Maximize Thermal Performance with Lightweight Precast Concrete Modular Cladding

Explore how lab-tested R-values deliver high-performance envelopes
Differentiate between a prescriptive and lab-tested R-value and explain why lightweight precast concrete modular cladding provides heightened thermal performance over traditional built-up building envelopes.
Lightweight Precast Concrete Cladding System

This modularized building envelope solution contains:

- Insulation
- Vapor barriers
- Integral water repellent
- Heavy-gauge steel frame
- Stainless steel fasteners
- Lightweight, 2-in thick precast concrete panel
- Windows, available
Insulation & Vapor Barrier

- Factory-applied polyurethane closed-cell foam insulation is sprayed into the thermal break and stud cavity.
- Minimum depth 1 ½-inches.
- Provides the vapor barrier too.
Heavy-Gauge Steel Frame and Fasteners

• The lightweight 2-inch thick precast concrete panel is fixed to a heavy-gauge steel frame with stainless-steel fasteners.
Cladding

- 2-inches of architectural precast cladding
- Maintains ability to introduce reveals, projections, and true brick finishes
- The cladding system is easily installed upon the building frame.
- Can be used to re-clad existing buildings using the as-built foundation and superstructure
STANDARD 6" 16-GAUGE OR 4" 14-GAUGE GALVANIZED STUD FRAME 2'-0" ON CTR

INTERIOR FINISH AND SHIMMING AS REQUIRED BY OTHERS

CLOSED-CELL SPRAY FOAM INSULATION BY MANUFACTURER.

1½" THERMAL-BREAK

(4" - 6")

(+¾" - 2¼")

6" THERMAL-BREAK

REFRACTORY ANCHOR

THERMAGUARD™ INSULATED STAINLESS STEEL CONNECTION ANCHORS ON NON-GRAVITY STUDS AND REFRACTORY ANCHORS ON GRAVITY STUDS.

CONCRETE

6X6 HOT-DIPPED GALVANIZED WELDED WIRE MESH REINFORCING

3/4" JOINT

SINGLE SEALANT LINE (DOUBLE SEALANT OPTION AVAILABLE)
The Air Gap in Architectural Precast Concrete Cladding

• The way that the exterior concrete face attaches to the frame creates a thermal air gap that is filled with factory-applied, closed-cell foam insulation.
• Provides a thermal break to allow for a layer of continuous insulation.
• Size of available air gap ranges from ½-inch to 2 ½ inches
• The air gap reduces thermal transfer across the assembly by as much as 25 percent, when compared to a traditional architectural precast system.
<table>
<thead>
<tr>
<th>Traditional Built-Up</th>
<th>Lightweight Precast Concrete Modular Cladding</th>
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</thead>
<tbody>
<tr>
<td><em>Onsite Construction</em></td>
<td><em>Factory Assembled</em></td>
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<td><em>Each layer added upon the other</em></td>
<td><em>Factory-Controlled Quality</em></td>
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<td><em>Frame</em></td>
<td><em>Integrated Design Process</em>—early coordination of design aesthetic, performance, and scheduling goals</td>
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<td><em>Vapor/air barriers</em></td>
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<td><em>Insulation</em></td>
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<td><em>Facade</em></td>
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<td><em>Multiple interior crews create the envelope</em></td>
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<td><em>Improper installation of components often occurs</em></td>
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<td><em>Thermal performance is impacted by insulation gaps and quality issues related to the limitations of on-site installation</em></td>
<td><em><strong>Higher Energy Performance</strong></em></td>
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Thermal Performance Metric: R-Value

• R-value is a measure of how well insulation, or an assembly, resists the flow of thermal energy.
• Higher R-values indicate better insulators.
• Lower R-values indicate poorer insulators.
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<th>Prescriptive R-Value</th>
<th>Lab-Tested R-Value</th>
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<tr>
<td>• Determined by calculations used to arrive at the <em>expected</em> thermal performance of the solution</td>
<td>• Determined by the assembly being tested to attain accurate data on the heat transfer that occurs through the insulated structure in representative test conditions.</td>
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Importance of Testing R-Values

• Example 1: Panel Configuration
  • ½-inch air gap
  • 4 inches foam
  • Prescriptive R-Value: 24.8
  • Lab Tested Value: 12.2

• Example 2: Panel Configuration
  • 2-inch air gap
  • 5.5 inches foam
  • Prescriptive R-Value: 38.5
  • Lab Tested R-Value: 24
Energy Codes

Use R-Values to Define Requisite Thermal Performance

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| **Walls, above grade** |                         |                         |                         |                         |                         |                         |
| R-5.7ci           | R-5.7ci        | R-5.7ci        | R-7.6ci        | R-7.6ci        | R-9.5ci        | R-9.5ci        | R-11.4ci       | R-11.4ci       | R-13.3ci       |
| R-13 + R-6.5ci    | R-13 + R-6.5ci | R-13 + R-6.5ci | R-13 + R-6.5ci | R-13 + R-6.5ci | R-13 + R-6.5ci | R-13 + R-6.5ci | R-13 + R-6.5ci | R-13 + R-6.5ci | R-13 + R-6.5ci |
| d R-13 + R-3.8ci | or R-20        | R-13 + R-3.8ci | or R-20        | R-13 + R-3.8ci | or R-20        | R-13 + R-3.8ci | or R-20        | R-13 + R-3.8ci | or R-20        |

| **Walls, below grade** |                         |                         |                         |                         |                         |                         |
| l'' NR            | NR             | NR             | NR             | NR             | NR             | R-7.5ci        | R-7.5ci        | R-7.5ci        | R-7.5ci        |

| **Floors**        |                         |                         |                         |                         |                         |
| NR                | NR             | R-6.3ci        | R-8.3ci        | R-10ci         | R-10ci         | R-10ci         | R-10.4ci       | R-10ci         | R-10ci         |
| NR                | NR             | R-30           | R-30           | R-30           | R-30           | R-30           | R-30           | R-30           | R-30           |

| **Slab-on-grade floors** |                         |                         |                         |                         |                         |
| NR                | NR             | NR             | R-12.5ci        | R-12.5ci        | R-12.5ci        | R-12.5ci        | R-12.5ci        | R-12.5ci        | R-12.5ci        |
• Architectural precast concrete cladding systems can satisfy the thermal requirements for IECC Zone 1-Zone 8.
• Suitable in locations—Miami to the North Slope Borough in Alaska.
Le Griffix, Montreal, Canada

- Key Design Objectives
  - High R-Value—the IECC has designated Montreal as a Zone 7.
  - Easy to assemble
  - Lightweight Precast Concrete Cladding
    - R-Value: 21
    - Lightweight: 30 lbs. per square foot
Johns Hopkins Campus
Nelson-Harvey Building East
Elevation (built circa 1970s)

- Key Design Objectives
  - Increase thermal performance
  - Provide an air and water barrier
  - Maintain cohesive look with rest of campus
  - Limit cladding system weight (5% dead load threshold for steel structural members, 10% building lateral.)
  - Meet aggressive design and construction schedule
  - Comply with current Baltimore City Building Code and ASHRAE standards
  - Achieve Baltimore City Green Building Systems 2 Green Star certification (LEED Silver equivalent)
The project required a weathertight exterior that had sufficient insulation. It needed to be a lightweight system that matched the Johns Hopkins signature brick aesthetic on campus.

Dan McKelvey
Associate Principal and Envelope Expert, Ayers Saint Gros
Project Materials — Wall Systems

- **Precast panel** — thin-brick mechanically bonded to lightweight precast concrete panel. System thickness of 2-1/2" brick/concrete on 6" CFMF = 8 1/2" overall thickness.

- **Aluminum curtain wall** — thermally broken curtain wall with fluoropolymer coating, insulating glazing, low-iron glass with ceramic frit and low-E coating.

- **Metal panel system** — aluminum panel with foamed-in-place polyiso core on CFMF
Completed
Nelson Harvey
Building
Entrance

Increased the insulation value of the building walls by 227%.
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