening up more time for professionals to focus on life-safety and good 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.

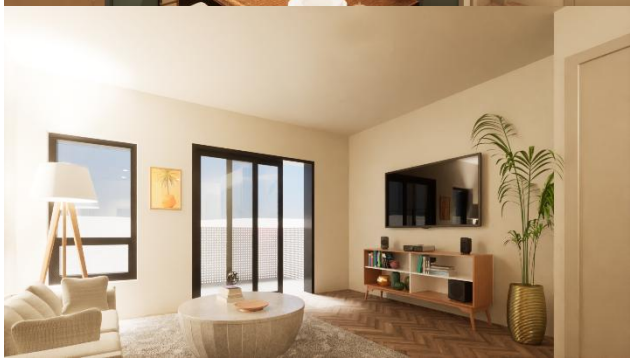
Lastly, AHJ submission can be through traditional 2D means such as printed and sealed package generated from the BIM, or the BIM digitally submitted for e-permit review in the near future. The BIM template will evolve in consideration of the range of e-permit software currently being piloted and adopted 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 prefab. mechanical pods will need to be designed to meet several standards covering plumbing, prefab. and safety. For example:

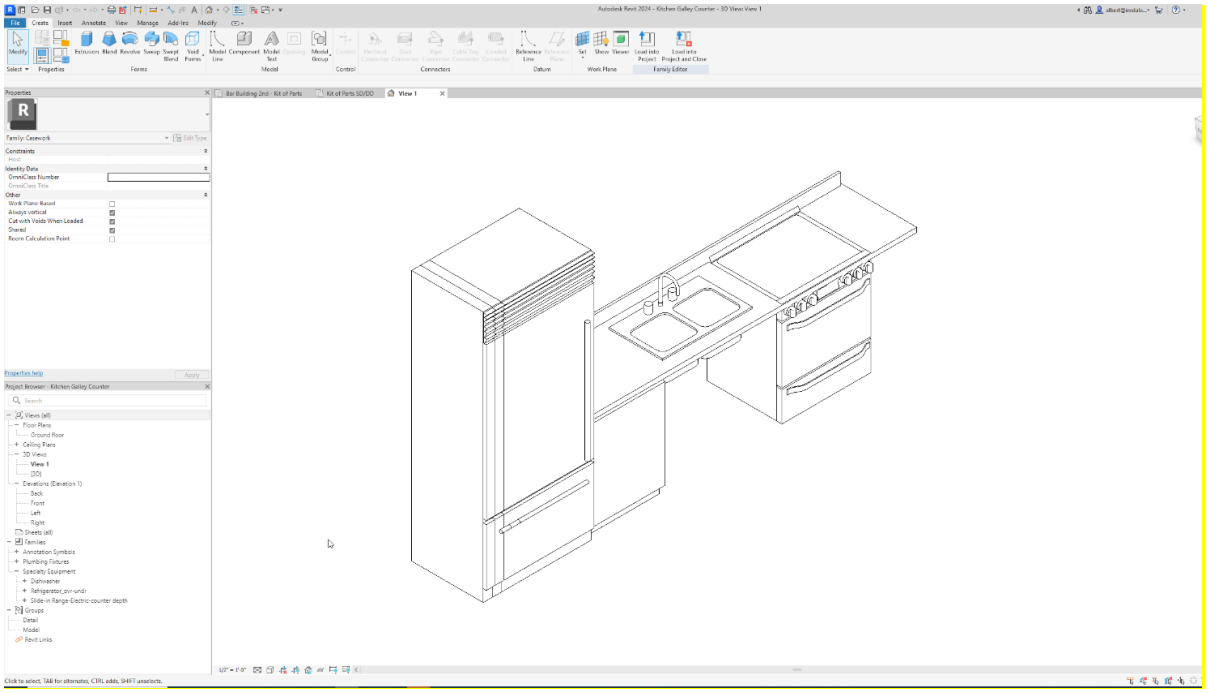
- Wall Type - Wet Wall / drop-in service panel: Fabricated by project - consultant design, supplier supplied.
- Window Family – windows, balcony/patio doors: Supplier standardization of standard product ranges - supplier supplied.
- Casework Family - Modular Millwork: DASH standardized design, supplier 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 development of standardized modular millwork (in coordination with suppliers) in the Toolbox can maximize space efficiency (especially in studio or 1-bedroom units) or allow for typical units to be converted into accessible units by swapping millwork, minimizing the need for extensive in-suite renovations.

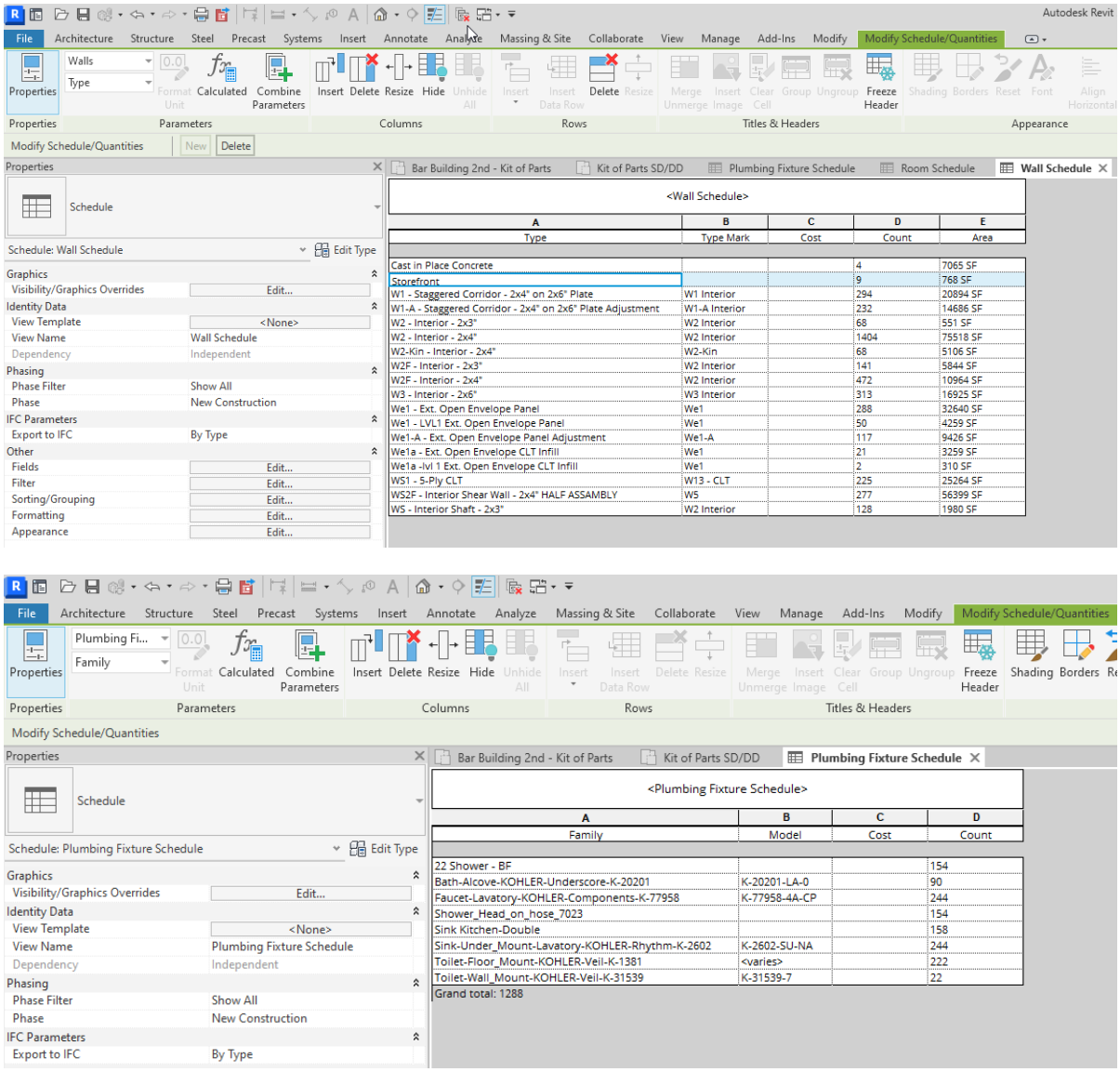
Images Right: With the building form set and validated, interior design and occupant specific consideration can be completed.



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.



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 Menus will also include elevation elements where possible such as balconies, sunshades or exterior light fixtures, as they need to be coordinated as they can interfere with critical path items related to structure, envelope and systems, or can impact prefabrication or sequence of construction if not accounted for. These items will be further developed as DASH grows.

USE OF MENUS OF COMPONENTS FOR FIT-OUT

Standardized apartment blocks and the use of menus of pre-vetted elements as standardized BIM elements will also streamline high occupant value design tasks such as interior design, adaptability, or other features such as amenity rooms, as critical path items are the focus of DASH. Design consultants can spend more time these high-value designs for occupant livability.

Other important tasks can also be made easier of faster with the use of BIM – if proper BIM practices are implemented, defined in the BIMx, and are committed to in a 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 RHB 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 RHB 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 a 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 (orientation, facings, shadow, etc.) suggest tweaks to window/wall ratios, system performance, etc. to optimize energy and carbon performance, and 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/door wall panels may significantly speed up design and construction (the Lego effect), while improving quality by shifting more construction into factories. 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.
5. 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.
6. 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 (in-development)
    - Structural details (in-development)
    - Prefab. Shop drawings (project-specific supplier responsibly)
    - M&E details (in-development)
- Building permit compliance – assist in field reviews, etc.
- Issue construction contract documents – both hard copies and digital models
- Set project construction schedule

CONTRACT DOUCMENTS: 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. On-going coordination with a cohort of fabricators and builders are critical for DASH, as a number of pilot projects in Metro Vancouver are considering the deployment of DASH 1.0.

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, Fabrcation and Construction:

3. Issue for Tender (IFC) Bidding Documents
4. Fabrication Shop drawings
5. Construction planning and rehearsal
6. 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.

Prefab. Shop Drawings: Bim Coordination

The utilization of BIM, and the universal file format IFCv4, the current cohort of prefab. Wall panel suppliers and builders will integrate the means to ingest and utilize the consultant team's BIM within their shop drawing process. This is particularly valuable as it reduces design intent interpretation errors, as well as maximizes the BIM's forms, wall types and connections with the supplier cohort's standardized wall panel products. This is intended to extend to the menu of digital components as DASH's engineering team develops their standardized components with their companion suppliers, fabricators and builders.