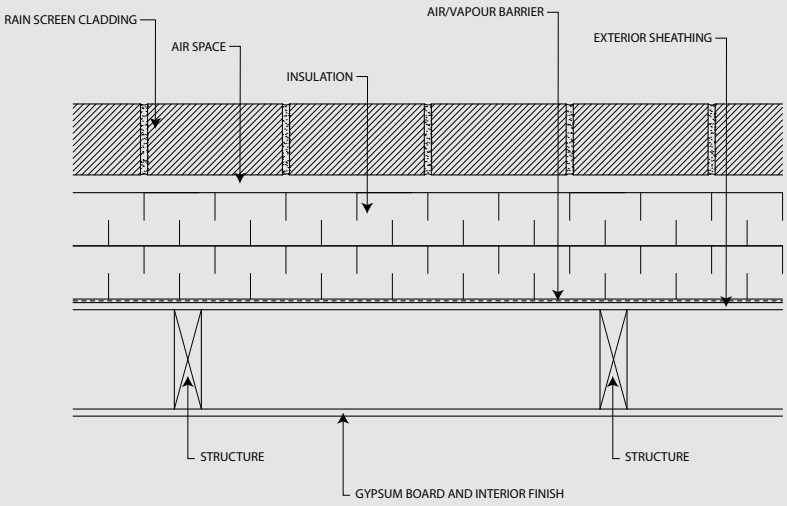
PERSIST
Better Envelope, Better Building

Alberta Infrastructure

DESIGN & TECHNOLOGY SERIES **01**



What is PERSIST?

PERSIST was originally developed in Canada by the National Research Council. One of the first groups to put these principles into application was the Building Services Branch of the Alberta Public Works Department, now known as Alberta Infrastructure (AI).

PERSIST stands for **P**ressure **E**qualized **R**ain **S**creen **I**nsulated **S**tructure **T**echnique. This design approach considers a wall assembly as a series of planes, each with a specific function, arranged to maximize their effectiveness and assembled durability.

Pressure Equalized refers to the equalization of the air pressure behind the rain screen cladding with that of the exterior environment. When a pressure differential exists, water and water vapour may be drawn into the wall assembly, which can cause damage and health concerns such as mold. While air pressure cannot be precisely equalized all the time, the even pressure across a rain screen system minimizes water entry through even the smallest of openings. In order to balance interior and exterior air pressure, the air/vapour (A/V) barrier must be both rigid and airtight (e.g. fully adhered to solid substrate). An unsupported A/V barrier can experience billowing that allows the volume, and therefore pressure, within the air cavity to fluctuate. This fluctuation can allow excessive and potentially damaging quantities of moisture into the assembly.

Rainscreen is a method of water management whereby the water shedding surface (cladding) of an assembly is separate from the exterior moisture barrier and air barrier. Most bulk water is deflected by the cladding; should moisture penetrate it, an air space between the cladding and the exterior moisture barrier creates a capillary break that prevents moisture from being pulled further into the assembly. Any water that accumulates in the air space can drain outward through weep holes in the cladding, or can dry without damaging the assembly. The exterior moisture barrier stops any remaining moisture, providing a third level of redundant moisture protection to the system[2].

Insulated structure refers to the placement of insulation outside of the structural frame (vs. insulating interior to/within the structural frame). An A/V barrier is installed on the exterior sheathing where it can more easily be made continuous. The sheathing provides structural stability while the self-adhering membrane provides a continuous seal.

How It Works

In order to improve constructibility and envelope performance, the structure must be designed to maintain simple, continuous planes from foundation to roof. A combined air/vapour (A/V) barrier is fully adhered to the exterior sheathing (supported by the building structure). The A/V barrier must be flexible enough to withstand normal movement, and sealed at all penetrations.

Next, a continuous layer of rigid insulation is mechanically fastened to the sheathing, and the rainscreen is applied. Consisting of cladding with an air cavity behind it, the rainscreen sheds bulk water, drains any water that penetrates through the cladding and protects the A/V barrier from UV exposure. Since the rainscreen is designed to tolerate some moisture ingress, drainage, flashing, and venting become critical to ensure water can exit and materials can quickly dry.

The cladding is attached to the structure with minimal penetration through the insulation and A/V barrier layers. Typically this has been with z-girts, however recent upgrades to the National Energy Code may require other approaches, such as fibreglass clips, in order to achieve the required insulation values and reduce heat loss through thermal bridging.

Advantages of PERSIST

- **R-Value:** PERSIST systems can be built with very high R-Values that meet or exceed the 2011 National Energy Code for Buildings.
- **Thermal Bridging:** Continuous exterior insulation minimizes heat loss through structural penetrations.
- **Air Leakage:** A PERSIST wall is easier to make airtight, reducing the amount of heat lost through small leaks and holes.
- **Moisture:** The self-adhering A/V barrier is located outside the sheathing but inside the insulation layer. The A/V barrier is fully supported and kept warm, preventing dew point issues and condensation inside the wall.
- **Deflection, Drainage & Drying:** Most water is shed by the cladding. Any water that gets beyond the cladding reaches an air cavity where it can drain or dry to the outside environment.
- **Robust & Green:** A more durable envelope requires less repair, thus reducing material waste. Combined air and vapour barriers simplify assembly and reduce the risk of construction defects. High insulation levels and low thermal bridging reduce energy use, greenhouse gas emissions, and facility operating costs.

The increased airtightness of a PERSIST building envelope requires that mechanical system designers adjust their building leakage estimates to prevent over-pressurization. In cold climates, additional insulation may sometimes be installed interior of the membrane within a stud wall infill system. This should be done cautiously, and only in buildings with low interior humidity. In conditions of high interior humidity and cold exterior environment, condensation could occur within the wall structure. Existing and historic buildings require special consideration; contact TSB for assistance.

Construction, performance, and cost benefits of PERSIST:

- Electrical and mechanical services for the interior can be freely installed or retrofitted into exterior walls without special construction techniques for air sealing.
- The structure of the building is wrapped inside the plane of insulation. This minimizes thermal movement and thermal bridging of the structure, and improves overall constructibility of the envelope.
- The sequential material installation promotes good construction detailing, efficient on-site assembly, and visibility of materials for quality assurance reviews.
- If small imperfections occur within the plane of the air seal, any condensation (in cold climates) will occur safely in the drained cavity between the cladding and the backup wall. Moisture-tolerant materials are the only materials outside the A/V barrier.
- If warm, humid, exterior air contacts a membrane that is cooled by interior conditioned air, the resulting condensation will be contained in the cavity exterior of the structure and drained/dried. In either warm or cold climates, if a significant air leakage problem occurs, it will be isolated and can be identified either visually or thermographically for repair. In other wall systems, moisture problems in walls are hard to spot because the air seal plane of the wall is hidden.
- Although exterior sealants must still be maintained to minimize mass water entry in the wall cavity, maintainability is enhanced; sealant integrity becomes mostly a visual concern. Sealants are no longer key to providing separation between the inside and outside environments, as they would be in a face sealed design.
- When retrofitting existing buildings or building enclosures with PERSIST, the building can remain occupied during most of the demolition and construction phases.

AI recommends the PERSIST approach[3] because it recognizes the imperfect nature of materials, design and construction, as well as the inevitability of moisture movement within the building envelope. PERSIST prevents damage to the envelope due to moisture, UV radiation, and extreme temperature fluctuations. Additionally, the PERSIST system provides an exceptionally robust and energy efficient system that ensures the longevity and lifecycle value of GoA facilities.

For PERSIST assembly details, please refer to Series 01 and 02 of the Standard Envelope Details (Appendix E) of the *Technical Design Requirements for Alberta Infrastructure Facilities*[2]

Information Sourced From:

1. https://www.nrc-cnrc.gc.ca/ctu-sc/files/doc/ctu-sc/ctu-n17_eng.pdf
2. RDH Engineering Ltd. *Study of Poured-in-Place Concrete Wall Performance in Coastal British Columbia,* 2005.
3. http://www.infrastructure.alberta.ca/Content/docType486/Production/TechDesignRequirements.pdf

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