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- Total Cost of Ownership
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Use of This Manual

This Oldcastle Precast Wall Panel System manual has been designed to assist Owners, Developers, Architects, Engineers, Contractors, and others interested in learning the benefits and uses of precast wall panels for a variety of applications. Use of the information in this manual will be helpful as reference for the design of buildings; however, every project must be designed to meet local site conditions and other local requirements.

The drawings and other information herein are illustrative only. Neither Equus Design Group, Inc. nor Oldcastle Precast, Inc. makes any representations as to the suitability of the product applications for any specific design or structure, and both disclaim any responsibility for techniques of application, correctness, interpretations, design methods, modifications or misapplications of the information contained herein.

Since no specific project or overall engineering responsibility is implied with the use of this manual and the information contained within, neither Equus Design Group, Inc., nor Oldcastle Precast, Inc., will be responsible for the failure of any designer to properly design nor any contractor to properly construct any building.

For more information, visit us at www.oldcastlesystems.com
THE NATION’S PRECAST LEADER

Oldcastle Precast is the largest provider of precast concrete engineered solutions in North America. Oldcastle continues to improve its dominant market position with over 80 locations nationwide and 5,000 dedicated employees. Owners, Architects, Engineers, Contractors, and Distributors rely on Oldcastle Precast for best-in-class in construction products. Our products service the entire construction spectrum, including building systems, electrical, transportation, communications, CATV, drainage, and environmental markets. Oldcastle Precast Building Systems serves the Mid-Atlantic, Northeast and New England Regions and is Oldcastle’s leader in Precast Wall Panel Systems.

ENVIRONMENTAL LEADERSHIP

The Leadership in Energy and Environmental Design (LEED®) Green Building Rating System™ has gained rapid acceptance since its inception in 2000. Oldcastle’s system of Precast Wall Panels is leading the precast industry in ways to make greener, more sustainable precast products available to Owners and Designers. Oldcastle’s carbon fiber reinforced, highly insulated, thermally broken, watertight, energy efficient wall panels, built with local materials and recycled content, provide numerous cost benefits to Owners and help both Owners and Designers in their mission for LEED certification.

TECHNOLOGICAL LEADERSHIP

Oldcastle is a national leader of innovative new technologies to support advancement in the design and manufacturing of precast concrete wall panels. Since insulated wall panel technology arrived in the United States five decades ago, Oldcastle has been steadily advancing improvements including a major leap forward with the introduction of carbon fiber grid reinforcing, a new method of providing non-corrosive, super-insulated, lighter-weight precast wall panels. As a founding member of AltusGroup, Inc., the nation’s first partnership of precast concrete manufacturers dedicated to carbon fiber technology, Oldcastle continues to maintain its leadership role in the industry.
TCO - IN THE OWNER'S INTEREST

Total Cost of Ownership is not only the cost of purchase, but all costs related to the use and maintenance of an asset.

Owners, Developers, Designers, and Builders carefully measure all associated costs over the life of a building when selecting building components. The exterior walls of a building are generally among the most important building components that determine Total Cost of Ownership.

VALUE DRIVEN BENEFITS

Total Cost of Ownership of the Oldcastle Wall Panel System includes important, cost-saving, value driven benefits including:

- Partnering Advantages
- Product Quality
- Energy Cost Savings
- Speed of Construction
- Durability
- Reduced Maintenance
- Reduced Insurance Premiums
- Fire Safety
- Long Life
- Security
- Strength
- Reduced Construction Risk
- Sanitation
- Versatility
- Human Comfort
- Moisture Resistance
- Sustainable Design

PARTNERING ADVANTAGES

Oldcastle recommends the creation of partnerships with Owners from design concept through building completion. By working closely with the owner’s team early in the design phases, Oldcastle can provide timely design assistance to ensure that the attributes of Total Cost of Ownership are maximized to the Owner’s benefit. A clear example of the benefit of early partnering is the creation of the most design effective sizes and shapes for precast components in order to minimize the costs associated with casting, transporting and erecting pieces.
PRODUCT QUALITY

Oldcastle’s system of design and production for precast wall panels includes rigorous procedures leading to the highest quality products at the lowest possible cost.

Plant vs. Site Construction
Factory controlled conditions, including weather enclosure, temperature control, and computerized factory batching, provide the type of product quality control that is not available for on-site construction, except at high cost.

PCI Certified Production
All Oldcastle Precast Building Systems manufacturing facilities are certified by the most rigorous standards in the industry, those of the Precast/Prestressed Concrete Institute, PCI.

Vendor Certifications
All vendor’s associated with Oldcastle’s products are required to follow stringent industry certification and testing standards.

Independent Plant Audits
As part of its quality control procedures, all Oldcastle plants receive semi-annual, unannounced, extensive quality audits by an independent engineering firm.

Engineering Support
Oldcastle provides full engineering design and shop drawing support to coordinate with other trades for high-quality project integration.

Design Services
Oldcastle’s staff works closely with owners and architects throughout the design and building construction process providing expert design assistance, project management, budget estimating and erection services.

ENERGY COST SAVINGS

Oldcastle’s fully insulated precast wall panel system is the nation’s leading energy-efficient building enclosure system creating maximum energy cost savings.

Maximum Insulation Benefit
Oldcastle provides high R-Value insulation thicknesses to meet the most demanding design specifications.

No Thermal Bridging
Using the CarbonCast® shear grid system, Oldcastle creates precast panels with insulation to separate the outer and inner wythes of concrete at the most demanding locations such as door and window openings and roof and foundation connections.

The Thermal Mass Benefit
Concrete has an inherent mass that conveniently absorbs and stores heat from both the sun and interior ambient heat. This helps to avoid large daily temperature fluctuations thereby reducing HVAC loads and lowering energy consumption. The result is lower heating and cooling costs.

Minimum Infiltration
Precast panels create large, uniform surface areas of the building exterior. Unlike masonry, metal or other building systems, there are very few joints in a precast wall system, thereby minimizing air and vapor infiltration.

Recycled Product
The recycled material, use of local material in the concrete mix, and very little on-site waste, contribute to its growing reputation as the green building product of choice.

SPEED OF CONSTRUCTION

Construction time and costs are both reduced significantly with the use of Oldcastle’s precast wall panel system.

Fast-Track Sequencing
Panels can be cast and stored at the Oldcastle plant while the permitting process is underway and while site and foundation work is proceeding.

Year-Round Construction
Despite harsh summer or winter weather at the job site, Oldcastle’s factory weather-controlled conditions allow for continuous production. Similarly, shipment and erection of panels is rarely slowed due to weather constraints.

Fast Erection
Panels are erected quickly enabling the contractor to enclose the building to speed interior work and enable fast occupancy for a quicker income stream. It is not unusual to install 220 LF of perimeter wall in a day with heights exceeding 40 feet.

Reduced Construction Costs
Factors that reduce construction costs, from the use of precast wall panels include: reduced temporary heating and general conditions to facilitate on-site construction; faster construction period resulting in reduced construction and construction financing costs; and, avoidance of delays due to unanticipated bad weather that can plague the schedule and costs of on-site construction.

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DURABILITY

Precast concrete is built to last. With concrete mixes routinely in the 5,000 to 6,000 psi range, the wall panels can withstand abuse, both on the exterior and interior, unlike any other product.

Reduced Maintenance Costs
The weather and impact-resistant characteristics of precast concrete result in reduced operating and maintenance costs, particularly for heavy-duty facilities such as manufacturing and warehouse structures.

Reduced Replacement Costs
Unlike many of the products in a building that require replacement over time due to break-downs and/or required updates, the precast panels will continue to gain strength, resulting in long-term cost savings and sustained building value.

PROPERTY PROTECTION

Precast concrete provides owners a building enclosure that protects the Owner’s valuable property investments. At the same time, precast concrete buildings meet the most stringent requirements of the actuaries who set insurance rates based on a number of fire, security and weather factors.

Fire Resistance
Precast concrete's inherent, inorganic, high fire-resistance properties help to reduce both the cost of fire protection systems and insurance rates.

Security
By selecting a virtually impenetrable precast wall panel system, building owners reduce the risk of security breaches that can lead to loss of property and high insurance premiums.

Weather Resistance
Harsh weather conditions are least likely to adversely affect an Oldcastle enclosed building compared to other exterior facades, a fact that creates more favorable rates in the insurance industry for buildings built of concrete.

Resistance to the Elements
Concrete wall panels are far more resistant to the elements of nature, such as moisture, mold, rot, termites, rodents, and even fire and hurricanes than any other building enclosure system.

Moisture Control
One of the most important benefits of a continuously insulated precast sandwich panel is its inherent ability to control moisture. The assembly of an 8” concrete panel (2-1/2” concrete, 3-1/2” eps or xps insulation, 2” of concrete) can produce an M (permeance) of < 1.0, qualifying it as a vapor retarder and an air barrier. The continuously insulated wall system also manages surface moisture by controlling condensation occurrences on both the exterior and interior faces.

Furthermore, precast concrete is one of the best building materials available to inhibit or prevent mold growth. Concrete is non-organic and mold requires moist organic nutrients to grow. Also, the low permeability of precast concrete inhibits the penetration of mold spores from the exterior.
WALL PANEL APPLICATIONS
WALL PANEL APPLICATIONS

Most medium to large scale projects benefit from the product quality, speed of construction, energy cost savings, reduced maintenance, and insurance cost savings offered by Oldcastle’s precast wall panels.

The benefits of using Oldcastle’s Precast Wall Panel System have an increasing number of owners and developers applying the system to a wide variety of building types:

WP.2 INDUSTRIAL
- DISTRIBUTION CENTERS
- WAREHOUSE FACILITIES
- MANUFACTURING
- FOOD PROCESSING
- DATA CENTERS
- INDUSTRIAL PARKS

WP.6 RETAIL
- SUPER CENTERS
- SUPERMARKETS
- DEALERSHIPS
- SHOPPING CENTERS
- RETAIL OUTLETS

WP.8 SPECIAL USES
- ENTERTAINMENT
- CULTURAL BUILDINGS
- PRODUCTION STUDIOS
- ATHLETIC FACILITIES
- TRANSPORTATION

WP.10 INSTITUTIONAL
- EDUCATIONAL
- CORRECTIONAL
Oldcastle’s Wall Panel System has increasingly become the product of choice for industrial building owners, developers, contractors and designers.

American manufacturers and distributors trend toward larger and taller facilities, flexibility for expansion, high energy efficiency, rapid delivery, durability, and corporate aesthetics make Oldcastle wall panels the most desirable building product for industrial related applications.

The wide array of building uses and types particularly well-suited for Oldcastle’s complete system of wall panel design and production include:

- DISTRIBUTION CENTERS
- WAREHOUSE FACILITIES
- MANUFACTURING
- FOOD PROCESSING
- DATA CENTERS
TRENDS IN INDUSTRIAL BUILDINGS

The National Association of Industrial and Office Properties (NAIOP) reports that major trends in American manufacturing and distribution include consolidation and development of major manufacturing and distribution operations (fewer locations and larger facilities); the need for flexibility (to accommodate growth and change); and, an increased awareness of energy and environmental issues.

The trend toward larger “megabox” projects, according to NAIOP is both in the “build-to-suit” and speculative development markets. Among the design features include trends for higher ceilings, larger building footprints, and more cross-docking operations to increase speed-to-market.

Oldcastle’s Precast Wall Panel System is designed to meet the trends of the industry through a variety of innovative measures.

Larger and Taller Facilities

Taller interior ceiling heights require taller exterior wall heights. Oldcastle’s technological solutions for a system of lighter-weight, yet stronger and more energy efficient, precast panels allows for the production, shipping and erection of individual panels up to fifty feet tall.

As the nation’s leading precast manufacturer, Oldcastle has the plant and personnel capacity to meet the needs of owners and builders requiring high volume production for large projects with demanding construction schedules.

Panels are erected full height, independent of other work on site. The result is unparalleled speed of construction, and completion dates impossible with other wall systems.

Precast wall systems also provide maximum space utilization when using load-bearing panels without perimeter support columns. And, precast panels allow wider openings without incurring any premium costs or conventional framing.

Flexibility for Future Expansion

As businesses continue to develop, the need to remain flexible enough to accommodate added growth is a key element of most business plans.

Adaptable System of Components

To meet the need for flexible building expansion, Oldcastle has created a system of precast wall panel products that can be modified for building expansion and reorganization. The system of non-load bearing panels is designed for relatively easy disconnection and movement to open sides of a building for expansion. And, Oldcastle’s creative ability to design whole buildings with the fewest number of panels and parts, makes adaptation even easier.

Aesthetic Considerations of Expansion

Because Oldcastle’s panels are produced under quality controlled factory conditions, new additional panels can be manufactured to closely match and/or complement the textures and colors of the original panels.
Energy and Environmental Issues

Oldcastle's thermally broken, highly insulated wall panels are the most energy efficient precast products available on the market.

Concrete – The Earth's Natural Resource

Oldcastle’s Precast Wall Panel System consists of an environmentally sound material, produced from sustainable resources with energy resourceful techniques:

- Concrete is produced from natural materials.
- No toxic substances are produced in its production or use.
- The production energy consumption of concrete is quite small.
- The dense, impervious nature of concrete saves energy year-round by reducing temperature swings.
- And, after its original purpose has been served, concrete can be crushed and recycled back into the environment.

Furthermore, the recycled material in the concrete mix and very little on-site waste contribute to its growing reputation as the green building product of choice.

Thermal Breaks

Among the largest contributors to building energy loss are the thermal bridges where the insulation in wall panels is not continuous throughout the panel, particularly at edges, openings and wythe connectors.

However, Oldcastle’s Precast Wall Panel System can carry the insulation completely through to the edges of the panels at window and door openings, as well as at roof and foundation intersections, creating a totally continuous and highly energy-efficient envelope.

Furthermore, with the use of low-conductivity carbon fiber shear grid to connect the outer and inner layers of concrete sandwiching the insulation, there is added assurance of maintaining the most energy efficient panel design available.

High R-Values

Within Oldcastle’s system of carbon fiber reinforced sandwich panels are thick layers of rigid insulation with the highest R-values attainable in precast wall design. Oldcastle offers R-values up to R-30 and even higher, to meet the needs of the most energy conscious owners and designers.

Cross Docking

An increasingly prevalent system of rapid movement of materials from distribution facilities to their next destination is the use of a greater number of shipping docks and staging areas. This practice, referred to as cross docking, helps to streamline the flow of product from receiving to shipping with a minimum of handling and storage in between.

Oldcastle’s wall panel system is adaptable to a variety of dock types, heights and widths to suit the owner’s needs for the most efficient and heavy-duty dock designs. The precast concrete panels are designed to withstand the abuse and high intensity traffic associated with cross-dock operations; and, Oldcastle’s system accepts the dock levelers, seals, shelters, doors, and accessories of the nation’s leading manufacturers.
Durable and Maintainable

Both on the inside and the outside of the building, Oldcastle's precast concrete wall panels provide a hardened finish that reduces the effect of impact if hit by vehicles or heavy equipment. At the same time, concrete wall panels are far more resistant to the elements of nature, such as moisture, mold, rot, termites, rodents, and even fire and hurricanes, than any other building enclosure system. Oldcastle’s precast wall panels are durable and easily maintainable ensuring long-lasting attractiveness and desirability to future tenants and owners.

In the food industry, precast wall systems offer processing plants economical, effective ways to meet government standards, especially those governing a clean, germ-free environment.

Aesthetics and Corporate Identity

Whether designing in a style to complement existing buildings, or in a unique style for stand-alone facilities, or as sets of buildings in an industrial park, Oldcastle has the precast kit of parts and palette of finishes, textures and colors to suit the needs of owners and architects.

Corporate Identity

Oldcastle Precast wall panels are extremely versatile in providing unique and custom ways to help your building stand out and be recognized, if desired. Wall panels can be created in a wide variety of shapes and configurations; and with the use of special formliners, virtually any design, corporate logo or text imaginable can be incorporated into the wall panels. The precast wall panels can also be used to support canopies, full glazing, and other configurations at the building entry or other locations.

Finishes

Oldcastle offers several types of panels in a variety of finishes. From our formliner finishes to reveals and custom mix designs, we can give any wall panel facility a distinctive exterior reflecting the desire of the owner. For less public facades, we can also provide economic finishes to give all of the benefits of precast, but at less cost.
In the modern era of "Big-Box" stores, "Supercenters," and Wholesale Warehouse Stores, with large footprints and tall spaces, Oldcastle’s precast wall panel products are particularly ideal.

By providing the opportunity to eliminate perimeter columns and beams, Oldcastle wall panels allow for easy rack and storage along exterior walls, increasing interior space and layout flexibility and increased safety for fork lift operation, as well as other benefits.

Oldcastle’s Precast Wall Panel System provides Owner’s with advantages for retail projects such as:

- SUPER CENTERS
- WHOLESALe WAREHOUSE STORES
- SUPERMARKETS
- DEALERSHIPS
- SHOPPING CENTERS
ADVANTAGES FOR RETAIL BUILDINGS

Among the advantages of precast wall panels for retail buildings include:

- Rapid Production and Erection
- Eliminate Perimeter Columns and Beams
- Energy-efficient Insulated Design
- Interior Durability
- Flexible, Wide Open Interior Layouts
- Added Security
- Reduced Maintenance Costs
- Appealing Exterior Aesthetics
- Expansion Capability
- Systemized Loading Dock Design
- Clean Germ-Resistant Environments
- Eliminate Interior Girt Framing
- Reduced Exterior Noise Transmission
- Increased Safety for Fork Lift Operation
SPECIAL USE FACILITIES

With the ability to easily provide large flexible open spaces with high ceilings and excellent acoustical separation, the Oldcastle wall panel system is ideal for many unique and special uses.

Among the special use facilities that Oldcastle’s Precast Wall Panel System is particularly suited includes:

- ENTERTAINMENT/THEATERS
- CULTURAL BUILDINGS
- PRODUCTION STUDIOS
- ATHLETIC FACILITIES
- TRANSPORTATION
CONSIDERATIONS FOR SPECIAL USE FACILITIES

Movie theaters, skating rinks, athletic clubs, and other recreation facilities are excellent opportunities to use the advantages of Oldcastle’s Precast Wall Panel System and its related components.

The **high performance, low maintenance, insulation, and durability** of precast concrete make it ideal for both public and private facilities.

The **design flexibility and versatility** of precast concrete can give your amusement/recreation project both a functional interior space as well as a pleasing exterior, whether to blend into an existing neighborhood or stand out as a bold statement.

The **ease of maintenance and durability** of precast concrete also make it an ideal material for reducing long term costs. Heavy use and high traffic can create chronic maintenance issues for other systems, but precast concrete’s **durability** is the ticket for a **cost-effective structure**, not only at construction, but also long into the project’s life.

The long-span and high-strength opportunities with precast also help in the design of **wide open spaces** with unobstructed views; and the **sound and vibration attenuation** characteristics add to the enjoyment of the facility’s users.
INSTITUTIONAL

Institutional facilities, typically publicly funded, are highly visible buildings that, due to their inherent high use and high traffic, are prone to maintenance and durability issues.

With many municipalities struggling with budget shortfalls, overcrowding and out-of-date buildings, the Oldcastle Precast Wall Panel System, with its competitive cost, speed of erection, inherent durability, ease of maintenance and sound attenuation, is ideal for institutional uses including:

- **EDUCATIONAL**
  - CLASSROOMS
  - LABORATORIES
  - GYMNASIUMS
  - MULTI-USE
  - CAFETERIAS
  - ASSEMBLY HALLS

- **CORRECTIONAL**
  - PROGRAMS
  - WAREHOUSE
  - RECREATION
  - HOUSING
CONSIDERATIONS FOR INSTITUTIONAL FACILITIES

EDUCATIONAL FACILITIES

The sound and vibration attenuation characteristics of precast concrete make wall panels ideal for educational uses by reducing outside noise and distractions and helping to provide a quality learning environment for both students and faculty. The low maintenance and durability of concrete also helps reduce long term costs and maintenance issues. With the ability to provide long spans and high ceilings, the Oldcastle wall panel system is advantageous for educational, classrooms, laboratories, gymnasiums and multi-use spaces.

CORRECTIONAL FACILITIES

Safety and security for correctional officers, civilian employees and inmates is paramount inside correctional facilities. The Oldcastle wall panel system, with the ability to create large, wide-open spaces with unobstructed views for visibility, security and safety is ideal for program spaces, warehousing, recreation and housing areas within correctional facilities. The strength, durability and ease of maintenance of precast concrete also assists in reducing facility maintenance and budget costs.
WALL PANEL DESIGN GUIDE
WALL PANEL DESIGN GUIDE

The Oldcastle Precast Wall Panel System is the nation’s most advanced complete wall panel system. With its flagship product, the CarbonCast® High Performance Insulated Wall Panel and its industry breakthrough design features, Oldcastle has built upon its reputation as the nation’s preeminent precast leader.

This section of the manual provides information and guidelines for Owners, Designers and Contractors about the Oldcastle Precast Wall Panel System, including:

DG.1 WALL PANEL TYPES
DG.4 PANEL SIZES AND TOLERANCES
DG.8 MANUFACTURING, TRANSPORTATION AND ERECTION
DG.12 LOADING DOCKS
DG.14 FACADE TREATMENT OPTIONS
Oldcastle produces precast concrete wall panel types to suit the specific needs of each owner and project. Wall panels come in a variety of forms and functions, including load and non-load bearing, insulated and non-insulated, and composite and non-composite panels.

The two most common types of wall panels made by Oldcastle are the **CarbonCast® Panel** and the **Solid Panel**. Other wall panel types, such as flat slab sandwich panels, are available for special applications.
CarbonCast® Panel

The CarbonCast® High Performance Insulated Wall Panel is the first major innovation in precast concrete in more than half a century, since the development of prestressed precast concrete.

CarbonCast® adds even greater long-term durability, lighter weight, finer finishes, improved insulating properties and greater sustainability to the already long list of precast benefits.

CarbonCast® High Performance Insulated Wall Panels use the patented C-GRID™ epoxy-coated carbon fiber trusses for shear transfer to achieve a fully structurally composite panel. The C-GRID is over four times stronger and less thermally conductive than conventional wythe connectors.

The results are:

- **Energy Efficient and Lighter Weight**
  The exceptional bonding and strength of C-GRID trusses allow the use of less concrete and more insulating foam to reduce energy use and lighten panels.

- **Superior at Load-Bearing**
  CarbonCast® vertical panels are available for both loadbearing and non-load bearing applications, and can be manufactured in thicknesses 8” to 12”, with widths up to 13’-6” and heights of 50’ or more.

- **Greener**
  Less energy is used in the fabrication and delivery of the CarbonCast® panels, and the enhanced thermal efficiency of the highly insulated panels results in reduced energy expenditures.
SOLID PANEL

Solid panels are uninsulated flat slab concrete panels of uniform thickness, typically 6 to 8-inches, which are cast on flat forming beds within controlled factory conditions. Non-load bearing conditions typically require no more than a 6-inch thickness, whereas load-bearing conditions usually require 8-inches. Solid panels can be made in a wide variety of shapes and configurations.

Solid panels are typically used for special applications such as:

- Interior bearing walls and fire walls without the need for insulation.
- Institutional buildings requiring unique, deep thickness for security reasons, e.g. correctional and other high-security applications.
- Residential and commercial applications where the owner and designer seek to insulate walls separately and apply specialty interior finishes.

FLAT SLAB SANDWICH PANEL

Available in both composite and non-composite panels, the flat slab insulated sandwich panel has two layers of concrete with rigid insulation sandwiched in between.

Cast in a form on a flat bed, these panels can be made in a wide variety of shapes and configurations.

SOLID PANELS are typically used as interior partition walls and can be either load or non-load bearing. These panels can weigh from 75 to 100 psf.

NON-COMPOSITE/NON-LOAD BEARING PANELS are typically used for components and cladding. Designed to resist only their self weight and wind loads, these non-structural panels weigh approximately 75 psf.

NON-COMPOSITE/LOAD BEARING PANELS have a thicker interior wythe which is used to support the structural frame. The exterior face of the panel is an architectural and non-structural concrete wythe. These panels weigh from 110 to 120 psf.

COMPOSITE/LOAD AND NON-LOAD BEARING PANELS are structural panels that have both concrete wythes tied together to act as one with low-thermally conductive carbon trusses. These structural panels are lighter and thinner than others and weigh approximately 75 psf.

WALL PANEL DEFINITIONS

Sandwich Panels are concrete wall panels that have two layers of concrete separated by a layer of rigid insulation. They can be broken down even further into Composite and Non-composite sandwich wall panels.

Composite panels are fabricated so that the two layers of concrete, with rigid insulation between, act together as a single unit to resist applied loads by providing a shear transfer between the concrete wythes.

Non-Composite panels are fabricated with two concrete wythes acting independent of each other, with rigid insulation between, typically with a non-structural exterior wythe and a thicker structural interior wythe.

Wythe connectors are used to tie two concrete wythes together. They penetrate the rigid insulation and are embedded in each concrete wythe. There is a wide range of connector sizes, shapes and materials based on the structural requirements of the wall panel. However, the CarbonCast® C-Grid is the most economical thermally and structurally efficient connector currently available.

Insulation used in concrete wall panels is of the cellular (rigid) type because it provides material properties that are most compatible with concrete. Cellular insulation comes in two main types, thermoplastic and thermosetting.
WALL PANEL SIZES AND TOLERANCES

Oldcastle Precast Wall Panels are produced in a variety of sizes to meet the needs of most clients and building types. Oldcastle's team of specialists provide valuable expertise for selecting cost-effective methods of creating panel sizes that take into account many variables - plant capacity, shipping constraints, crane considerations, and efficient building design. Owners, designers and contractors also need to be aware of tolerance standards for the different phases of wall panel construction, from fabrication to erection to interfacing with other building materials.
WALL PANEL SIZES

Oldcastle precast wall panel sizes are a function of crane and truck limitations as well as manufacturing considerations. With effective planning during the early design phases of a building, economic advantages can be obtained.

Crane and Truck Considerations

With an average panel weight of 75 lb/sf, the maximum precast wall panel size is largely determined by plant and site crane capacities as well as the capacity of the transporting truck and weight limit restrictions of various states’ roadways.

Oldcastle typically transports wall panels with lowboy or drop deck truck trailers. Depending on local transportation regulations, most panels 12 feet wide by 40 feet long can be shipped without special permits. However, panels up to 13’-6” wide by 50 feet long, and even longer if necessary, can be transported on tilt frame trailers, usually requiring special permits and/or escorts.

Manufacturing Considerations

The cost of precast concrete wall panels is determined primarily by piece size and piece repetition. The labor cost of setting up forms for the production of concrete panels can be expensive if used for a single pour; however, with re-use of the same form for repetitive panels, the panels become increasingly cost-effective. This is particularly true for panels with openings, reveals, and other special surface features. The more repetition, the less the cost of the panel.

Early Planning With Oldcastle

Close collaboration of the owner and designer with Oldcastle’s talented group of architects and engineers to determine the most effective manner to achieve overall design goals can lead to significant cost savings.

Economy Rules Of Thumb

Maximizing panel sizes creates fewer pieces and results in:
• Fewer setups
• Fewer castings
• Fewer crane picks (plant and site)

Repetition of panel sizes, openings and details saves costly form setups and changes.
TOLERANCES

Tolerance refers to the permissible limit of dimensional variation in building construction. The tolerances of precast concrete wall panels in building construction refer to the set of dimension variations that are reasonable for fabrication, erection, joints, and interface with other building materials.

It is important for the owner, designer, contractor, and precast manufacturer to have a clear understanding of the expectations of tolerances.

The Precast/Prestressed Concrete Institute (PCI) establishes tolerance standards that are widely accepted in the building industry. The groups of tolerances established by PCI for precast design are: product tolerances; erection tolerances; and interfacing tolerances.

**Product Tolerances**
Product tolerances refer to the dimensions of individual precast components, including length, width, thickness, shape, and size and location of openings. Refer to PCI Manual 116 for Product Tolerances.

**Erection Tolerances**
Erection tolerances refer to the placement of the individual precast products in relationship to the adjacent construction. Unlike product tolerances that are set by the ability to produce in a factory-controlled environment, erection tolerances involve the general contractor, other subcontractors and the precast erector. Refer to PCI Manual 127 for Erection Tolerances.

**Interfacing Tolerances**
Interfacing tolerances are those set for the joining of precast components to adjacent precast components and/or other building materials. Examples include window and door openings and joints.

**Finish Tolerances**
During the design phase it is recommended that the owner request a 12” square sample of the selected color, texture and finish for final approval. Prior to initial panel fabrication it is recommended that a 48”x48” or 96”x96” panel mock-up be created to establish a minimum acceptable standard for the panel color, texture and finish.
**Panel Edge Design**

Acceptable production and erection tolerances allow for some planar differences of panels resulting in potential planar misalignments. Though direct butt joints are available and can be provided, it is recommended that chamfers be used at the edges of panels. Chamfers help alleviate possible uneven shadow lines of joints, help reduce damage that may be caused during storage, transportation and erection, as well as setting the sealant away from sun and weather exposure.

**Joint Design**

The most important performance mission of precast concrete wall panels is to keep rain and other weather elements from penetrating the building. A key advantage of precast concrete over other exterior wall systems is its relative impermeability – water does not penetrate precast concrete. Nevertheless, the joints between panels are subject to weather penetration and it is essential that in the production and erection of precast panels that joint widths meet the exacting requirements for satisfactory application of sealant materials.

**Typical Joint Design**

Typical panel joints are 5/8” - 3/4” wide on the exterior and 1/2” on the interior. The typical joint between precast panels has a single line of sealant for weatherproofing and a closed-cell insulating backer rod to set the depth and shape of the sealant. Exterior sealant selection should be based on the ability to maintain elastic properties, weather performance and resistance to harmful UV rays.

**Sealant Depth**

Equal in importance to the width of the sealant joint is the depth. For joints designed for ¾ to 1 inch wide, the depth should be equal to one half the width. In plan view the shape of the sealant should concave, similar to an hourglass. The backer rod provides the interior concave shape; the sealant applicator provides the tooled concave shape at the exterior. It is essential to avoid depths too shallow or too deep to avoid premature debonding of the sealant to the concrete surfaces.

**Expansion Joints**

Where considerable movement is expected between adjacent wall materials, an expansion joint wider than a typical joint is designed for sealing with specialty seals specified by the architect or engineer-of-record.

**Corner Joints**

Corner joints are typically butt joints or quirk miters. Butt joints are more easily fabricated and erected, and special care needs to be taken to ensure the insulation returns back to the adjacent panel to maintain the continuous insulation. Quirk miters require more attention during fabrication and erection, but the final position ensures continuous insulation.
Oldcastle’s precast wall panels are manufactured year round inside PCI certified facilities under strict standards and production procedures. Extreme care is taken during all phases of the panels movement, from production and manufacturing through transporting and erection, to final building completion, to ensure the highest quality panel is delivered.
MANUFACTURING

Forming Beds
Precast concrete panels are typically formed on flat steel beds with steel rails placed to form the panel sides. Bulkheads, or blockouts, are used to form any openings in the panel. The exterior face of the panel is typically the bed side, as it produces a very smooth consistent finish.

Factory Controlled Conditions
All Oldcastle precast wall panels are made with minimum 5,000 psi concrete and can be produced year round, in all weather conditions, because they are made inside a plant, in a controlled environment. All Oldcastle plants are PCI certified and are subject to two, unannounced, quality inspections each year by an independent engineering firm.

Mixtures and Admixtures
Self Consolidating Concrete (SCC) is a velocity modifier that allows concrete to flow easier and results in less pitting on the finished surfaces. This results in a smoother, more uniform panel finish without segregation of aggregates.

Super Plasticizers, also known as water reducers, are primarily added to concrete to improve the workability of a concrete mix during the initial pour.

Air Entrained concrete contains microscopic air pockets that allow water to expand and contract through freeze-thaw cycles, reducing cracking and spalling and increasing the durability of the concrete.

Photocatalytic Cement has self-cleaning and pollution-reducing properties produced by the use of a photocatalyst, a material that uses solar energy to accelerate chemical reactions. As photocatalytic cement responds to the UV rays in sunlight, oxidation accelerates in the concrete, speeding up the rate the concrete will decompose pollutants that come into contact with its surface.
TRANSPORTATION

Shipping Sizes
Panel sizes up to 13’-6” feet wide and 50 feet long are routinely handled by Oldcastle’s fleet of specially designed truck beds. Laws for shipping sizes and weights vary by each state in which the panels are being transported. Early planning with Oldcastle’s team of specialists will lead to a clear understanding of shipping constraints and transportation economies.

ERECTION

Erection of CarbonCast® precast panels can be performed by Oldcastle’s in house field crew, an erection subcontractor, or the general contractor, depending on the most cost effective and logistically desirable approach as determined in consultation with the owner. Early planning by the erection specialists is critical for safe, cost effective and efficient scheduling.

Crane Size and Site Access
Speed and economy of erection are directly related to crane size and type; and, crane size and type are determined by panel sizes; the reach needed; types of connections required; and the potential for unencumbered access to the site.

The logistics for erection vary by each site; however, Oldcastle’s wall panels have been erected both in high density urban areas with limited access and in areas where access is virtually unencumbered. Proper access and ground stability for trucks and cranes are crucial for a fast and smooth installation.

On-Site Staging
To limit the time needed for expensive crane equipment at the site, it is necessary to plan carefully for its continuous use. Ideally, wall panels are lifted from the trucks in an orderly manner with little down time of the crane. Erection specialists, working with owners and contractors, need to find accessible staging areas for trucks so that scheduling of delivery is as efficient and cost effective as possible.

Temporary Bracing
Depending on site conditions and sequencing of construction, Oldcastle provides a variety of optimal solutions for the temporary bracing of wall panels.
THE MANUFACTURING, TRANSPORTATION & ERECTION OF A PANEL

1. SET UP FORM
2. POUR CONCRETE
3. LIFT FROM FORM
4. ROTATE TO VERTICAL
5. STORE IN YARD
6. TRANSPORT TO SITE
7. LIFT FROM TRUCK
8. ROTATE TO VERTICAL
9. ERECT BUILDING
The most important area of a distribution center is the loading dock area. This is where productivity is dependent upon efficient layout and design of the area where goods are received and shipped.

Increasingly, managers are adopting the practice of **cross docking** to expedite the flow of product from shipping to receiving with a minimum of handling and storage in between.

Oldcastle’s wall panel system is adaptable to a variety of dock types, heights and widths to suit the owner’s needs for the most efficient and heavy-duty dock designs. The precast concrete panels are designed to withstand the abuse and high-intensity traffic associated with cross-dock operations; and, Oldcastle’s system accepts the dock levelers, dock seals, shelters, doors, and accessories of the nation’s leading manufacturers.
**Straight Docks**
Straight docks are the most economical to build and they optimize interior space.

**Saw Tooth Docks**
Saw tooth docks are used on restricted site areas where trucks are difficult to maneuver in and out of the dock area.

**Interior Docks**
Interior docks provide protection from weather, but are the least common type due to their considerable cost to build and operate.

**Dock Doors**
Dock door sizes are dependent on a host of owner-driven factors, not the least of which is the size of the vehicles to be serviced. Increasingly, laws and technology are allowing trucks to be taller, wider and lower. This requires that loading docks be capable of being built to a variety of standards and to be capable of accepting specific dock equipment for flexible applications. Oldcastle’s Precast Wall Panel System provides a virtually unlimited array of sizes and styles to meet the owner’s needs.

**Energy Efficient Dock Design**
The greatest area of energy loss in a building is often the area of the loading dock. Oldcastle’s system of wall panel design for loading dock areas includes fully insulated panels with thermal breaks to prevent heat loss or gain due to the effects of thermal bridging.

At the same time, the Oldcastle system is adaptable to a variety of dock seals and canopies to control temperature loss while, at the same time, improving employee comfort, reducing insect infiltration, and protecting products.
Oldcastle offers a range of colors, textures and other façade treatment options for exterior building components. The choice of appropriate aggregates and textures, combined with well-conceived production and erection details, can achieve a wide variety of design objectives.

The variety of facade treatment options offered by Oldcastle creates an enormous range of design opportunities for owners and architects.
Colors and Textures

Design flexibility is possible in both color and texture of precast concrete by varying aggregate and matrix color, size of aggregates, finishing processes, and depth of exposure. Combining color with texture accentuates the natural beauty of aggregates.

Color and, consequently, color tone are affected by light, shadow, density, time and other surrounding or nearby colors. Color selection should be made under lighting conditions similar to those under which the precast concrete will be used, such as the strong light and shadows of natural daylight. Surface texture influences color. The building’s appearance is a function of the architect’s use of light, shadow, texture and color.

Cement (plus coloring agent) exerts the primary color influence on a smooth finish because it coats the exposed concrete surface. As the concrete surface is progressively removed and aggregates are exposed, the panel color increasingly exhibits the fine and then the coarse aggregate colors.

Nevertheless, the color of the cement always has an effect on the general tone of the panel. Cement may be gray, white, buff or a mixture. All cements have inherent color and shading differences depending on their source; and local sources are often preferable.

Pigments and pigmented admixtures often are added to the matrix to obtain colors that cannot be obtained through combinations of cement and fine aggregate alone. White portland cement, for example, will produce cleaner, brighter colors.

Fine aggregates have a major effect on the color of white and light buff colored concrete, and can add color tones when the surface is given a shallow profile to increase their exposure.

Coarse aggregate colors become dominant as the surface of the concrete is removed to obtain a medium or deep aggregate exposure profile. Some finishing processes change the appearance of aggregates. Sandblasting, for example, will give the aggregate a matte finish.
Architectural Coatings

The U.S. paint and coatings industry offers a diverse collection of product coatings specifically manufactured for exterior concrete application. Depending upon the visual effects and performance requirements of owners and architects, Oldcastle can make specific recommendations for high-performance coatings to suit most conditions.

Coatings that work successfully on concrete include acrylics, epoxies, and polyurethanes. Generally, alkyd or oil-based coatings should not be specified as they may chemically react with the alkaline concrete and moisture.

For successful results, coatings must be applied at the proper thickness, and under proper weather and temperature conditions, as specified by the coating manufacturer in product data.

Reveals

A reveal is a groove in a panel face used to create a desired architectural effect. Used effectively, reveals offer a simple and cost-effective way to break up an expanse of precast concrete. The exterior articulation helps designers to modulate the scale of the building.

Reveals can be placed vertically, horizontally, diagonally, and in a variety of sizes and shapes. Reveals typically measure 1/2” deep with a 45-60 degree bevel or “draft” for ease of stripping from the concrete form. Generally, the preferred minimum draft for ease of stripping from a mold is one inch in eight inches (1:8), although in special cases the draft may be reduced to 1:12.

Designers often use reveals in combination with panel joints to express floor, ceiling or roof lines; emphasize changes in texture; and, highlight planning modules or structural bays.

Ornamental Decoration

For owners and architects seeking to create ornamental decoration or three-dimensional relief on concrete panels, Oldcastle offers solutions.

Similar to the techniques used for creating reveals, wide recesses can be created in the concrete using block-outs within the formwork to provide three-dimensional relief. Blockouts generally have the same depth and draft considerations of reveals, however they can be large or small depending upon the desired design effect.

Additionally, clay products such as thin brick, terracotta or tile can be cast into the concrete to create ornamental decoration. The design possibilities are limitless. To develop the best adhesion to the concrete, the backside of the clay products should have grooved or dovetail-like slots.
SAMPLE CONCRETE FINISHES

Oldcastle Precast offers a wide range of precast concrete colors and textures. The architect should contact the local Oldcastle representative in the early design stages and throughout the development of the design for information on how to best obtain the visual effect desired.

Note:
These samples serve only as a visual guide for initial selection of color and texture. It is important to note that the colors and textures seen will vary depending on local conditions. Since it is impossible to reproduce exactly on paper the true colors of precast mix designs, some variations from these samples must be expected.

Additionally, due to different material sources or different techniques in various plants, the architect should not expect to select a photographic sample and obtain exact matching by all precast concrete producers. Samples should be required to ensure that the desired colors and textures can be satisfactorily matched.

Photos courtesy of PCI
Oldcastle offers owners and architects the option to cast concrete in forms with specialty formliners to create almost any desired visual effect. Oldcastle works directly with the nation’s premier manufacturers of formliners represented in the patterns shown on these pages. In addition to a vast array of patterns and textures offered as standard, there is also the option to create custom formliner finishes in almost any style imaginable.

The images shown here represent a small sampling of the textures and patterns available. The samples shown are only a visual guide for initial concept, not for actual selection. The Oldcastle representative will make available more accurate literature and samples when requested.

Oldcastle offers owners and architects the option to integrally cast brick in concrete. From the nation’s premier manufacturers of thin brick, there is a wide array of brick options available. Advantages of brick-embedded concrete include no flashing, lintels or weep cavities; no efflorescence; and reduced construction time.

The images shown here represent a small sampling of the available color and texture blends. Brick corners and edge caps are also available. The Oldcastle representative will make available more accurate color literature and samples when requested.
ARCHITECTURAL & STRUCTURAL DETAILS
USE OF THESE DETAILS

The drawings and other information contained herein are illustrative only and neither Equus Design Group, Inc. nor Oldcastle Precast, Inc. makes any representation as to their fitness for any specific design or structure, and disclaim any responsibility for techniques of application, correctness, interpretations, design methods, modifications or misapplications of these drawings and references.

Since no specific project nor overall engineering responsibility is implied with the use of this manual and the information contained within, neither Equus Design Group, Inc. nor Oldcastle Precast, Inc. will be responsible for the failure of any designer to properly design nor any contractor to properly construct any building.
1. TYPICAL BUTT CORNER DETAIL
2. TYPICAL MITER CORNER DETAIL
3. TYPICAL BUTT PANEL-TO-PANEL DETAIL
4. TYPICAL CARBONCAST PANEL SECTION

ARCHITECTURAL DETAILS
There are numerous ways to detail wall panel openings. The details shown on this sheet are some examples. Depending on many variables - level of use (heavy or light), insulation requirements, and size of opening, each detail can be used for roll-up doors, man doors, windows and louvers.
USE OF THESE DETAILS

These details represent a sampling of typical Oldcastle Building System details for various building conditions. Please consult an Oldcastle representative for specific details for each project.

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1. PANEL-TO-PANEL SHEAR CONNECTION DETAIL

2. TYPICAL MID-SPAN CONNECTION DETAIL

3. TYPICAL MITER CORNER CONNECTION DETAIL

4. TYPICAL BUTT-END CORNER CONNECTION DETAIL

STRUCTURAL DETAILS
SUSTAINABLE DESIGN
SUSTAINABLE DESIGN & DEVELOPMENT

RESOURCE EFFICIENCY
Sustainable properties of precast concrete include the following:

- **Resource Efficient**
  Concrete is made from three of the earth’s most abundant resources:
  - Water
  - Stone, sand and gravel aggregates
  - Cement which is predominantly limestone, the most abundant mineral on earth

- **Recycled Products**
  Precast concrete typically includes recycled components such as fly ash, slag cement, and silica fume, all waste by-products from power plants, steel mills, and other manufacturing facilities.

- **Ecologically Preferable**
  Compared to logging for wood products and iron ore mining for steel production, the extraction from the earth of aggregate and limestone is the least disruptive to land and the fragile ecology that it supports; and aggregate and limestone quarries can be restored to nature reserves, parks and other recreational, commercial or residential uses.

- **Highly Durable**
  Concrete actually gets stronger with age. It can take years, even decades, for concrete to fully hydrate and reach its highest strength. The Pantheon in Rome, a concrete building circa 180 a.d., is still in use. The longer the life span of the building, the more sustainable benefit it has.

- **Minimizes Waste**
  By creating products that are built at the factory to the exact sizes required, concrete minimizes construction waste.

- **Recyclable**
  Concrete can be crushed and reused as aggregate in new concrete mixtures particularly for infrastructure projects such as roads, sidewalks, and bridges, as well as for environmental erosion control. The ASTM definition of coarse aggregate includes crushed concrete, and the definition of manufactured sand includes crushed concrete fines. The U.S. Army Corps of Engineers and the Federal Highway Commission encourage the use of recycled concrete for their projects. Furthermore, the steel used for its reinforcement, normally obtained from recycled steel, can be recycled again.

- **Resourceful Finish Options**
  Concrete, without any applied finish is a beautiful, natural looking product, particularly when well designed with reveals to create architectural interest. Also, reusable formliners can be used to create finishes of concrete surfaces to expose the natural beauty of concrete.

SUSTAINABILITY
The responsible management of energy and environmental resources is the greatest challenge in the building industry. Labels such as “environmentally friendly” or “green” are not just catchy marketing phrases at Oldcastle. We believe in maximizing opportunities for long-term sustainable development with our products.

The Oldcastle Precast Wall Panel System helps owners and designers to achieve the highest levels of sustainable building design. From manufacturing to completion the Oldcastle team creates projects that are designed for:

- Resource Efficiency
- Energy Efficiency
- Human Comfort
- LEED® Certification

Thin Brick embedded on precast panels is an energy efficient solution to all masonry projects. The raw clay materials, fuels used for manufacturing and shipping are about seventy-five percent less than those used in full-bed-depth brick projects. Furthermore, precast panels with embedded brick do not require sources of energy loss such as the weep holes and air space required in conventional masonry construction.
ENERGY EFFICIENCY

Well-informed building owners look for bottom-line savings in energy efficient building design and technologies. Exterior wall system selection is key to creating energy efficient buildings.

Oldcastle’s CarbonCast® precast concrete sandwich wall panels, consisting of an exterior wythe of concrete (typically 2-1/2” thick), an inner layer of continuous rigid insulation, and an interior wythe of concrete (typically 2” thick), are an ideal product for energy conservation. The concrete walls include thermal mass properties that absorb and retain heat and the insulation provides low thermal conductivity (high R-value).

• Air Leakage Control
  Air leakage is one of the greatest areas of heat and energy loss. Air leakage typically occurs around windows, doors and building joints. Precast concrete wall panels are extremely efficient at reducing potential sources of air leakage because there are few joints; and concrete has excellent characteristics for preventing the passage of air and moisture.

• Reducing Solar Heat Gain
  Solar heat gain contributes to the need for high cooling loads, one of the greatest consumers of energy. The higher the solar gain, the greater the energy consumption. Building orientation, shading devices, and light reflectance can help to control the amount of solar gain.

  The orientation of a building on the site contributes heavily to its ability to offset solar gain. Rectangular buildings placed in an east-west orientation will have the least amount of glazing in the direction of the morning and afternoon sun and the most amount of glazing on the north and south facades. The north façade receives very little sun and the south face can be controlled with shading devices and, to some extent, solar control glass. Oldcastle Glass®, www.oldcastleglass.com, can provide additional information on the variety of best glass choices that contribute to the sustainable aspects of design.

  Precast concrete also is generally a light color (high-albedo) which helps to reflect solar radiation to reduce cooling loads. Dark colored materials such as roofs, paving and walls cause an effect called “heat islands,” a growing concern in urban and suburban areas where temperatures are higher than rural areas because the surfaces capture solar gain. Light-colored precast concrete roof pavers, and roof garden waterproofing systems are products available from Oldcastle to help reduce the “heat island” effect.

• Lighting and Daylighting
  Through proper design, including glass selection and shading devices, natural light from windows (“daylighting”) can be used to significantly reduce the amount of artificial lighting. Effective daylighting and energy efficient light fixtures and controls can help to significantly reduce building energy costs.

• Thermal Mass Benefits
  Thermal mass is the property of a building material to store and over time release heat. Concrete, with its high thermal mass, is able to store large quantities of heat. Early civilizations such as the American Southwest Indians took advantage of thermal mass by using thick adobe walls to keep their homes cool during the day and warm at night.

  Today, however, thermal mass and its effect on energy performance is one of the most controversial issues facing designers, owners and manufacturers. Some manufacturers claim high “mass-enhanced” R-values exceeding normal “steady state” R-values by wide amounts; however, the only way to measure the effect of thermal mass is through rigorous computer calculations taking into account precise building location, orientation, climate and other variables. Clear definitions and standards are needed.

R-Values Defined

R-value: R-value is "resistance" to heat flow. The higher the R-value of a wall, the better it is at resisting heat loss or heat gain. Published R-values of various building materials are based on steady state laboratory tests.

Steady State R-value: R-values are measured in testing laboratories in a "guarded hot box" where one side of the material is kept at a steady warm temperature and measurements are taken of how much energy is required to keep the other side at a steady cooler temperature. The amount of energy that passes through the material is measured as BTU/sq.ft.°F. R-value is the resistance of the material to the passing of that energy. Concrete has an R-value of .06/inch; insulation R-values vary from 3.0/inch to 8.2/inch.

Mass-Enhanced R-value: Sometimes referred to as “effective” R-value, mass-enhanced R-value refers to the ability of high-mass materials, such as concrete, to achieve better energy performance over time than would be expected by simply using published steady state R-values. Sophisticated computer software such as DOE-2 or BLAST is used to analyze the effect of thermal mass over long periods of time; however, the actual performance is highly dependent on building location and, in particular, climate. This makes national publication of mass-enhanced R-values difficult at best and unreliable at worst.
When and Where is Thermal Mass Most Effective?

Energy is conserved the most when there are significant changes in heat flow during the day. For example, in climates where there are large daily temperature swings, exterior walls are heated during the day and cooled at night. When the outdoor temperatures are warm during the day, the interior surface of the walls remain relatively cool because the heat does not rapidly penetrate a concrete mass. When the outside temperature swings to nighttime cooling, the concrete mass is slowly cooled by releasing the heat retained during the day creating a thermal lag. The effect of this is:

- Reduction of heating and cooling loads for less energy consumption.
- Reduction in size of heating and cooling equipment required.
- Reduction of peak hour heating and cooling loads allowing off-peak energy usage when rates are lowest.

Although the thermal mass of concrete is beneficial in most U.S. climates, the greatest benefits occur in the southwest regions where daily temperature swings are largest, particularly in the fall and spring months. At the other extreme, such as Alaska, where 24-hour outside winter temperatures are well below indoor temperatures, mass has little or no effect on R-value performance.

Based upon a study conducted by the masonry industry comparing theoretical thermal mass benefits of various U.S. regions, and documented in an article by Martin McBride for The Construction Specifier, the thermal mass benefit is evident in northeast climates, though significantly lower in comparison to southwest regions.

Thermal Mass Benefits of the Oldcastle Precast Wall System

Simply put, there is no other precast concrete wall system on the market that surpasses the thermal mass potential of the Oldcastle Precast Wall System. The system contains the five most important components of a successful thermal mass assembly:

- **High Heat Capacity** – Heat capacity (HC) is the amount of heat necessary to raise the temperature of a given mass 1°F. HC is used in energy codes to determine when a wall has enough thermal mass to use “mass criteria” or “mass credit” as a means for determining R-value. ANSI/ASHRAE/IESNA Standard 90-1-2007, the standard referred to by many energy codes, defines “mass wall” as a wall with an HC exceeding 7 BTU/sq.ft.°F; the concrete in a typical CarbonCast® wall has an HC of 10.8, qualifying it for thermal mass credit calculation.

- **Low thermal conductivity** – The rigid insulation placed in the middle of two separate concrete wythes assists the concrete to retain its collected heat by effectively reducing unwanted heat transfer, an optimum combination of two materials working together.

- **Continuous Insulation** – ASHRAE 90-1-2007 requires that a “mass wall” have “continuous insulation across all structural members without thermal bridges...,” just as the CarbonCast® wall system is designed.

- **No thermal bridge** – The two wythes of concrete are connected together using a patented high strength “shear grid” consisting of thermally low conductive carbon fiber to virtually eliminate any thermal bridge.

- **Inner Surface of Concrete** – The thermal mass of concrete works best when the mass is exposed on the inside surface of the wall, as in the two-wythe Oldcastle system.

Thermal Mass Summary

The Oldcastle precast walls contain the beneficial properties of a highly effective thermal mass system; nevertheless, there is need for industry-wide nationally recognized and standardized testing to quantify expected energy performance. Alex Wilson, executive editor of Environmental Building News and former executive director of the Northeast Sustainable Energy Association summarizes the benefits of high-mass building materials as “highly dependent upon where the building is located, how it is designed, and how it is operated. How we should give credit — in terms of energy performance — for high-mass building materials is still very much open for debate. Until standardized procedures for determining the regional significance of the mass effect are widely applied, there will likely be continued confusion and continued exaggeration regarding the energy benefits of thermal mass.” A great deal of work remains to be done to standardize the measurements of the beneficial effects of thermal mass. Oldcastle supports efforts of some of the nation’s leading researchers, including Oak Ridge National Laboratory, to bring these issues into public awareness.
**HUMAN COMFORT**

- **Excellent Indoor Air Quality**
  
  The quality of the indoor air is crucial to the well-being of the occupants. Building owners and occupants are increasingly demanding “green” buildings that minimize the type of pollutants that lead to “sick building syndrome.”

  Precast concrete has extremely low emissions of the type of off-gassing substances that plague many buildings with “sick syndrome.” Precast concrete is also one of the best building materials available to inhibit or prevent mold growth. Concrete is non-organic and mold requires moist organic nutrients to grow. Furthermore, the low permeability rating of precast concrete inhibits the penetration of mold spores from the exterior.

  Concrete alone cannot achieve goals of reducing indoor air pollutants. Designers must carefully choose low volatile organic compounds (VOC) materials such as carpet, partitions and paint; and engineers must carefully design the mechanical systems for appropriate levels of ventilation and air circulation. But, in conjunction with these design choices, precast concrete is by far the best building material to achieve beneficial indoor air quality.

**LEED™ CERTIFICATION**

The Leadership in Energy and Environmental Design (LEED) green building rating system is administered by the U.S. Green Building Council (USGBC), a coalition of building industry leaders working to promote buildings that are environmentally responsible, profitable and healthy places to live and work.

LEED certification is typically voluntary, yet there are increasing numbers of tax benefits and/or grants being offered for green buildings. Many U.S. government agencies and some states and localities are mandating that LEED requirements be met, and some are even requiring LEED certification for public buildings.

While civic pride for building “green” can bring some satisfaction to building owners, tangible economic benefits that come from certification will generate the most enthusiasm. For example, meeting many of the green building practices that lead to LEED certification can result in energy and cost savings over the life of the building. Furthermore, workers in LEED certified environments can have increased productivity translating directly into company profits.

The LEED rating system divides credits and prerequisites into five categories:

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Indoor Environmental Quality
- Innovation and Design Process

Prerequisites and credits are based mostly on established governmental or trade group standards. The number of points a project earns determines the level at which a project can be certified. The certification levels are Platinum, Gold, Silver and Certified.

The Oldcastle Precast Wall Panel System can help owners and designers achieve LEED certification. Compliance with LEED prerequisites and obtaining LEED credits can be obtained through:

- **Use of Recycled Content**
  
  This credit is for projects that “use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% of the total value of the materials in the project.” Supplementary cementitious materials, such as fly ash, silica fume, and slag cement, are considered pre-consumer. Recycled concrete or slag as aggregates qualifies as post-consumer.

- **Optimizing Energy Performance**
  
  This credit is allowed if energy cost savings can be shown compared to a base building that meets the requirements of ASHRAE 90-1-2007. Oldcastle’s precast concrete wall system, with high insulation value, high thermal mass, and low infiltration, for example are benefits in creating energy cost savings.

- **Use of Regionally Produced Concrete Products**
  
  Oldcastle has plants in most U.S. regions to meet the requirement to “use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum 10% of the total materials value.”

- **Having a LEED Accredited Professional**
  
  A credit is given if a LEED Accredited Professional is part of the project team. Oldcastle’s team of engineers includes LEED Accredited Professionals.

For an excellent discussion on how to achieve LEED certification through the use of precast concrete products, see “Achieving Sustainability with Precast Concrete,” by Martha VanGeem, P.E., LEED A.P., in PCI Journal, Jan., Feb. 2006.
CASE STUDIES
I. Project Description - This 983,000 SF industrial warehouse complex has 36 foot clear ceiling heights, 196 loading doors arranged in a cross dock format and 4 drive in doors. The perimeter load bearing insulated wall panels have embedded bearing seats for bar joist and joist girders, eliminating interior perimeter steel.

II. Project Team -
Owner/CM/Contractor: Greenfield Builders, Inc. Indianapolis, IN
Architects: MH Architecture
Precaster and Precast Specialty Engineers: Oldcastle Precast Building Systems

III. Major Features -
CarbonCast® Industrial Wall Panels
- 293,000 Square Feet of Precast Wall Panel
- 538 Precast Concrete pieces
- 12'-0" wide panels, typical
- 46'-6" tall panels, typical
- 10" thick wall panels
- R-20 insulation
- Erected in 30 days
- Steel Form Finish (smooth)

ALOVATS ‘A’ & ‘B’
Monroe, New Jersey
ADVENTURE AQUARIUM
Camden, New Jersey

I. Project Description - This new structure is an expansion building to the existing aquarium and accommodates three new exhibits, a main entry atrium, a new food service area, gift shop and restaurant. The new exhibits include the "West African River Experience", the "Jules Verne Gallery" and the 550,000 gallon Shark Realm tank.

II. Project Team -
   Owner: State of New Jersey
   Contractor: Whiting-Turner Contracting, Co., Towson, MD
   Architects: Granary Associates, Philadelphia, PA
   Precaster and Precast Specialty Engineers: Oldcastle Precast Building Systems

III. Major Features -
   CarbonCast® Industrial Insulated Wall Panels
   • 38,000 Square Feet of Precast Wall Panel
   • Load and Non-Load Bearing Panels
   • 41'-0" tall panels, typical
   • 10" thick wall panels
   • R-16 wall insulation
   • Steel form finish with reveals (painted)
I. Project Description - 270,000 SF state-of-the-art film studio and production facility with 5 sound stages with up to 45 foot ceiling heights, a 3-story office complex, screening rooms and other support facilities.

II. Project Team -
Owner: Steiner Equities Group, New York, NY
General Contractor: Steiner Building Co., New York, NY
Architects: Richard Dattner & Partners Architects PC
New York, NY (building exterior)
Precaster: Oldcastle Precast Building Systems

III. Major Features -
Total Precast Concrete Structure
• Exterior Load and Non-Load Bearing Panels
• Interior Load Bearing Panels
• Hollow Core Plank
• Beams and Columns
• Stairs and Landings
• Erected in 30 days
• 1,957 Precast Pieces
  133,500 s.f. of 12" hollowcore plank (553 pcs)
  109,800 s.f. of 8" wall panels (586 pcs)
  9,100 l.f. of columns and beams (366 pcs)
  102,300 s.f. of 12" wall panels (360 pcs)
  92 stair and landing pieces
REFERENCES & RESOURCES
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The following associations, organizations and agencies offer useful information on the wide range of subjects in precast concrete products and, in particular, precast wall panels.

Oldcastle Precast Building Systems

- www.oldcastlesystems.com

Associations, Organizations, Agencies:

- Precast Concrete Institute – www pci.org.

Books, Articles and Online Resources:

- “Architectural Precast Concrete,” PCI/Pre-Cast Concrete Institute, Third Edition, 2007.
- “Designing with Precast and Prestressed Concrete,” PCI/Pre-Cast Concrete Institute, a looseleaf manual available from PCI.
- “Guide for Precast Concrete Wall Panels,” ACI 533R-93 (Reapproved 2004), American Concrete Institute.
- “Total Precast Concrete Structures,” Canadian Precast/Prestressed Concrete Institute.

Articles and Resources on Sustainability:
