
432 MANHATTEN PARK AVENUE IN NEW YORK, USA

CAST-IN-SITU CONCRETE APPLICATION: AALBORG WHITE® CEMI 52,5R-SR5



PROJECT DESCRIPTION

432 Park Avenue is an upscale residential project in Manhattan, also the tallest of its kind in the western hemisphere. This unique project designed by Rafael Viñoly required excellent performance on structural stability, construction efficiency and sustainability using cast-in-place white concrete technology. The building is 1,396-feet (425.5 m) high with 96 stories and adjacent to Central Park, Rockefeller Center and Broadway, together they form part of Manhattan's urban skyline. The crowded location determines the building's extremely thin and elongated image, occupying a very small area with only 93 square feet.

According to the White Paper written by Joe Nasvik, the project uses self-compacting concrete based on high strength Aalborg White® cement, achieving below high performance for the concrete developed by the engineer,

- High compressive strength — up to 14,000 psi
- High modulus of elasticity (MOE)— 7.7 msi (millions of psi)
- Self-Consolidating Concrete(SCC) — 30-inch spread requirement.
- Aalborg White® Portland cement concrete with good color consistency

- Low heat of hydration — columns and other building elements were considered mass concrete, not to exceed 160°F.
- A pumpable mix for the entire height of the building
- Two-hour plus working time
- Low shrinkage
- Concrete floors “walking-hard” within five hours of placement in all weather
- Mixtures must have the same performance criteria in all weather
- Sustainable mixtures — 70 percent Portland Cement replacement with pozzolan materials.

432 Park Avenue is also LEED certified, meaning that the concrete can effectively reduce noise and heat transfer. The construction team replaced 70% Portland cement with sustainable SCM to reduce carbon in the concrete.

432 Park Avenue is undoubtedly one of the most distinctive buildings in the white cast-in-place concrete project around the globe, due to its outstanding performance in design expression, physical properties and construction techniques.

WORKING WITH AALBORG WHITE[®] PORTLAND CEMENT

Ready-mix producers and concrete contractors typically have little experience with white portland cement concretes, where different cement chemistry can affect behavior.

Cement clinker is composed of four primary chemical compounds that are carefully regulated by cement manufacturers; tricalcium silicate (C3S), dicalcium silicate (C2S), tricalcium aluminate (C3A), and tetracalcium aluminateferrite (C4AF).

The C3S is primarily responsible for early setting and strength gain, C2S for ultimate strength, C3A for early heat generation and early strength, while C4AF allows manufacturers to reduce the temperature needed in the kiln. C4AF also imparts the gray color to cement. Making portland white is primarily achieved by limiting the amount iron and magnesium oxides (C4AF), which is normally about 8 percent of the clinker but is 1 percent or less in white portland. This reduction increases the percentages of the other ingredients, causing the overall strength of white portland to increase too.

Chemical admixture performance is closely related to cement chemistry, especially to the C3A content, which can vary significantly between any given cements.

Knowledge of cement chemistry and admixture interaction allows ready-mix producers, manufacturer representatives, and admixture experts to work together to produce concrete mixes that meet project requirements. Early involvement is critical.

Author: Joe Nasvik

PROJECT PARTICIPANTS:

White Cement Producer: Aalborg Portland A/S

Developer: CIM Group / Macklowe Properties, NYC

Design Architect: Rafael Viñoly Architects NYC

Executive Architect of Record: SLCE Architects, NYC

Structural Engineer: WSP Cantor Seinuk, NYC

Construction Manager: Lend Lease, NYC

Foundation: Mayrich, NYC

Concrete Contractor: Roger & Sons, NYC

Ready-mix Concrete: Ferrara Bros. Building Materials Corp, NYC

Concrete Consultant: BASF, Cleveland, Ohio

Core Forming System: DOKA, Little Ferry, New Jersey

Exterior Climbing Forms and Deck: DOKA

Floor Forms: PERI Valley Cottage, New York

Concrete Pump: Putzmeister, Acworth, Georgia

High Strength Reinforcement: SAS Stressteel Inc., Fairfield, New Jersey