

# High Performance, White Concrete

## 432 Park Avenue



At the time of completion, 432 Park Avenue is the tallest residential building in the Western Hemisphere. A luxury condominium tower designed by famed architect Rafael Vinoly, 432 Park Avenue showcases cutting edge design through its square geometric footprint, white facade, and repetitive checkerboard-style window pattern. As would be expected, the construction of a supertower in midtown Manhattan was an incredible feat for the entire construction team. However, beyond the typical challenges of achieving the desired strength, fluidity, pumpability, and modulus of elasticity, the construction team had to deal with an ambitious time schedule and a deceptively difficult design requirement: the white color.

**Developer:**

CIM Group/Macklowe Properties

**Construction Manager:**

Lend Lease

**Architects:**

Rafael Vinoly Architects

SLCE Architects

**Structural Engineer:**

WSP Cantor Seinuk

**Concrete Contractor:**

Roger & Sons Concrete, Inc.

**Concrete Producer:**

Ferrara Bros. Building Materials Corp.

**Requirements:**

Architectural surface finish

Pumpable, flowable self-consolidating concrete

Slump flow spread: 30 in. (760 mm)

Heat of hydration: max 160 °F (71 °C)

56-day modulus of elasticity (MoE):

7.25 million psi (50 GPa)

Sustainable mixture with 70% replacement of portland cement

56-day compressive strength:

14,000 psi (96 MPa) for the lower

floors, and 10,000 psi (69 MPa)

for the upper floors

**Products Used:**

MasterGlenium<sup>®</sup> 7500

high-range water-reducing admixture

MasterSure<sup>®</sup> Z 60

workability-retaining admixture

MasterSet<sup>®</sup> DELVO

hydration-controlling admixture

Metamax<sup>®</sup> metakaolin

## The Challenge

To achieve the white exterior color, the concrete contractor, Roger & Sons Concrete, Inc., and the concrete producer, Ferrara Bros. Building Materials Corp., utilized white cement in place of typical gray cement, which is much more forgiving in terms of mixing, pumping and placing. White cement reacts more quickly and is temperamental, which meant that Ferrara Bros. needed to pay careful attention to the quality control process (trucks, raw material, weather adjustment, etc.) in order to ensure very good consistency among the concrete batches, every time.

The rapid construction schedule was an additional challenge, with a goal of one floor per week for a total of 90 floors.

Thus, the combination of the white exterior color, the aggressive timeline, and the general requirements of building a superstructure made this one of the most challenging concrete projects that has ever been executed.

## The Solution

Ferrara Bros., in collaboration with Master Builders Solutions, their concrete admixture supplier, utilized their understanding of concrete at the nanoscale level and Green Sense Concrete optimization service to develop a self-consolidating concrete mixture that addressed the challenges of the fast-reacting white cement. The team was able to hold workability for three hours without compromising strength through the use of high-performance concrete admixtures that controlled slump and set time. This ensured the concrete remained fluid enough to pump to the higher floors.

Quality control was an equally important element of the project, and Ferrara Bros. and Roger & Sons closely monitored and adjusted the mixture at all times to manage weather variations, transportation times, and placement requirements.

Master Builders Solutions' Green Sense Concrete service also helped Ferrara Bros. reduce CO<sub>2</sub> emissions through a reduction in portland cement content, contributing to the LEED status of the project as well.

## Project Facts

- 1,396 ft (426 m) tall with 93.5 ft (28.5 m) square footprint
- Metamax<sup>®</sup> high-reactivity metakaolin was used in place of silica fume (which is gray in color) to meet high MoE requirements

## Achievements

- Architectural surface finish
- MoE: 7.67 million psi (52.9 GPa) at 56 days
- Compressive strength: 20,500 psi (141 MPa) at 56 days
- Heat of hydration: 147 °F (64 °C)

**Chart 1. Environmental impact of sustainable concrete for 432 Park Ave. as compared to standard reference mixture\***

Environmental Impact Category	Environmental Benefits
Energy usage	822,000 kWh (2,959,200 MJ)
Greenhouse gas emissions	21,120,000 lb CO <sub>2</sub> eq (9,579,000 kg CO <sub>2</sub> eq)
Water emissions	191,500,000 gal (724,900,000 L)
Solid waste	605,000 lb (274,400 kg)

\*Based on 90,000 yd<sup>3</sup> (69,000 m<sup>3</sup>) of concrete developed for four compressive strengths.

## About Master Builders Solutions

Master Builders Solutions is a leading global manufacturer of concrete admixtures, as well as other sustainable solutions for the construction industry, focussed on delivering its vision: **Inspiring people to build better.** Master Builders Solutions provides value-added technology and market-leading R&D capabilities to improve the performance of construction

materials and to enable the reduction of CO<sub>2</sub> emissions in the production of concrete. Founded in 1909, Master Builders Solutions has ca. 1600 employees operating 35 production sites globally, supporting their customers in mastering their building challenges of today – for a decarbonised future.

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