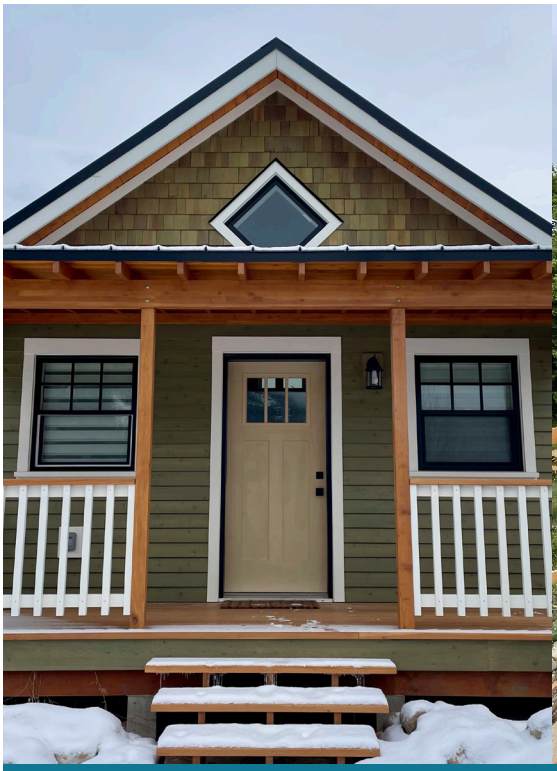
Achieving Step-Code:
A Compact, Comfortable Laneway Home in Nelson

Regional District of Kootenay Boundary



STEP CODE 5 EXCEEDED

This home meets the Step 5 requirements based on airtightness, low thermal energy demand intensity (TEDI) and mechanical energy use intensity (MEUI).

KEY BENEFITS

This building surpassed Step Code 5 requirements, thanks to high efficiency building equipment selection and envelope construction. For a modest construction cost premium the owners were able to ensure their added rental space would be very energy efficient, reducing utility costs and providing high-quality, comfortable rental housing in Nelson.

BUILDING SYSTEMS

Space Heating and Cooling	Air-Source heat pump (ASHP) with one indoor fan coil unit provides both heating and cooling
Mechanical Ventilation	Washroom exhaust fan operating in conjunction with passive through-wall vent kit to allow for fresh air
Domestic Hot Water Heating	Residential electric water heating tank
Glazing	Double-pane, Low-E, argon filled windows with vinyl/uPVC frames 13.5% fenestration-door-to-wall ratio
Foundation	Concrete support piers

BUILDING TYPE
Laneway House

LOCATION
Nelson, BC

ORIENTATION
West Facing

CLIMATE ZONE
5

SIZE, FLOORS
5,15ft^2 / 47.9 m^2 - 1 Floor

YEAR BUILT
2022

ROOMS
1 Bed / 1 Bath

KEY FEATURES

Designed to provide additional space for home owners, while reducing additional energy consumption. Environmental impact was minimized further by building with low embodied-carbon materials.

Architectural details:

- Open living room/kitchen to maximize the small footprint of the building.
- Covered deck on the building's west aspects to the building entrance.
- Master bedroom connected to bathroom with compact washer/dryer combination and loft storage area.

ESTIMATED COSTS

Total build cost:
$240,000 ($466/ft^2)

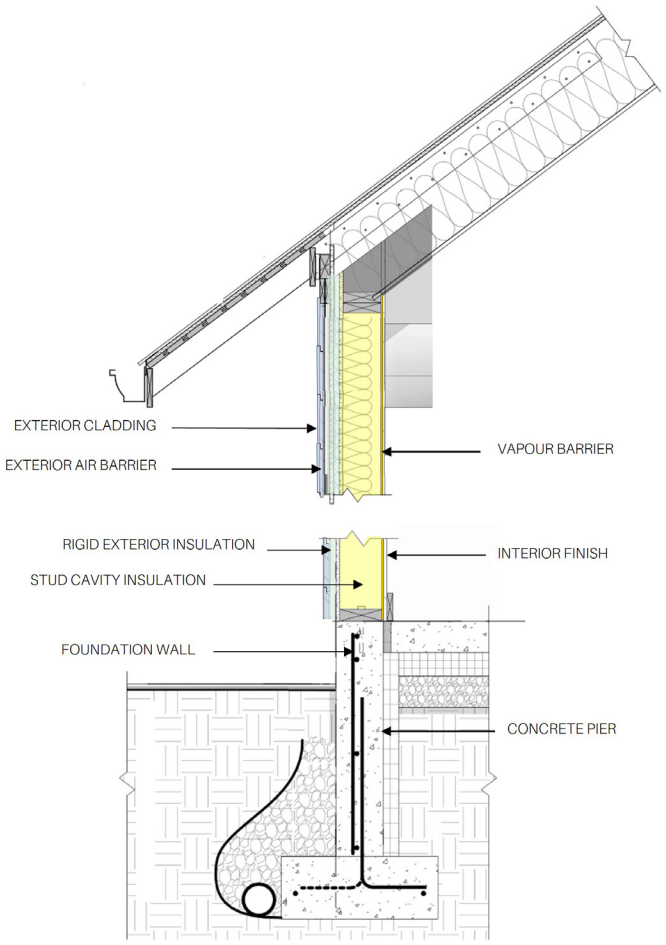
Step Code cost premium:
Approx. $25,000 (10%) over a traditionally built house to Step 3

Modelled annual energy cost:
$1,350

Building Envelope

CEILING DETAILS	
Roofing System	Metal roofing on 2x4″ cross strapping
Roof Underlay	Pro Clima Mento Plus underlay over 1/2″ plywood
Framing	11 7/8 TJI rafters
Insulation	Dense packed cellulose (R-44)
Vapour Barrier	Pro Clima Intello Plus vapor barrier
Interior Finish	Gypsum board
EXTERIOR WALL DETAILS	
Cladding	Cedar siding
Air Barrier	Pro Clima Solitex Mento Plus housewrap
Stud Cavity	Dense packed cellulose (R-27)
Framing	Staggered stud 2″ x 4″ on 8″ plate @ 24″ OC
Vapour Barrier	Pro Clima Intello Plus vapor barrier
Interior Finish	Gypsum board drywall
FLOOR AND FOUNDATION DETAILS	
Floor System	3/4″ plywood with taped seams over 2x12″ joist system dense packed with cellulose (R-41)
Foundation Wall	8x8″ concrete piers

TYPICAL WALL SECTION



Insulating the floor with cellulose to reduce heat loss, while also using a low embodied-carbon material.

Window detail with rainscreen membrane to mitigate impacts of air leakage in wall penetrations.

Air-Source heat pump providing heating and cooling via an exterior fan coil unit.

Staggered stud construction selected to reduce material use.

Balancing Design + Efficiency

When finalizing architectural and mechanical design considerations, often traditional owner 'wants' will have an impact on energy efficiency and mechanical system costs or performance trade-offs, particularly when trying to achieve Step Code requirements.

A major focus for this build was to balance up-front cost with the project goals of energy efficiency and low carbon emissions. Ultimately this goal was achieved, with the builder able to deliver the house at an estimated cost premium of only 10% above that of a conventional build.

Also, a goal of this project was to showcase a holistic approach to construction with minimal carbon emissions. In order achieve the Step Code, locally available and low embodied-carbon materials (such as cellulose insulation and cedar wood) were selected, that still provided the required building performance. Other design choices including the use of piers to reduce concrete use and avoiding extruded polystyrene (XPS) further reduced the project's environmental impact.

Builder's insights

"Surprisingly, we didn't have to go out of our way or spend more to find low carbon building materials. Often, they were readily available and among the lower cost material options."

Mike Coen - Build Environmental

Tips for success

Take Time to Focus on Airtightness
Upon reflection of this project the builder emphasized the importance of being diligent with envelope sealing and vapour barrier installation. They recommend the use of smart membranes and high-quality sealing tapes to help meet Step Code airtightness requirements. The benefits of spending time on airtightness are increased even more in larger builds with more wall surface.

Try to Use Materials with Reduced Embodied-Carbon
Another major factor in the environmental impact of construction projects is the embodied-carbon of selected materials. Embodied emissions are those associated with the harvesting, transporting and manufacturing of building materials. Using materials with lower embodied-carbon emissions, particularly those sourced locally, will help reduce a project's environmental impact.

Use Other Resources and Education
Throughout construction the builder referenced a variety of resources used to develop their knowledge. They recommend reaching out to other professionals with energy efficient or embodied carbon building experience and making use of other local resources such as the City of Nelson's Low Carbon Building Materials guide, available on their website.

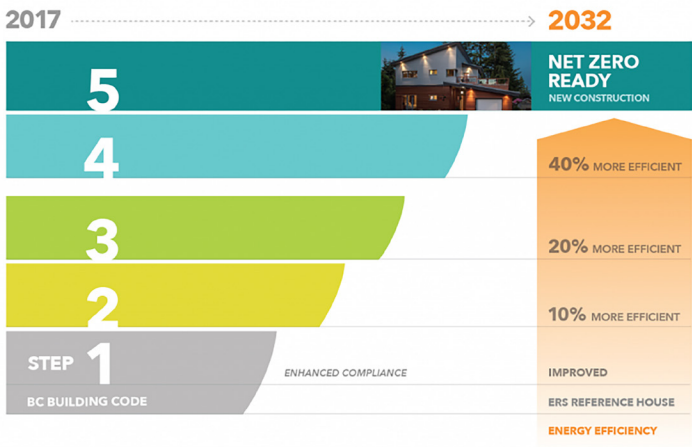
"This project was an opportunity to showcase the benefits and energy savings possible with deliberate material choice, attention to detail and informed design. For a minimal increase in cost we were able to reduce the overall impact of the project and exceed Step 5."

MIKE COEN – BUILD ENVIRONMENTAL

ENERGY ASSESSMENT RESULTS

PERFORMANCE CATEGORY AND METRIC	TARGET (STEP 5)	ACHIEVED (STEP 5)
Building Equipment and Systems Compliance Metric: Mechanical Energy Use Intensity (MEUI)	105 kWh/(m²·yr)	100 kWh/(m²·yr)
Building Envelope Compliance Metric: Thermal Energy Demand Intensity (TEDI)	20 kWh/(m²·yr)	17 kWh/(m²·yr)
Airtightness Compliance Metric: Air Changes per Hour at 50 Pa (ACH@50PA)	1.0 ACH	0.9 ACH
Energy Use Reduction vs. EnerGuide Reference House		27%
Annual Energy Consumption (Estimated from Energy Model)	Electricity	11,700 kWh
	Natural Gas	None

ENERGY STEPCODE
BUILDING BEYOND THE STANDARD



Mechanical Energy Use Intensity (MEUI) is the sum of energy used for space heating, cooling, domestic hot water and ventilation. Measured per square metre of heated floor area per year. – kWh/m²/yr

Thermal Energy Demand Intensity (TEDI) is the annual heat energy needed after accounting for internal heat gain and solar heat gain. Measured per square metre of heated floor area per year. – kWh/m²/yr

Air Changes Per Hour (ACH@50Pa) is the metric used for blower door airtightness testing. Measured per hour at a 50 Pascal pressure differential.

ACKNOWLEDGEMENTS

Builder Build Environmental
buildenvironmental.com

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