WALL ASSEMBLY COMPONENTS[1]		RSI	R
1	exterior air film	0.03	0.17
2	fired clay brick 4" (102 mm)[2]	0.07	0.40
3	more than 3/4" (20mm +) air space	0.18	1.02
4	spun bonded polyolefin (house wrap)	0.00	0.00
5	2" (50.8mm) extruded polystyrene type 3/4	1.78	10.10
6	1/2" (12.7mm) Plywood sheathing	0.11	0.62
7	2x6 framing filled with R22 batt @ 16" o.c.	2.55	14.48
8	polyethylene	0.00	0.00
9	1/2" (12.7mm) gypsum board	0.08	0.45
10	finish: 1 coat latex primer and latex paint	0.00	0.00
11	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**4.92**	**27.92**
Centre of Cavity RSI / R Value		6.24	35.44
Installed Insulation RSI / R Value(nominal)		5.65	32.10
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		5.08	28.83

Note: [1]Values 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. [2]The thermal resistance of the mortar was not considered. [3]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane Breather Type."

0.49

27.9

0.2 0.3 0.2 0.2 0.2

Summary

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

- The brick veneer with the vented or ventilated air space behind it acts as a rain screen.
- The asphalt impregnated paper installed over the insulative sheathing must have lapped joints and be lapped over flashing (located at the bottom of the wall assembly). The insulative sheating installed onto the wood sheathing must have taped joints. Both act as secondary drainage planes and drain any liquid water to the outside through weep holes. Flashing should extend behind the insulative sheating.
- If polyethylene vapour retarder is used in an assembly, the inward drying potential of the wall is greatly reduced.
- 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 is a reduced risk of interstitial condensation on the wood sheathing or 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.

Water Vapour Diffusion from Outside

- The risk of solar driven moisture problems can be reduced by the addition of the layer of relatively low permeability insulative sheathing. In certain climates, elevated relative humidity in the stud cavity can occur at times when enough water vapour

gets driven into the wall.
- A well vented cavity behind the brick veneer (vented at both the top and bottom) is recommended to reduce the potential for moisture to be driven into the wall.
- The risk of solar driven moisture problems can be reduced by the use of a variable permeance "smart" vapour retarder.

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.
- Should moisture get into the assembly, it has very good drying potential towards the outside:
    - Fibreglass batt is very vapour permeable
    - Wood sheathing is relatively vapour permeable when on the cold side of a wall, where relative humidity is typically higher
    - Weather barrier is vapour permeable
    - Vinyl siding is ventilated, allowing convective drying to the outside

Drying Potential

- If polyethylene vapour retarder is used in an assembly, the inward drying potential of the wall is greatly reduced.
- If low vapour permeance insulative sheathing is used in an assembly, the outward drying potential of the wall is greatly reduced.
- Built-in moisture must be managed to reasonable levels.

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Exterior wood sheathing provides both structural resistance to "racking" and a nailing substrate for cladding materials
- 19.2" stud spacing will typically require exterior sheathing and/or insulation panels to be installed horizontally, whereas 16" and 24" stud spacing can accommodate vertically installed panels (most panel goods have fastener spacing guidelines printed on the material based on vertical installation)
- 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)
- Thickness of exterior rigid insulation that is 2" or more may require strapping for adequate fastening of exterior cladding and increase costs
- 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@cwc.ca