

CANADIAN GREEN BUILDING AWARDS 2024

SABMag WINNER



ONE SEED ARCHITECTURE + INTERIORS

BIRD'S WING PASSIVHAUS DUPLEX +

3235-1



## BIRD'S WING PASSIVHAUS DUPLEX +



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Bird's Wing Passivhaus Duplex + is a new housing typology that elegantly adjusts to the occupants' needs for space and flexibility, without waste. The name "Bird's Wing Passivhaus Duplex +" has several layers of meaning, describing the architecture, planning, and unique objectives of this custom duplex that includes two primary dwelling units as well as two flexible lock-off suites:

- + Certified Passive House, net zero ready, simplicity of form.
- + Low-embodied carbon assemblies, healthy materials, efficient use of materials (build less).
- + Soft density: 4 households under its' wing, within the scale of its single-family neighbourhood.
- + Adaptability: units can expand and contract for generational flexibility.
- + Accessibility for ageing-in-place
- + Affordability

The architecture of Bird's Wing Passivhaus Duplex + incorporates a folding roof line, like the wing of a bird in flight. The modern and minimalist design demonstrates a shared commitment to sustainability and innovation. Bird's Wing is located two blocks from an active commercial street. With a Walkscore of 92 and Bikescore of 91 there is rarely a need to drive, and still both parking spaces are equipped with electric car chargers. The design is rooted in nature. The result marries thermal efficiency with spatial efficiency in a perfect balance of design, space, and nature.



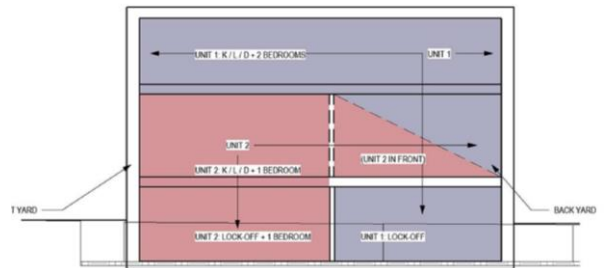
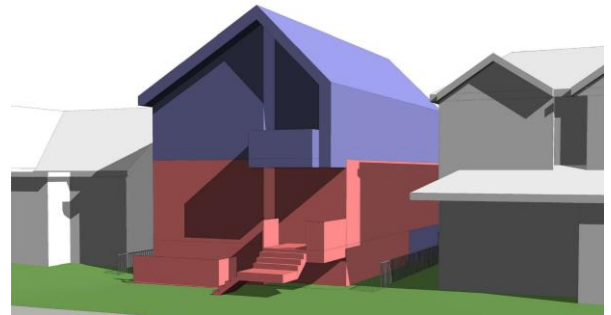
<b>Site Area:</b>	450m <sup>2</sup>
<b>Gross Floor Area:</b>	370.2m <sup>2</sup> (measured to exterior cladding)
<b>Treated Floor Area:</b>	269.0 m <sup>2</sup> (as per PHPP)
<b>Energy Intensity:</b>	35.4 kWh/m <sup>2</sup> /year (PER data in PHPP)
Heating Demand:	14.7 kWh/m <sup>2</sup> a (PHPP)
Base Building:	12.6 kWh/m <sup>2</sup> a (heating, cooling, ventilation)
Process Energy:	22.8 kWh/m <sup>2</sup> a (DWH, lighting, appliances, expected plug loads)
<b>Reduction in Energy Intensity:</b>	Passive House Certified +/- 80%-90% more efficient
<b>Recycled Mat. Content:</b>	83% cellulose insulation, 40% batt insul., 80% metal roofing, 8% fiber-cement, 95% composite decking, interior doors, 40% tiles,
<b>Water Consumption:</b>	low-flow fixtures, drought-resistant plants, permeable surfaces reduce +/-20%.





## STRATEGIC DECISIONS

+ Soft density: Bird's Wing Passivhaus Duplex + provides four comfortable, yet compact homes within what appears to be a single-family home. Each is unique, bright, and connected to the outside through large operable windows on all sides. Consistent with Passive House goals of efficiency and simplicity to avoid wasting energy, we also did not waste space nor materials. Every square inch is considered, impactful, and multi-functional. The planning a creative three-dimensional puzzle of interlocking pieces. The suites bend and fold around each other to maximize efficiency and provide evocative volumes within strict zoning regulations.



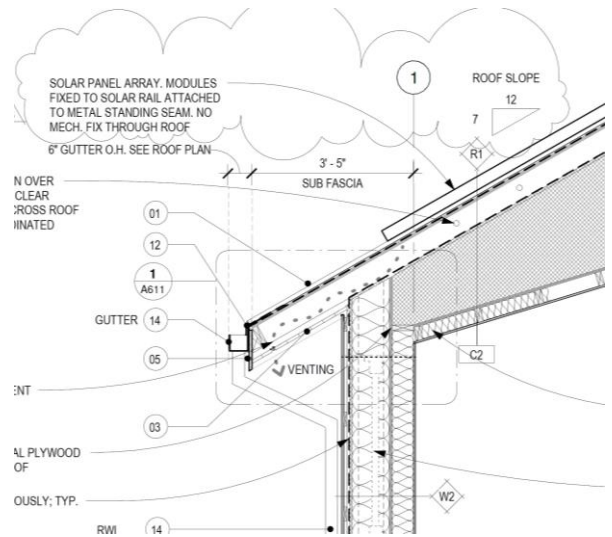
**SECTION – LONGITUDINAL**





Despite the interior complexity, the footprint of the home is continuous from foundation to roof, and incorporates a single notch in plan, to create architectural interest while keeping the thermal envelope simple. Thermal bridges were all but eliminated by way of self-supporting decks that are independent structures, and over-framing roof eaves above the thermal envelope.

+ Affordability in Vancouver, where land comes at a premium, splitting the cost of land and construction between two families, while also creating income generating and sustainable rental suites, made the dream of building a low-carbon Passive House duplex a reality.



**SECTION DETAIL – EAVE + CONT. WRB / AB**





## COMMUNITY

+ Community: Bird's Wing brings four households together, with communal outdoor living spaces for larger gatherings, while providing each with their own functional spaces within. The rental suites are within the Passive House thermal envelope, providing healthy and high-performance rental suites for the community and the owners with rental income and flexibility in how they use their homes.

+ Adaptability: of the home's configuration is critical for affordability as well as ageing-in-place. Units within can expand or contract to suit changing needs over time, without the need for expensive renovations. The interconnected lock-off suites on the lower level can provide rental income or can be offered as a live-in suite to a caretaker. As needed, the owners can expand their primary units to incorporate the lock-off suites for additional space, or they can contract their space moving to a lock-off suite, increasing their income stream significantly by renting out the larger two bedroom, two bath units. This chronological flexibility enables maximum density in the community.





+ Accessibility: we faced several accessibility related challenges including a compact footprint over three storeys in a zone requiring raised front porches and sunken basements. The entry for each unit incorporates space for a future outdoor lift. Once at the level of the entry porch, the interior is easily accessed via low-threshold front door. The upper unit has a single straight stair from the entry, designed to accommodate a future interior chair lift. All primary living spaces are on one floor for ease of access, including the primary bedroom, bath, kitchen, dining, living room, and ample functional storage.

These are the homes that neighbourhoods need for community resiliency. Large and small, accessible, flexible, healthy, sustainable homes.





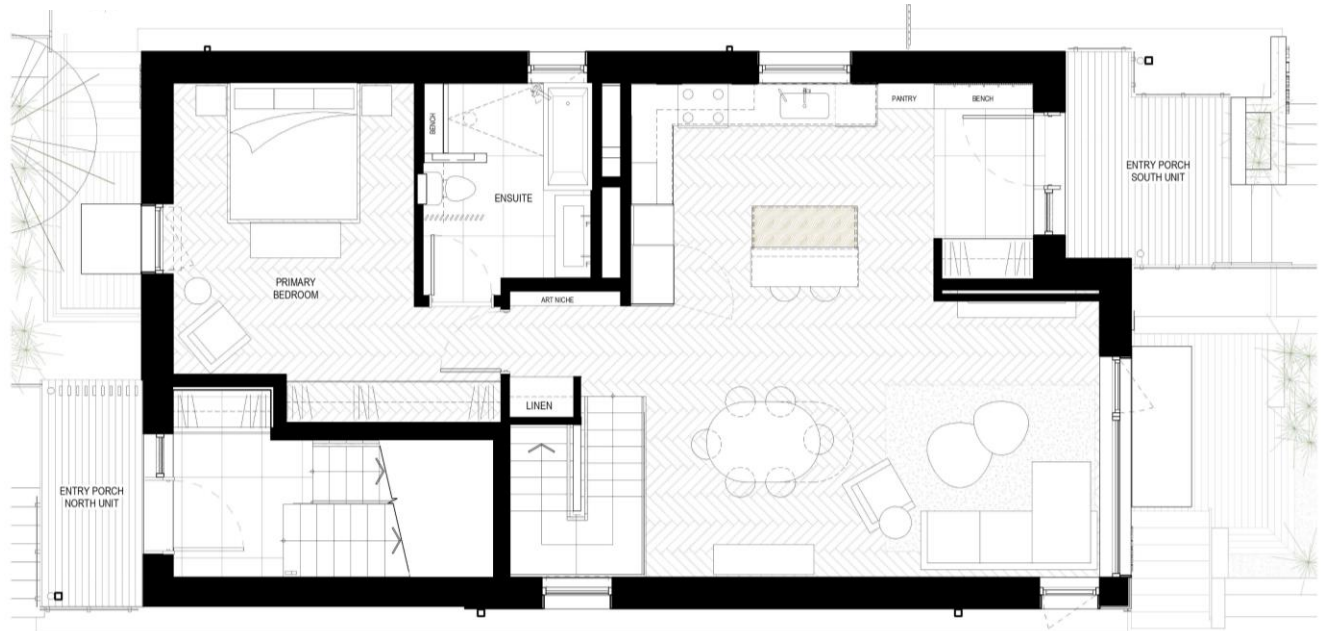
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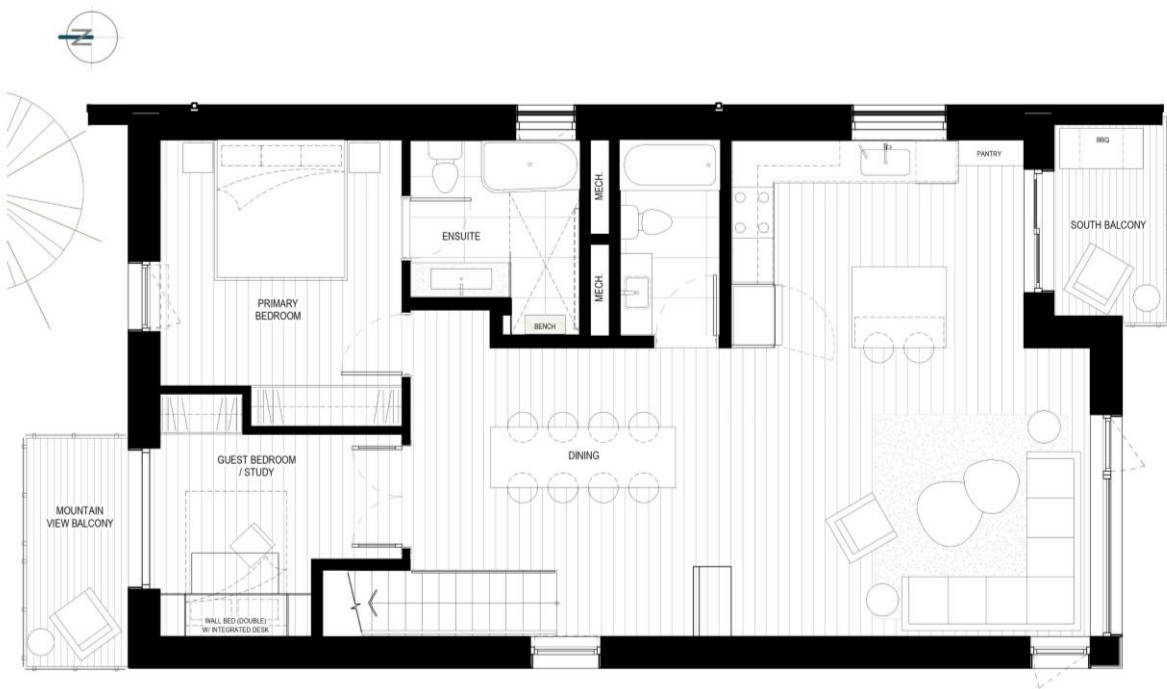


**LOWER FLOOR PLAN**

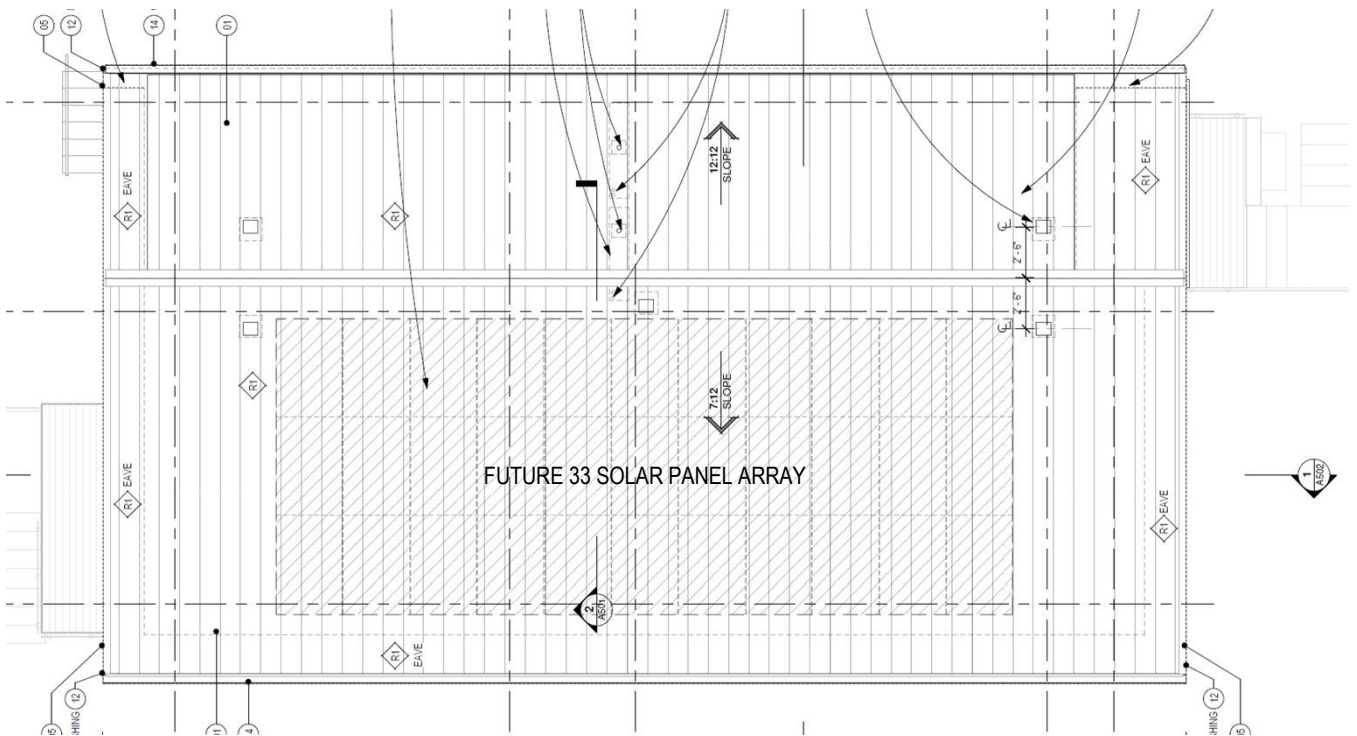


**MAIN FLOOR PLAN**





**UPPER FLOOR PLAN**



**ROOF PLAN**





## OPERATING ENERGY PRESENT + FUTURE

+ Passive House research, education, design, and construction constitute the world's best approach to reducing building operating energy demand, a major source of climate heating emissions. This certified Passive House boasts:

- + Heating demand of 14.6 kWh/m<sup>2</sup>a
- + Air tightness of 0.33ACH @ 50Pa
- + Walls R 55 (U 0.1W/m<sup>2</sup>K)
- + Floor R52-R69 (U 0.08-0.1 W/m<sup>2</sup>K)
- + Roof R 145 (U 0.04 W/m<sup>2</sup>K)
- + Zehnder HRVs
- + Electric heat pump mini-split
- + CO<sub>2</sub> Heat pump DHW
- + Drain heat recovery



Building and Test Information	
Test file name:	EN13829-DE 2023-05-09 1415
Building volume [m <sup>3</sup> ]:	986
Floor Area [m <sup>2</sup> ]:	269
Total Building Envelope Area [m <sup>2</sup> ]:	768.7
Elevation [m]:	45
Building Height (from ground to top) [m]:	10.7
Results	
Air flow at 50 Pa, V <sub>50</sub> [L/s]	89.78
Air changes at 50 Pa, n <sub>50</sub> [/h]	0.33
Specific leakage at 50 Pa, w <sub>50</sub> [L/s/m <sup>2</sup> ]	0.3338
Effective leakage area at 50 Pa, A <sub>e</sub> [cm <sup>2</sup> ]	98.52

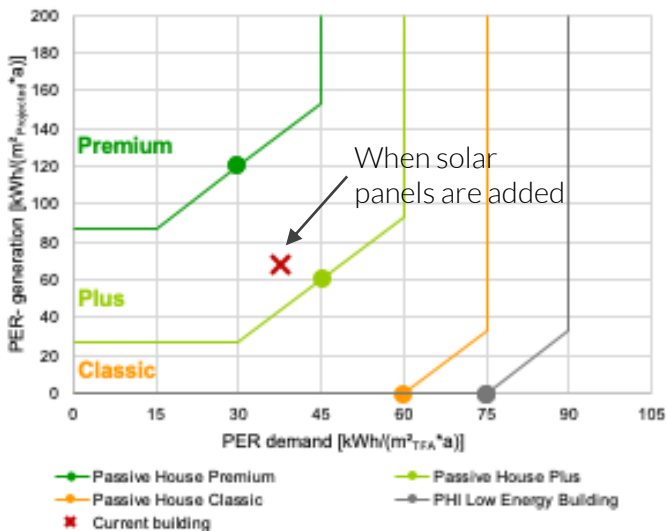


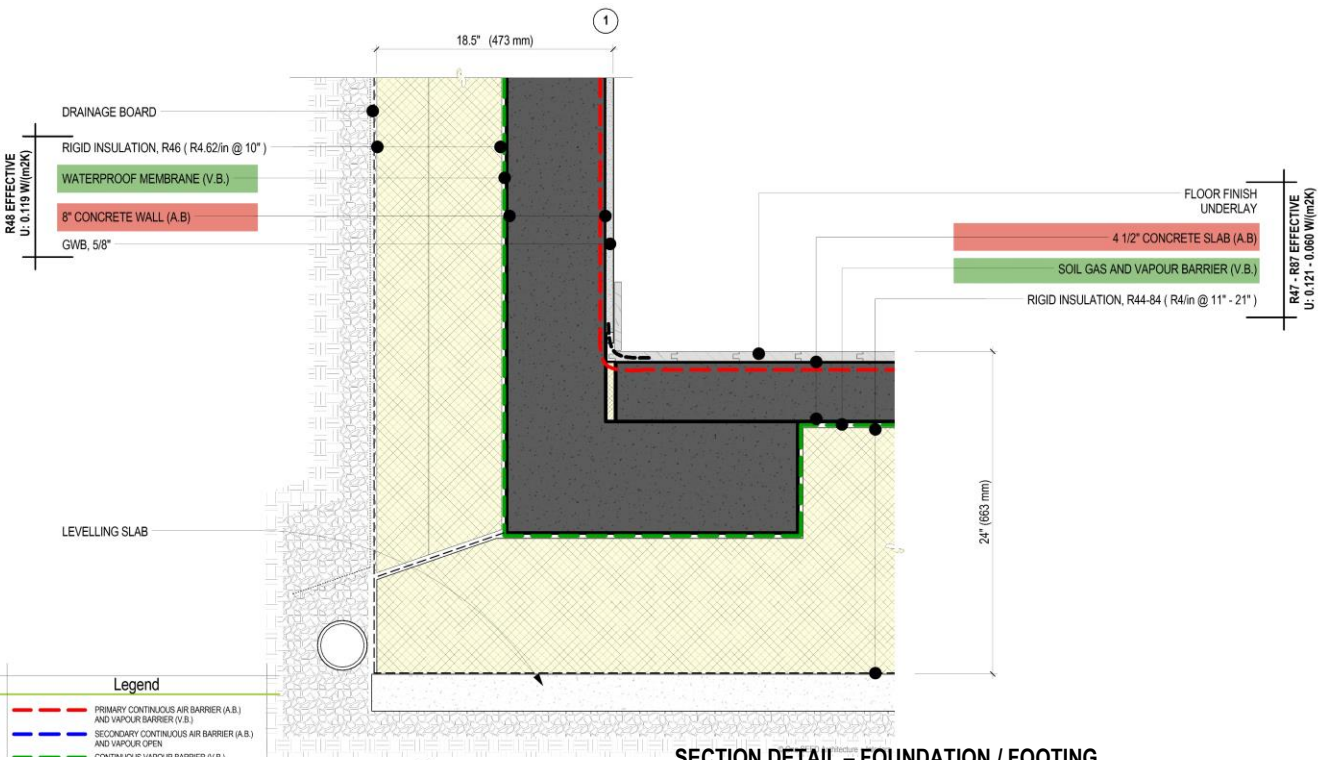
+ Passive heating and cooling: Each unit has a full floor plate, open to the south at the front with ample access to daylight (SHG) and passive cross-ventilation through strategically placed side and back windows. The stacked arrangement (one unit over the other) strays from the guidelines imposed by the City, and your typical mirrored duplex, but we pursued this relaxation to provide both units with equal access to large south facing windows and passive heating and cooling.

+ Net Zero ready: Bird's Wing is net-zero ready for Passive House Plus certification with the addition of only 33 solar panel for four units! On-site generation of renewable energy is an ideal complement here where the heating demand is so low, the PV systems can be modest in size and cost.

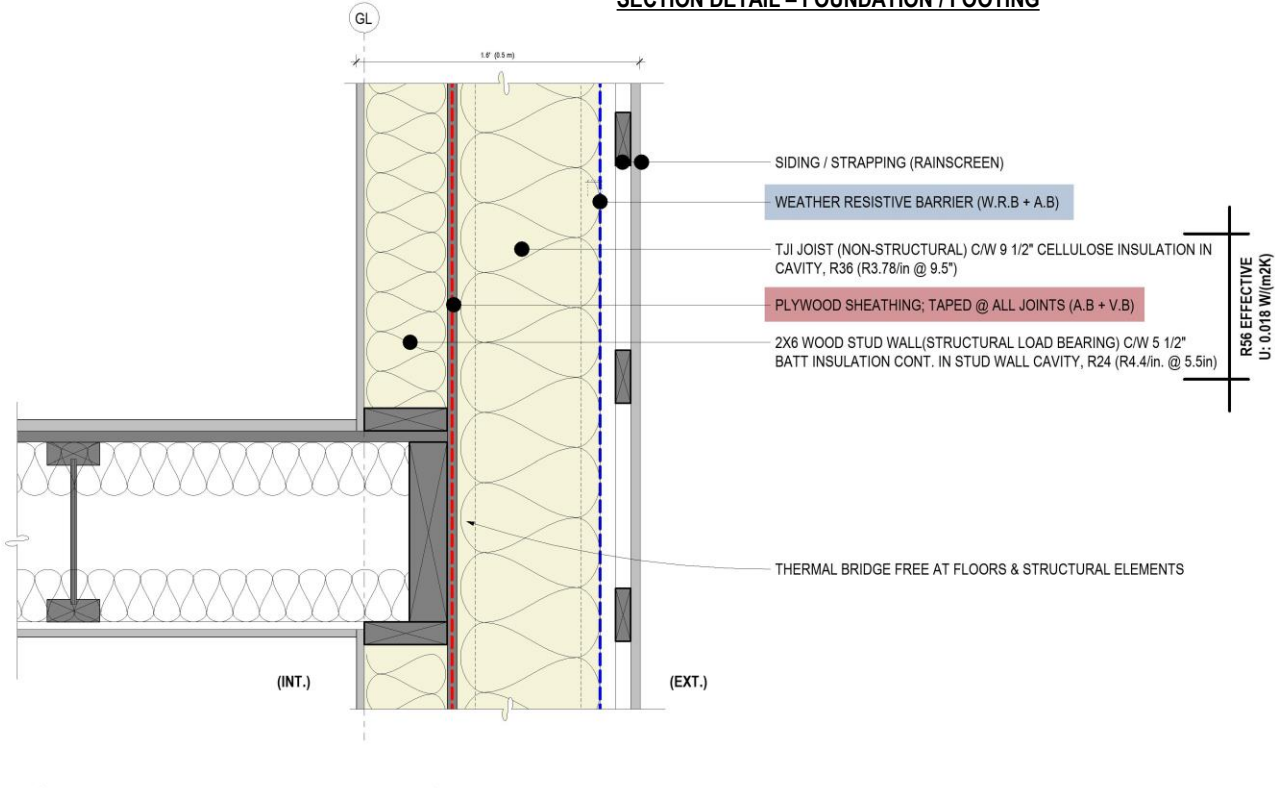


Primary Energy Renewable PER



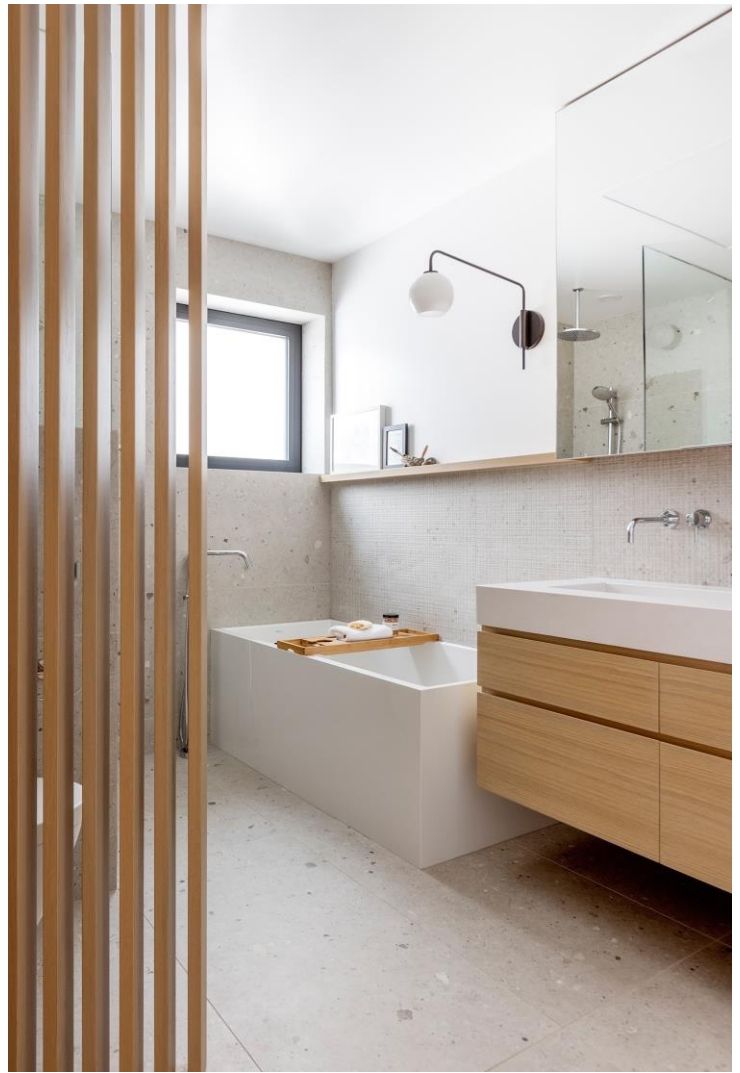


**SECTION DETAIL - FOUNDATION / FOOTING**



**SECTION DETAIL - WALL AT INTERMEDIATE FLOOR**





## MATERIAL AND RESOURCES + BUILDING LIFE CYCLE CONSIDERATIONS

+ Low-embodied carbon: . We went beyond low-carbon materials and specified several key building components that are considered carbon sinks. We limited fossil fuel-based materials including petrochemicals, spray foam insulation, rigid foam insulation, and vinyl. We limited the concrete in our foundations using grade beam footings and slab thickening rather than strip footings. We specified additives in the concrete mix to reduce embodied carbon.

The LCA study results:                   + 10,100 kgCO<sub>2</sub>e reduction in embodied carbon compared to baseline  
   + 30.8 metric tons CO<sub>2</sub>e of stored carbon.

+Vinyl free: as vinyl is red-listed on the Living Building Challenge as it is toxic, hard to recycle, does not decompose, and has high-embodied carbon, we did not use vinyl membranes, windows, nor flooring. Our windows and doors are fiberglass and locally sourced wood.





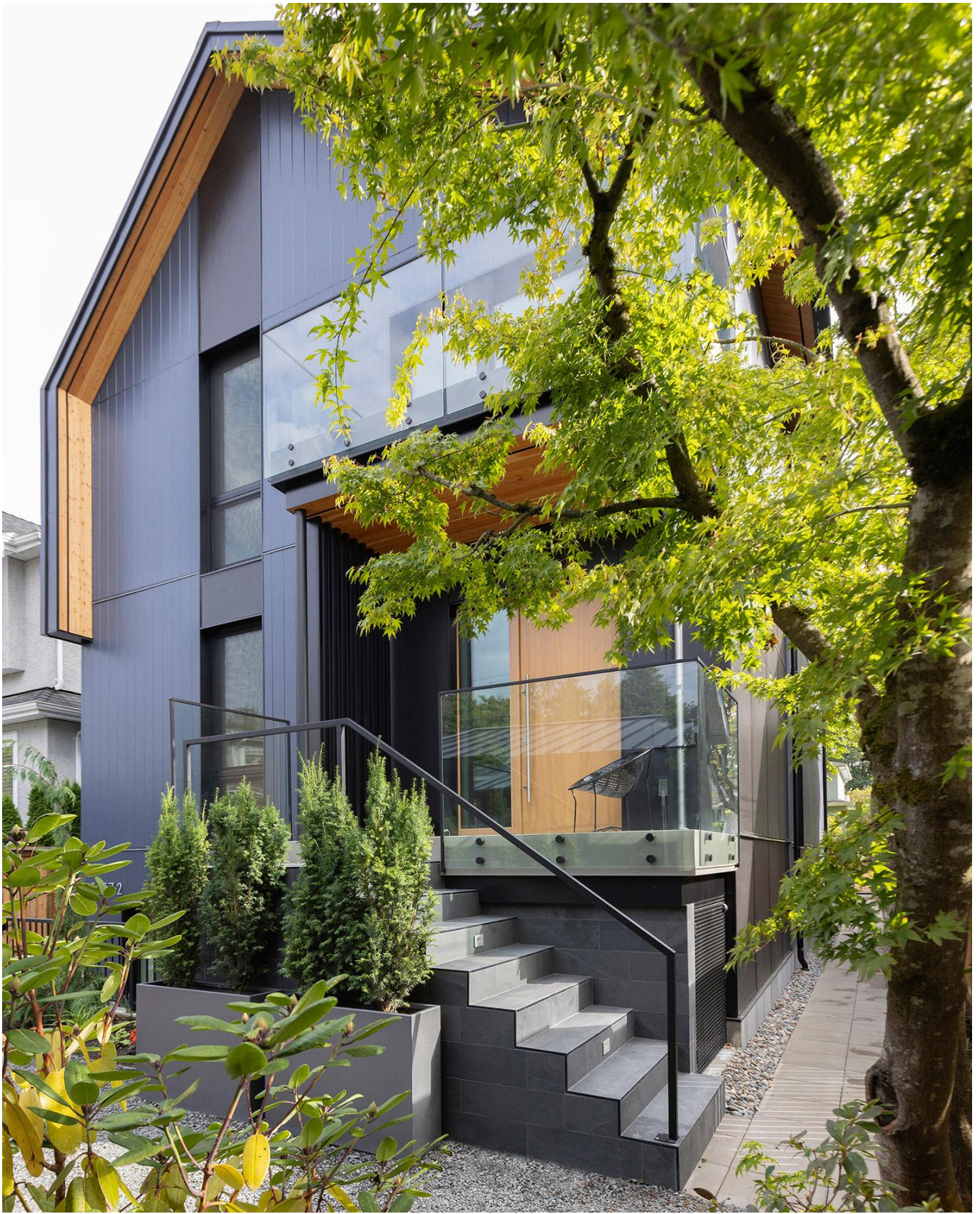
+ Build Less: As embodied carbon tallies the sum of GHG emissions attributed to materials throughout their life cycle, reducing the sheer quantity of materials used reduces embodied carbon, which we did providing 4 units within the scale of a single-family home. The simplicity of this outer envelope, compared to a more “typical” home design which commonly features dormers, multiple rooflines, bay windows, and overhangs and decks over living spaces, results in a significant reduction in materials required.

+ Deconstruction was considered in the design and detailing, favouring materials that could easily be dismantled and reused or recycled, like the mechanically fastened steel or fiber cement siding. We avoided adhesives where possible. The old house on site was deconstructed for recycling and salvage rather than demolished, diverting huge amounts of building materials from the waste stream.

+ Indoor air quality: Non-toxic and healthy materials were selected for paints, stains, and interior finishes.

+ Durability: We invested in a high-performance envelope to increase the longevity and durability of the build. With many homes in the Vancouver area being built with a 10 – 25 year expected life span, this duplex is expected to last for hundreds of years, again reducing material consumption and embodied carbon.





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## **25** INTERNATIONAL PASSIVE HOUSE CONFERENCE 2021



### EDUCATION + INFORMATION SHARING

We were all, as an integrated team of client, architect, and builder, motivated by creating a sustainable demonstration project that pushes market transformation.

+ Supporting Women in Construction: Uniquely, this was a female led team, where Architect, Contractor's PM, Structural Engineer, and Geotechnical Engineer were all women. We also led a site tour for the HAVAN Women's Council whose mandate is to "engage, encourage and empower women within the residential construction industry."

+ Outreach: We took an open book approach with this project and tried to share lessons learned designing and building Bird's Wing with the greater community:

- + Public construction site tours for iPHA's Open House Days.
- + Educational video highlighting eco initiatives.
- + Presented project at the International Passive House Conference.
- + Presented project on Homebuilders' Assoc. of Vancouver podcast.



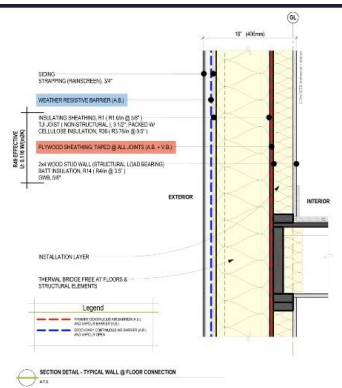


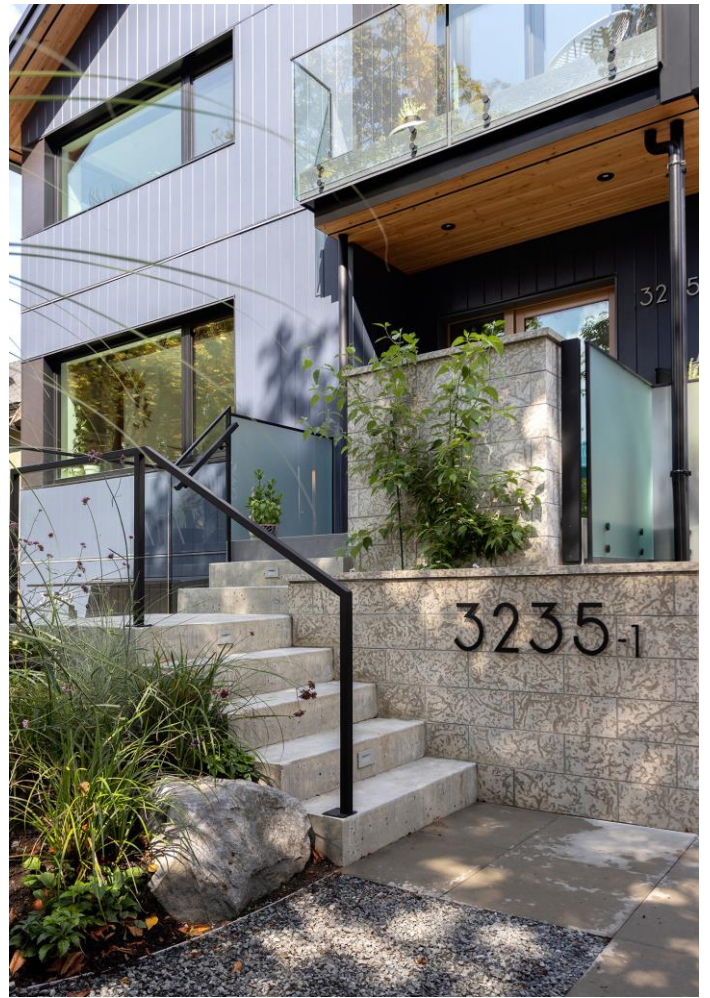
**INTERNATIONAL PASSIVE HOUSE CONFERENCE PRESENTATION:**



**+ Limit carbon-intensive materials**

- Petrochemicals
- Spray foam insulation (polyurethane)
- Rigid foam insulation – EPS and XPS (polystyrene)
- Vinyl (PVC, CPVC, PVDC) windows, flooring, siding, decking, etc.





## BIRD'S WING PASSIVHAUS DUPLEX + DREAM TEAM

- ARCHITECTURE / INTERIOR DESIGN: One SEED Architecture + Interiors [oneseed.ca](http://oneseed.ca)
- BUILDER: Naikoon Contracting [naikoon.ca](http://naikoon.ca)
- LANDSCAPE DESIGN: Acre Horticulture [acrehorticulture.com](http://acrehorticulture.com)
- CPHD: Kenneth Chan JRG Building Engineering [jrgbuildingengineering.com](http://jrgbuildingengineering.com)
- PH CERTIFIER: CertiPHlers Cooperative [certiphlers.com](http://certiphlers.com)
- STRUCTURAL: Timber Engineering [timberengineering.ca](http://timberengineering.ca)
- GEOTECHNICAL: Promatech Geotechnical Engineering
- MECHANICAL: Ecolighten Energy [ecolighten.com](http://ecolighten.com)
- PHOTOGRAPHY: Janis Nicolay Photography [janisnicolay.com](http://janisnicolay.com)



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