

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® 7500 high-range water-reducing admixture

MasterSure® Z 60 workability-retaining admixture

MasterSet® DELVO hydration-controlling admixture

Metamax® metakaolin

Project Profile

High performance, white concrete

432 Park Avenue



Photo courtesy: Richard Berenholtz

The Background

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.

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 BASF, 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.

BASF's Green Sense Concrete service also helped Ferrara Bros. reduce CO₂ 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[®] 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)

More Information

The Master Builders Solutions brand brings all of BASF's expertise together to create chemical solutions for new construction, maintenance, repair and renovation of structures. Master Builders Solutions is built on the experience gained from more than a century in the construction industry.

The know-how and experience of a global community of BASF construction experts form the core of Master Builders Solutions. We combine the right elements from our portfolio to solve your

specific construction challenges. We collaborate across areas of expertise and regions and draw on the experience gained from countless construction projects worldwide. We leverage global BASF technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make you more successful and drive sustainable construction.

The comprehensive portfolio under the Master Builders Solutions brand encompasses concrete admixtures, cement additives, chemical solutions for underground construction, waterproofing solutions, sealants, concrete repair & protection solutions, performance grouts, performance flooring solutions.

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

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

Based on 90,000 yd³ (69,000 m³) of concrete developed for four compressive strengths.



Photo courtesy: Richard Berenholtz

*Effective January 1, 2014, the names of BASF's Master Builders Solutions brand products have changed: Glenium 7500 became MasterGlenium 7500, RheoTEC Z-60 became MasterSure Z 60, DELVO Stabilizer became MasterSet DELVO.

Contact

United States
23700 Chagrin Boulevard
Cleveland, Ohio 44122-5544
Tel: 800 628-9990 ■ Fax: 216 839-8821

Canada
1800 Clark Boulevard
Brampton, Ontario L6T 4M7
Tel: 800 387-5862 ■ Fax: 905 792-0651