A.5 PEER Wall — Exterior Insulated Finished System Panel

EIFS wall for prefabricated exterior energy retrofit

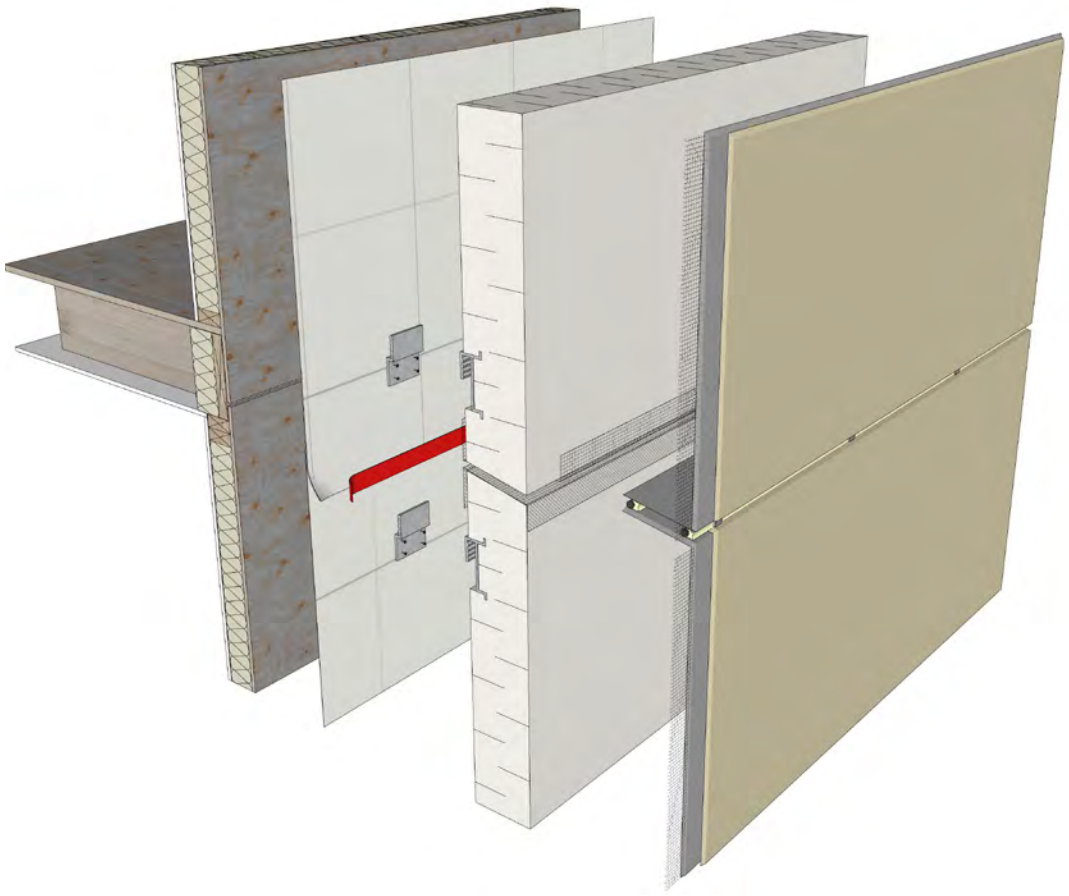


Figure 1 Exploded view of partial retrofit panel components at floor line transition

Developed by Natural Resources Canada's
Prefabricated Exterior Energy Retrofit (PEER) team

A.5 PEER Wall — EIFS Enclosure Assembly Overview

The following is a description of the retrofit panel layers installed on the exterior of the existing house. See also the Typical Construction Details on page 55.

Exterior

- Finish coat
- Base coat with reinforcing mesh
- EPS board insulation
- Air barrier membrane + water resistive barrier
- Existing assembly (not shown)

Interior

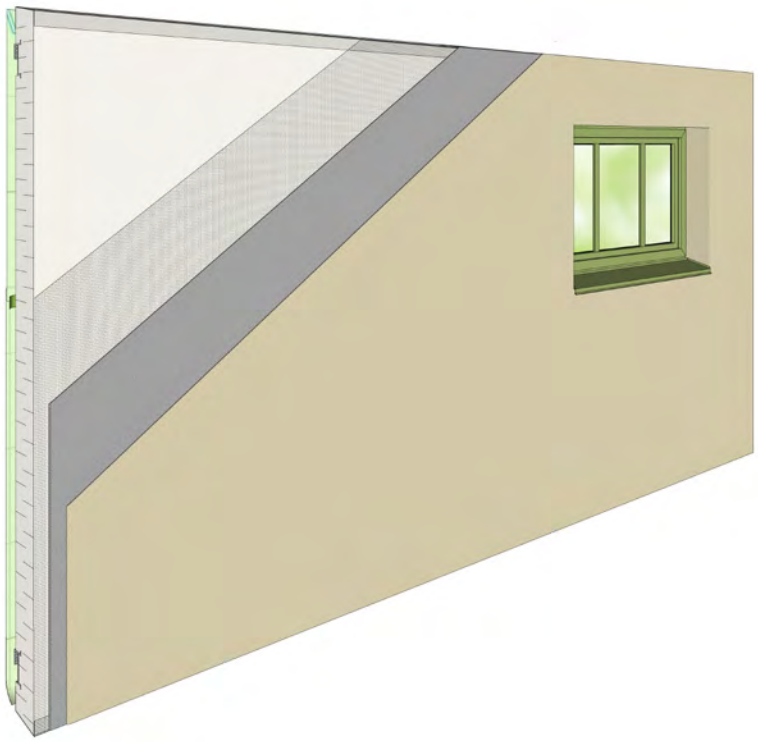


Figure 2 Retrofit EIFS wall panel overview (green highlights indicate site-applied perimeter joint/tie-in components)

Retrofit Description

- The Exterior Insulated Finished System (EIFS) panel is provided by Dryvit (Fedderlite M system) or similar panelized EIFS system. The panel is comprised of EPS insulation board with a reinforced base coat and a textured finish coat. The back of the panels have continuous aluminum receiver channels set into the EPS with hotwire.
- The EIFS panels are attached to the existing wall assembly through a cleat system. The EIFS channels clip onto intermittent cleats fastened to the existing backup wall.
- Joints are sealed with drained two-stage joints between the panels and a single-stage joint at the bottom-of-wall. The weather resistive barrier (WRB/AB) must be site installed and is a mechanically fastened sheathing membrane installed on the backup wall.
- The panels are installed over a small drained/unvented cavity behind the EIFS panels.
- New windows must be site installed into the old wall as the EIFS panels are non-load bearing. Air barrier and water resistive barrier transitions at window interfaces and sill flashing must also be site installed.

Potential Benefits of an EIFS Panel Retrofit

- All work (except window installation and interior window trim) is done from the exterior leaving the home livable during construction.
- Site installation work is limited, reducing installation times and disruption to residents.
- Eliminates on-site framing and uses panels to simplify installation.
- Insulation thickness can be varied to accommodate energy performance goals and lot-line setbacks.
- Provides a layer of continuous insulation reducing thermal bridging through framing.
- Increases air tightness, reduces drafts and noise, and lowers energy costs.
- Reduces potential for moisture ingress with careful detailing.
- Provides opportunity for seismic upgrades to meet regional requirements.
- Allows for quality assurance of the air barrier system transitions on site prior to installing EIFS panels.

Key Considerations

Air sealing: The air barrier (AB) is provided by the new sheathing membrane on the existing wall. Flexible membrane around windows, doors, and other penetrations and transitions complete the AB. Sealing at the top plate and base-of-wall where the new sheathing membrane connects to the existing house is also required. Openings around electrical, mechanical, and other service penetrations are sealed throughout the construction process. These are critical details to ensure an airtight barrier.

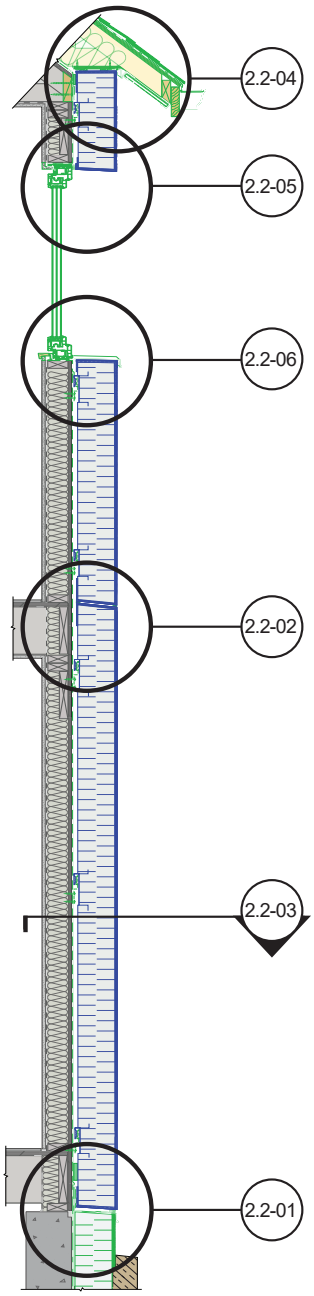
Connection to existing structure: This retrofit uses a cleat attachment system. A series of channels embedded into the back of the EIFS panels clip onto intermittent wall cleats that are fastened to the existing wall. New windows are site installed into the existing wall frame as the panels are not load bearing.

Water control: A mechanically fastened sheathing membrane is provided at the backup wall as the primary water control and water resistive barrier (WRB). The panels joints are two-stage drained joints and a small non-vented drainage cavity is also provided between the panels and backup wall.

Cladding: The EIFS panels are a complete cladding system that is fully manufactured off-site. Site installation is limited to windows and doors, the WRB, the cladding attachment system, and completing the air barrier at joints, penetrations, and other interfaces.

Cladding is not highly impact-resistant. Best used in low-traffic areas or for applications second storey and above

Durability: The EIFS panels will have a reduced drying potential dependant on the thickness of the EPS insulation. Applications should be modelled to assess risk.



Typical Construction Details

The sample details shown in the following pages are intended to illustrate typical transition approaches both for air barrier and panel/insulation continuity. Note that these are example details, and project-specific details should always be developed to account for the unique conditions of each project.

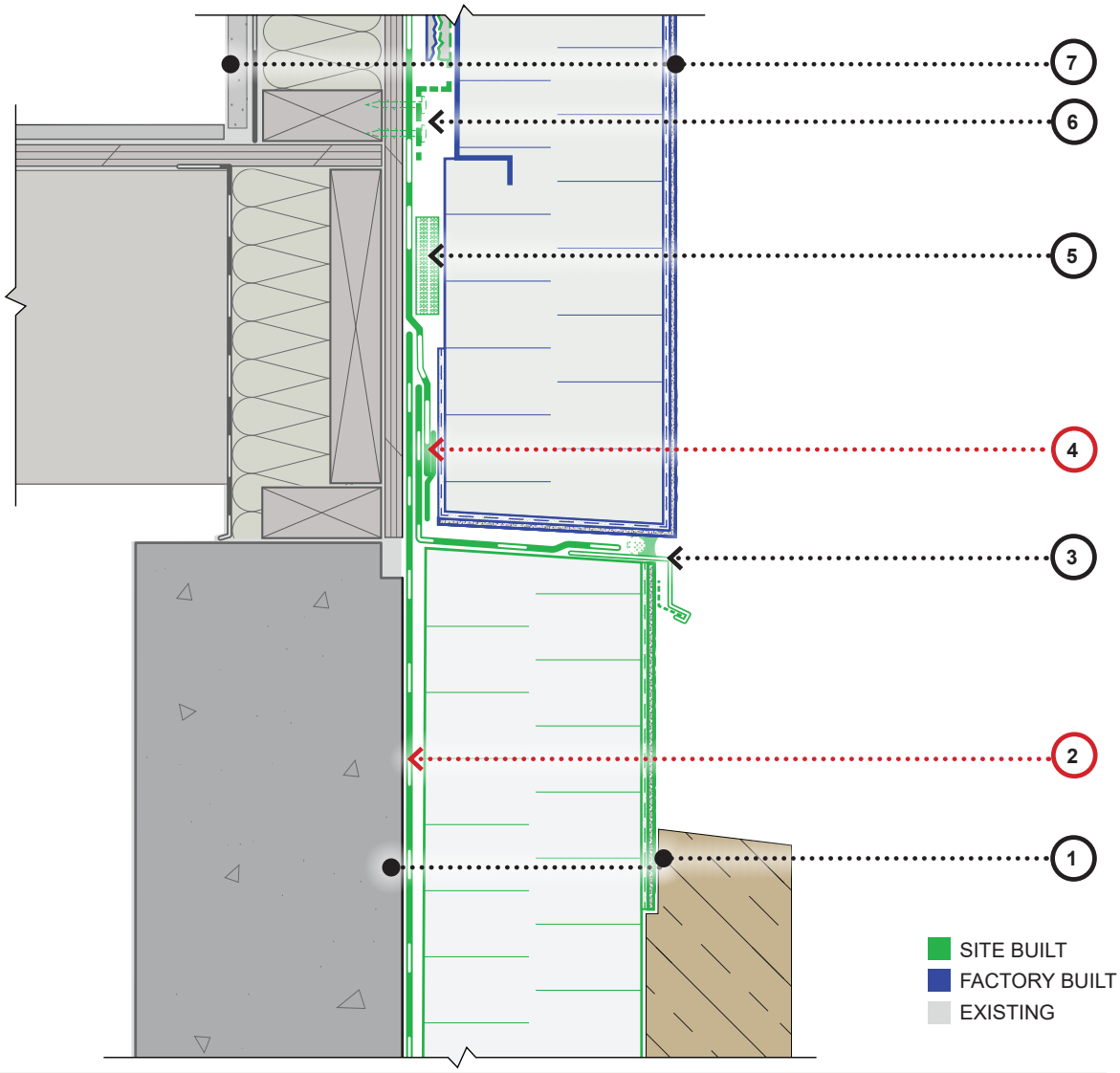
The annotations and legend in each sample detail contains red “AB” and "AB/WRB" icons to indicate the various air barrier and where applicable water resistive barrier components are present.

Each detail also include a colour legend as follows for the grey, green, and blue components shown:

- SITE BUILT
- FACTORY BUILT
- EXISTING

List of Details

Figure 3 House section detail wayfinder.

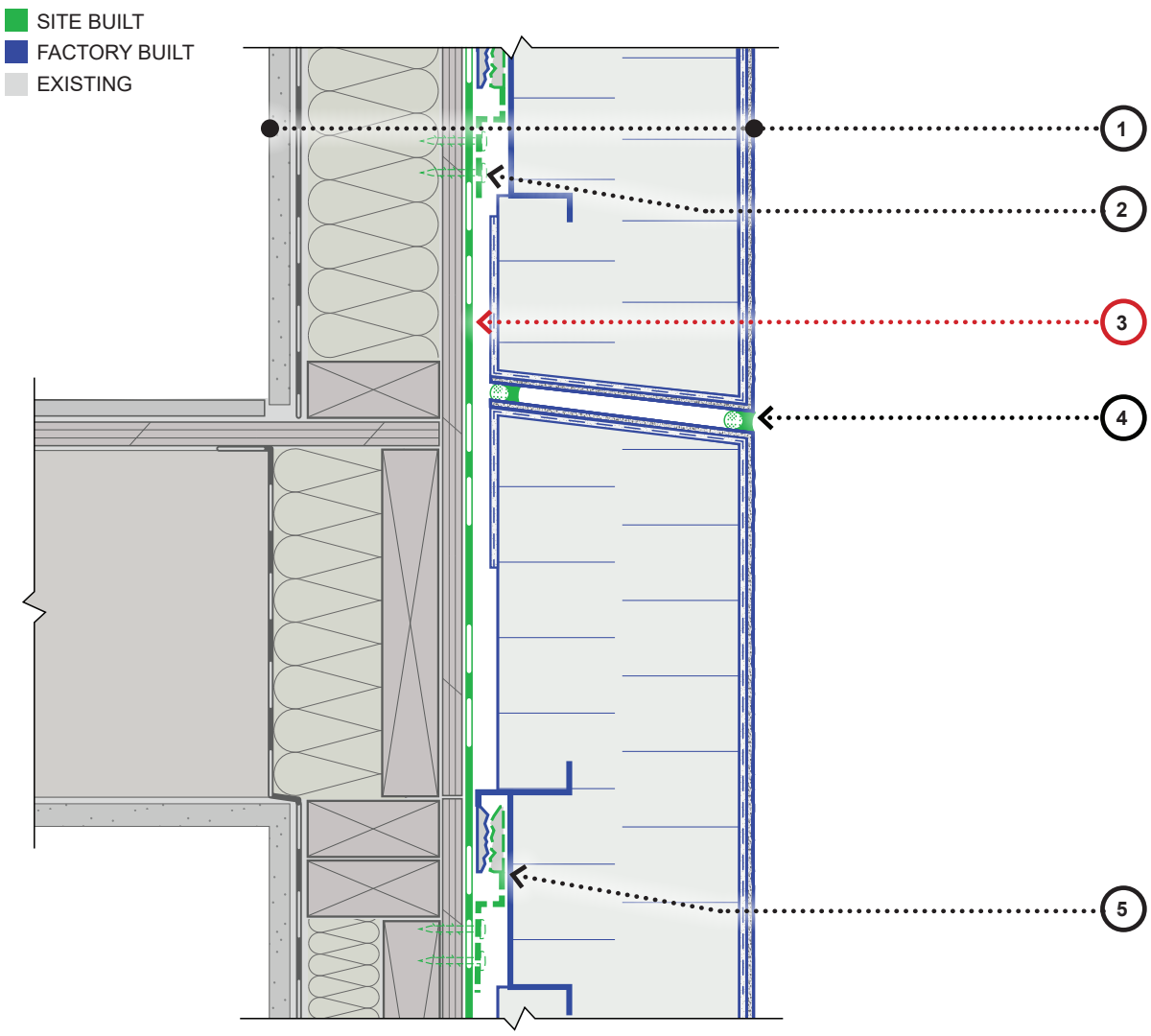


LEGEND

1. Wall Assembly:
   - Parge coat + mesh-reinforced base coat layer
   - EPS foam insulation
   - Self-adhered transition membrane (AB/WRB)
   - Existing assembly
2. Site installed self-adhered transition membrane on foundation wall.
3. Site installed through wall membrane flashing adhered to flashing. Caulking and backer rod with intermittent weep holes.
4. Site installed field membrane lapped onto through wall flashing membrane and tapped at seams. (AB/WRB)
5. Reticulated air foam baffle.
6. EIFS panel clips fastened to existing assembly.
7. EIFS Wall Assembly.

Detail A.5–01 | Base of Wall at Foundation

PEER Wall A.5 — EIFS Panel

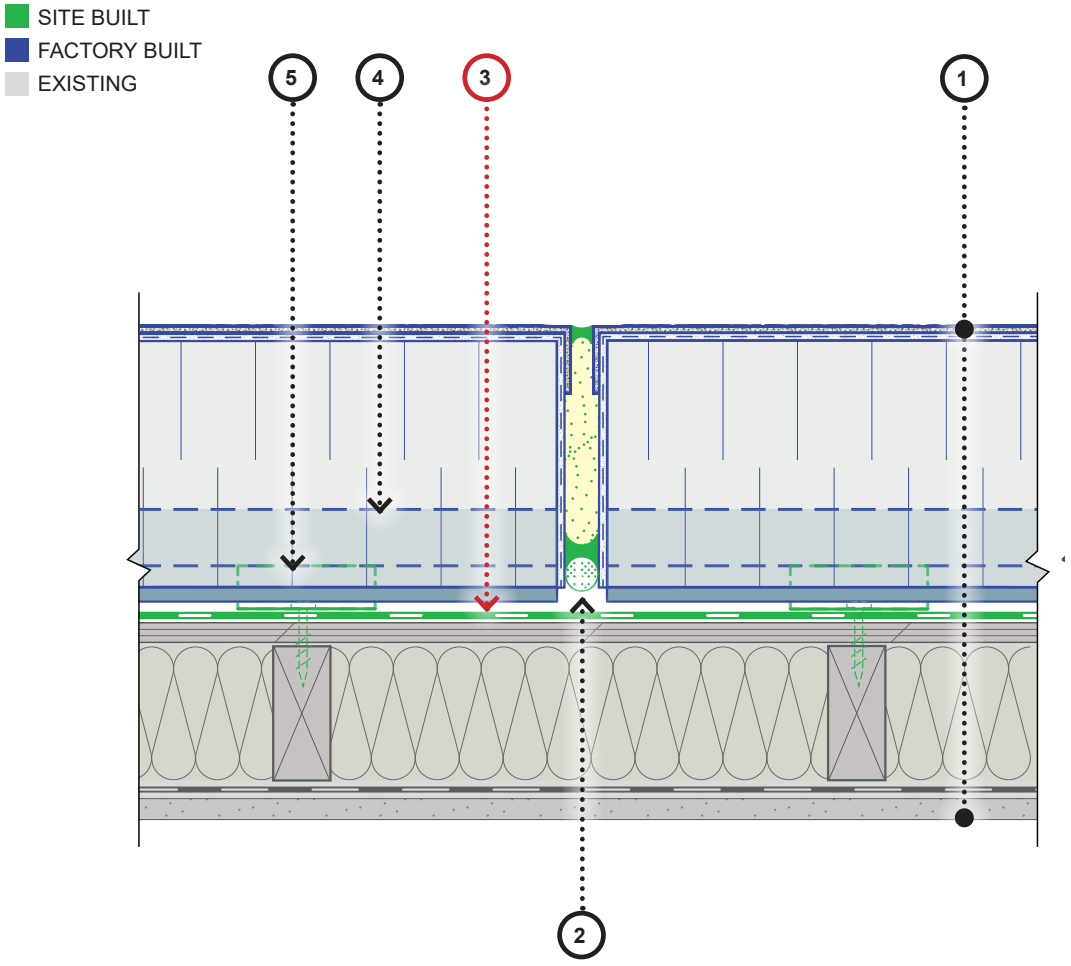


LEGEND

1. EIFS Wall Assembly.
2. EIFS panel clips fastened to existing assembly.
3. Site installed field membrane. (AB/WRB)
4. Two-stage drainage channel with intermittent weeps through caulking.
5. EIFS panel clips fastened to existing assembly.

Detail A.5–02 | Horizontal Panel Joint

PEER Wall A.5 — EIFS Panel

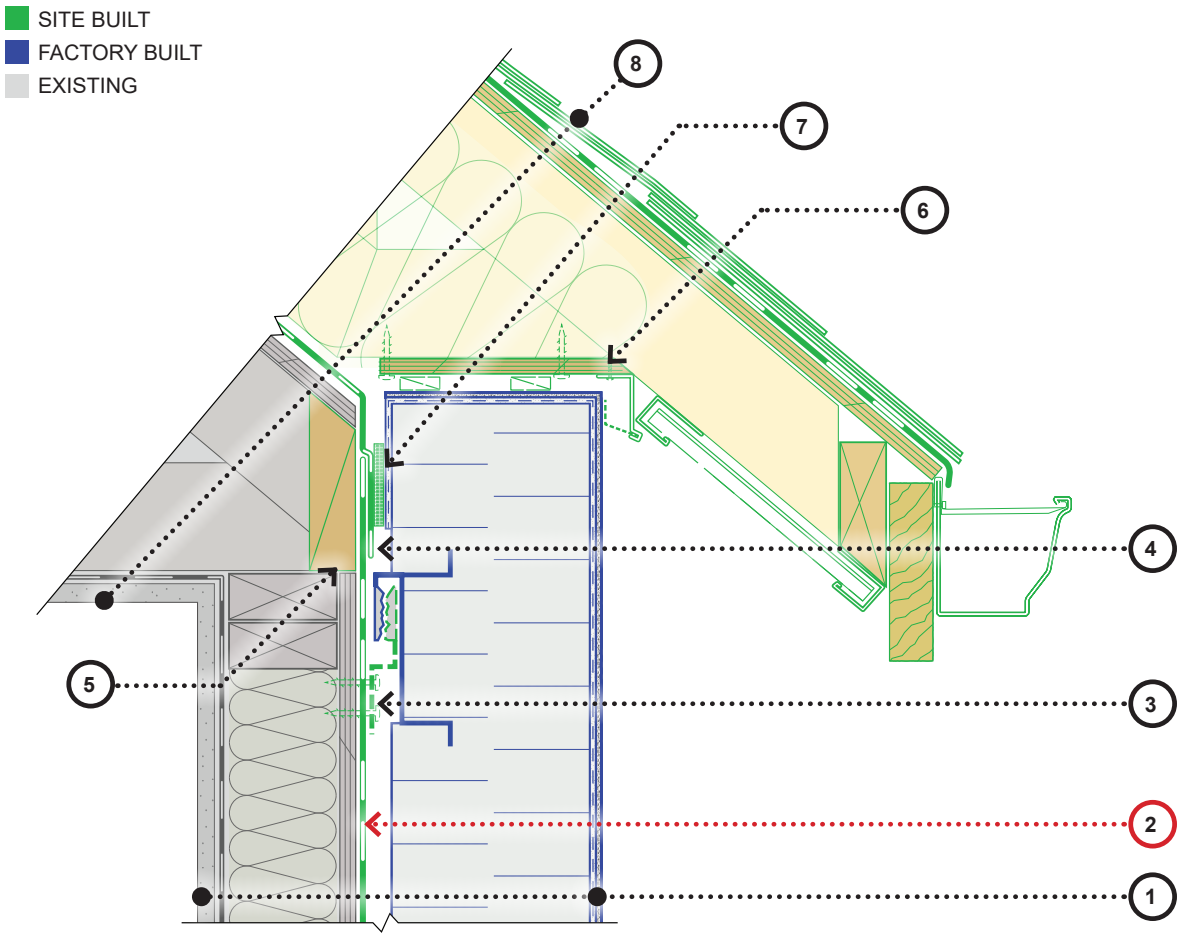


LEGEND

1. EIFS Wall Assembly.
2. Self expanding foam joint sealant used as backer for caulking at exterior side. Backer rod used at interior side.
3. Site installed field membrane. (AB/WRB)
4. EIFS clip channel secured to site installed clips.
5. Site installed clips fastened to existing assembly.

Detail A.5–03 | Vertical Panel Joint

PEER Wall A.5 — EIFS Panel

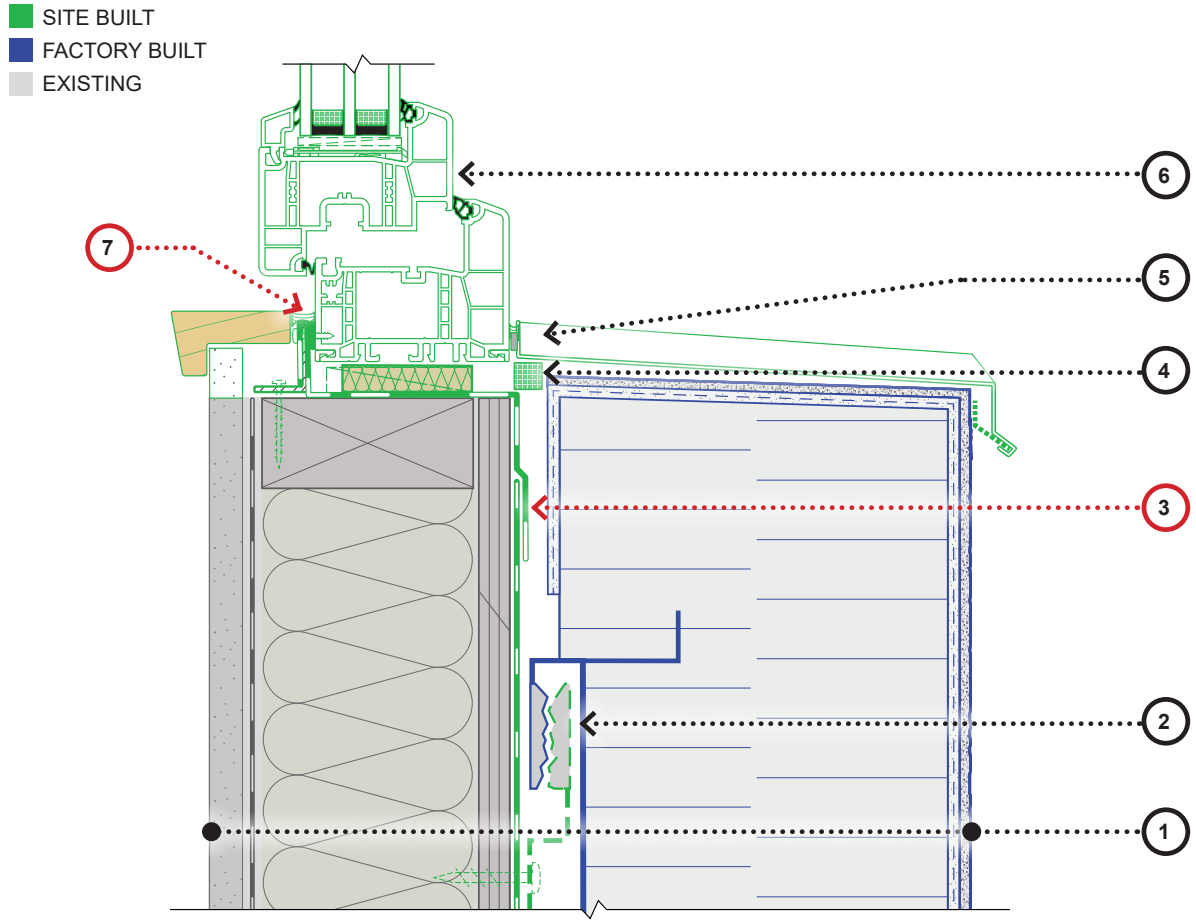


LEGEND

1. EIFS Wall Assembly.
2. Site installed field membrane. (AB/WRB)(AB/WRB)
3. EIFS panel clips fastened to existing assembly.
4. Roof membrane lapped onto fastened field membrane and taped at seams. (AB/WRB)
5. Site installed wood blocking to receive roofing membrane.
6. Plywood shim fastened to site installed roof structure to provide clearance for vented space behind EIFS panel.
7. Reticulated air foam baffle.
8. Chainsaw retrofit roof assembly.

Detail A.5–04 | Top of Wall

PEER Wall A.5 — EIFS Panel

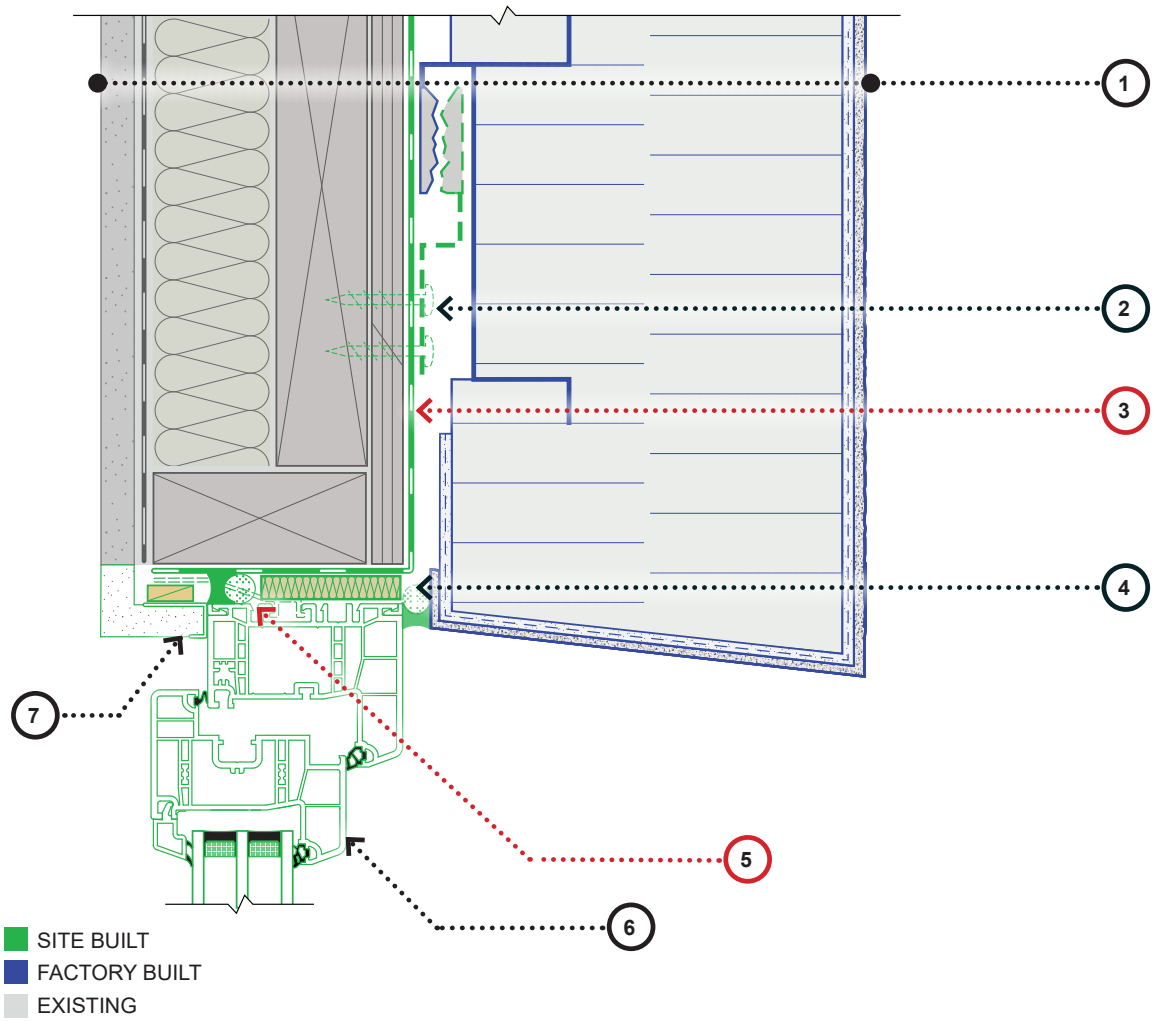


LEGEND

1. EIFS Wall Assembly.
2. EIFS panel clips fastened to existing assembly.
3. Site installed self-adhered sill membrane over sill angle and lapped onto field membrane. Membrane transition seems taped. (AB/WRB)
4. Reticulated air foam baffle.
5. Window sill flashing clipped to sill trim with perforated metal receiver and adhered to face of window frame with foam tape and sealant.
6. Site installed new triple-glazed window secured in place with sill angle at sill.
7. Site installed window set into continuous sealant over sill angle and secured with screws. (AB/WRB)

Detail A.5–05 | Window Sill

PEER Wall A.5 — EIFS Panel



LEGEND

1. EIFS Wall Assembly.
2. EIFS panel clips fastened to existing assembly.
3. Site installed field membrane lapped onto existing assembly. (AB/WRB)
4. Site installed backer rod and caulking with intermittent weeps between new window and EIFS panel.
5. Continuous sealant installed between rough-opening and window head/jambs. (AB/WRB)
6. Site installed new triple-glazed window secured in place with clips at head and jambs.
7. Interior gypsum.

Detail A.5–06 | Window Head

PEER Wall A.5 — EIFS Panel

APPENDIX B: PEER PANEL CLEAR FIELD R-VALUES, EMBODIED CARBON, AND WEIGHT LOOK-UP TABLES

Summary: Table B-1 summarizes the clear field R-value, embodied carbon, and mass for various permutations of PEER panel prototypes.

Scope: Is limited to the wall panel construction itself. Rainscreen strapping included but cladding excluded. Existing building's back-up wall excluded. Demolition excluded. Other building envelope components (roof, foundation, fenestration) also excluded.

Method: Material takeoffs for a typical 26x9' (234ft^2 or 21.74m^2) panel were assumed. Associated emissions estimated with the NRCan Material Emission Calculator (V1.0). These were then normalized on a ft2 (m^2) basis. Clear Field Thermal Resistance was calculated using the Isothermal Planes method[3].

3 2021 ASHRAE Handbook—Fundamentals—Chapter 25 (F25.8), American Society of Heating, Refrigeration and Air-conditioning Engineers, Inc., Atlanta, GA.

Panel System	Sheathing	Panel Thickness		Clear Field R-value (Isothermal planes)		Specific Net Carbon Footprint		Specific Mass	
		(in)	(mm)	(RIP)	(RSI)	(kg CO_2e / ft^2)	(kg CO_2e / m^2)	(lb/ft^2)	(kg/m^2)
2x4 Wood-frame Standoff Panel @ 16" OC w/ 2" standoff insulated with dense-pack cellulose	1/2" OSB	6 3/4	171.5	20.7	3.65	0	-3	4.97	24.28
2x4 Wood-frame Standoff Panel @ 24" OC w/ 2" standoff insulated with dense-pack cellulose	1/2" OSB	6 3/4	171.5	21.1	3.72	0	-3	4.76	23.23
2x4 Wood-frame Standoff Panel @ 24" OC w/ 4" standof insulated with dense-pack cellulose	1/2" OSB	8 3/4	222.3	28.0	4.92	-1	-6	5.56	27.14
2x4 Wood-frame Standoff Panel @ 16" OC w/ 4" standoff insulated with dense-pack cellulose	1/2" OSB	8 3/4	222.3	28.3	4.99	-1	-6	5.34	26.08
Structural Insulated Panel (5 1/2" EPS-I)	1/2" OSB (x2)	8 1/4	209.6	25.6	4.51	2	21	4.43	21.63
Structural Insulated Panel (5 1/2" Neopore GPS-I)	1/2" OSB (x2)	8 1/4	209.6	31.0	5.47	1	15	4.43	21.63
Structural Insulated Panel (7 1/4" EPS-I)	1/2" OSB (x2)	10	254.0	32.1	5.65	2	25	4.64	22.64
Structural Insulated Panel (7 1/4" Neopore GPS-I)	1/2" OSB (x2)	10	254.0	39.3	6.92	2	17	4.64	22.64
Structural Insulated Panel (9 1/4" EPS-I)	1/2" OSB (x2)	12	304.8	39.5	6.96	3	31	4.89	23.87
Structural Insulated Panel (9 1/4" Neopore GPS-I)	1/2" OSB (x2)	12	304.8	48.7	8.58	2	21	4.89	23.87
Nailbase (5-1/2" EPS-II)	3/4" OSB	8	203.2	24.8	4.38	2	21	3.35	16.37
Nailbase (5-1/2" Neopore GPS-II)	3/4" OSB	8	203.2	30.9	5.44	2	19	3.35	16.37

Panel System	Sheathing	Panel Thickness		Clear Field R-value (Isothermal planes)		Specific Net Carbon Footprint		Specific Mass	
		(in)	(mm)	(RIP)	(RSI)	(kg CO_2e / ft^2)	(kg CO_2e / m^2)	(lb/ft^2)	(kg/m^2)
Nailbase (7-1/4" EPS-II)	3/4" OSB	9 3/4	247.7	32.9	5.79	2	25	3.35	16.37
Nailbase (7-1/4" Neopore GPS-II)	3/4" OSB	9 3/4	247.7	39.1	6.89	2	23	3.35	16.37
I-Joist Panel (9-1/2" TJIs @ 16"OC c/w R-3.7/in cellulose)	1/2" OSB (x2)	12 1/4	311.2	29.5	5.19	0	-5	10.42	50.86
I-Joist Panel (9-1/2" TJIs @ 24"OC c/w R-3.7/in cellulose)	1/2" OSB (x2)	12 1/4	311.2	30.5	5.37	0	-5	9.83	48.01
I-Joist Panel (9-1/2" TJIs @ 16"OC c/w R-4.0/in mineral wool)	1/2" Gypsum	11 3/4	298.5	29.8	5.26	3	33	8.52	41.62
I-Joist Panel (9-1/2" TJIs @ 24"OC c/w R-4.0/in mineral wool)	1/2" Gypsum	11 3/4	298.5	31.0	5.46	3	32	7.91	38.62
I-Joist Panel (9-1/2" TJIs @ 16"OC c/w R-3.6/in fibreglass batt)	1/2" OSB	11 3/4	298.5	28.5	5.02	1	8	7.16	34.95
I-Joist Panel (9-1/2" TJIs @ 24"OC c/w R-3.6/in fibreglass batt)	1/2" OSB	11 3/4	298.5	29.5	5.19	1	7	6.51	31.76
I-Joist Panel (9-1/2" TJIs @ 16"OC c/w Hemp fiber batt / R 3.7/inch	1/2" OSB	11 3/4	298.5	28.8	5.08	0	1	7.96	38.88
I-Joist Panel (9-1/2" TJIs @ 24"OC c/w Hemp fiber batt / R 3.7/inch	1/2" OSB	11 3/4	298.5	29.9	5.26	0	0	7.34	35.85
I-Joist Panel (9-1/2" TJIs @ 16"OC c/w Straw Bale / R 3.3/inch	1/2" OSB	11 3/4	298.5	27.4	4.82	-3	-30	10.63	51.87
I-Joist Panel (9-1/2" TJIs @ 24"OC c/w Straw Bale / R 3.3/inch	1/2" OSB	11 3/4	298.5	28.2	4.97	-3	-31	10.11	49.34

Table B-1: Clear field R-value, estimated embodied carbon and mass of various variations of PEER panel designs

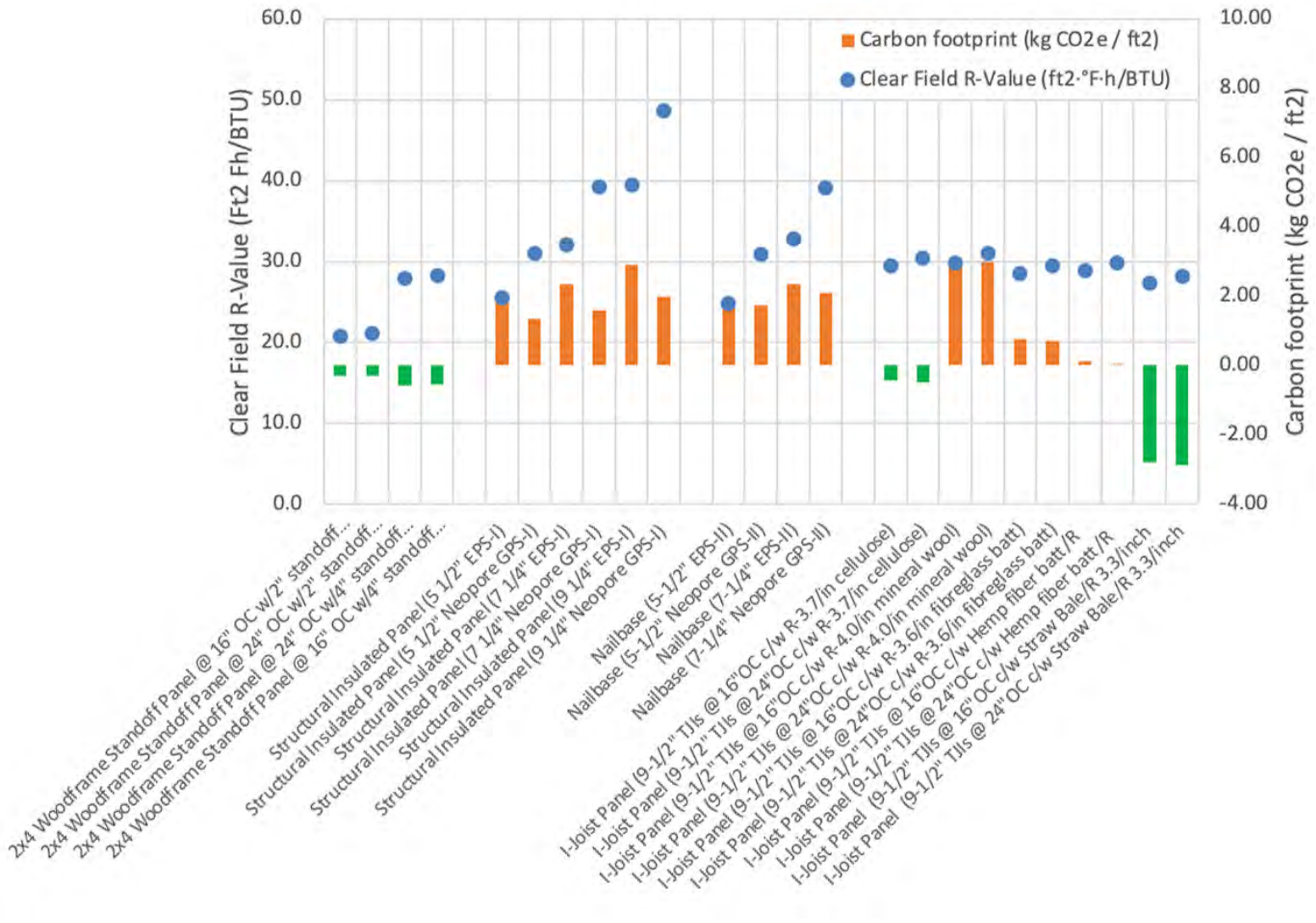


Figure B-1: Estimated clear Field R-value and embodied carbon content of variations of the PEER panels described in Appendix A. The blue dots represent the R-value, orange bars represent embodied carbon content per ft^2, green bars represent panels that are net-carbon storing. Note–cladding omitted from R-value and embodied carbon estimates.

APPENDIX C: CANADIAN HOUSING STOCK CHARACTERISTICS

The following plots present the typical thermal characteristics of the Canadian housing stock by vintage, and by province or territory. The data is taken from energy evaluations performed on low-rise housing through Canada's national home energy rating system, the EnerGuide Rating System (ERS). The ERS dataset represents approximately 5% of the Canadian housing stock and gives insight into the current performance of the stock.

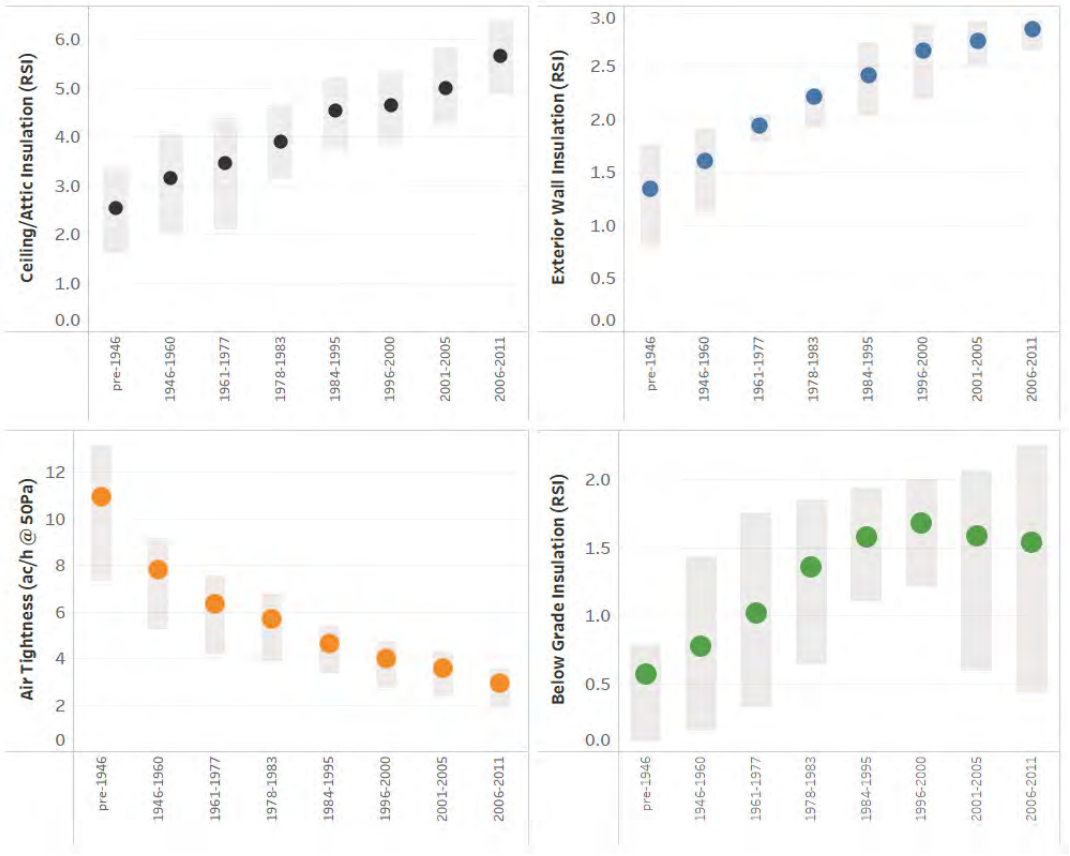


Figure C.1: Thermal characteristics of Canadian housing by vintage

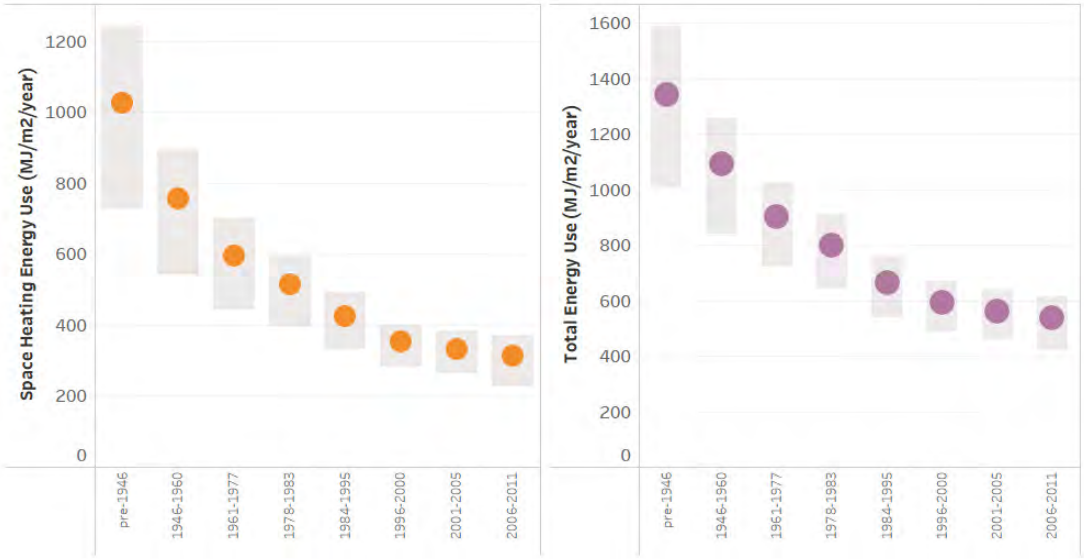


Figure C.2: Space heating and total energy use by vintage

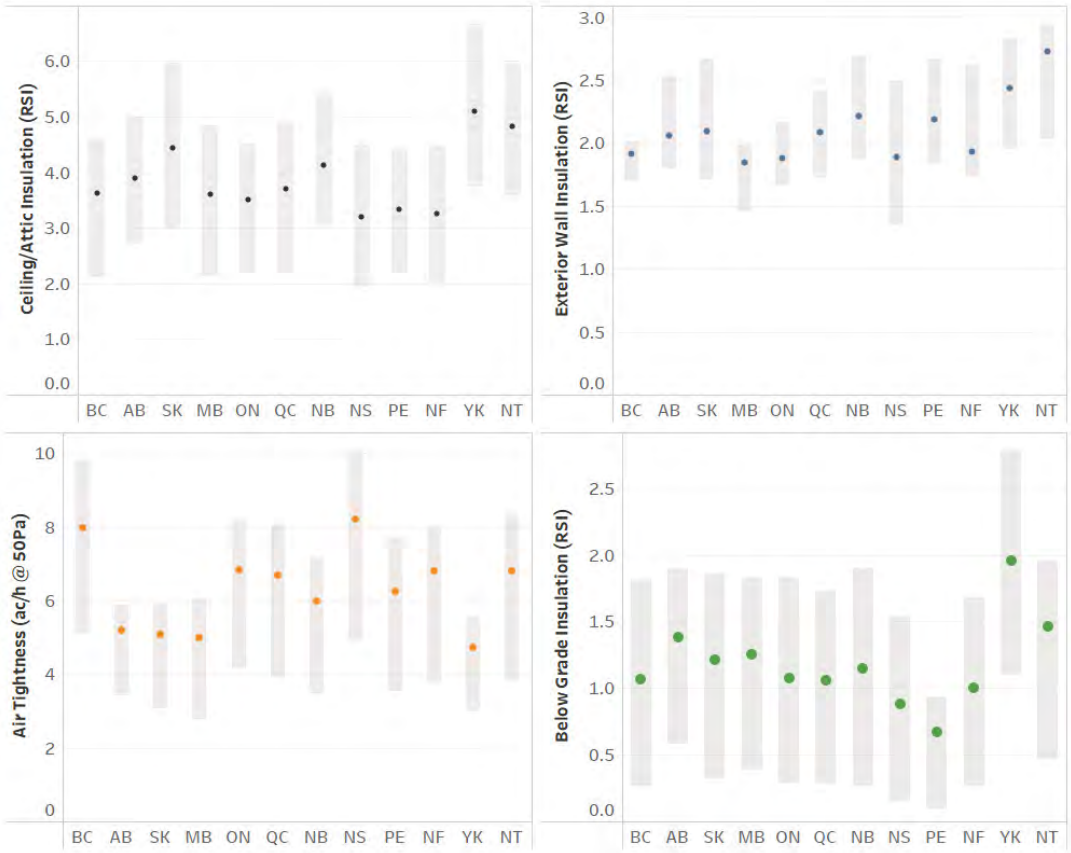


Figure C.3: Thermal characteristics by province or territory

APPENDIX D:
SAMPLE TENANT COMMUNICATIONS

The PEER Project—renovating the outside of your home to reduce your energy costs and improve your comfort

The building your home is in has been identified as a (potential) location for an exciting prefabricated exterior energy retrofit (PEER) transformation. This information sheet tells you what you need to know about the project.

What is a prefabricated exterior energy retrofit?

The building enclosure is a term used to describe all the elements of a house that keep the heat in and the weather out. The enclosure consists of the walls, windows, doors, roof, and foundation. Older homes tend to have poorly insulated and leaky enclosures. This contributes to high heating bills, poor comfort, and risk of condensation, which can lead to mould.

A prefabricated exterior energy retrofit consists of wrapping the whole house in a new enclosure. This will consist of factory-built, insulated panels that include new windows and doors, custom built to attach to the exterior of the building. The panels will be lifted into place using a crane. This ensures that the whole project is quickly completed with minimal disruption. Some additional work will be done to remove existing windows and doors and make sure that there is proper ventilation (exchange of air from inside the house to the outside to promote good indoor air quality).

How will this benefit me?

- **You can continue to live in your home normally when this work is being done**. With minimal disruption.
- **You will save on utility bills.** The new building enclosure (walls, windows, doors and roof) will significantly reduce heat loss and drafts from your home. This will save money on your heating bill.
- **You will be more comfortable.** After the renovation your home will be less drafty and will have better indoor air quality.
- **You will be helping the environment by contributing less to climate change.** The new walls will mean that you're using less energy to heat your home.
- **Your home will look better.** The renovation will give the house a "facelift" and modernize its appearance.

What should tenants expect?

During [timeframe], the building will be measured and its condition will be assessed.

- Field technicians will be in the area for 1–2 days taking building measurements from the outside using surveying instruments
- The survey equipment will include laser technology (LiDAR—Light, Imaging, Detection, and Ranging) and cameras. LiDAR measures the distance to surrounding objects by sending out laser pulses and measuring return time of reflected light. Infrared cameras will be used to capture heat signatures to identify where heat is leaking from your home.

Figure: LiDAR Scanner and Infrared Camera

- These technicians will be setting up their equipment in various locations around the building (including front and rear yards). Each measurement scan can take anywhere from 10–20 minutes.
- The data will be used to take precise measurements to design and custom build panels that will be installed on the exterior of your home.

On [insert date], a technician is coming to do **a blower door test** to measure how much air leaks from your home, and other aspects of your home's energy performance, such as type of furnace and amount of insulation in the walls. For this test, the technician will need access to the inside of your home for a few hours.

After the scans and tests, the team will take the information collected to evaluate the feasibility of the project and potentially design and build the panels. We will notify you again to share when in-site construction is expected to start. When it does, it should only last a few weeks.

What do I have to do?

To help this project we would like you to answer a few questions about your comfort level in your home and energy use habits. We will also ask for your consent to access your natural gas and electricity bills for the past two years. This will help us predict and measure the energy and cost savings from the renovation. A representative will follow up with specific questions and a consent form.

Because the majority of this work will be done from the outside, there will be minimal disruption to you. You will not, for example, have to move out or be away from your home for any period of time.

Let us know if you have any questions or concerns

For more information,

Contact:
Mark Carver
Buildings and Renewables Group
Natural Resources Canada, CanmetENERGY
mark.carver@nrcan-rncan.gc.ca

About CanmetENERGY

Natural Resources Canada's CanmetENERGY is the Canadian leader in clean energy research and technology development. Our experts work in the fields of clean energy supply from fossil fuel and renewable sources, energy management and distribution systems, and advanced end-use technologies and processes. Ensuring that Canada is at the leading edge of clean energy technologies, we are improving the quality of life of Canadians by creating a sustainable resource advantage.

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