



WALL ASSEMBLY COMPONENTS ¹		RSI	R
1	exterior air film	0.03	0.17
2	vinyl siding (no air space)	0.11	0.62
3	asphalt impregnated paper ²	0.00	0.00
4	0.8" (20.32mm) extruded polystyrene type 3/4	0.71	4.00
5	2x6 framing filled with R19 batt @ 16" o.c.	2.36	13.40
6	smart vapour retarder ³	0.00	0.00
7	more than 3/4" (20mm +) air space	0.00	0.00
8	1/2" (12.7mm) gypsum board	0.08	0.45
9	finish: 1 coat latex primer and latex paint	0.00	0.00
10	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		3.41	19.32
Centre of Cavity RSI / R Value		4.39	24.92
Installed Insulation RSI / R Value(nominal)		4.05	23.00
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		3.54	20.06

Note: ¹Values are for generic insulation products. Where a specific insulation product is used in the assembly, the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. ⁴Smart vapour retarder properties are based on [CertainTeed's MemBrain™ Continuous Air Barrier and Smart Vapour Retarder](#) product.

LEGEND High Pass Pass Conditional Pass Conditional Fail Fail

Outboard to Inboard ratio exception - Please check permeance of the non-wood based sheathing. As per 2015 NBC 9.25.5.1 (4), if the non-wood based sheathing has a permeance greater than 30 ng/(Pa·s·m²) and has a thermal resistance greater than R4, it does not need to comply with the outboard to inboard ratio requirement of 9.25.5.2.

OUTBOARD TO INBOARD RATIO **0.24**

SIMULATED DURABILITY ANALYSIS

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m²) must comply to NBC 9.25.5.2.

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
DURABILITY RATING BASED ON SIMULATIONS AND FIELD EXPERIENCE					
OUTBOARD TO INBOARD RATIO COMPLIANCE (not listed locations only, HDC < 6000)	0.2	0.3	0.2	0.2	0.2

19.3

R_{eff}

Summary

This is a very durable wall overall in all the climate zones listed, due to both the rain screen properties of the siding combined with the benefits of the insulative sheathing. The siding is non-absorptive to moisture, thus avoiding solar-driven moisture issues, while maintaining good drying potential towards the outside due to the "air-leakiness" of the siding should any moisture find its way behind it. The asphalt impregnated 30 minute paper and the layer of insulative sheathing acts as secondary drainage planes behind the siding, and also reduces the risk of interstitial condensation by raising the temperature of the wall assembly inboard of it. However, the low vapour permeability of the insulative sheathing reduces the drying potential of the assembly inboard of it, so care must be taken to minimize the leakage of warm, moist indoor air into the assembly by means of a continuous interior air barrier, and rain water leaks into the assembly must also be managed by proper detailing and use of flashings/ sealants etc.

Due to the low permeance of the XPS layer, there is reduced drying potential to the outside.

Energy & Thermal Performance

- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce the framing factor by 10% to 20%)
- Maximum nominal R-value of cavity insulation is typically limited to R19,20,22,24 (fiberglass batt) to R30 with medium density spray-applied insulation
- Continuous exterior Insulation significantly minimizes the effect of thermal bridging and enhances overall effective R-value of the entire assembly
- Due to the limited permeance of exterior insulation materials, keeping the wall dry through detailed flashing and rigorous air barrier applications is important

Exterior Moisture/Wetting



- Any liquid water leaking past the siding will be intercepted by the asphalt impregnated 30 minute paper or by the layer of insulative sheathing between the asphalt impregnated paper and the OSB. Both act as a secondary drainage plane and drain any liquid water to the outside. The asphalt impregnated 30 minute paper must have lapped joints and be lapped over flashing (located at the bottom of the wall assembly).
- The siding is non-absorptive and rain shedding.
- Care must be taken at all penetrations and transitions (windows, etc.) by use of proper detailing as well as sealants and/or flashing to ensure water does not leak into the assembly.
- Built-in construction moisture must be managed to reasonable levels.

Air Leakage Transported Moisture from Inside



- The effect of the insulative sheathing has a slightly reduced risk of interstitial condensation in the stud cavity from warm moisture-laden interior air leaking into the wall assembly, as the insulative sheathing raises the temperature inboard of it, causing the dew point in the heating season mostly to fall outboard of the inner surface of the insulative sheathing
- For colder climates, the thickness of the insulative sheathing must be increased to maintain dew point condensation from falling outside of the inner surface of the stud cavity and insulative sheathing.

- Air leakage into the assembly must be managed by means of a continuous air barrier (preferably both interior and exterior). Proper detailing at any connection or penetrations (window openings, electrical boxes, plumbing penetrations etc.), will also help reduce heating and air conditioning costs.
- This wall assembly has good drying potential towards the outside due to the ventilation behind the siding in the furring space allowing for convective drying.
- This wall assembly has good drying potential on the outboard side of the XPS towards the outside, but not from the inboard side of the XPS. This is due to the ventilation behind the siding in the furring space allowing for convective drying.

Water Vapour Diffusion from Outside

- Solar driven moisture is not a significant issue with vinyl, fibre cement, metal, Maibec type coated wood siding (with all surfaces coated) or other similar non-absorptive and rain-shedding sidings, provided they are detailed properly, they have a ventilated (openings at the top and bottom of the assembly) air gap minimum 3/8" behind them, and that they are installed in accordance to manufacturer guidelines.

Water Vapour Diffusion from Inside

- Vapour diffusion from the inside must be controlled by the installation of a vapour retarding membrane (such as polyethylene, a vapour retarder paint or variable permeance "smart" vapour retarder if the code allows) on the inside behind the gypsum board or painted onto the gypsum board according to code.

Drying Potential

- Built-in moisture must be managed to reasonable levels.

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Insulation, weather barrier and air barrier details and materials are readily available and understood within the Canadian industry
- Constructing walls with exterior insulation is rapidly becoming common practice in some Canadian Zones
- Handling, application and process integration of rigid insulation by Suppliers and Framers can initially affect cycle time - however, production cycle times quickly return to normal after the first few built units
- Materials such as studs, wood sheathing panels and/or insulation sheet goods are readily available in pre-cut lengths for 8' and 9' wall heights
- Exterior insulating sheathing can be an effective exterior air barrier when joints and seams are properly sealed with compatible air barrier qualified tapes, mastic, or caulking
- The fastener spacing, size, and embedment into the backup wall attaching the insulation and cladding depends on the cladding weight, the stud spacing of the backup wall, the sheathing type and thickness, and the exterior insulation type and thickness.

Affordability: Cost Implications

- Cost of exterior rigid insulation material and labour vary widely from region to region
- Reduction in wood use framing stud members is possible (19.2" OR 24" o.c.) with no

additional engineering required.

- Alternative bracing methods can be substituted for the wood sheathing panel (e.g. T-slot inlet bracing) - however, details for wall bracing, tall walls, and more than 3-storey construction may require additional engineering
- Wall thickness adjustment could require minor increase of foundation wall thickness (e.g. 8" to 10" foundation width) and increase costs
- Wall thickness adjustment could require minor jamb extensions or additional trim details on openings in the enclosure (i.e. for windows and doors)
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce overall lumber costs by upwards of 10 to 20% (i.e. for softwood and panel products)

Esthetics: Architectural Design

- This wall assembly design can be used up to 3 storey construction under most prevailing building codes
- Exterior wood sheathing provides a nailing substrate for cladding materials including various siding applications (vertical or horizontal)
- Wall thickness adjustment could require minor increase of foundation wall thickness (e.g. 8" to 10" foundation width) and increase costs
- Wall thickness adjustment could require minor jamb extensions or additional trim details on openings in the enclosure (i.e. for windows and doors)
- Exterior wall dimension width may have minor effect on interior dimensions (i.e. stair widths on exterior walls and overall interior useable square footage)

DISCLAIMER: The Canadian Wood Council's Wall Thermal Design Calculator has been developed for information purposes only. Although all possible efforts have been made to ensure that the information on this tool is accurate, the CWC cannot under any circumstances guarantee the completeness, accuracy or exactness of the information. Reference should always be made to the appropriate Building Code and/or Standard. This tool should not be relied upon as a substitute for legal or design advice, and the user is responsible for how the tool is used or applied.

Although all possible efforts have been made to ensure that the information on this tool is accurate, we cannot under any circumstances guarantee the completeness, accuracy or exactness of the information. Suggestions regarding this tool are welcome. If you feel that areas are missing, unclear or incorrect, please forward your suggestions to effectiveR@cwcc.ca