



Precast Architectural Cladding Panels

# carboncast™

Precast for the  
21st Century:  
lighter, stronger,  
smarter.



altusgroup™

 carboncast™

 **C-GRID™**  
REINFORCED  
C-GRID is a trademark of TruFib, LLC

## Precast Has Never Looked Better

Architects have chosen precast concrete architectural cladding panels for more than four decades because they offer exceptional versatility, speed of enclosure and durability. No other material provides the combination of colors and textures, fire-resistance, range of shapes, acoustical insulation, weather-tightness, long-term durability, low maintenance and accelerated construction schedule. However, the weight of the precast concrete components can pose challenges for designers when developing a building's steel or concrete superstructure—especially in recladding applications, poor soil or high seismic and wind zones.

Help has arrived. CarbonCast technology can reduce the weight of architectural cladding panels by up to 66 percent while offering insulation values of steady-state R-6 to R-20 and improved durability. This is because

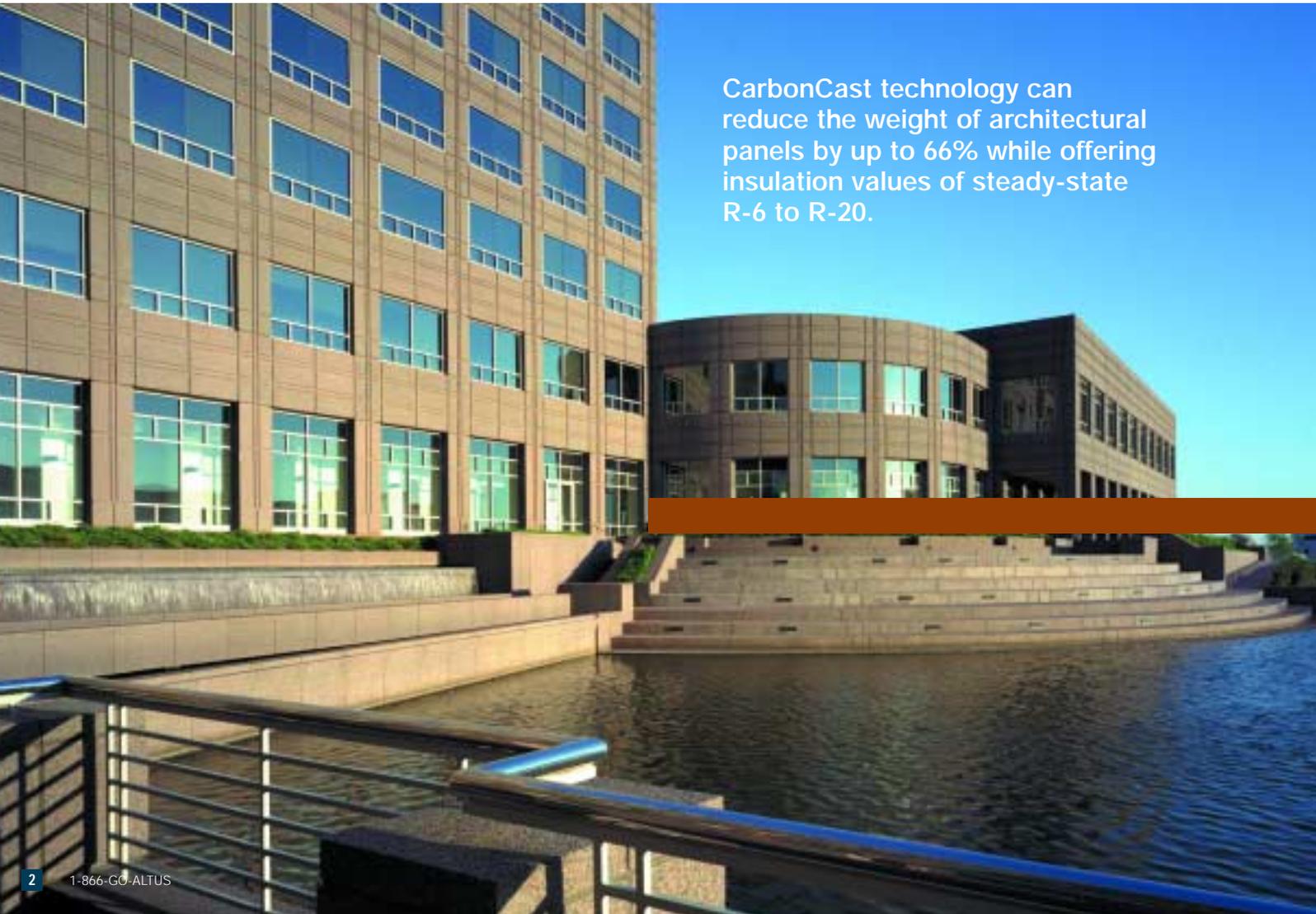
CarbonCast panels use non-corrosive, high-strength, resin-bonded carbon fiber reinforcing grid, C-GRID™, for face reinforcing instead of steel. Ultra-strong, 1mm thick C-GRID requires less concrete cover than welded wire, enabling lighter precast sections and even longer product life, especially in corrosive environments.

## The Biggest Advance in Precast Since Its Invention

CarbonCast Architectural Cladding Panels take a technology you already know—precast concrete—and improve it by replacing the steel mesh reinforcing used for shrinkage and temperature-induced crack control with a stronger, non-corrosive, composite material that requires less concrete cover and increases durability.

Lightweight, insulating, back-ribbed CarbonCast Architectural Cladding Panels employ a steel-reinforced Vierendeel-like truss frame attached to a thin, C-GRID-reinforced diaphragm face. Insulating foam forms the ribs and displaces concrete to provide insulation. C-GRID carbon fiber shear trusses mechanically link the face and truss ribs to develop a rigid panel that will withstand fire, wind and rain.

They also incorporate patented V-Ribs designed to create a thermal break with the face of the panel. Solid zones at the panel's perimeter can be covered at the factory or in the field with rigid insulation to create a highly insulating composite assembly. This design virtually eliminates the potential for condensation and mold in the wall assembly and can increase net usable or rentable floor area by reducing the width needed for interior studding and other insulation.



CarbonCast technology can reduce the weight of architectural panels by up to 66% while offering insulation values of steady-state R-6 to R-20.

CarbonCast Architectural Cladding Panels speed installation compared with ordinary precast because lightweight CarbonCast panels can be made larger—requiring fewer crane picks—or can be erected more efficiently because more panels can be staged at one time “under the hook” of the crane, reducing delays caused by jockeying panels into position for picking. Depending on design, CarbonCast panels are priced competitively with conventional precast or other curtain-wall systems such as brick-veneered masonry or concrete or brick-veneered stud walls. And after factoring in reductions to sub-structure requirements and potential HVAC system and operating savings, CarbonCast Architectural Panels can help pay for themselves—especially in mid- and high-rise buildings.

**Carbon Fiber Takes Fighter Jets Beyond Mach 2. Imagine What It Can Do for Your Walls.**

Super-thin, non-corrosive carbon fiber is the space-age “enabling technology” that allows CarbonCast Architectural Cladding Panels to be lighter, more durable and often lower in cost than conventional precast products that

rely on steel mesh face reinforcing. Steel mesh can have problems with corrosion—especially in salt-laden environments—if the concrete cover is too thin. When steel corrodes, it more than doubles in volume and causes cracking or spalling. It may also cause unsightly staining when wet.

Exceptionally strong, C-GRID carbon fiber reinforcing grids provide over 6,000 lbs/lf of tensile strength to resist wind loads and other forces acting on architectural cladding panels. The high strength carbon fibers used to make C-GRID are over four times stronger than steel and their close spacing and near-surface placement contribute to superior crack control behavior in concrete structures.

C-GRID's highly efficient structure, corrosion-resistance and strength allow AltusGroup precast manufacturers to dramatically reduce the amount of concrete cover in each panel. The result: panels can weigh up to 66 percent less and last even longer than conventional precast or most other cladding systems.



**ONE ADVANCE LEADS TO ANOTHER**

Within the last decade, industrial-grade carbon fiber has been developed for broad use in construction applications. It has many of the same strength-weight benefits as high-performance carbon fiber, but at a significantly lower cost.

Each carbon fiber “tow” or strand is actually comprised of thousands of ultra-thin fibers that are bundled together. These tows are assembled perpendicular to each other into a grid using a continuous rotary-forming process that also chemically binds them with a heat-cured epoxy resin. The tough epoxy resin and tight orthogonal structure of C-GRID also help create a strong mechanical bond with the concrete.

Generally, thinner and more open grid patterns are used near the surface for secondary reinforcing, while thicker and tighter grids are used for more demanding applications such as shear transfer between V-Ribs and the face of architectural panels or the wythes of CarbonCast Insulated Wall Panels.



# Unlimited Form, Finish, Texture

## Versatility As Infinite As Your Imagination

Precast concrete gives architects and building owners a virtually unlimited array of design and finish options. CarbonCast Architectural Cladding Panels are no exception. They provide designers outstanding flexibility in terms of:

- **Form**—Articulations such as reveals, custom faces, cornices and other shapes. Deep window recesses can be included with reduced additional cost.
- **Finish**—An almost limitless variety including colors, applied finishes and veneers such as thin brick, tile and stone.

- **Texture**—Custom surface texturing can range from delicate to bold—including polishing, etching and blasting—to yield the right unique appearance.

In addition to preventing staining and spalling, C-GRID reinforcement is superior in crack control compared with steel mesh. This unique characteristic is especially important in architectural panels where appearance is paramount.



## COMMERCIAL / INSTITUTIONAL APPLICATIONS

- Offices
- Health Care
- Education
- Retail
- Institutional
- Correctional
- Cultural
- Transportation
- Multi-Unit and High-Rise Residential
- Mixed Use

From ultra modern to historically accurate, CarbonCast meets your design objectives.



**FACTORY ACCENTS**

Reveals  
 Precast Trims  
 Cornices  
 Bullnoses  
 Custom Ribs and  
 Other Textures  
 Radiused Shapes

**SURFACES**

Precast  
 Brick Form Liner  
 Stone Form Liner  
 Molded Clapboard  
 Factory Veneers  
 Tile  
 Thin Brick  
 Dimensional Stone

**FACTORY FINISHES**

Stain  
 Acid Wash  
 Light Blast  
 Medium Blast  
 Heavy Blast  
 Exposed Aggregate  
 Honed  
 Polished

**FIELD FINISHES & ACCENTS**

Synthetic Trims  
 Clear Sealer  
 Paint  
 Stain

**SHAPE, SIZE, ACCENT AND FINISH OPTIONS—APPEARANCE AND COST GUIDE**

**INDUSTRIAL AND ARCHITECTURAL WALL PANELS**

**SHAPES**

	Appearance Uniformity	Relative Cost
Perimeter–4 sides	■	\$
Perimeter–5 or more sides	■	\$\$–\$\$\$\$
Non-Rectangular	■	\$\$–\$\$\$
Curved Shapes/Surfaces	■	\$\$\$\$
Punched Shapes (openings)	■	\$\$
Returns	■	\$\$\$

**SIZES**

	Appearance Uniformity	Relative Cost
Small Pieces	■	\$\$\$\$
Large Pieces	■	\$
Thick Panels (up to 2 hour rated)	■	\$

**ACCENTS**

	Appearance Uniformity	Relative Cost
Plain (no reveals)	□	\$
Shallow Reveals (3/4" or less)	■	\$\$
Deep Reveals	■	\$\$\$
Reliefs (repetitive)	■	\$\$\$
Precast Trims and Projections	■	\$\$\$\$

**COLORS**

	Appearance Uniformity	Relative Cost
Grey Cement	□	\$
White Cement	■	\$\$
Light Pigments	■	\$\$
Dark Pigments–high dosage	■	\$\$\$–\$\$\$\$
Locally-Sourced Aggregates	■	\$

□ Low ■ Medium ■ High

**INDUSTRIAL AND ARCHITECTURAL WALL PANELS**

**COLORS (continued)**

	Appearance Uniformity	Relative Cost
Quartz & Marble Aggregates	■	\$\$–\$\$\$\$
Granite Aggregates (non local)	■	\$\$–\$\$\$\$
Standard Mixes (where available)	■	\$
Custom Mixes	■	\$–\$\$
Two Mix Colors per Piece	■	\$\$\$–\$\$\$\$

**FINISHES**

	Appearance Uniformity	Relative Cost
Form Finish	□	\$
Paint/Stain/Stucco	■	\$\$
Light Blast	■	\$\$\$
Medium or Heavy Blast	■	\$\$
Acid Etched	■	\$\$
Retarded (exposed aggregate)	■	\$\$\$
Acrylic Brick (where available)	■	\$\$\$–\$\$\$\$
Standard High-Repetition Form Liner (ribs, molded brick, stone, etc.)	■	\$\$\$
Custom or Low Repetition Form Liner	■	\$\$\$–\$\$\$\$
Thin Brick or Tile	■	\$\$\$–\$\$\$\$
Stone Veneer (stone by others)	■	\$\$\$
Honed or Polished (where available)	■	\$\$\$\$
Form-Finished Edges	■	\$
Other Edge Finishes	■	\$\$

NOTE: Concrete is made from natural materials which vary in the colors they yield over time. Samples will represent a color in the range of colors produced by a mix design. Older samples should only be used as a guide for initial color and finish selection. Fresh 12" x 12" samples should always be used to make final color and finish selections. As with natural stone, mock-ups produced near to the time of actual production should be used to confirm final color and finish selections.

## Less Is More. Way More.

With standard precast architectural wall panels, secondary steel reinforcing requires two to three inches of concrete cover to protect it from corrosion, especially in aggressive environments. And overall, traditional precast panels with reveals are typically six inches thick and weigh 75 pounds—or more—per square foot. All that concrete adds weight—and that means added cost.

Non-corrosive C-GRID carbon fiber reinforcement eliminates the need for all that extra concrete. The section properties and reduced weight of CarbonCast wall components—which weigh as little as 27 pounds per square

foot—translate to lower transportation and erection costs, as well as savings on building superstructure.

## Factory Insulation Lowers Weight, Reduces HVAC Demand and Fights Mold

To use less concrete while still providing panels that permit deep window recesses, we replace the displaced concrete with insulating polystyrene foam. The added R-value provided by the foam—which can be steady-state R-8 or more depending on panel configuration—can improve the thermal efficiency of the structure, leading to corresponding reductions in HVAC equipment. Compare that to brick or glass curtainwall assemblies that have no significant or much lower R-values.

The insulating foam provides another important advantage: it also reduces opportunity for mold growth. Compared to uninsulated cladding, when used with an appropriate vapor retarding gypsum wallboard assembly, the thermally broken, insulated faces of CarbonCast panels can prevent condensation on the interior side from warm, moisture-laden air. And when the perimeter ribs of a CarbonCast panel are factory- or field-insulated with a low permeance rigid foam, the likelihood of condensation—and mold—in the wall is substantially reduced.

## Lighter and Better: a Case Study

On a 34-story building, for example, engineering calculations show that changing to a ribbed or rib-backed CarbonCast Architectural Cladding Panel with a 1¾" concrete face reduced the dead load on each typical exterior column by at least 250,000 pounds, compared with a conventional 6" thick concrete face.

The dramatic weight reduction decreased design loads and gave the design team an option to reduce the size or number of columns required around the perimeter, resulting in an estimated superstructure cost reduction equal to 25 percent of the architectural cladding cost.



Using less concrete and more insulating foam reduces energy use and lightens panels.



Foam Insulation for the Optimum High Performance Insulated Wall System

CarbonCast Insulated Wall Panels can be made with one of three types of rigid foam insulation boards: EPS—Expanded Polystyrene, XPS—Extruded Polystyrene, or ISO—Polyisocyanurate. Each type of foam has unique properties. When used at recommended thicknesses and in conjunction with precast concrete wythes, plastic foams produce assemblies with an M (permeance) of <1.0, qualifying as vapor retarders as defined by Chapter 2 of the 2003 International Building Code. Designers should select foams for CarbonCast panels based on project-specific requirements including location, end-use, R-value and budget.

PROPERTIES OF FOAM INSULATIONS	EPS <sup>10</sup>	XPS	ISO
Typical Density—pcf	1.0, 1.15, 1.35, 1.80	1.30, 1.55, 1.80	2.00
R-Value @ 75°F <sup>1</sup> (ASTM C518)	3.8, 4.0, 4.2	5.0	5.6 <sup>2</sup>
Water Vapor Permeability/inch (ASTM E96) <sup>3</sup>	3.5, 3.5, 2.0	1.1	1.0
Compressive Strength—psi (ASTM D1621)	13, 15, 25	15, 25, 40	20
Recycled Content <sup>4</sup>	≤15%	≤15%	≤15%
Maximum Service Temperature (°F)	165°F	165°F	250°F
Flamespread (ASTM E84) <sup>5,6</sup>	<75	<75	<75
Smoke Developed (ASTM E84) <sup>5</sup>	<450	<450	<450
% Vol. Water Absorption in 24 hours (ASTM C272) <sup>7,8</sup>	3%, 3%, 2%	.3%	NA
% Vol. Water Absorption in 2 hours (ASTM C209) <sup>9</sup>	NA	NA	1.5%
Cost	\$—\$\$	\$\$\$	\$\$\$\$

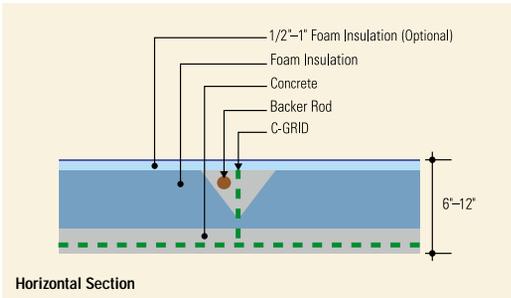
1. R-Value = 1/U = hr x ft<sup>2</sup> x °F/Btu; R-Values shown are @ 75°F mean temperature
2. R-value is for unfaced insulation. Faced insulation may deliver higher values.
3. Water vapor permeability, expressed in terms of maximum perms, is for unfaced insulation. Permeability is a property for 1" thick material. Permeance depends on thickness and decreases (improves) as material thickness increases. Permeability can be improved with the addition of film facers. Consult manufacturers for specific data and availability.
4. Higher percentages of recycled content are available, but vary by material and plant location, and may adversely affect other properties such as R-value or compressive strength.
5. These numerical ratings are not intended to reflect hazards presented by these materials under actual fire conditions.
6. IBC 2003 2603.4 and 2603.5 and IRC R318.2.1 require foam boards to be protected with a 15 minute thermal barrier (e.g., 1/2" gypsum board or an equivalent material, such as 1" of concrete).
7. Water absorbed by unfaced insulation after 24 hours of full immersion in water.
8. EPS and XPS foam boards withstand repeated wetting, are non nutritive, and do not provide a food source for mold growth.
9. Water absorbed by unfaced insulation after 2 hours of full immersion in water.
10. EPS foam boards sourced as PerformGuard™ EPS are specially treated to provide termite resistance in accordance with ICC ES EG 239 (see ICC ES ESR-1006).

Sources: ASTM C-578 (EPS & XPS) ASTM C1289 (ISO) NA = Not Available

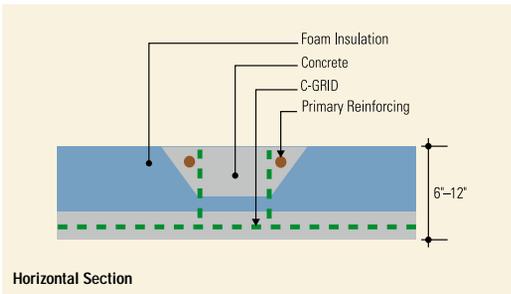
PerformGuard is a registered trademark of AFM R-Control

# Lightweight and Worry-Free

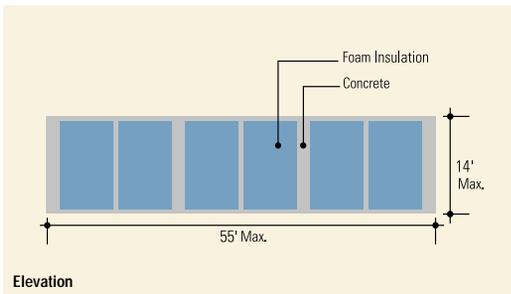
CarbonCast technology may allow you to replace an existing exterior envelope system with a new high performance one, saving time and expense.



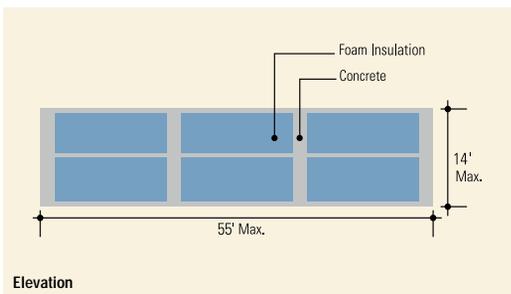
**Architectural Panel** Secondary Vertical Rib



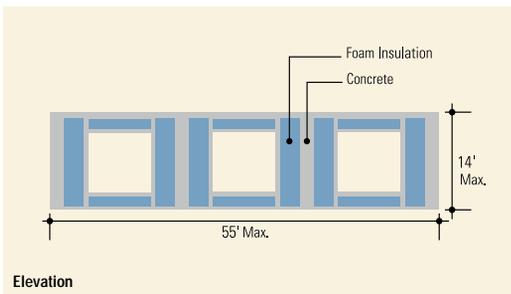
**Architectural Panel** Primary Vertical Rib-A



**Architectural Panel** Vertical Back Rib



**Architectural Panel** Horizontal Back Rib



**Architectural Panel** Punched Openings



### Eliminate Troubles Before They Arise

Other lightweight building envelope alternatives can have problems. Brick wall assemblies are prone to weather delays and susceptible to efflorescence. EIFS has well documented liability issues. GFRC is not widely available and has no insulation value. And hybrid systems that have a concrete face supported by a steel stud backing create essentially flat, unarticulated panels that severely curtail your design options and limit thermal performance.

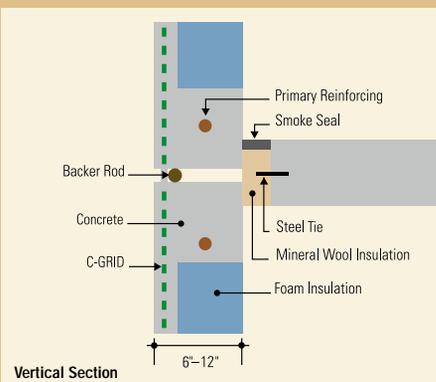
CarbonCast Architectural Cladding Panels offer all the durability, speed and aesthetic benefits of conventional precast concrete, but without all the weight. And without all the worry that accompanies other lightweight systems.

### The Perfect Fit For Recladding

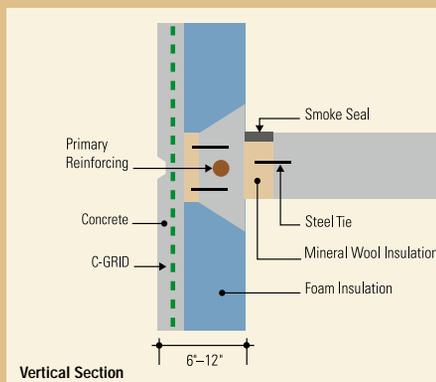
Because CarbonCast Architectural Cladding Panels can be fabricated as thin as 1¾" and as light as 27 pounds per square foot, they are well suited for recladding applications where thickness, weight and accessibility are issues. In some cases, lightweight CarbonCast technology allows you to install a new exterior envelope after removing the existing one, saving time and money in the renovation process.

### Keep Unsightly Views Out Of Sight

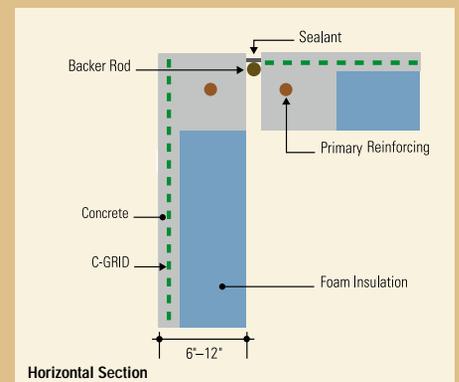
CarbonCast Panels can also be an excellent choice for screen walls around penthouse enclosures, refuse containers and service areas. These panels can be as thin as 1¾" and can be finished on both sides where the back of the panel will be exposed to view.



**Architectural Panel** Panel-to-Panel Firestop



**Architectural Panel** Rib Firestop



**Architectural Panel** Butt Corner

## Improves the Job Site, Not To Mention the Rest of the Earth.

In addition to their durability and aesthetic versatility, CarbonCast Architectural Cladding Panels offer an assortment of environmental benefits ranging from erection speed and reduced job site disruption to energy savings and use of recycled materials.

## Score Points With LEED

The improved insulating properties of CarbonCast panels lead to more energy-efficient buildings with lower operating costs, making CarbonCast a suitable choice for environmentally friendly designs. In fact, if pursuing Leadership in Energy and Environmental Design™ (LEED) certification, carbon fiber reinforced precast panels can contribute up to 23 Materials and Resources credits out of the 26 necessary for certification.

In addition, C-GRID reinforced precast panels are more environmentally friendly than other building enclosure systems because they:

- Use local materials and less concrete
- Make use of some industrial and post-consumer waste, e.g. primary reinforcing steel, slag, fly ash and rigid foam boards
- Are lighter, can eliminate other perimeter components and reduce structure costs and are more efficient to ship and erect

- Enhance access around the perimeter of the building and cause less site disruption.
- Are more thermally efficient—reduced first cost of HVAC mechanical equipment and long term energy use
- Offer integral light colors to reduce ALBEDO, which lowers the “heat island” effect of building
- Can be recycled—not a burden on local landfills

**Improving the R-Value of a wall assembly can help achieve nearly 40% of the core credits required for basic LEED certification.**

## READY TO PASS THE TOUGHEST TEST: YOURS

Rigorous laboratory testing has affirmed a number of CarbonCast's performance characteristics. Below is a sampling of tests that demonstrate the suitability of CarbonCast Architectural Cladding Panels for a variety of applications.

### C-GRID Material Properties

- Strand Tensile Strength & Cross-Shear Strength
- Behavior Under Sustained Loads & Fatigue Behavior

### C-GRID Reinforced Concrete Behavior

- Tension Tests and Pull-out Strength of Shear Grid
- Effect of Temperature on C-GRID used for Shear Transfer
- RILEM Moisture Absorption Test for 1" Concrete Wythes

### CarbonCast Architectural Cladding Panel Performance

- Flexural Strength & Uniform Static Load
- Effects of Thermal Cycling
- Strand Bond Behavior in Panels Made with Nylon Fiber Reinforced SCC Concrete
- Missile Impact Test
- ASTM E119 Fire Test\*

\*CarbonCast is safe and fire-ratable when used with gypsum board wall assemblies. Floor-to-floor fire stops can also be cast into panels as required by fire codes.

**CarbonCast Architectural Cladding Panels lead to more energy-efficient buildings with lower operating costs.**





### All the Benefits of Precast

Delivered ready to erect, precast wall panels avoid the costly scheduling, quality and safety issues associated with coordinating various trades, delays, scaffolding and site congestion caused by laborers and stored materials and equipment.

For decades, architects and engineers have depended on the strength, durability and design possibilities of precast concrete to achieve:

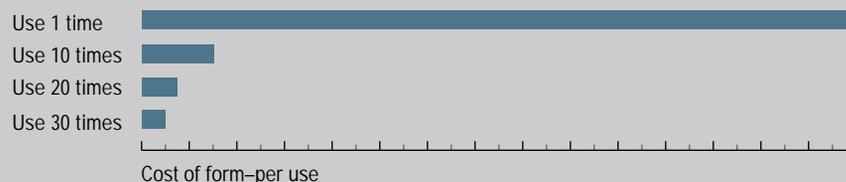
- Outstanding durability, including fire and impact resistance
- Unlimited aesthetic options
- Excellent design flexibility
- Peace of mind—quality-oriented, consistent factory fabrication enables greater quality control, superior consistency of finish and greater strength and impermeability
- Exceptional sound isolating properties
- Improved resistance to mold compared to most other systems
- Fast-track construction—faster to erect, fewer uncontrollable delays, lower costs. (Up to five times faster than field fabrication)
- Excellent thermal efficiency and weather tightness which can reduce HVAC system requirements and energy consumption
- Low maintenance and life cycle costs



AltusGroup precasters will provide extensive design and specification assistance, connection detailing, erection planning, erection and other services to ensure a hassle-free, high quality installation.

### REPETITION EFFECT ON PANEL SQUARE FOOT COST

Repetition is a key element in economical precast design and manufacture. You can benefit from dramatic economies of scale with a “master form” concept that maximizes the reuse of forms while still allowing for minor variations.



Example panel is 200 square feet and the initial form cost is equal to the production cost of the precast panel.



**AltusGroup Producer Members:**

**Oldcastle Precast, Building Systems Division**

Baltimore, MD; Morrisville, PA; Spokane, WA; South Bethlehem, NY  
www.oldcastlesystems.com

**High Concrete Group™**

Denver, PA; Lebanon, PA; Williamsport, PA; Springboro, OH; Paxton, IL  
www.highconcrete.com

**Metromont Corporation**

Atlanta, GA; Greenville, SC; Charlotte, NC; Nashville, TN  
www.metromontusa.com

**TechFab, LLC**

Anderson, SC  
www.techfabllc.com

**Gate Precast Company**

Oxford, NC; Monroeville, AL; Kissimmee, FL  
Jacksonville, FL; Winchester, KY; Nashville, TN  
www.gateprecast.com

**Heldenfels Enterprises, Inc.**

Corpus Christi, TX; San Marcos, TX  
www.heldenfels.com

**Shockey Precast Group**

Winchester, VA; Fredericksburg, VA  
www.shockeycompanies.com

**Blakeslee Prestress**

Branford, CT  
www.blakesleeprestress.com

**Innovation Partners:**

**A.L. Patterson, Inc.**

www.alpatterson.com

**AFM R-Control**

www.r-control.com

**Degussa Admixtures, Inc.**

www.degussa-nafta.com  
www.masterbuilders.com

**Endicott Tile**

www.endicott.com

**High Concrete Accessories**

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**Innovative Brick Systems**

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**JVI Inc.**

www.jvi-inc.com

**Lafarge North America, Inc.**

www.lafargenorthamerica.com

**Meadow Burke**

www.meadowburke.com

**Owens Corning**

www.owenscorning.com

**Sika Corporation (USA)**

www.sikacorp.com

**Zoltek Corporation**

www.zoltek.com

**Revolutionary Thinking from the Leading Minds in Precast**

AltusGroup, Inc., a company founded by some of the industry's largest precasters and C-GRID developer TechFab LLC, was incorporated to make CarbonCast technology—and future innovations—available throughout North America.

AltusGroup members collectively support more than 25 manufacturing and sales locations in the United States and over 200 specification-oriented sales, marketing and engineering professionals, and generate more than \$1 billion in annual revenue. With pooled research resources, knowledgeable manufacturing engineers and a national network of quality-conscious, PCI-certified plants (www.pci.org), sales support staff and university collaborators, AltusGroup can help you achieve your design, construction and budget objectives.

Innovative CarbonCast products are available throughout the United States and many locations in Canada, with an unparalleled network of service and support, offering:

- Extensive testing and the backing of trusted industry leaders
- A central source for complete technical information, including CAD details, specifications and engineering design standards.
- Local sales and technical representatives to help with design and construction challenges
- Uniform quality standards and details consistent with the IBC and local codes

Other high performance CarbonCast precast products available from AltusGroup include:

- High Performance Insulated Wall Panels
- Pretopped Double Tees
- Foundation and Wall Panels for Multi-Unit Residential Applications
- Floor and Roof Decks for Multi-Unit Residential Applications

For more information about AltusGroup, CarbonCast precast concrete components and the C-GRID technology, call 866-GO-ALTUS or visit www.altusprecast.com.



See us in Sweets in section 034500/ALT

