

Joseph Lstiburek, Ph.D., P.Eng, ASHRAE Fellow

Building Science

Adventures In Building Science

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What is a Building?

A Building is an Environmental Separator

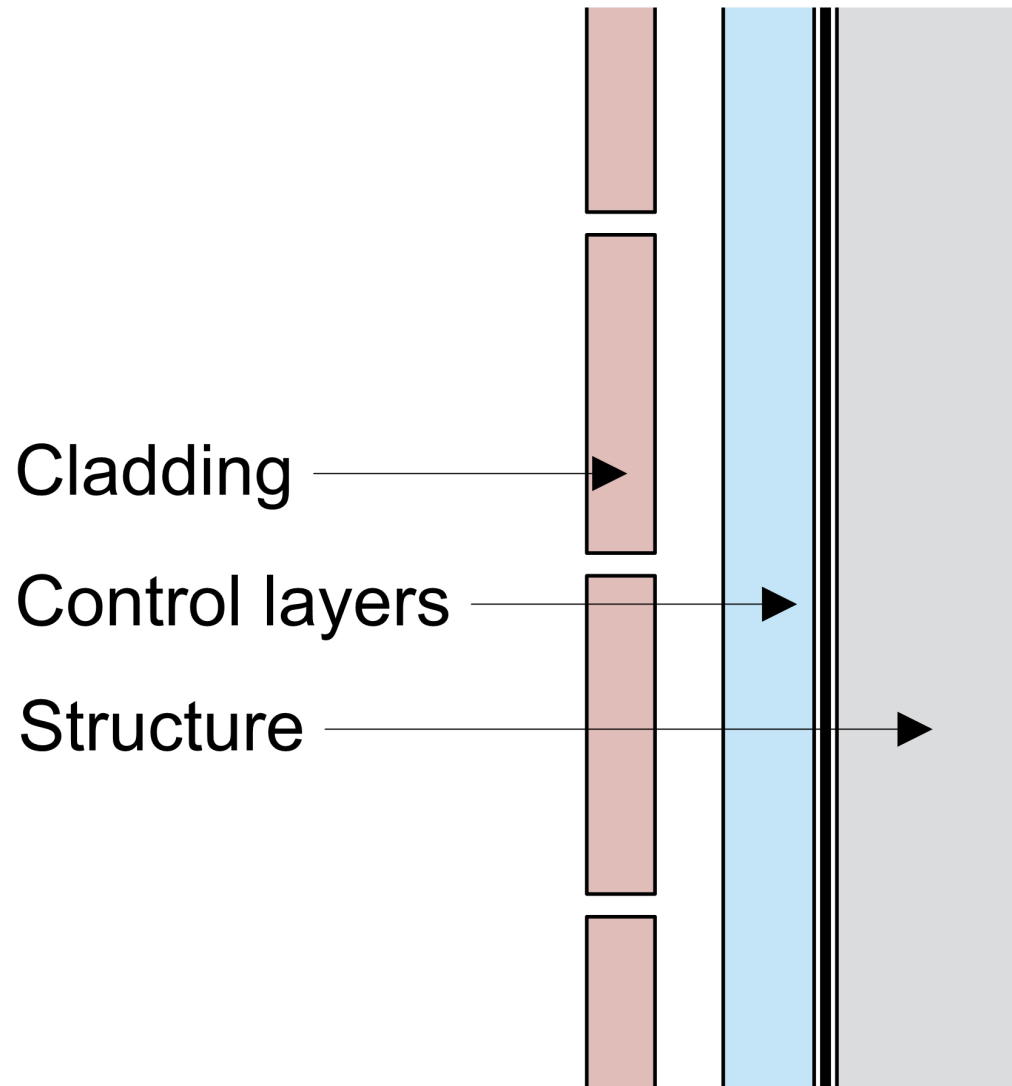
- Control heat flow
- Control airflow
- Control water vapor flow
- Control rain
- Control ground water
- Control light and solar radiation
- Control noise and vibrations
- Control contaminants, environmental hazards and odors
- Control insects, rodents and vermin
- Control fire
- Provide strength and rigidity
- Be durable
- Be aesthetically pleasing
- Be economical

Water Control Layer

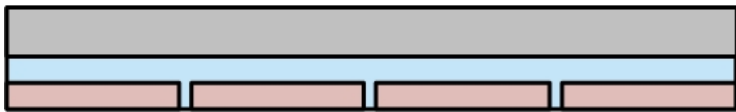
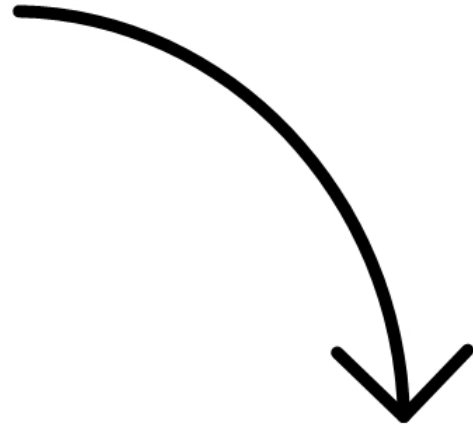
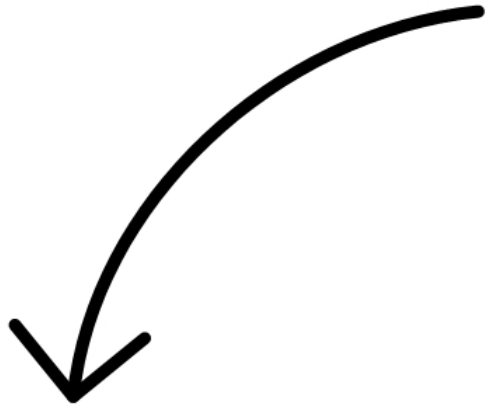
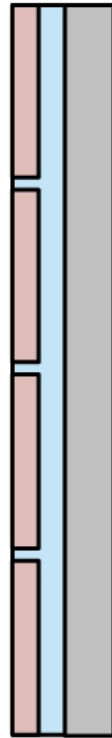
Air Control Layer

Vapor Control Layer

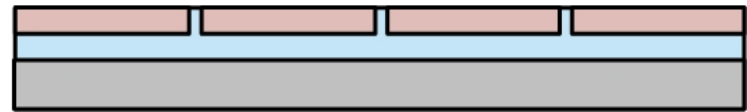
Thermal Control Layer



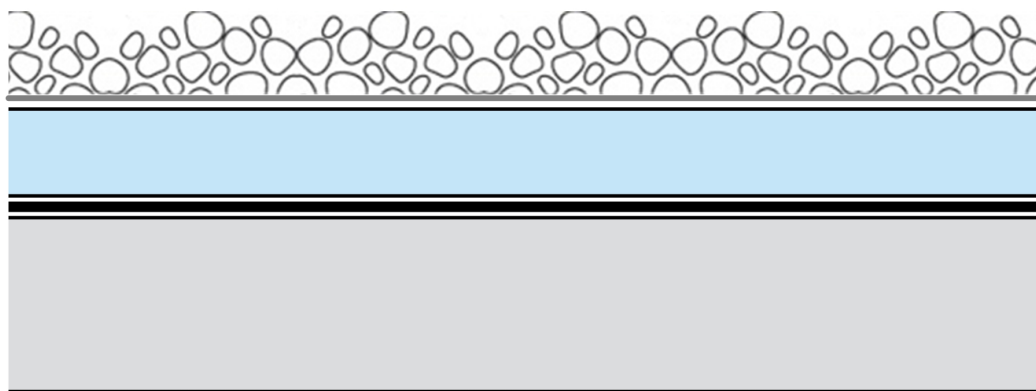
Wall



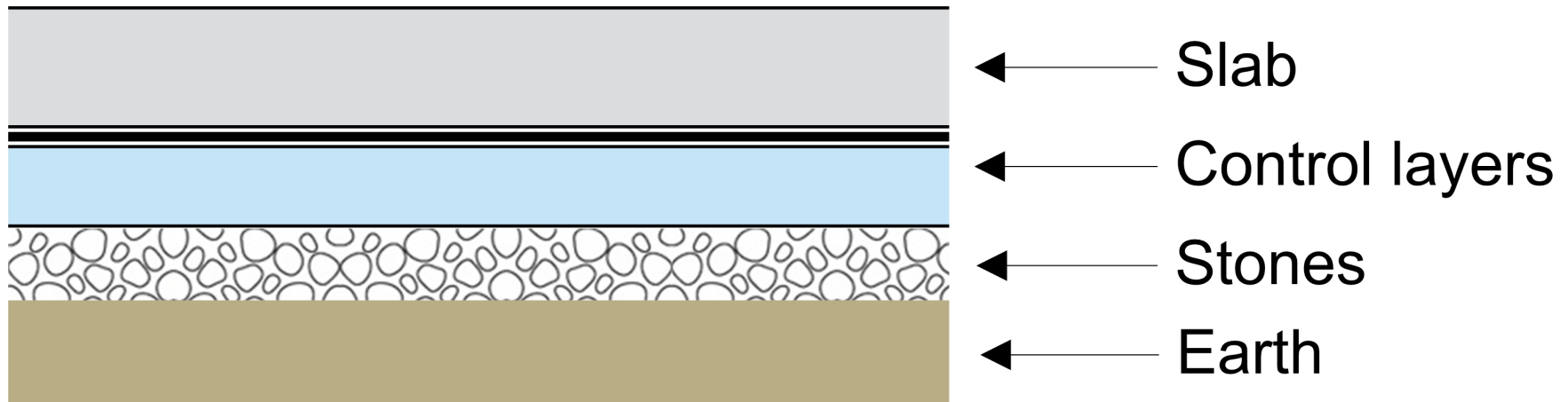
Slab

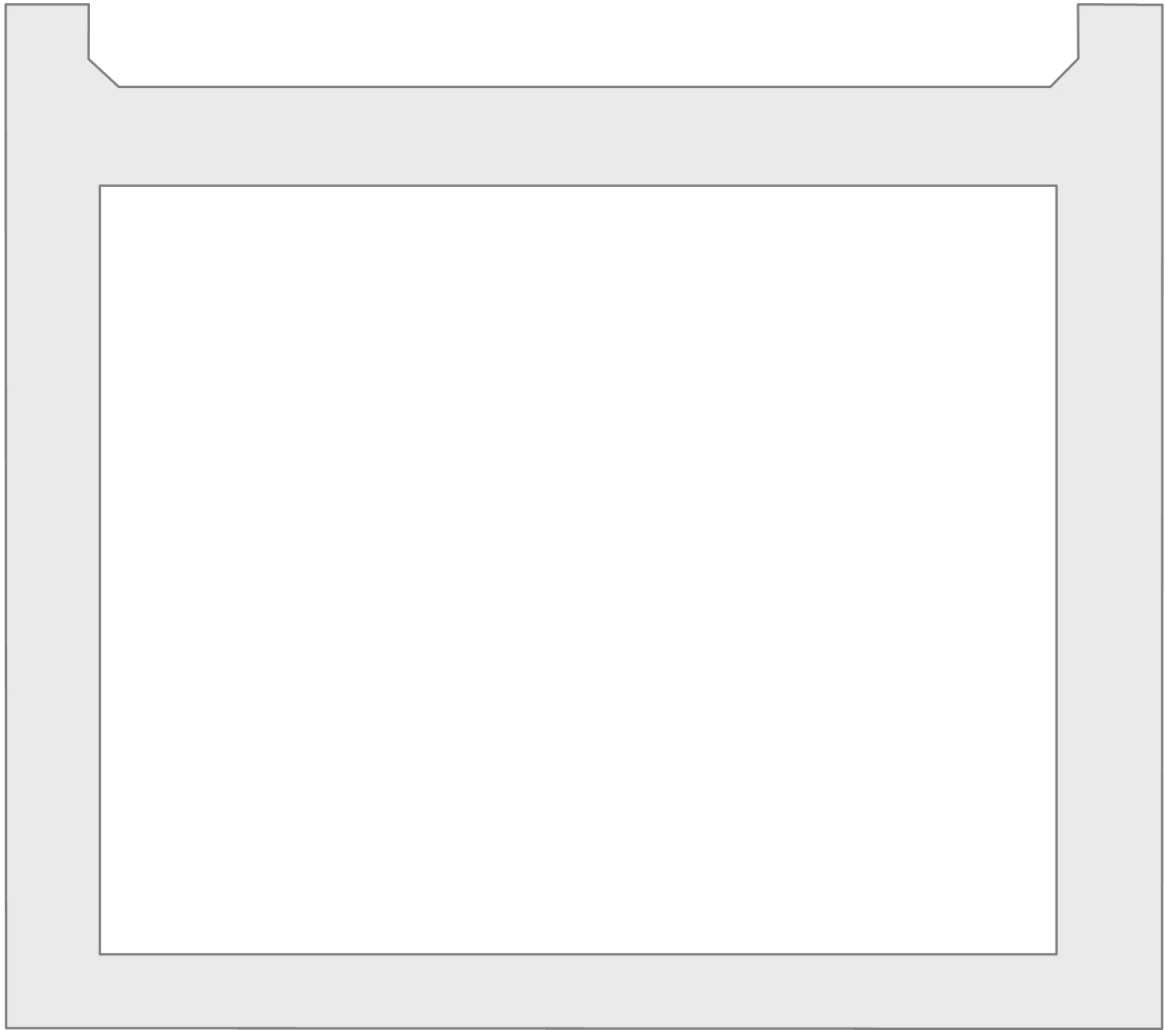


Roof

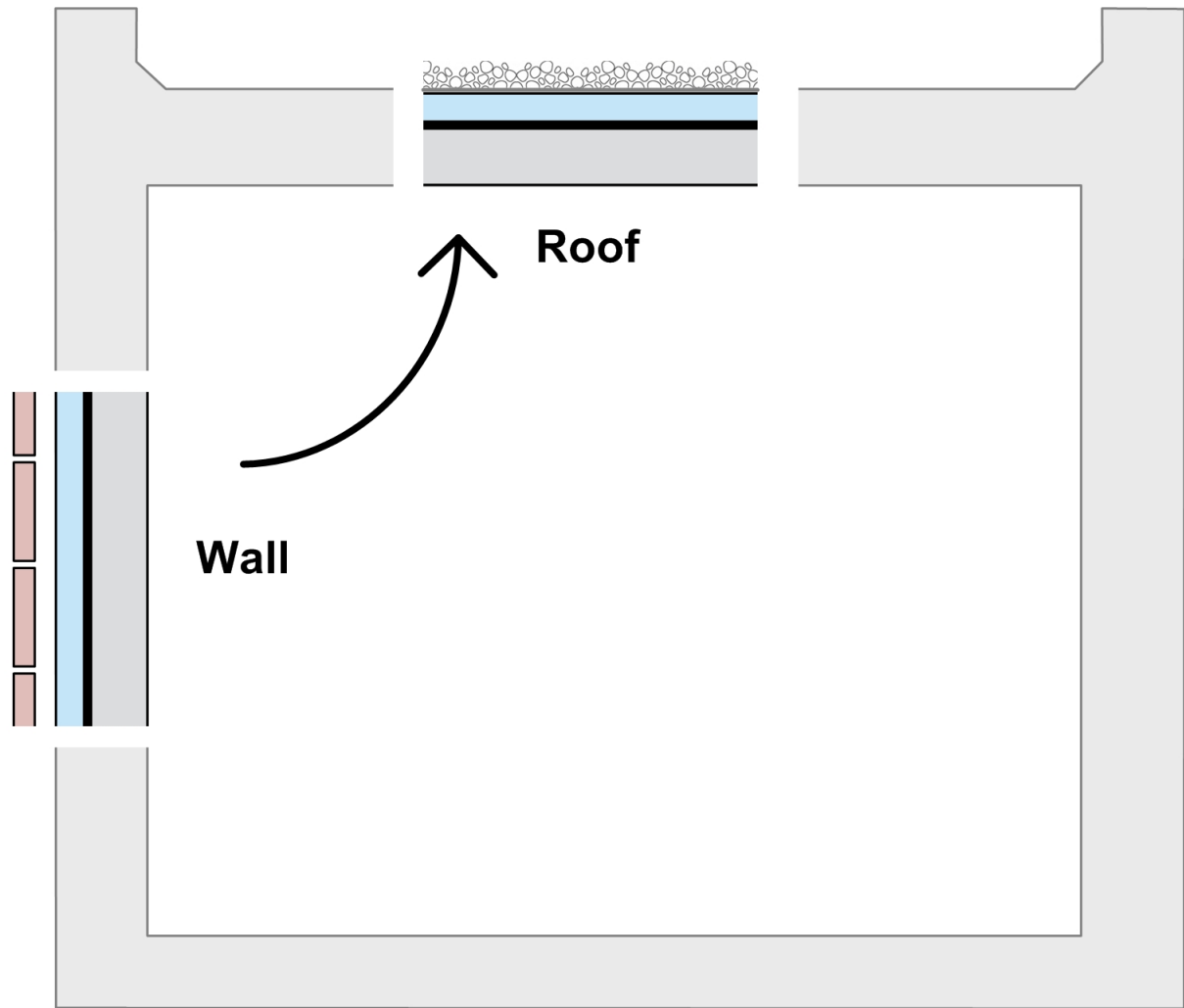


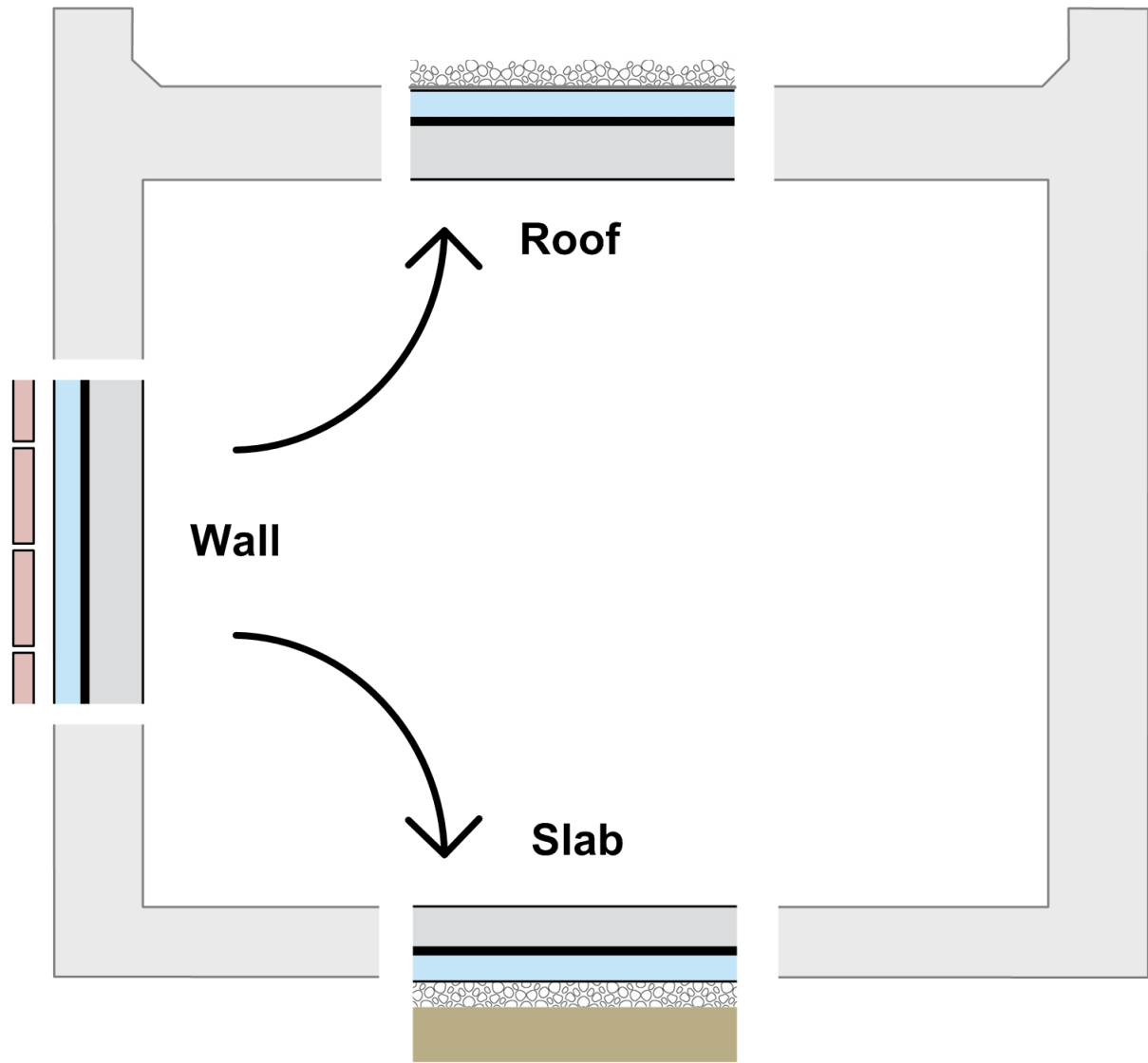
- ← Ballast
- ← Filter fabric
- ← Control layers
- ← Roof structure

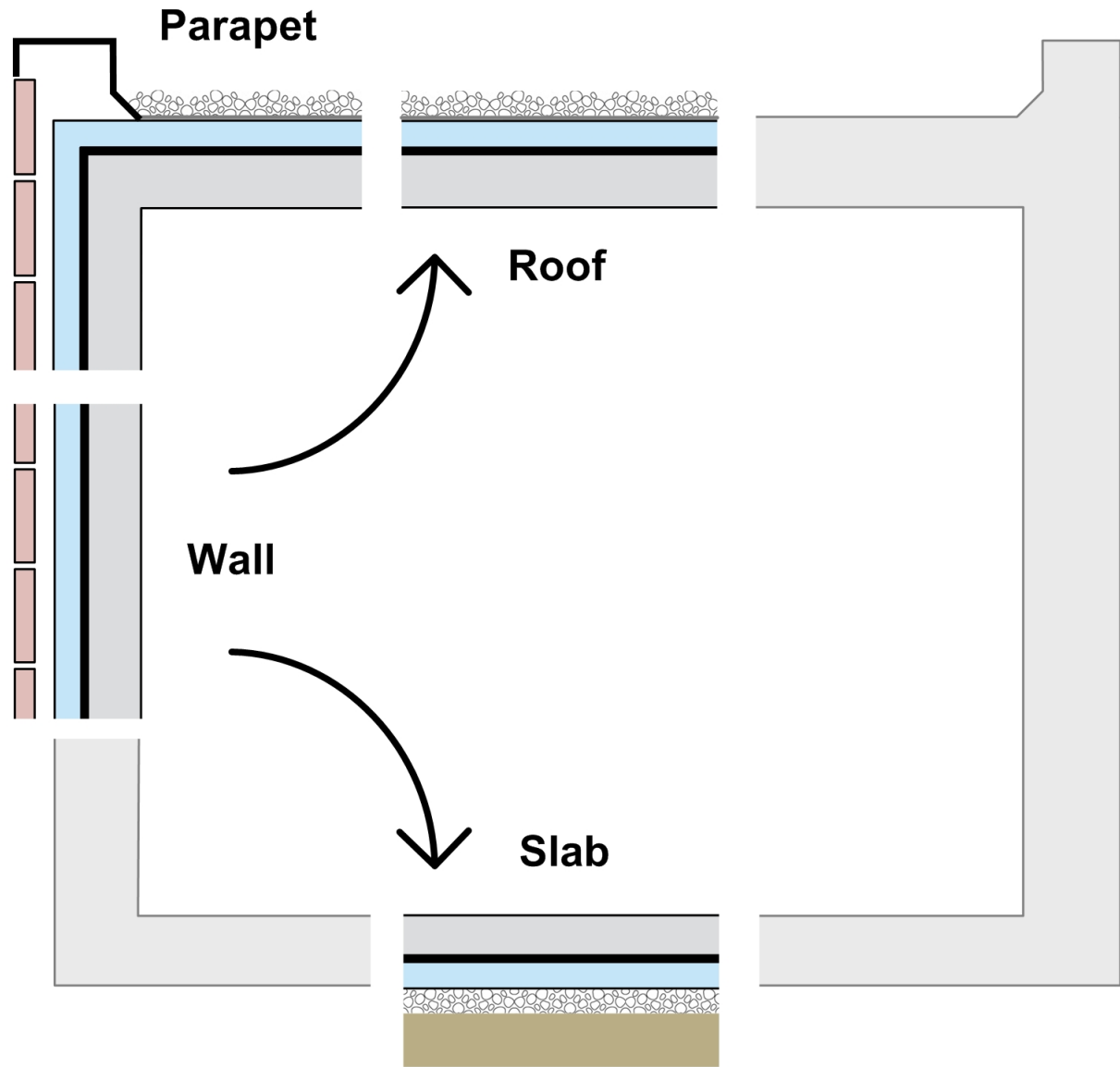


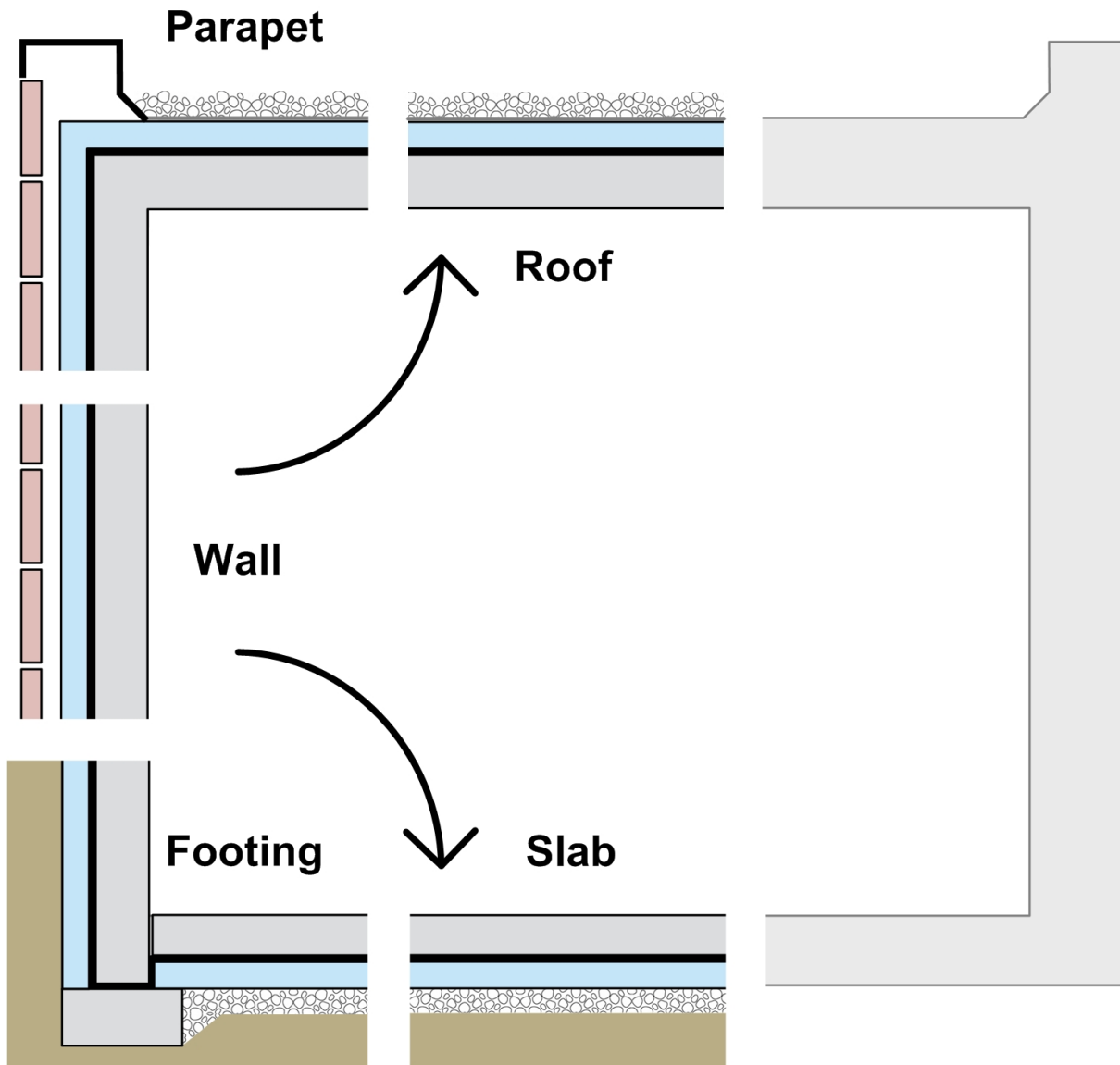


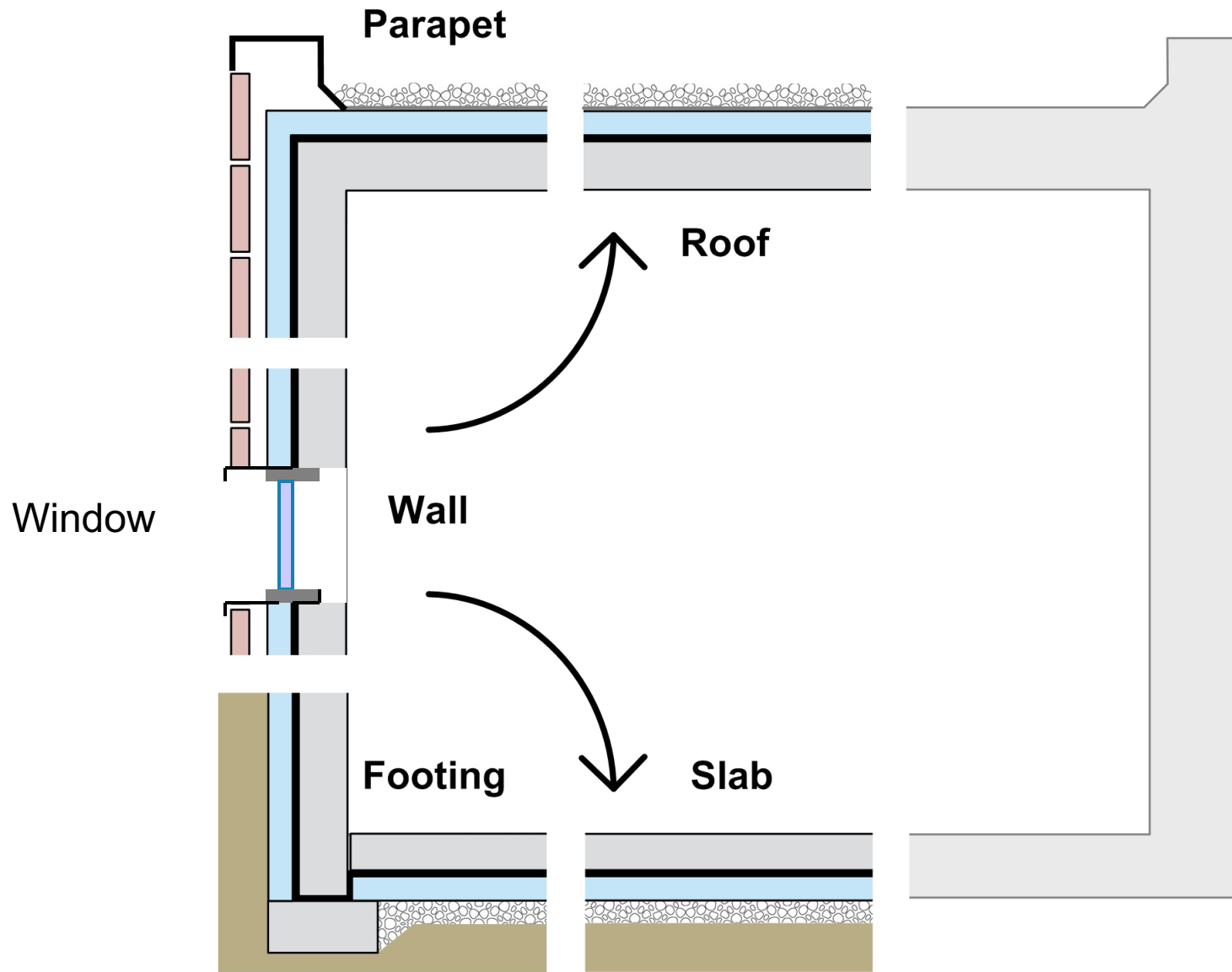


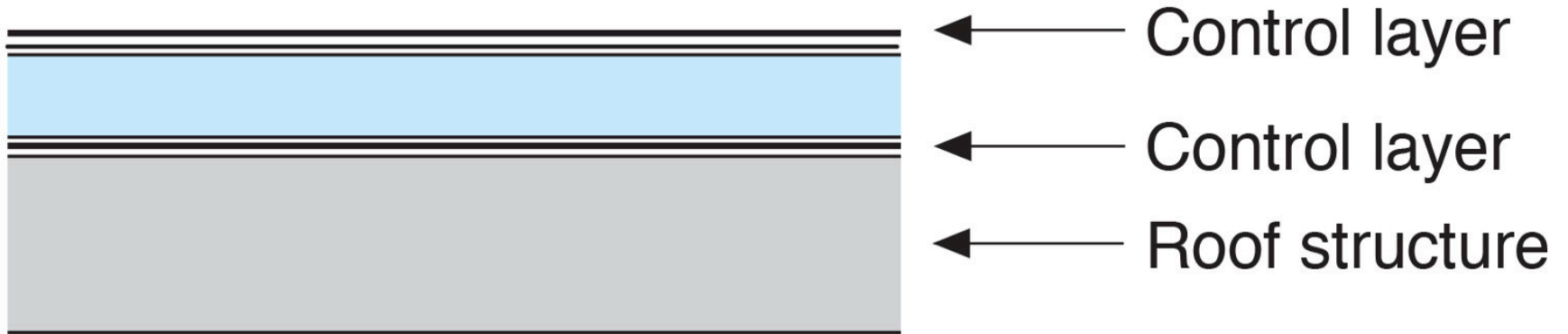


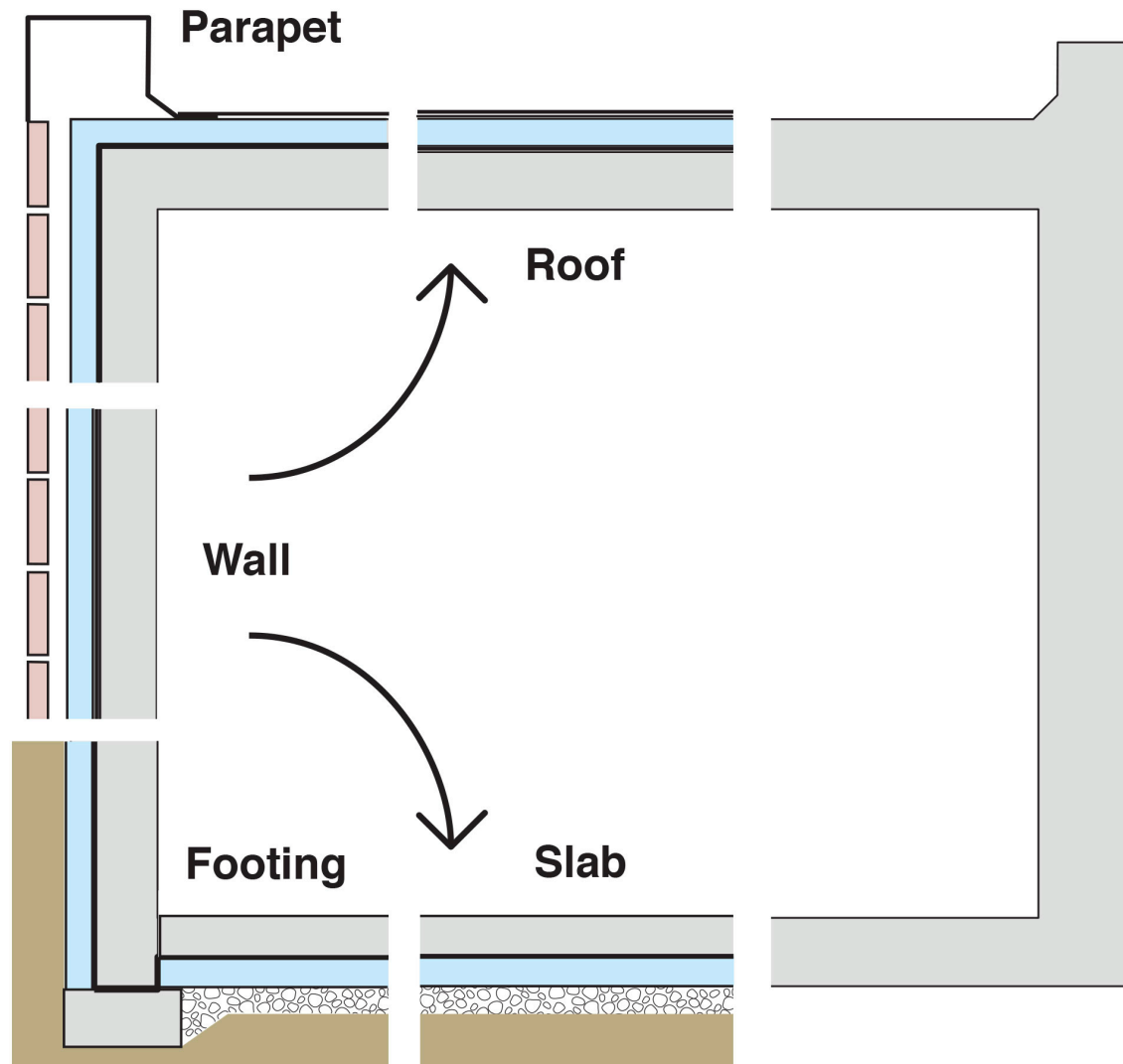


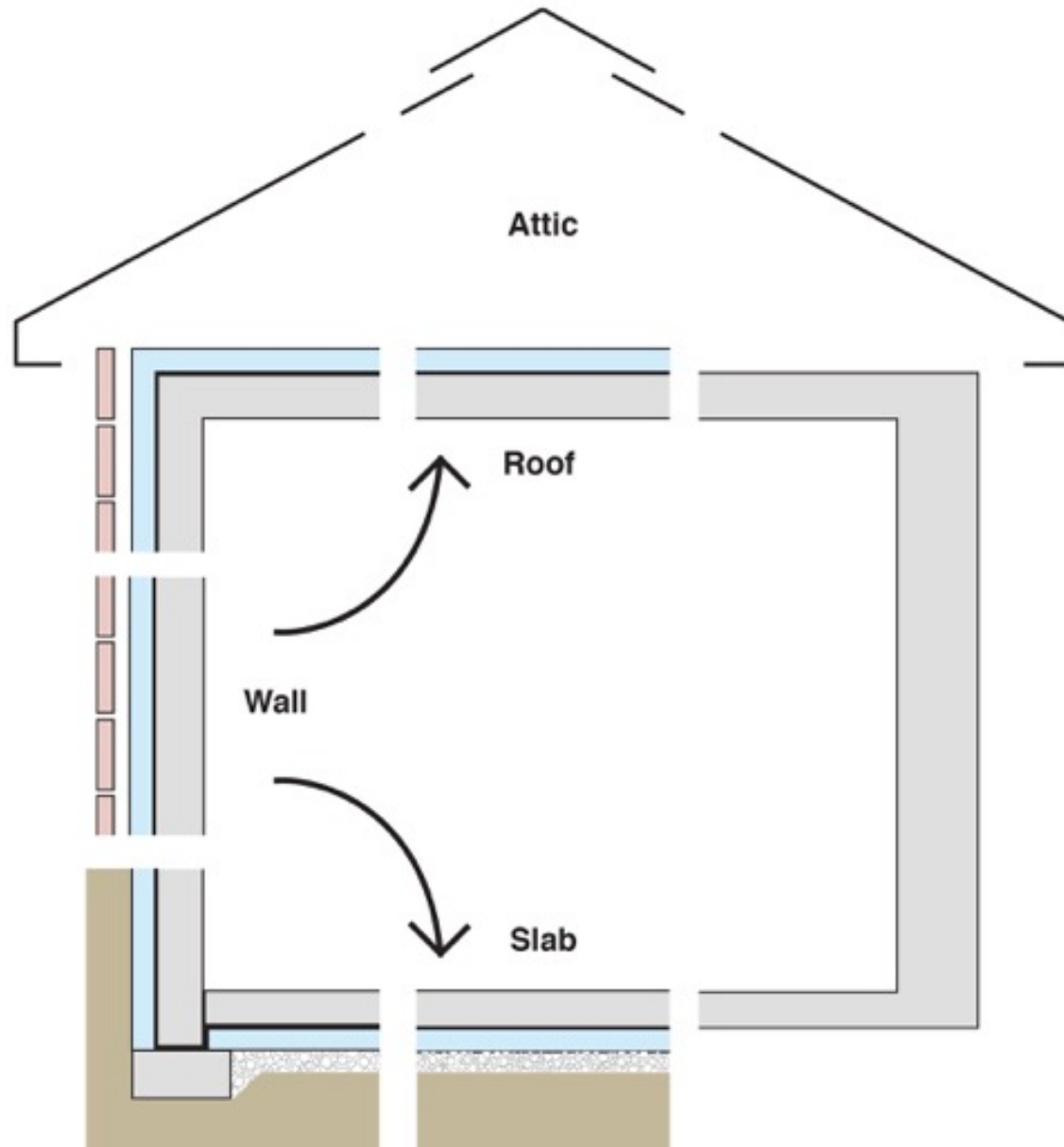


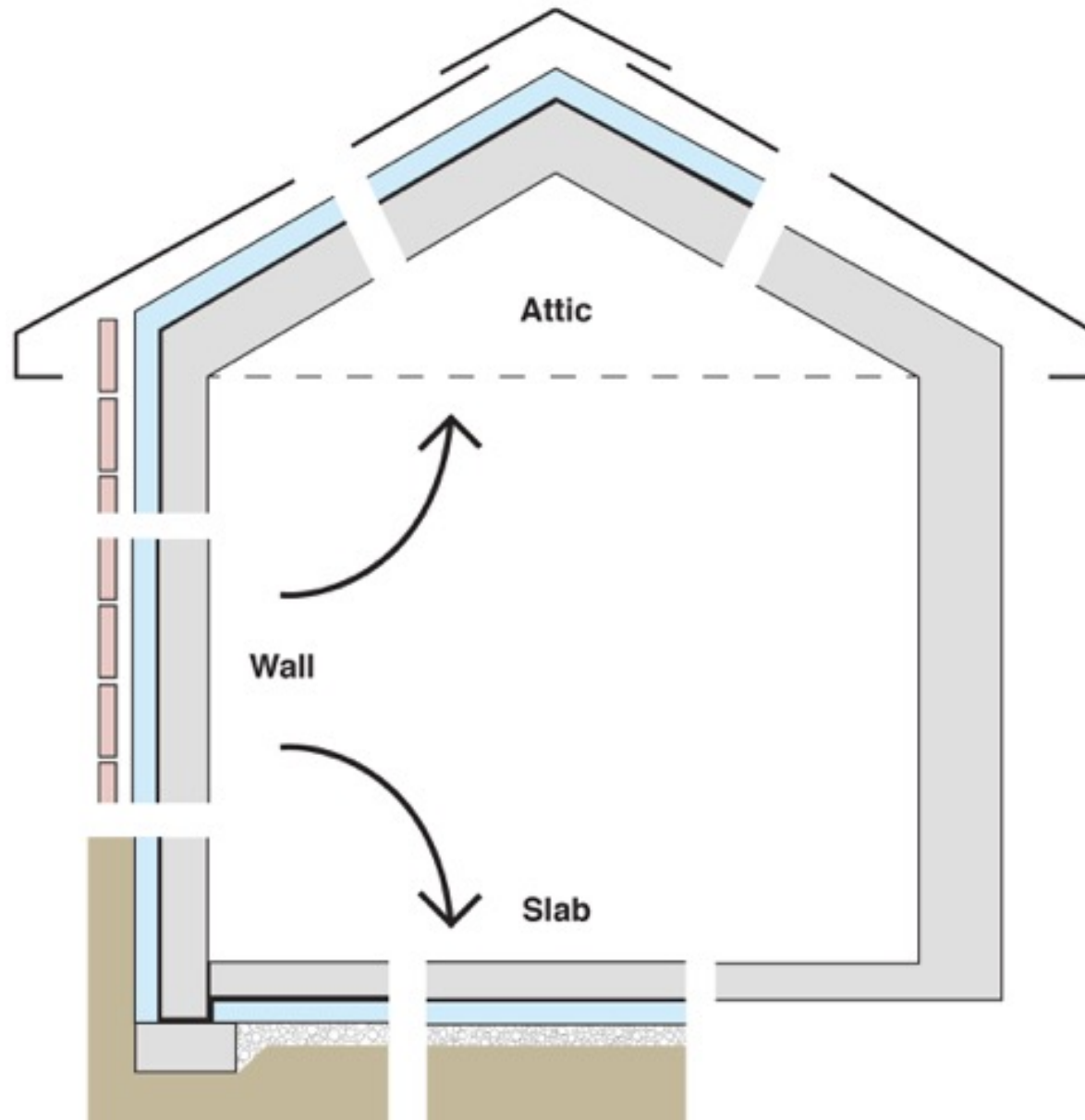


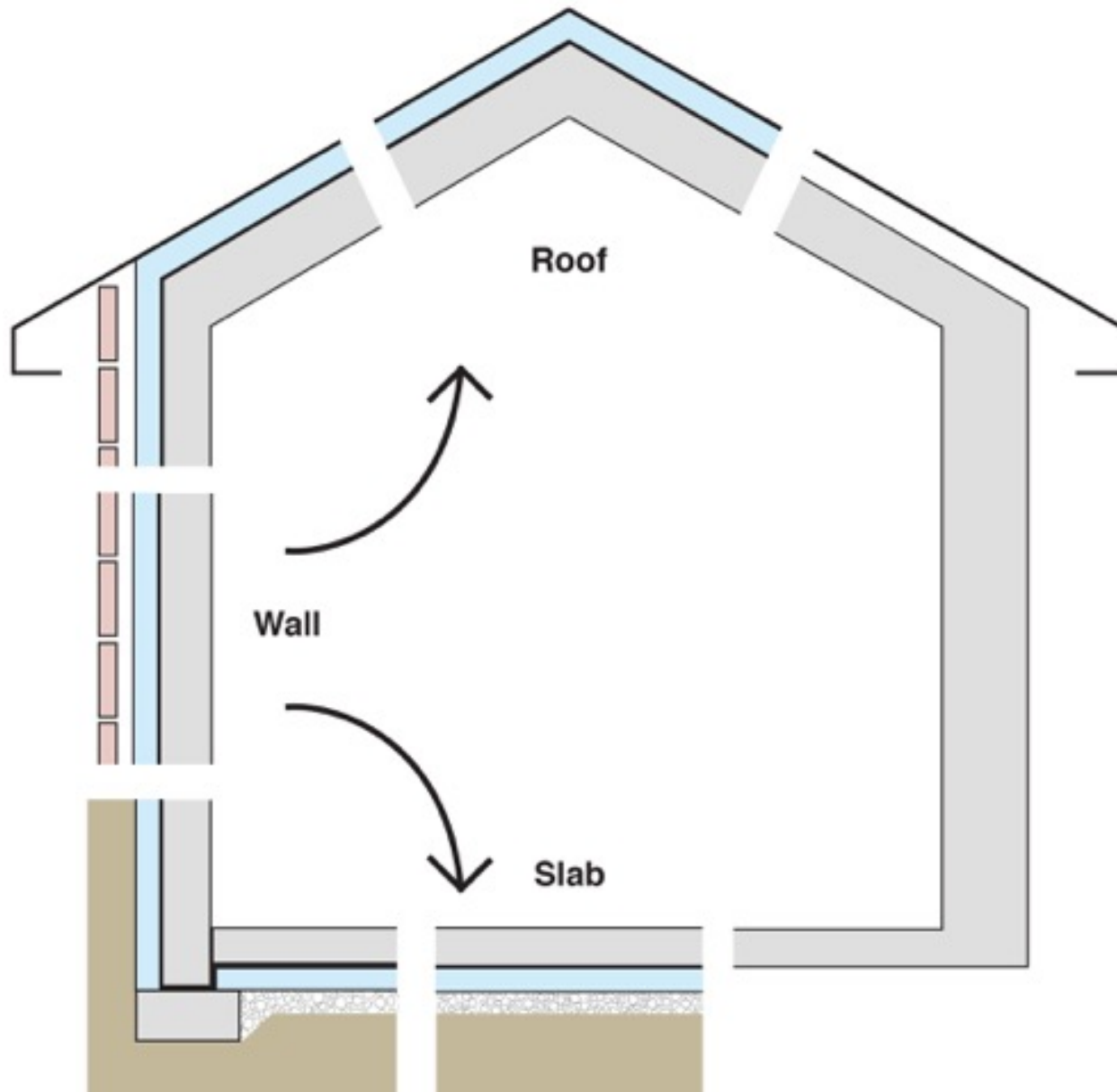


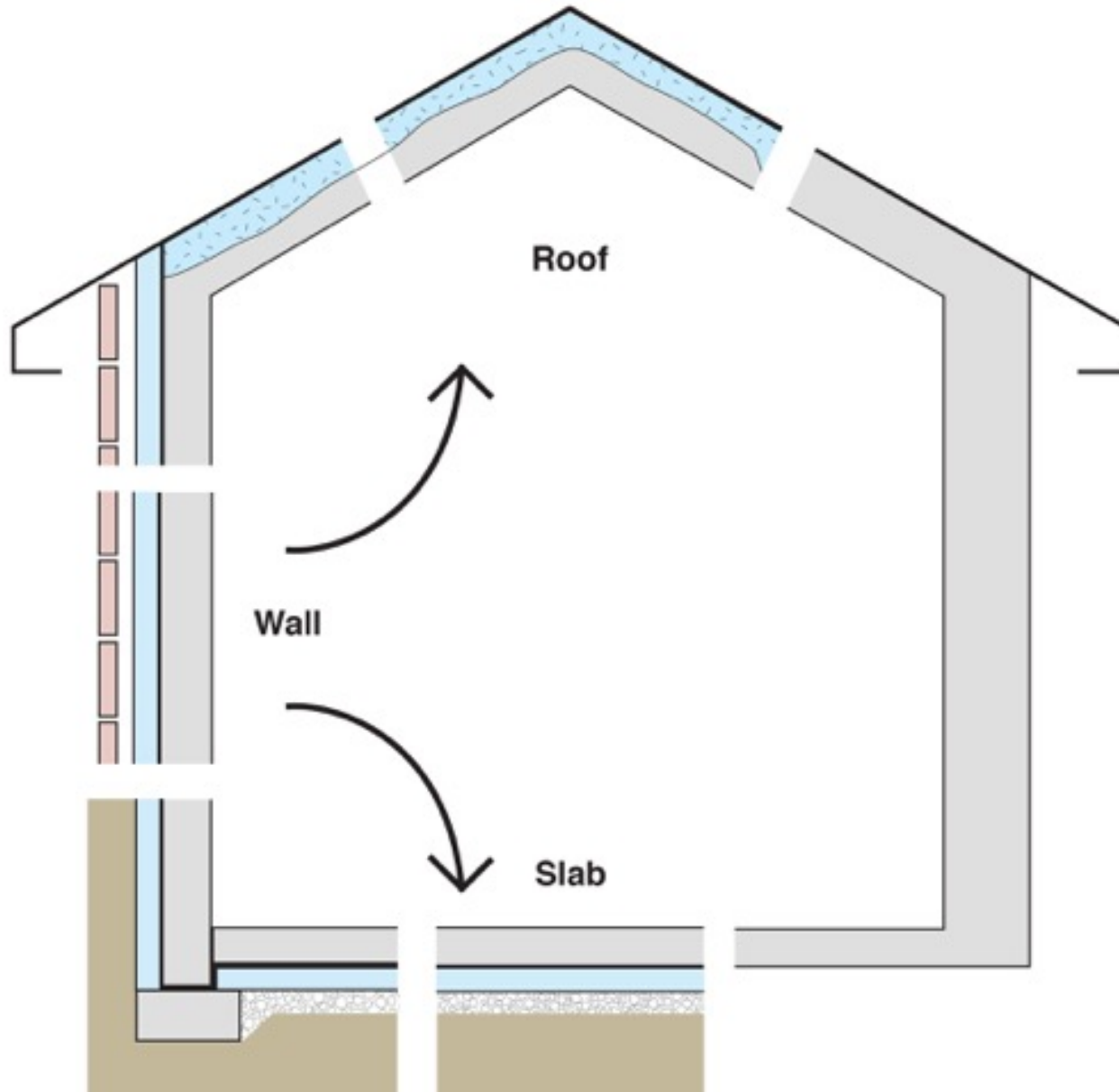




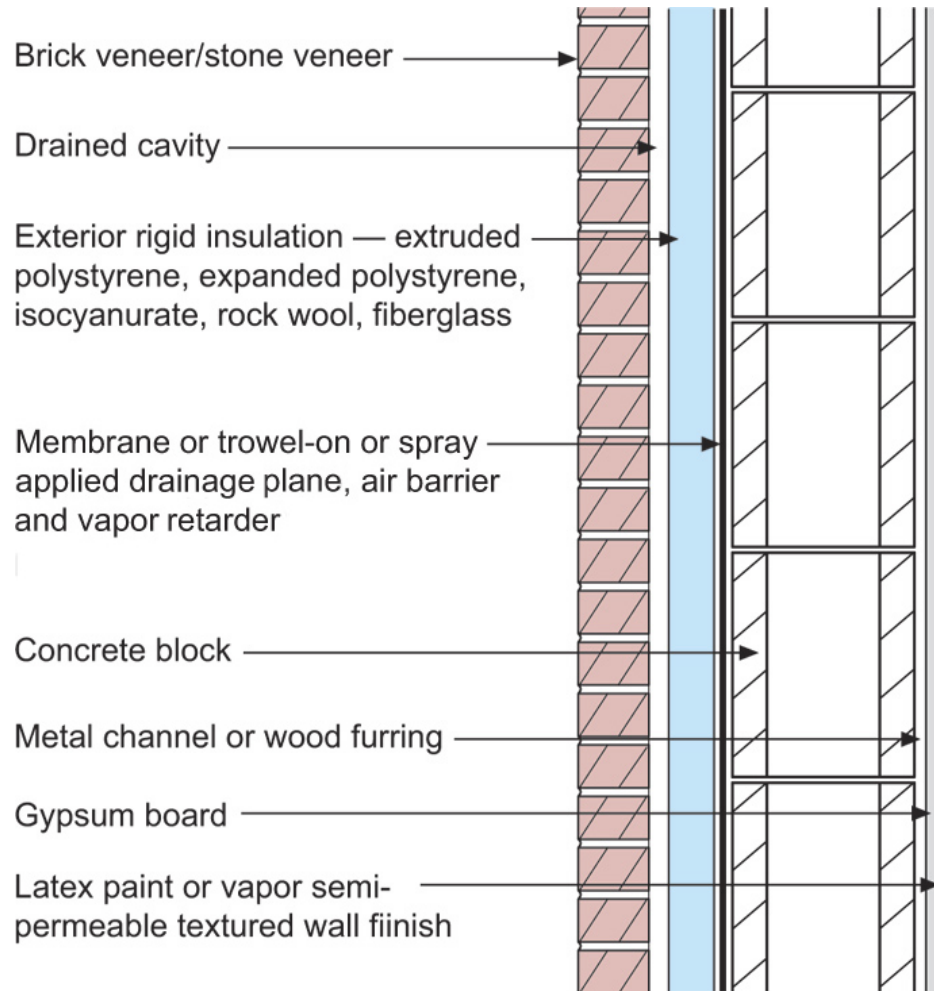




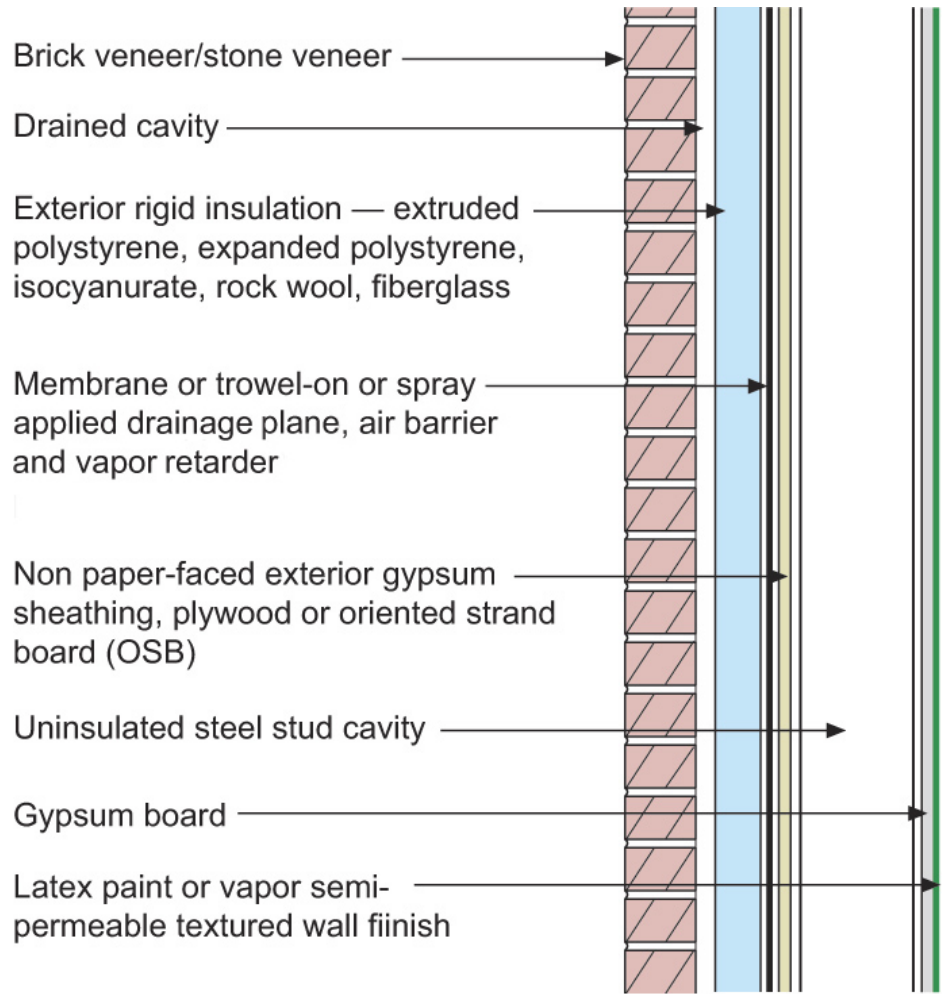




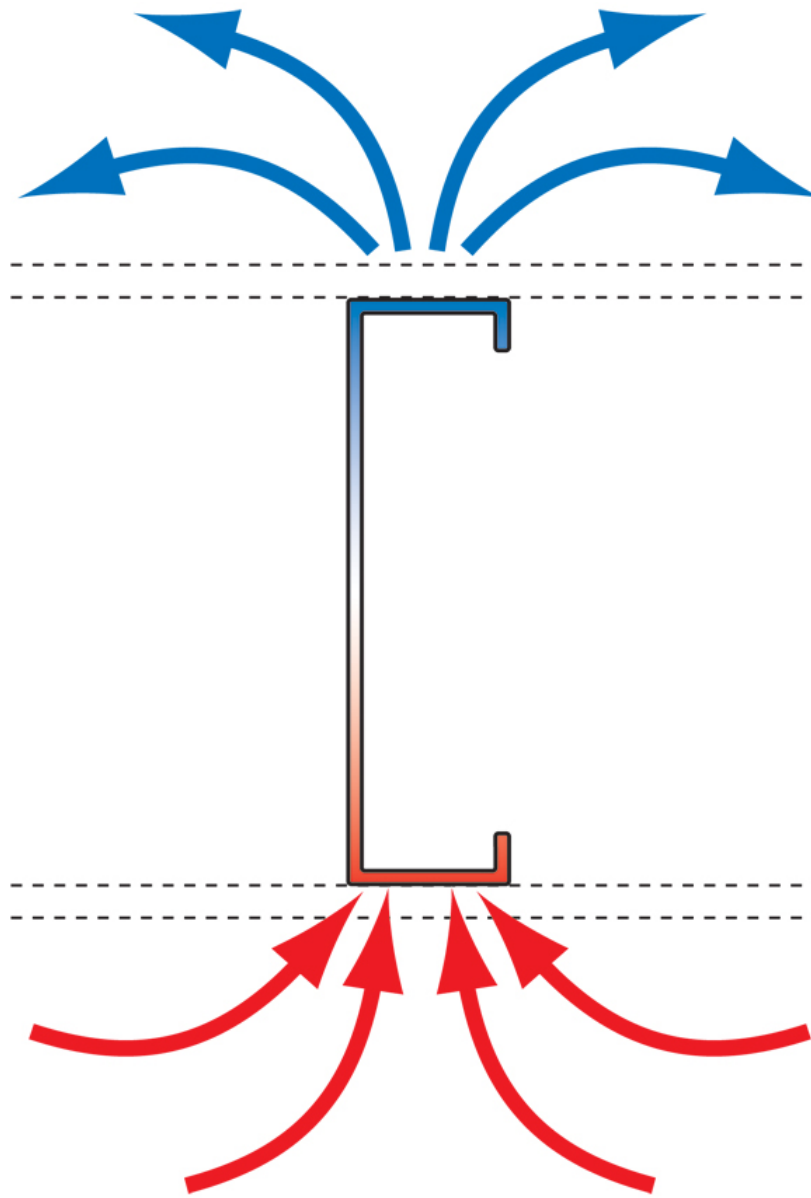
Configurations of the Perfect Wall



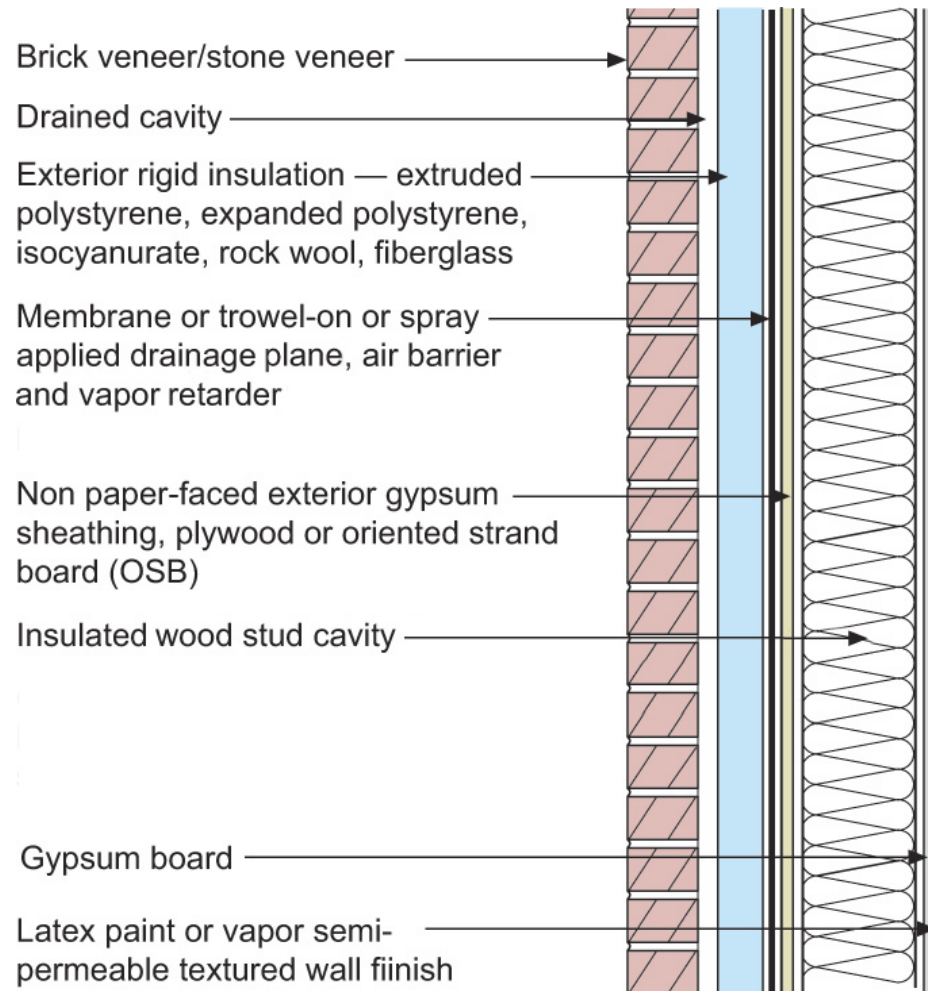
Vapor Profile



Vapor Profile

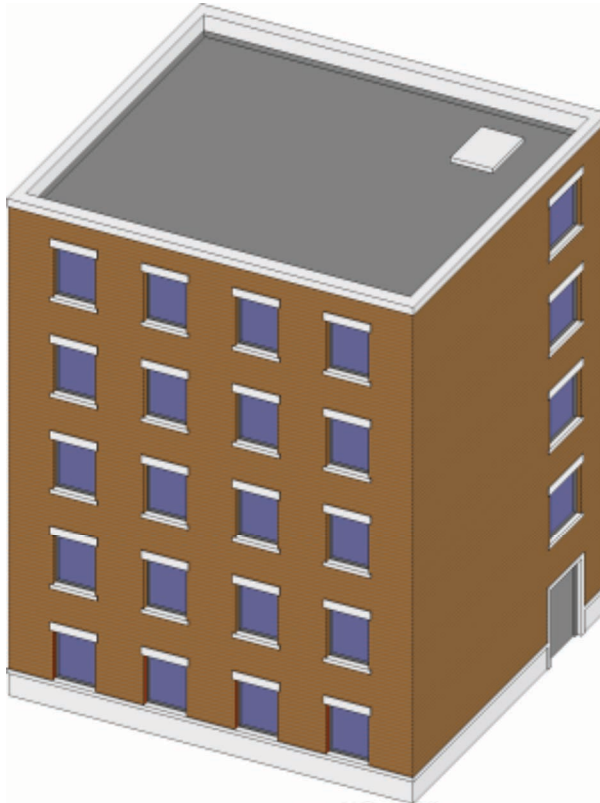






Vapor Profile

Commercial Enclosure: Simple Layers



- Structure
- Rain/Air/Vapor
- Insulation
- Finish







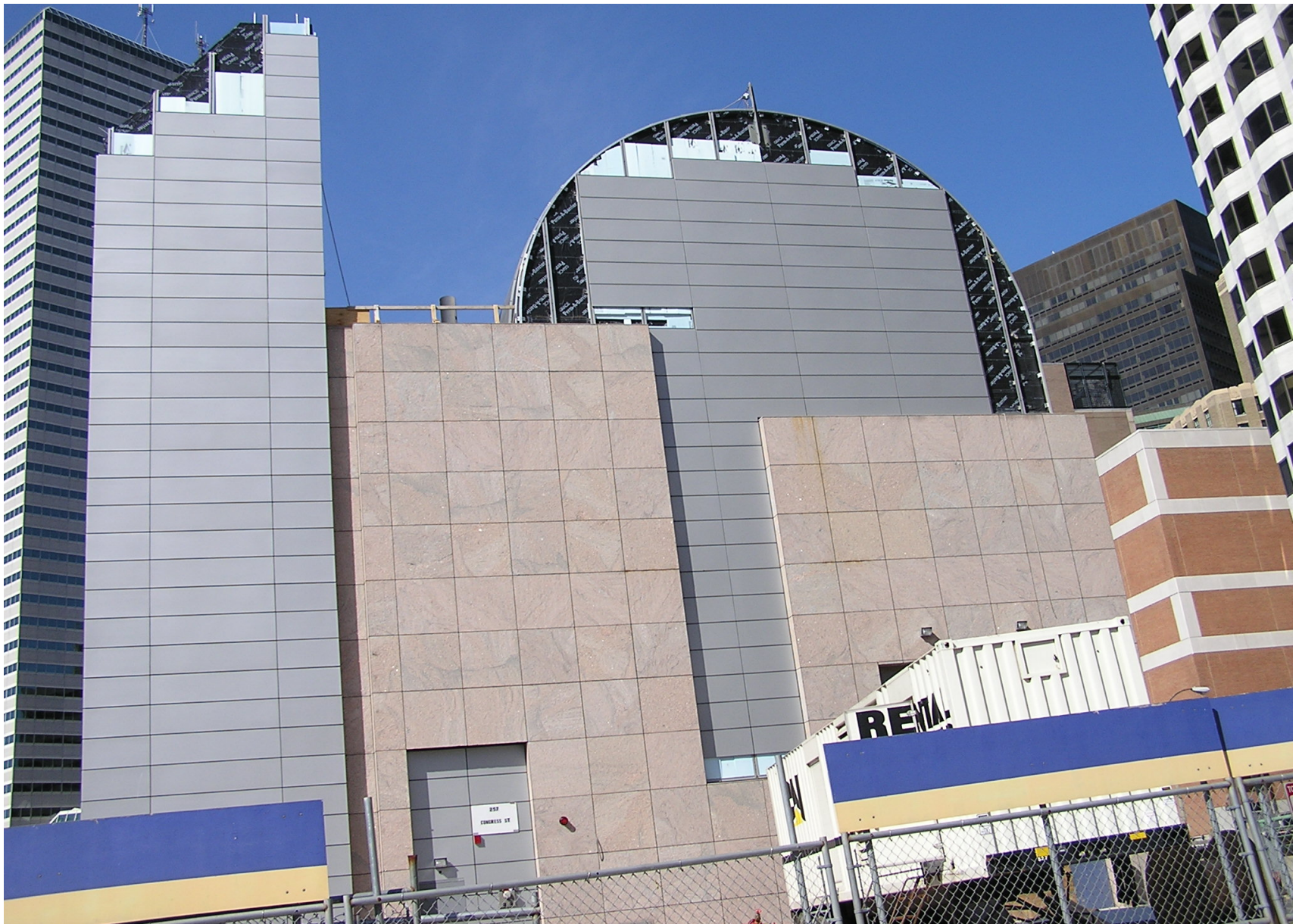




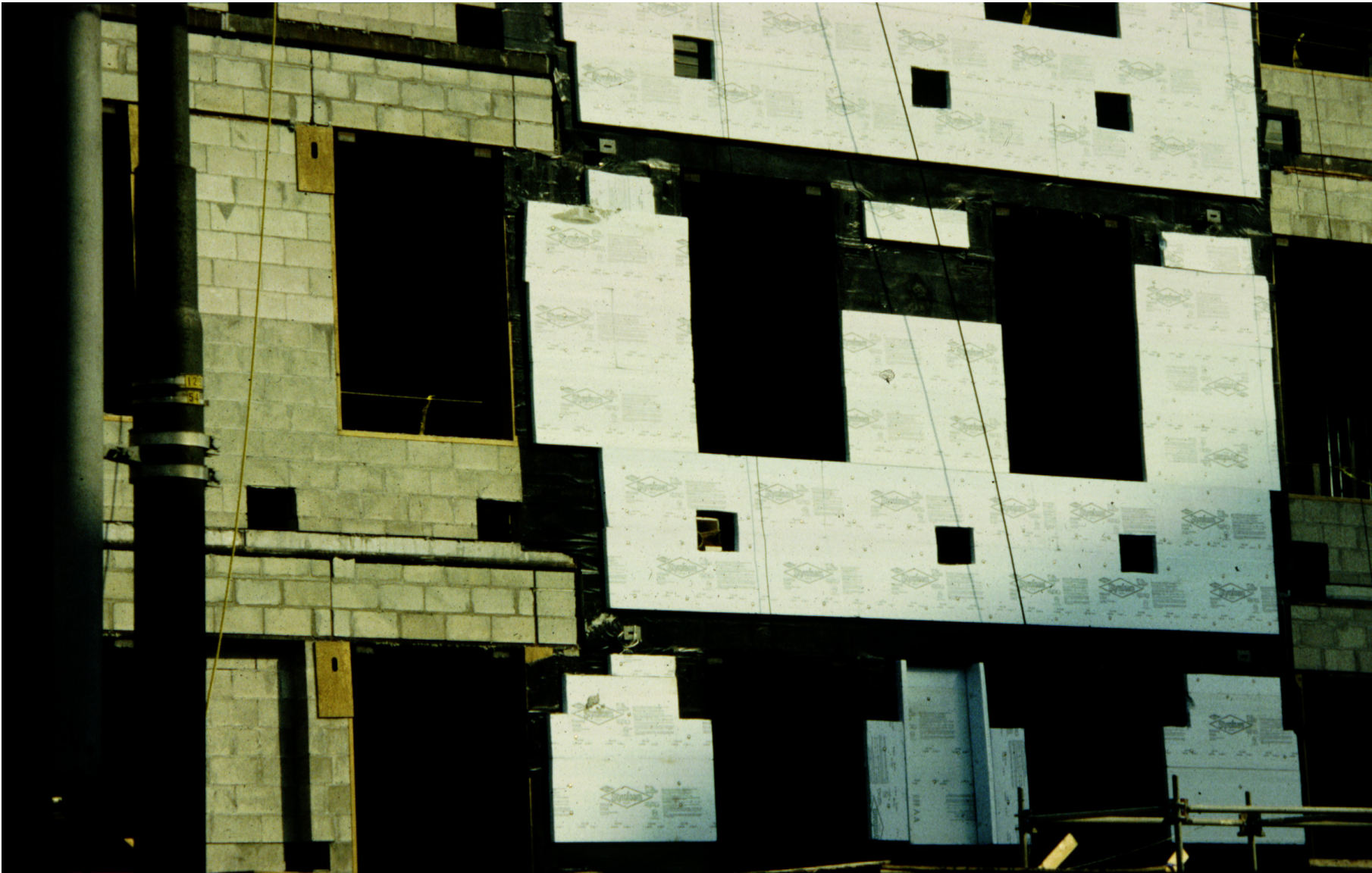










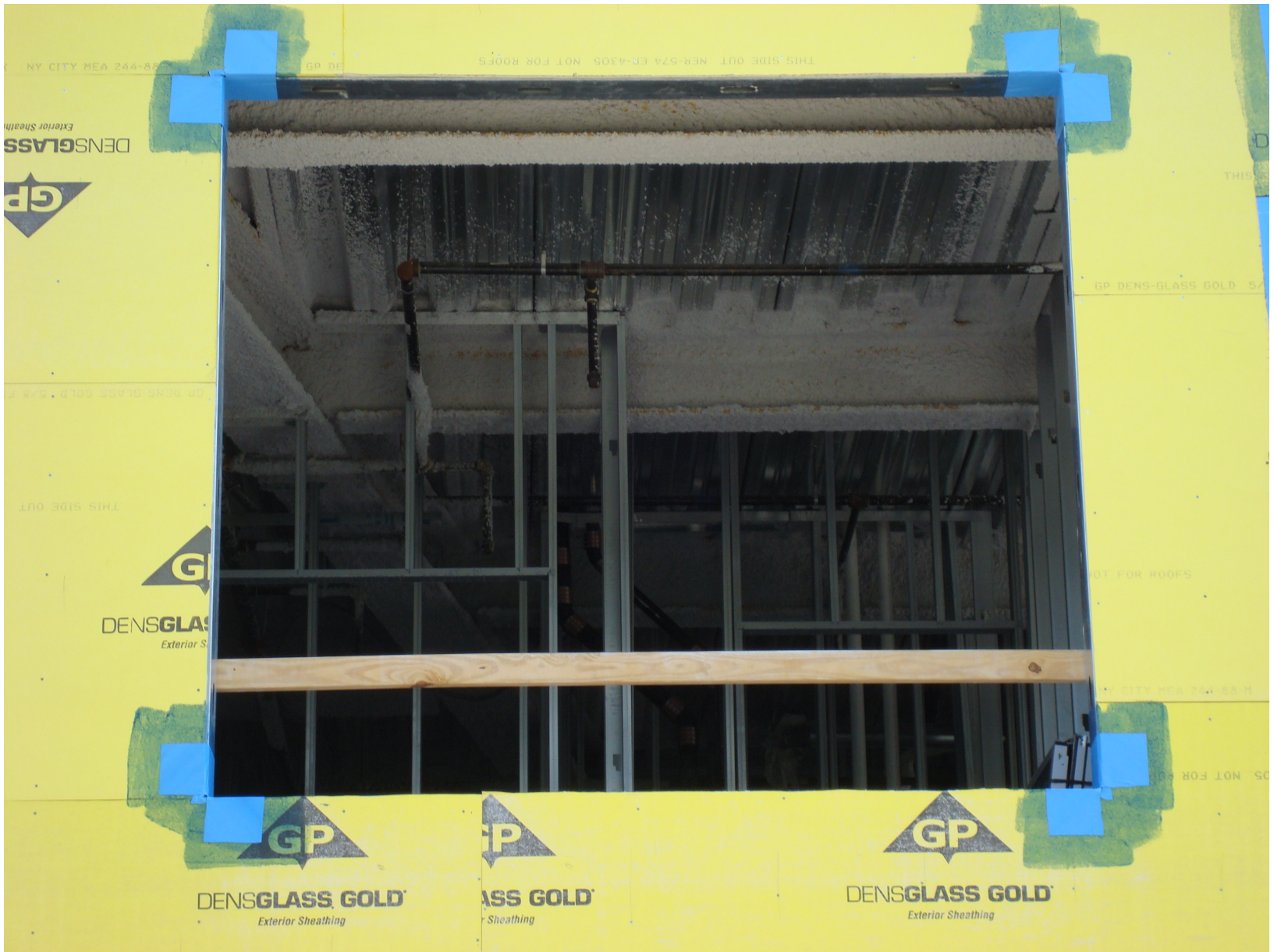




























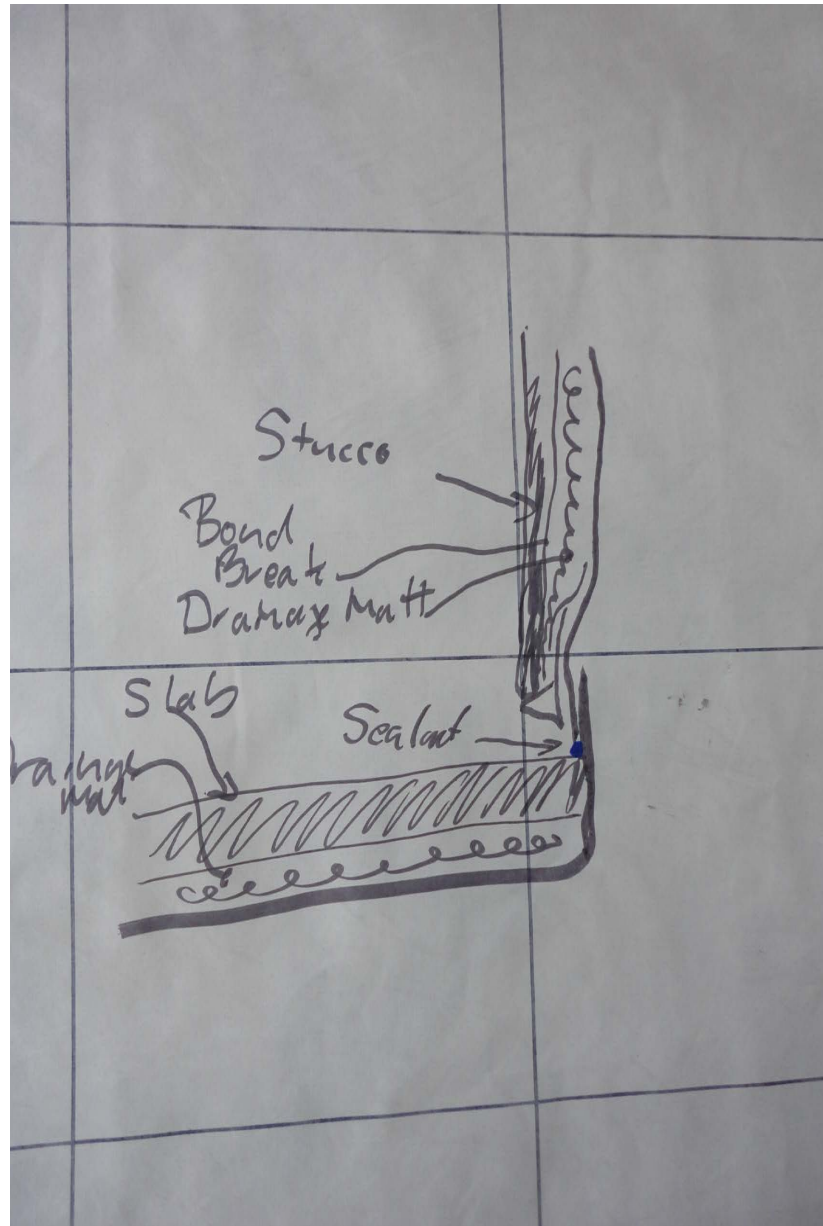














Meets the ASTM E1677 Type I Air Barrier requirements when installed as an air barrier according to DuPont™ Tyvek® installation instructions / Satisfait aux exigences de la norme ASTM E1677 pour les pare-air de type I lorsqu'ils sont installés conformément aux instructions d'installation des produits DuPont™ Tyvek®.
Meets ICC-ES AC-308 Water-Resistive Barrier & Air Barrier material requirements. ICC-ES Evaluation Report ESR-2375 / Satisfait aux exigences de la norme ICC-ES AC-308 pour les membranes résistantes à l'eau et au pare-air. Rapport d'évaluation ESR-2375 de l'ICC-ES.
Meets ICC-ES AC-308 Breather Type Sheathing Membrane / Membranes de revêtement perméables à la vapeur d'eau - CCMC #13253-R Air Barrier Material / Matériau d'étanchéité à l'air.

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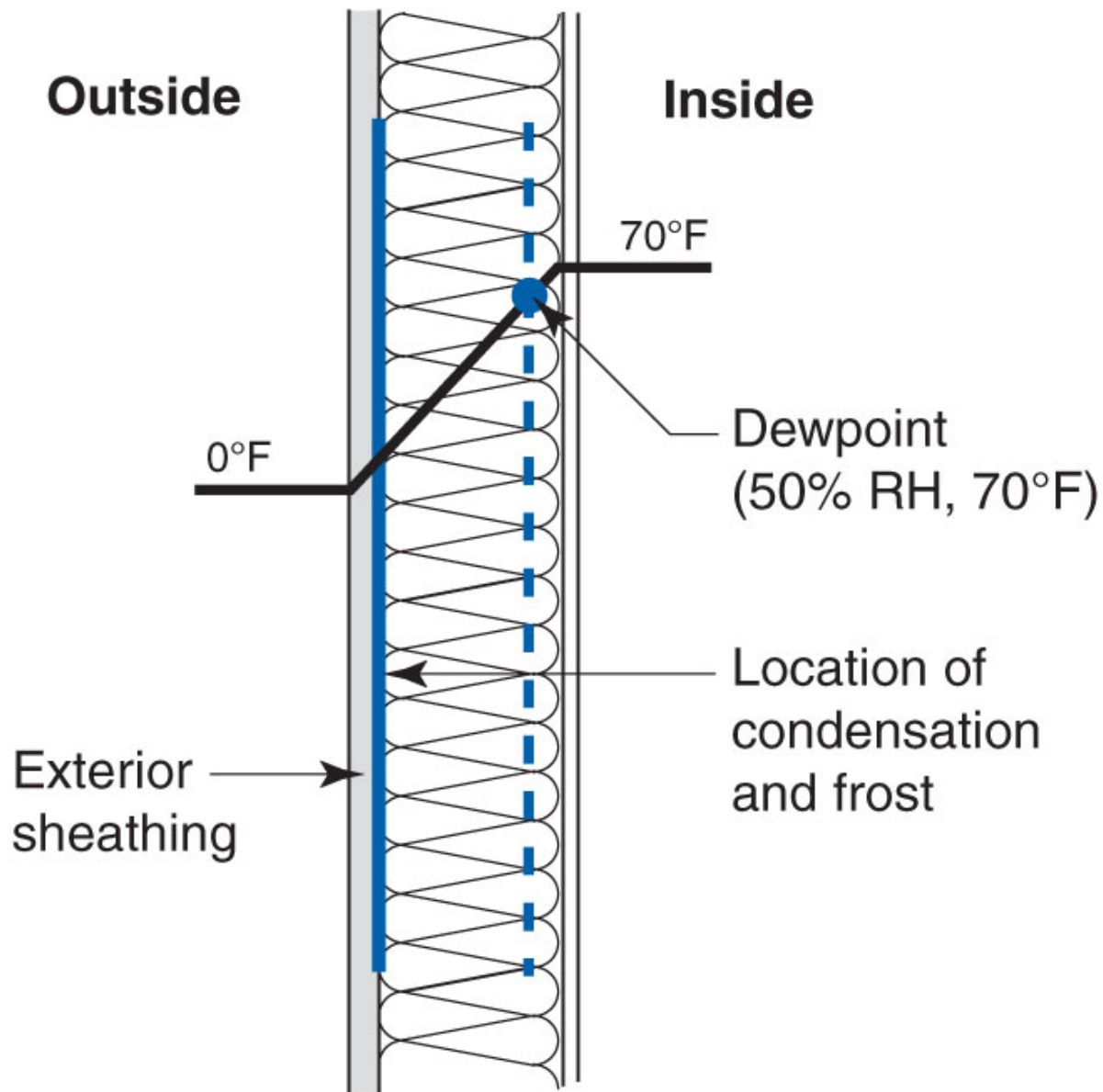




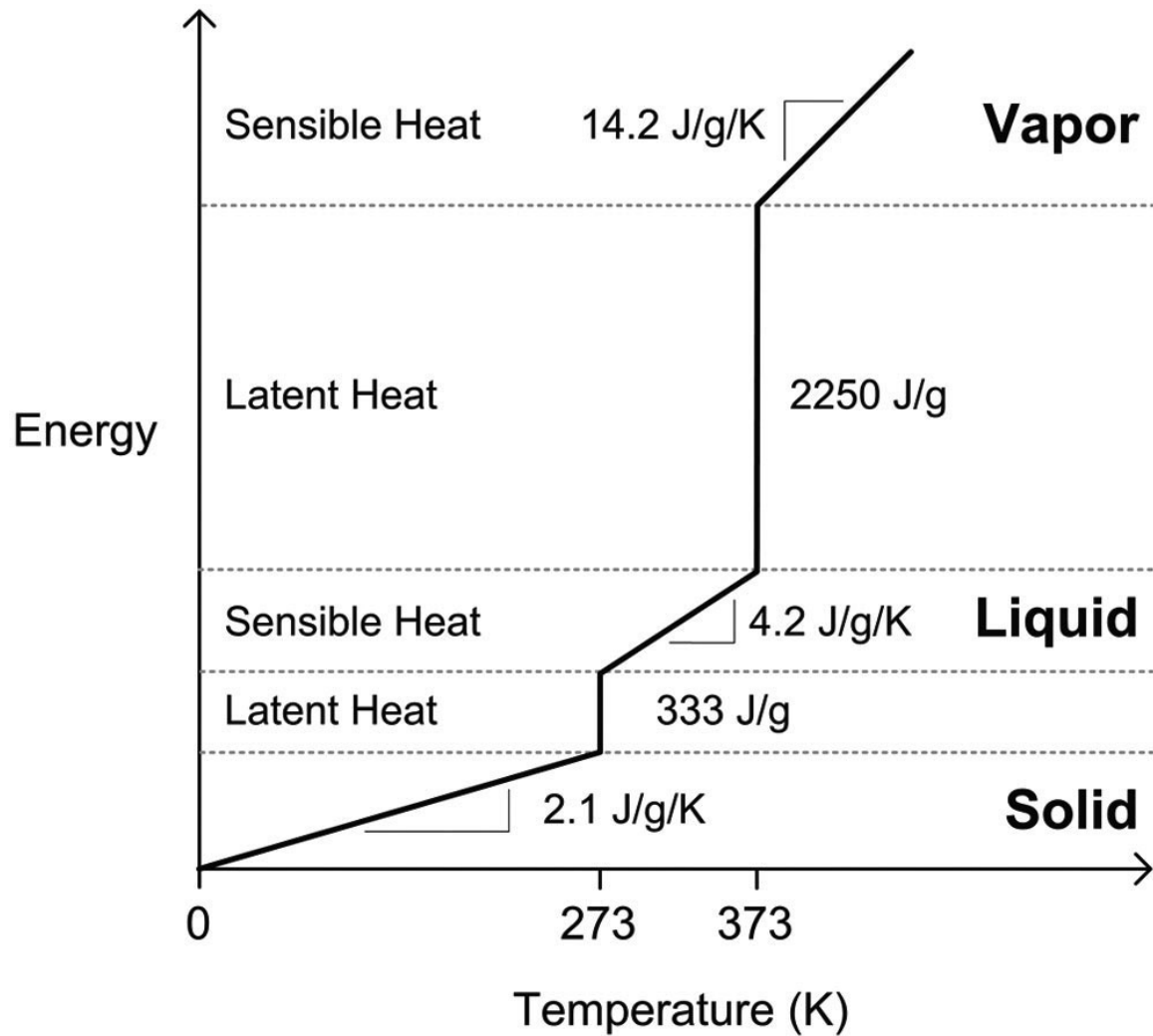










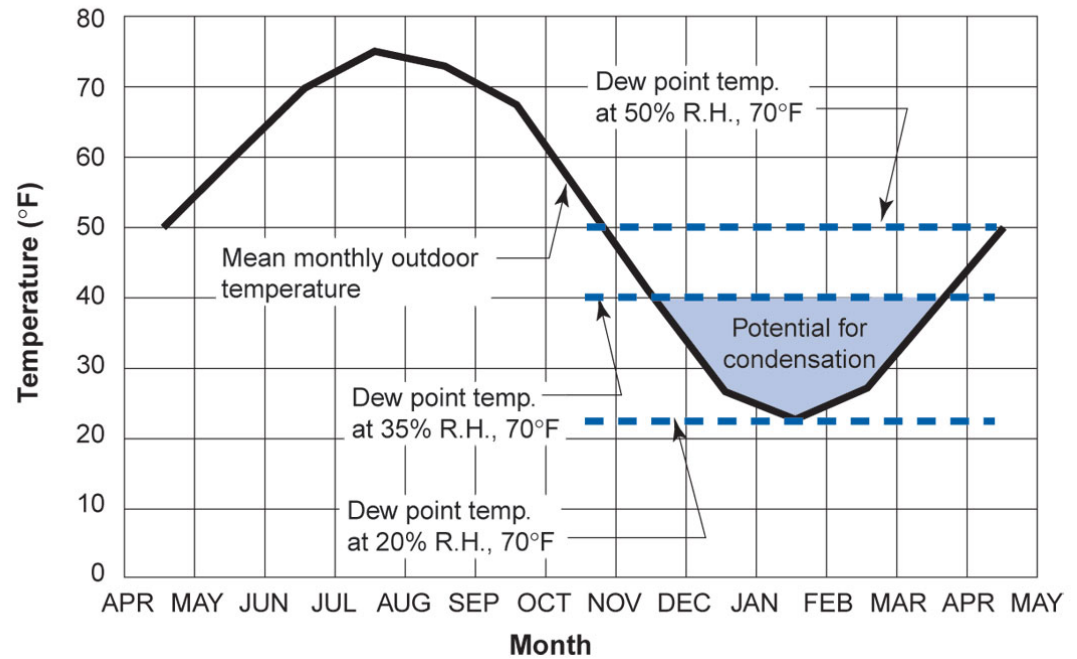
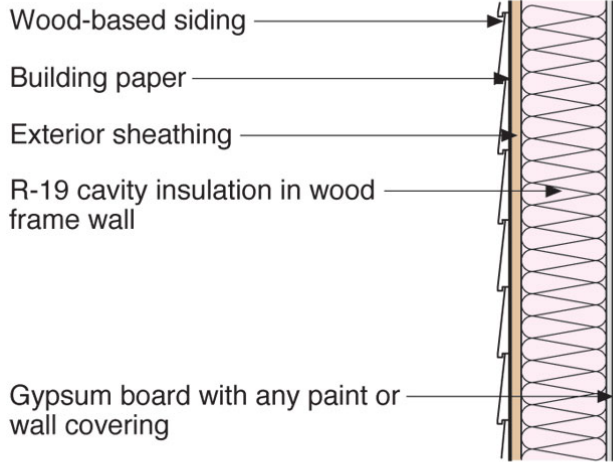


Simple linearized energy-temperature relation for water

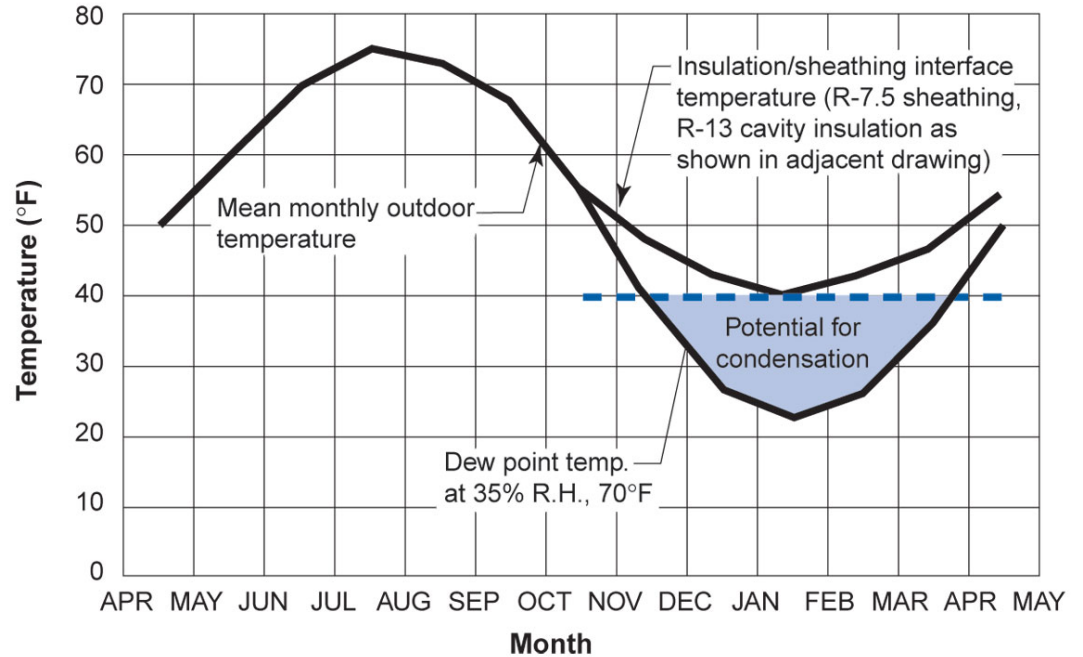
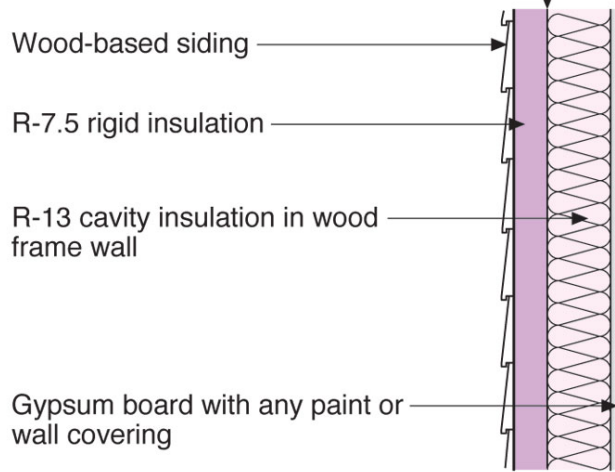
From Straube & Burnett, 2005



The inside face of the exterior sheathing is the condensing surface of interest



The inside face of the insulating sheathing is the condensing surface of interest



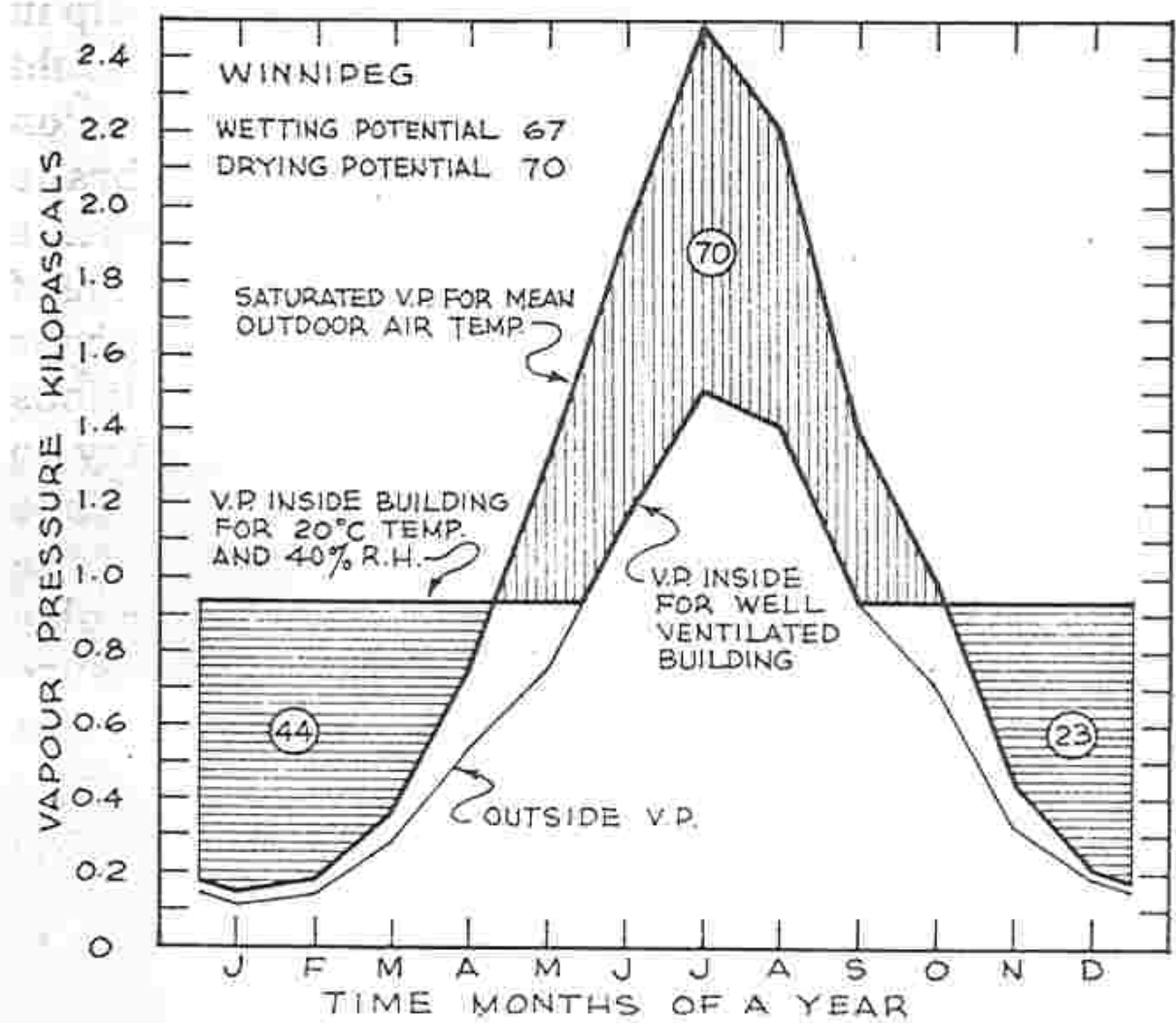
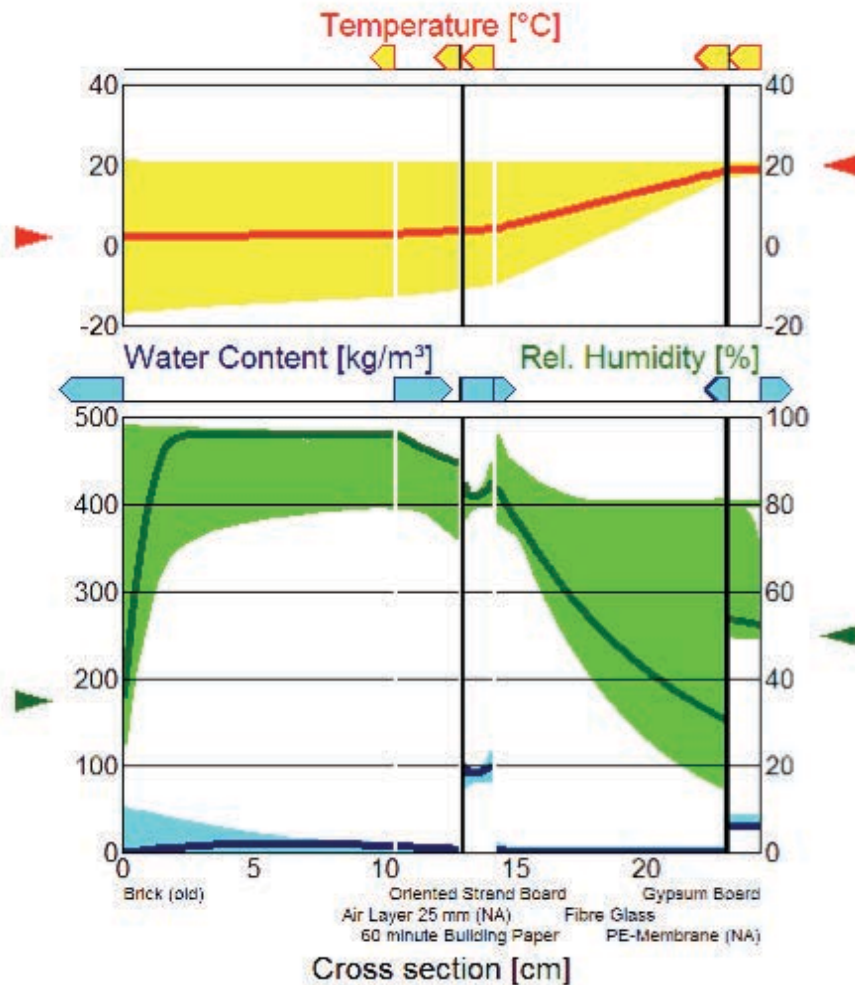


Figure 8-7. Outside vapour pressure, saturated vapour pressure and inside vapour pressure for Winnipeg.



WUFI® 3.3 Pro. IBP
Run

16 Feb
2001

100%

100%

WUFI software interface showing a circular navigation menu, a date display for 16 Feb 2001, and various control buttons.