

Milwaukee Art Museum Addition

Milwaukee, WI



Team

Owner:

Milwaukee Art Museum, Inc.

Architect:

Calatrava Valls, Zurich, Switzerland

Architect of Record:

Kahler Slater Architects, Milwaukee, WI

Engineer:

Graef Anhalt Schloemer & Associates
Milwaukee, WI (Structural and Civil)

General Contractor and

Construction Management:

C.G. Schmidt Construction, Milwaukee, WI

Concrete Supplier:

Central Ready Mixed L.P., Milwaukee, WI

Reinforcing Bar Fabricator:

Ambassador Steel, Waukesha, WI

Reinforcing Bar Detailing:

The City Rebar, Morrison, IL

Custom Formwork:

Union Brotherhood of Carpenters Locals
344 and 264, Milwaukee, WI

Total Project Cost:

\$120 million

Total Project Size:

140,000 sq ft (added to existing museum)

Photography:

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CRSI Concrete Reinforcing
Steel Institute

www.crsi.org

Critics have called the Milwaukee Art Museum addition an event as much as a building, a moving work of art in an elaborate urban ballet. The museum welcomes twice the number of annual visitors as it once had, with millions coming to see this innovative structure where the boundaries between engineering, sculpture and architecture merge.

The overall design is based on a concept of Spanish-born architect, sculptor and engineer Santiago Calatrava, the expanded museum incorporates shapes and finishes never seen before in steel reinforced concrete. The inherent beauty, strength and versatility of reinforced concrete played a vital role in bringing Calatrava's vision to life.

STRUCTURAL FRAMING SYSTEM

Sculptural art rendered in steel reinforced concrete. Certainly strength was an element in Calatrava's selection of reinforced concrete for this one-of-a-kind project. But he also chose the material for its ability to take on the sculpted forms that define all spaces of the expanded museum. Every area of the addition includes curved walls, arches and ceilings. The main pavilion features 76 graceful arches supported by a keel beam, giving visitors the sense of being inside the belly of a great ribbed ship. Even the 100-car underground garage itself, is as beautiful as a gallery with its distinct curved walls accented by 22 long horizontal reveals.

Yet surprisingly, most of these concrete surfaces don't look like concrete. The building's smooth exterior appears bright white; the pale, glossy interior walls seem as if they were somehow formed from curved drywall. How did crews sculpt steel and concrete into these remarkable forms? What was it like to construct a building where, as one worker put it, the concepts of "plumb" and "straight" have almost no relevance?

UNIQUE DESIGN FEATURES

Challenges for the concrete placement throughout the new museum went beyond the extreme congestion of reinforcing bar needed to hold the unique shapes. To consolidate the rapid-setting, flowing mix, forms had to be vibrated after each placement. Most forms were filled slowly from the bottom up using specially constructed steel pipes that lifted as the level of the concrete rose.

Slow, careful work created the building's ring beam, which ranges from 10' thick at its core to a mere 8" in the section soaring out over Lake Michigan. The keel beam in the main pavilion also called for innovation, with craftspeople building a 30-foot-by-60-foot rolling cart that held forms and shoring, which moved along as the beam took shape 30 feet above floor level.

REASONS FOR CHOOSING REINFORCED CONCRETE

Advances in concrete technology, CAD drafting and construction techniques have continued to move the edge of reinforced concrete structures forward. The sculptural qualities seen in Calatrava's museum design now grace many striking steel reinforced concrete structures around the world.