

WHAT IS WHITE CEMENT?

Use white cement for architectural concrete, specialty applications, and increased safety.

White cement is readily available throughout North America. Except for color, white and gray cements have essentially the same properties.

Specifying White Cement

All white cements manufactured in North America are made to strict standards to meet customer needs. Color is an especially important quality control issue in the white cement industry, where consistency in brightness and tone are principal concerns. The color of white cement depends on both the raw materials and the manufacturing process. Metal oxides (iron, manganese, and others) that are present in the finished material influence its whiteness and undertone, making it imperative to use carefully selected raw materials (See Figure 1).



Fig. 1. White cement is subject to exacting quality control procedures that minimize color variation during manufacturing. This provides a neutral base for concrete finishes whether they are white or tinted.

Depending on the intended use or application, white cement can be manufactured to conform to a number of American Society for Testing and Materials (ASTM) specifications. A typical specification for white cement could read as follows: Cement shall be white portland cement conforming to the requirements of the Standard Specification for Portland Cement, ASTM C150, for Type ___ portland cement except that it shall contain no more than 0.50% by weight ferric oxide (Fe_2O_3).

White cement is typically specified to ensure clean, bright, consistent colors, including light pastels. White cement allows a wide range of color options for producing structural and architectural concrete, as well as masonry and cementitious building products (Figure 2). The final color and look of concrete and masonry materials are affected by many factors:

- color of cement
- color of supplementary cementitious materials
- color and dosage of pigment
- color, gradation, and cleanliness of fine and coarse aggregate
- surface treatment of finished concrete
- water content
- type and dosage of admixtures

Cement of the same type and brand from the same mill should be used throughout the entire job to minimize color variation. When possible, adequate quantities of all materials – cements, supplementary cementing materials, and aggregates – should be stockpiled to ensure a single source and uniform color. Mockups constructed at the project site serve as reference panels for comparison. If a change in source materials is needed, additional test panels should be fabricated.



Fig. 2. White cement produces dynamic concrete. Courtesy of Condell Medical Center.

Precast Panels, Floors, and More: White Concrete and Structural Performance

White cement concrete can be an integral part of any structural design for demanding applications, such as high-rise buildings, bridges, and parking structures. For buildings, construction methods include both precast and cast-in-place exterior cladding, interior walls, and floor slabs (Figures 3 and 4). Due to its high performance and consistency in color and

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strength, white cement has been widely embraced by the precast concrete, surface coatings, and masonry industries.

Architectural concrete products such as masonry block and Cast Stone commonly incorporate white cement. An advantage of specifying these products in white cement tones is the wide range of complementing mortar materials that can be specified to tie projects together in a distinctive design.



Fig. 3. Polished and elegant white cement concrete floors complement white concrete walls in the Tampa Museum of Art, and are durable under heavy foot traffic. Courtesy of Southland Concrete Contractors.



Fig. 4. Workplace safety: white concrete floors work well in industrial settings, too. The light color reduces shadows and improves lighting efficiency in large buildings, such as warehouses.

Advancements in surface treatments and admixtures have simplified the casting of architectural concrete and expanded possibilities. Finishes that expose the matrix of the concrete by polishing, acid etching, chemically retarding, and sandblasting are becoming more common. In precast applications, white cement is sometimes used exclusively in the exposed layer, producing a decorative facing mix that is just a few inches thick.

For floors and pavements, decorative concrete mixtures can be used full-depth or in a topping course. As with precast facing mixes, topping courses can reduce material costs for reflective and decorative pavements. It should be recognized, however, that placement of topping courses and facing mixes requires more planning, time, and labor.

Decorative concrete floors made with white cement can be specified in place of other upscale finishes because they are durable and attractive. Polishing, in particular, has experienced rapid growth due to advancements in equipment along with more sophisticated installers.

White concrete floors, pavements, and other surfaces are highly reflective. In interior spaces, this property reduces the need for artificial lighting. Lower levels of lighting in interiors can impact cooling requirements, thereby reducing energy costs. Reflective surfaces improve nighttime safety and deliver greater illumination for retail, manufacturing, and warehousing operations.

In addition to structural applications for buildings and floors, durable white cement-based finishes and products include:

- Cast Stone
- decorative and ornamental concrete
- concrete masonry and mortar
- swimming pools
- traffic barriers
- stucco and plasters
- tile grout
- roof tiles
- patching materials
- terrazzo surfaces
- countertops

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Fig. 5. Road safety: white traffic barrier sections are bright and highly visible to drivers.



Fig. 6. Fire safety: the façade of this residence combines two noncombustible finishes, portland cement plaster (stucco) and manufactured stone veneer products, for an attractive appearance. These products are frequently made with white cement.



Fig. 7. Pool safety: White or light-colored surfaces offer the most safety for high visibility in pools. Plaster finishes for swimming pools provide long life and low maintenance.

For transportation projects, white or colored concrete creates a strong visual contrast and offers an opportunity for passive traffic safety. Median (“Jersey”) barriers made of white concrete not only physically separate vehicles from hazards, but are highly visible, even at night and in wet conditions. These barriers are made either as cast-in-place or precast concrete elements. Light colored elements in roadways provide a traffic calming effect that increases safety for all modes of transportation (see Figure 5).

Numerous noncombustible finishes are possible with white cement. From cement plaster (stucco), to masonry and decorative cast items, finishes are colored by using a combination of white cement and pigments.

Ornamental concrete pieces are used as building accents (see Figure 8). One well known product for this purpose is Cast Stone, a mixture of fine and coarse aggregates, portland cement, pigments, chemical admixtures and water. Cast Stone is a masonry product,

manufactured to simulate natural cut stone and is used as an architectural feature, trim, and facing for buildings or other structures. In addition to use in new construction, Cast Stone is a cost effective repair material for historic buildings made of natural materials that may no longer be available or that lack adequate durability for today’s exposure conditions.

With coast to coast distribution centers in the U.S. and Canada, white cement is a readily available concrete ingredient that works well in many applications. It offers aesthetic and performance benefits to pavements, buildings, and other structures. For more information on white cement and its use in structural, architectural, and decorative applications, please visit the PCA website www.cement.org and look for Architectural & Decorative Concrete in the Concrete Technology area under Materials & Applications.



Fig. 8. The fine texture, intricate detail, and excellent color consistency are hallmarks of Cast Stone.

Related PCA Publications

- *Color and Texture in Architectural Concrete*, SP021
- *Finishing Concrete Slabs with Color and Texture*, PA124
- *Portland Cements*, IS004
- *Portland Cement Plaster (Stucco) Manual*, EBO49
- *Durability Studies of Exposed Aggregate Panels*, RX158
- *Masonry Mortars*, IS040
- *White Cement Concrete and Colored Concrete Construction*, WC002

Other Related Publications

- *Architectural Precast Concrete* (MNL 122)
- *PCI Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products* (MNL 117)
- *Architectural Precast Concrete Finishes Guide*
- *Architectural Precast Concrete Color and Texture Selection Guide*
- *Standard Specification for Cast Stone 04 72 00*, CSI
- *Guide to Decorative Concrete*, ACI 310 (add when published)
- *Guide to Cast-in-Place Architectural Concrete Practice*, ACI Committee 303 Report
- *Guide to Portland Cement Plastering*, ACI Committee 524 Report
- *Guide for Precast Concrete Wall Panels*, ACI Committee 533 Report
- *Guide for the use of Polymers in Concrete*, ACI Committee 548 Report
- *Installation of Exterior Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster*, ASTM C1063
- *Application of Portland Cement-Based Plaster*, ASTM C926
- *Terrazzo Color Palette*, NTMA

Organizational Resources

ACI: American Concrete Institute, 38800 Country Club Drive, Farmington Hills, Michigan 48331; phone: 248-848-3700; fax: 248-848-3701; web site: concrete.org

APA: Architectural Precast Association, 6710 Winkler Road, Suite 8, Fort Myers, Florida 33919; phone: 239-454-6989; fax: 239-454-6787; web site: archprecast.org

ASTM: American Society for Testing and Materials, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, Pennsylvania 19428-2959; phone: 877-909-2786; web site: astm.org

CSI: Cast Stone Institute, 813 Chestnut Street, P.O. Box 68 Lebanon, Pennsylvania 17042; phone: 717-272-3744; web site: caststone.org

NPC: National Plasterers Council (swimming pools), 4344 Laura Street, Port Charlotte, Florida 33980; phone: 919-766-0634; fax: 919-766-0650 web site: npconline.org

NTMA: National Terrazzo & Mosaic Association Inc., P.O. Box 2605, Fredericksburg, Texas 78624; phone: 800-323-9736; fax: 888-362-2770; web site: ntma.com

PCA: Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077-1083; phone: 847-966-6200; fax: 847-966-8389; web site: portcement.org

PCI: Precast/Prestressed Concrete Institute, 200 West Adams Street #2100, Chicago, Illinois 60606; phone: 312-786-0300; web site: pci.org



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