Wall Panel Design Manual
Introduction

Precast concrete wall panels are an extremely versatile product. They have the capability to be an integral component of a traditional building system as well as part of an entire precast concrete building system. This Wall Panel Systems Design Manual provides information about the various types of precast wall panels and building systems that are available from EnCon Companies, and the ways each system is best used. Owners, contractors, architects, and engineers will discover that wall panels can function in a wide variety of settings and offer a myriad of benefits. A few of the countless benefits include the economical, environmentally friendly, and timely construction compared to traditional building methods.

Every segment of the construction industry can benefit from the high performance of precast concrete wall panels. They are an energy-saving, resilient, and easy-to-maintain building envelope that require minimal upkeep. In addition, they provide a finished interior hard wall and eliminate the need for exterior columns for support. Precast wall panels can be rapidly constructed, are fire resistant, mold and mildew resistant, and decrease sound transmission. They also meet unique building needs and challenges, and offer unrivaled design flexibility in every area including shape, style, finish, color, texture, and decorative ornamentation. Thus, when low building costs, reduced energy expenditure, minimal maintenance, long-term durability, and minimal fire insurance rates are important, a precast wall panel system is the ideal building arrangement for any structure, whether it be a low-, mid-, or high-rise edifice. Regardless of the type of design, EnCon’s precast concrete wall panels and wall panel building systems provide owners, designers, and contractors with benefits that are unsurpassed.

The following information includes sections that address frequently asked questions and technical data, as well as product cross section details and connection concepts. Also enclosed are sample specifications and a set of typical general notes. For further information, or to discuss a project, please see the contact list on the back cover of this manual.
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Benefits over other Construction Materials

There are a variety of wall panel building systems on the market but none compare to or contain the benefits of precast/prestressed concrete.

<table>
<thead>
<tr>
<th></th>
<th>EnCon Precast Wall Systems</th>
<th>Tilt-Up</th>
<th>Metal Panel</th>
<th>Masonry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Flexibility</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Durability</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Low Life Cycle Costs</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Maintenance</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Resistance</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant-Production for Quality Assurance</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Thermal Efficiency</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Year Round Rapid Construction</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security and Safety</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Produced Under a Plant Certification Program</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Product System Use

Residential: Single Family, Multi-Family, Multiple Unit

Precast wall structures are the ideal building system. In addition to their many benefits, they offer an average reduction in heating and cooling costs of 50%. The panels eliminate heat transfer, keeping warm air in and cold air out in the winter, and the opposite during the summer months. The safety, security, and high fire resistance panels keep insurance rates low. Wall panels, especially insulated panels, minimize noise between units and help dampen noise outside of the structure. Precast concrete also helps minimize mold, mildew, and other water related damage by providing superior moisture control and protection.

Retail

Durable and easy to care for, wall panels are perfect for public spaces. A large variety of surface options make precast wall panel systems especially well-suited to retail centers that desire a particular aesthetic appearance. The rapid construction time of a wall panel system minimizes initial costs and enables prompt occupancy and revenue returns.
**Education**
The finished and resilient interior and exterior surfaces of a precast wall system retains its excellent condition and attractive appearance throughout the life of the structure. Energy efficient insulated panels eliminate the need for additional insulation, air gaps, and thicker wall sections. Due to its high level of fire-resistance, precast wall panels provide advanced safety for students and staff members of educational buildings.

*Fox Meadow Middle School*

**Commercial/Warehouse/Manufacturing**
Precast wall panel systems offer high value and long life while meeting demanding requirements. It provides a smooth, hard interior surface that resists abrasive damage caused by heavy equipment. Also, precast allows for great expanses under the roof without perimeter support columns, as well as openings wider than conventional ones. This makes it particularly convenient for loading and unloading materials and supplies. Floors can be poured after the walls are erected and the roof is in place. This protects the floor from construction damage and avoids schedule delays due to inclement weather.

*GCC Office, Shop & Warehouse*

**Office**
Corporate owners and managers profit from the accelerated occupancy, insurance and tax benefits, and reduced construction financing that a precast wall panel system offers. The panels are an excellent option for an office park environment as exteriors can be matched to those of other buildings to help new construction blend with existing structures. This system also accommodates the moving of walls for the possibility of future building expansions.

*The Aerospace Corporation*
Religious
With a precast wall system, a multitude of aesthetic choices, such as customized designs and finishes, are available to create nearly any motif. Also, insulated panels provide excellent sound reduction, events held in one space do not disturb concurrent activities in adjacent spaces. In addition, precast wall panels offer long-term energy and cost-saving benefits with a nearly maintenance-free façade.

Eastern Hills Community Church

Secure Environments: Food Industry, Medical/Laboratory Facilities
Precast wall systems offer clean, germ-free environments for facilities, such as food-processing plants and medical offices, where this is of utmost importance. This is an economical and effective way to meet government standards. Interior panel surfaces can be given a smooth finish that is easy to clean, free of air voids, and resists soiling. In addition, the concrete can be microbiologically treated to provide enhanced mildew resistance. Also, ledges that might collect dirt can be eliminated, and durable interior walls are able to endure the continued application of harsh chemicals.

Judicial and Military
Precast wall panels are strong and hard-wearing for an increased level of safety and security. They resist rust, dents, and punctures as well as forces of nature that can damage or destroy other buildings. Panels can be produced to exact specifications in a wide variety of dimensional choices to meet building requirements. Precast insulated panels have been tested and shown to exhibit exceptional blast resistance, a typical requirement for these facilities.

Fort Carson Division Headquarters
Product Variations
Wall panels are versatile pieces that can be used as architectural, structural, or combination elements. Insulated wall panels can be designed as composite or non-composite, and loadbearing or non-loadbearing. In addition, panels can be cast with blockouts for electrical conduit, HVAC ductwork, windows, and entrance and egress openings. Because of the substantial number of variations and combinations of panel configurations and manufacturing tolerances, this manual has provided you with the following list of features that can help with product selection and specification.

Manufacturing Tolerances
There are two distinct sets of tolerances in the manufacturing of precast/prestressed concrete. These can include dimensional, surface finish, and color variation. Typical structural grade product is produced under PCI MNL 116 while architectural product is produced under PCI MNL 117. This however should not imply that all product made to PCI MNL 116 is gray and has large variations in dimensions or all exterior façades of structures are produced to the more stringent architectural requirements of PCI MNL 117. Any combination of the quality guidelines can be put together to facilitate the most economical wall panel system while ensuring the aesthetic and architectural intent. As opposed to a painted precast panel, a brick panel would require significantly tighter tolerances.

Our Structural Plus panels are manufactured to PCI MNL 116 for dimensional tolerances and PCI MNL 116 for color and surface finish variation.

Color
Panel color is developed through a variety of techniques:
- Colored Pigment
- Colored Aggregate
- Surface Finish Variation
- Supplemental Material – Paint and Stain

Structural Plus panels come in colors based on local aggregates, gray cement, and pigment. Currently, these colors are Gray, Cinnamon Toast, and Cream.

Finish
Panel finishes can vary from a form finish, to a very smooth finish, to a heavy exposed aggregate finish. The installation of the finish is a cement or matrix removal process. The material removal can be accomplished with a high pressure sand, or acid and high pressure wash.

Thermal Efficiency
These panels can be insulated with limited solid zones to 100 percent thermal efficient. Typical steady state thermal R-values are on the order of 8 to 15. If thermal mass is accounted for, and the interior surface is the concrete panel or contains a single layer of gypsum, effective R-values can be on the order of 12 to 22. In addition to R-values, precast concrete provides the advantage of thermal mass. This benefit enables the storage of heat which is released over time, leveling the peak fluctuations in mechanical HVAC equipment demand.
Loadbearing vs. Non-Loadbearing (Gravity)
For the most efficient structural system, the exterior wall panels should be loadbearing. This solution prevents interior columns adjacent to the panels, and eliminates the roof or floor perimeter spandrel beams. Non-loadbearing panels can be referred to as cladding, or curtain wall systems, and are common building envelopes. They can be connected to any type of structural frame, including precast concrete, cast-in-place concrete, or steel. When designated as non-loadbearing, they are typically designed to resist wind and seismic forces generated by their own weight. Either of these bearing systems can include wall panels with or without windows, spandrels, Mullions, or column covers.

Typical Combinations

**Industrial Grade Wall**

<table>
<thead>
<tr>
<th>Concrete Color</th>
<th>Gray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Finish</td>
<td>Paint Ready</td>
</tr>
<tr>
<td>Insulation</td>
<td>Insulated or non-insulated</td>
</tr>
<tr>
<td>Loadbearing</td>
<td>Loadbearing or non-loadbearing</td>
</tr>
<tr>
<td>Inlay Material</td>
<td>None</td>
</tr>
<tr>
<td>Liner</td>
<td>None</td>
</tr>
<tr>
<td>Dimensional Tolerance</td>
<td>PCI MNL 116</td>
</tr>
<tr>
<td>Color and Surface Finish Tolerance</td>
<td>PCI MNL 116</td>
</tr>
</tbody>
</table>

*Sand Creek High School*

**Structural Plus**

<table>
<thead>
<tr>
<th>Concrete Color</th>
<th>Gray, Cream, Cinnamon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Finish</td>
<td>Light to medium sandblast finish</td>
</tr>
<tr>
<td>Insulation</td>
<td>Insulated or non-insulated</td>
</tr>
<tr>
<td>Loadbearing</td>
<td>Loadbearing or non-loadbearing</td>
</tr>
<tr>
<td>Inlay Material</td>
<td>Thin brick, block</td>
</tr>
<tr>
<td>Liner</td>
<td>Thin plastic liner</td>
</tr>
<tr>
<td>Dimensional Tolerance</td>
<td>PCI MNL 116</td>
</tr>
<tr>
<td>Color and Surface Finish Tolerance</td>
<td>PCI MNL 116</td>
</tr>
</tbody>
</table>

*Falcon High School*

**High End Architectural**

<table>
<thead>
<tr>
<th>Concrete Color</th>
<th>Any variety based on aggregate and pigment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Finish</td>
<td>Exposed Aggregate, sandblast, or acid-etch</td>
</tr>
<tr>
<td>Insulation</td>
<td>Insulated or non-insulated</td>
</tr>
<tr>
<td>Inlay Material</td>
<td>Stone, brick, etc.</td>
</tr>
<tr>
<td>Liner</td>
<td>Stone, brick, etc.</td>
</tr>
<tr>
<td>Loadbearing</td>
<td>Loadbearing or non-loadbearing</td>
</tr>
<tr>
<td>Dimensional Tolerance</td>
<td>PCI MNL 117</td>
</tr>
<tr>
<td>Color and Surface Finish Tolerance</td>
<td>PCI MNL 117</td>
</tr>
</tbody>
</table>

*Centralia High School*
Product Types

Shear Walls
Shear walls are also structural components and function as part of the lateral resistance system of a building, withstanding forces from wind, blast, or earthquake. They can be load bearing or non-load bearing and include both solid and window panels.

Structural panels can be loadbearing or non-loadbearing, but are manufactured to PCI MNL 116 tolerances. Loadbearing panels are structural components that transfer gravitational or vertical loads from other elements, and contribute to the strength and stability of a structure. Loadbearing elements include solid wall panels and composite and non-composite insulated panels, both of which can contain blockouts.

Column Cover
A column cover is a precast panel that covers one or more sides of a column.

Spandrels
Spandrels are used to fill the space between the top of a window or door in one story, and the sill of the window in the story above, or a parapet. As part of the exterior of a building, spandrel panels span the distance between wall panels that act as columns. These panels can be loadbearing or non-loadbearing.

Mullions
Mullions are structural components that vertically divide adjacent windows and/or doors. They are non-structural members and do not typically carry any dead load. They will generally only support wind load from the window/door unit, carrying it back to the building structure.

Truss Wall
EnCon also provides a metal truss wall. This is a medium performance product that can have an enhanced thermal efficiency over solid panel and panels with solid zones in through the insulation. Prestress steel serves as primary out-of-plane flexural reinforcing. A metal truss is used for reinforcing to produce composite shear transfer. The panels are designed as nearly 100% composite and thus require less concrete than a non-composite panel.

Truss Wall Advantages
- Composite action between wythes
- Lighter panel
- Edge to edge Insulation
- Minimal thermal bridging
- Minimal condensation regions
- Increased useable floor area
CarbonCast®
EnCon also provides CarbonCast®. This is a high performance product that can be thermally efficient with carbon fiber reinforcement. Prestress steel serves as primary out-of-plane flexural reinforcing. A resin-bonded, carbon-fiber grid is used for reinforcing to produce composite shear transfer. Since carbon is non-corrosive and non-thermally conductive, it eliminates the risk of internal deterioration and thermal loss. Since the panels are designed as 100% Composite, the panel requires less concrete, allowing the panels to be thinner and lighter weight. In addition, carbon can be used in the panel as transverse reinforcement, limiting the exposure and risk of corrosion.

CarbonCast® Advantages
- Composite action between wythes
- Thinner panel
- Lighter panel
- Edge to edge Insulation
- Minimal to no thermal bridging
- Minimal to no Condensation regions
- Thermally non-conductive wythe connections
- Increased useable floor area

Building System Variations

Envelope Systems
Architectural or non-loadbearing panels, often referred to as cladding or curtain walls, are the most common use of precast for building envelopes. They can be connected to any type of structural frame, including precast concrete, cast-in-place concrete, or steel. Architectural wall panels enclose a space and do not transfer vertical loads. They are typically designed to resist wind and seismic forces generated by their own weight. These precast pieces can include wall panels with or without windows, spandrels, mullions, and column covers.

Loadbearing Systems
Loadbearing panels are structural components that transfer gravitational or vertical loads from other elements and contribute to the strength and stability of a structure. Loadbearing elements include solid wall panels and composite and non-composite insulated panels, both of which can contain blockouts.
Lateral Force Resisting Systems, either Loadbearing or Non-Loadbearing

Shear walls are also structural components and function as part of the lateral resistance system of a building, withstanding forces from wind, blast, or earthquake. They can be loadbearing or non-loadbearing and include both solid and window panels.

Architectural Enhancement Panels

Architectural wall panels can be used to enhance the appearance of multiple construction applications. Integrated with steel, stone, masonry, or even cast-in-place concrete, highly detailed and ornate panels can dramatically improve the exterior of a structure. Personalized emblems, symbols, or logos add additional visual interest.

Product System Benefits

Precast concrete wall panel systems have demonstrated high value and versatility in every market. No other material or system combines as many benefits as a precast wall system.

Advantages of an EnCon Precast Wall Panel System

The EnCon Companies have delivered high quality precast concrete structures throughout the United States, and hold a strong commitment to partnership, customer care, and product excellence. From design support to product installation, they maintain a full service, integrated approach to delivery. As a result, clients receive the benefits and convenience of a single source supplier. This helps limit the project risk, as well as the number of subcontracts needed.

- **Design Flexibility**
  Precast wall panels can be produced in different sizes and depths, offering more design flexibility than other building systems where components may be limited to standard sizes and dimensions. Wall systems can accommodate nearly any design requirement, unusual lengths and widths, wide openings, and varying wall thicknesses. Specially constructed forms allow for the casting of curved or radiused panels to create uniquely shaped buildings. Panels can be cast with blockouts for windows, ductwork, and electrical, as well as entrance and egress openings. Panels can also be fabricated with pre-installed windows and stud nailers applied at the plant. The entire panel can then be lifted into place with minimum preparation.

- **Aesthetically Versatile Exteriors**
  Precast is an extremely adaptable material and offers unlimited aesthetic options. Exterior surfaces can be finished to complement the surrounding landscape as well as match the design of an existing structure. Precast easily accommodates the use of other building materials to create a cohesive appearance. Unique and intricate personalized designs can be cast into the panels using form liners. This makes it easy to add details such as reveal patterns, names, emblems, and symbols. Multi-color paint treatments can further highlight architectural
Precast concrete is naturally fire resistant while wall panel systems inhibit fire spread. This helps to ensure a blaze remains contained. Consequently, more time is provided for fire detection, evacuation, and suppression. Wall panels protect a building from the spread of adjacent fires and aid in compliance with special building code requirements. Foam blockouts are used to accommodate plumbing, mechanical, and electrical penetrations. This minimizes the amount of on-site core drilling and decreases job-site risk. Precast concrete’s structural stability provides resistance to damage caused by forces of nature that including seismic events. Wall panels can be treated and finished to create a room free of dust, particles, and other contaminants. These characteristics are of particular importance to healthcare and research facilities.
• **Moisture Resistance and Acoustical Control**
  Fabricated with a low water-to-cement ratio, highly dense precast concrete inhibits water penetration. Precast wall panels eliminate the need for drywall, supplying an added measure of protection against mold and mildew growth. Panels, especially insulated panels, diminish noise transmission for greater privacy and reduce sound transmission from outside a building to the inside.

• **Loadbearing vs Non-Loadbearing**
  The wall panel system can function as a structural loadbearing element as well as an architectural skin. This eliminates the need for floor and roof support framing. In many cases, spread footings are not necessary as a special built-in beam feature at the base of a panel enables it to span from caisson to caisson.

• **Fire Resistance**
  Fire ratings are based on a Rational Fire Design calculation method or an IBC Prescriptive Fire Rating method. A fire rating is dependent upon equivalent thickness, heat transmission thickness, cover on the prestressing strand, and end restraint. A standard 8 in.-thick Hollow Core system has a two hour fire rating. However, higher ratings (three or four hour) may be achieved with topping and gypsum board, or the application or a spray-on, fire-resistant material to the underside of the slab.

• **Blast Resistance**
  Insulated wall panels have been shown to hold superior strengths and energy absorption characteristics. This has been revealed through recent, full scale testing and blast simulations with end results that place precast wall systems high above traditional building methods.
**Precast vs. EIFS**

EnCon’s precast products stand up to other options within the industry as the premier building system.

The quality of EnCon’s Insulated Precast Concrete Products is unsurpassed as each piece is engineered against cracking under all service conditions. Their products are predominantly used for the exterior building envelope and are designed to prevent moisture infiltration into the structure, for the life of the structure. In addition, many of the products are prestressed, a reinforcing technique developed to increase span, capacity, and decrease the propensity for cracking. Because of the high standards placed on the precast design and manufacturing process, it is a more durable and efficient choice than its counterparts within the industry.

EIFS, an alternative to precast, is a finishing technique in which cementsitious top and base coats are applied to Expanded Polystyrene Insulation. The insulation is then applied directly to the structured sheathing either through glue or mechanical fasteners. Due to this method of construction, the finished exterior can be somewhat soft and susceptible to cracking, indentations, and penetrations, damaging the finished surface. In turn, water infiltration and mold become common problems.

Another form of EIFS consists of a pre-manufactured panel of insulation with a structural metal frame coated in a thin base and finish coat. Although this is a similar concept to that of a precast panel, the EIFS Panel system is typically not engineered for rigidity or to prevent surface cracks. The latest EIFS system designs have included a vapor barrier between the insulation and sheathing. Although this provides better moisture control in the field, portions of the insulation and mechanical fasteners still penetrate this membrane and create a potential source of moisture intrusion.
Typical Design and Delivery Process

The flow chart below highlights the general process from project initiation to completion. The tables contain representative project schedules and demonstrate the primary scheduling benefit of precast concrete construction. There are a number of interrelated yet overlapping activities that allow faster turnaround and quicker job completion.
Embedded Brick
When thin brick is cast into concrete wall panels, this produces embedded brick; a material that can be implemented to create an entire structure as well as decorative elements on a building façade.

Advantages of Embedded Brick over Traditional Masonry
Along with aesthetic appeal and low cost, there are numerous benefits surrounding brick-embedded concrete over conventional masonry. These include no lintels, flashing, weep cavities, air space, waterproofing, or efflorescence. In addition, there is no time-consuming, on-site construction of masonry products.

Other Benefits Include:
- Pleasing traditional appearance of brick, while leveraging the strength, speed, and economy of precast concrete
- Due to low absorption rates, thin brick is rated not to effloresce
- Inlaid thin brick walls required no periodic sealing or tuck-pointing repair
- Thin brick precast conforms to PCI standards for brick embedded in precast

Split-face Inlay
For those seeking a brick finish that is both visually appealing and economical, EnCon offers thin brick wall panels that come with various options including a range of finishes, sizes, and shapes of brick. There are also pieces that are used to create architectural corners, arches, soldier courses, and other traditional brick patterns.

**Brick Patterns**

- **Running Bond**
- **Flemish Bond**
- **Soldier Course**
- **Stack Bond**
- **English Bond**

- **Arches**
- **Numerous Bonding Patterns**
- **Ornate Corbels**

**Brick Sizes**

- **Norman Brick**
- **Modular Brick**
- **Utility Brick**

- **Brick Corner**
- **Edge Cap**
Requirements of Embedded Brick Units

- Have dimensional tolerances +0 in. -1/16 in. on all units 8 in. or under; +0 in. -3/32 in. on all units larger than 8 in.
- Have a 24-hour cold water absorption rate nor more than 6% when tested per ASTM C67
- Maintain a consistent plane of +0 in. -1/16 in. (+0 -1.6 mm)
  - All Shapes shall confirm to the architect’s specified angle with a tolerance of ±1” (Measured per ASTM C67)
- Maintain an out-of-square dimension ±1/16 in. (±1.6 mm). Measure per ASTM C67
- Rate “not effloresced” per ASTM C67
- Exhibit minimum tensile bond strength or 150 psi (1.0MPA) when tested per ASTM C482
- Exhibit no detectable deterioration (spalling, cracking, chafing, etc.) when tested in accordance with ASTM C666 Method B, modified to withstand 300 cycles
- Be shown to demonstrate minimum of modules of rupture or 250 psi per (1.7MPA) when tested in accordance to ASTM C67
- Rate “not affected” by chemical attack when tested per ASTM C650

Considerations when Choosing Embedded Brick Wall Panels

A number of things should be considered during the design and detailing of each specific project. These include brick and panel sizes and shapes, loadbearing conditions, panel openings, and brick panel tolerances.

- Modular brick sizes should be used when determining panel widths, heights, and openings.
- The use of concrete banding at the edges of precast panels and openings should be considered. Banding can minimize the cost of having to cut brick to odd sizes, or the need to build panels to sizes that only fit the module of the brick. Banding helps with this by creating a solid concrete face along a panel edge to which the brick is set against. It can also be used to differentiate floor locations, panel joints, and other architectural effects. Banding also permits panel heights, widths, and opening sizes to be nearly any dimension, independent of brick coursing.
- It is vital that masonry coursing be continuous from panel to panel, both vertically and horizontally. This is important when concrete banding is not used at the edge of panels.
- When a formliner pattern that is rectilinear or modular is used, aligning the brick pattern with the concrete pattern should be considered. This will help to align openings in the different patterns, as well as create a well-ordered, visually pleasing façade.
- When using concrete banding at jambs of window or door openings, ¾ in. is the minimum recommended concrete jamb band width.
- Precast header and sill heights and lengths should be placed symmetrically within the brick modular pattern.
- Corner brick can be used for both panel ends and brick returns at window and door heads and jambs. Opening sizes should fit symmetrically within the brick module. Please note that creating opening sizes to fit the brick module may require ordering custom size windows.
- Although it is more costly than using standard modular sizes, cutting brick to special sizes at edges of panels and panel openings can be achieved if necessary. If a special size opening is required, the opening should be located so that the brick is cut equally on either side of the opening.
- Industry standard manufacturing tolerances of both precast panels should be considered during the design of each project.
- Tolerances that should be taken into consideration include floor-to-floor heights, panel heights, brick coursing, joint sizes, loadbearing conditions, and joint details.
Frequently Asked Questions
The following section relates to typical questions regarding wall panels, specific terms and properties, and the manufacturing and erection process.

What is a Sandwich Panel?
Insulated wall panels are also referred to as sandwich panels. An inner core of insulation is surrounded or sandwiched between two precast concrete layers or wythes.

What is a Wythe?
A wythe is a layer within, or on the surface of a sandwich panel or insulated wall Panel.

What is a Wythe Tie?
A Wythe Tie is the name of the material that connects two or more layers of concrete (wythes) together in an insulated wall panel.

What are R-values?
R-value, or Thermal Resistance, is one measurement of the thermal performance of a system. There are two types of R-values discussed in the construction industry. These are Steady State R-values and Effective R-values. The Steady State R-value is traditionally based on the measured, one dimensional resistances of the construction materials that comprise the system for a given assembly of materials.

Although there are a number of factors that influence R-values, the Effective R-value is primarily a combination of Steady State R-value and Thermal Mass.

There are no standard methods of calculating Effective R-values. One method, however, is the development of a multiplier for mass wall systems or the Dynamic Benefit for Massive Systems (DBMS). This multiplier relates the Steady State R-values to Effective R-values using a standardized lightweight wood frame structure as a base line. The standardized home is modeled with each wall system in order to determine the total building energy load for a given duration and climate.

The Steady State R-value of the exterior wall system for the standardized lightweight wood framed home is then manipulated until the energy loads are the same as the mass wall system in question. The ratio of the Steady State R-value of the modified wood structure to the Steady State R-value of the mass wall system is equal to the DBMS. One benefit of this approach is that it allows for the evaluation of similar mass wall construction techniques, wall assemblies of sandwiched insulation, and wall assemblies of sandwiched concrete.

The industry standard for thermal performance comparison should be a comparison of Steady State R-values. This method is an excellent predictor of R-values with variations in material thickness, solid zones, or thermal shorts. It has been adopted by the Precast and Prestressed Concrete Institute Design Handbook as the preferred method of calculating R-values for complex assemblies.