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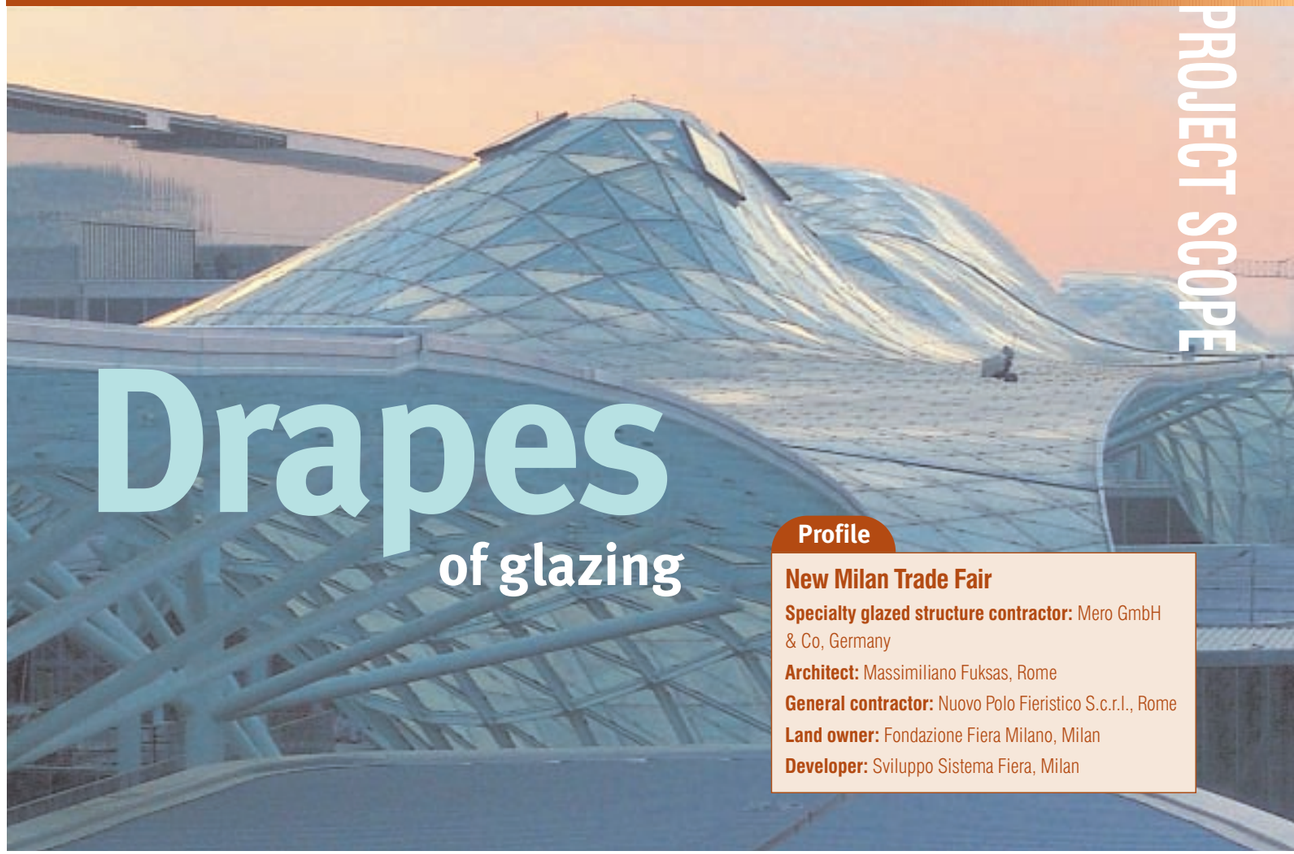
New Milan Trade Fair

Glass Magazine® Volume 55 Number 10 October 2005 New Milan Trade Fair • Guide to building codes • GlassBuild America review



Drapes
of glazing

Profile

New Milan Trade Fair

Specialty glazed structure contractor: Mero GmbH & Co, Germany

Architect: Massimiliano Fuksas, Rome

General contractor: Nuovo Polo Fieristico S.c.r.l., Rome

Land owner: Fondazione Fiera Milano, Milan

Developer: Sviluppo Sistema Fiera, Milan

Admirers of the free-form school point to the trade-show venue as a classic beauty

By Sahely Mukerji

It's a large sail that launches Milan.

That's how the Italians describe the New Milan Trade Fair that opened March 31. Located in Rho-Pero along the axis from Milan to the international airport of Malpensa, the New Fair's magnificent and colossal structure occupies a gross floor area of 530,000 square meters, with eight pavilions large enough to hold Saint Peter's Square and only 12 pillars.

The New Fair complements the existing exhibition space, the City Complex, in Milan. The two components were designed as a system to boost trade-show business in the Lombardy region. The New Fair is expected to double the amount of money generated by fair activities in Milan and enhance the area's quality of life.

The pavilions' 20 exhibition modules link via a 1,300-meter long central passageway suspended 6 meters above the ground. The eight pavilions create a gross exhibition area of approximately 345,000 square meters; the external exhibition area covers 60,000 square meters. The hotels, eating areas, and a commercial gallery with more than 200 shops within the complex also offer recreation and culture. Approximately 20,000 parking spaces serve visitors.

The design, the engineering

Architect Massimiliano Fuksas of Rome designed the fairground using leading-edge architectural features that provide a people-friendly meeting place and a forum for exchanging ideas. "I thought about a unitary complex of simple geometry," Fuksas says on his Internet site. "The project is characterized by the great central axis: The great transparent coverage modifies spaces and represents the continuity of the vision. The service center, the offices, the convention area are the fulcrum. ... The pavilions, with big façades made of reflecting metal bring back the life and the images of the pathway.

Sources

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Massimiliano Fuksas, Massimilliano Fuksas architetto, Piazza del Monte di Pieta, 30, 00186 Roma, + 39 06 68807871, office@fuksas.it

Suppliers

Glass fabricator:
BGT Bischoff Glastechnik AG, Germany

Curtain walls:
Permasteelisa Group, Europe

Steel:
Mero GmbH, Germany

Hardware:
Mero GmbH

Skylights:
Mero Skin Glazing System, Germany

Out of crisis comes completion

Near the completion of the New Fair construction, Mero GmbH of Germany, the holding company of the Mero organization with strategic and financial planning responsibility for the various Mero business units, met with an unexpected financial crisis in July 2004. A German tribunal decreed the state of insolvency and put the company in bankruptcy. Nuovo Polo Fieristico S.c.r.l. of Rome, the general contractor, replaced Mero GmbH and took charge of managing work at the New Fair.

However, employees at Mero GmbH continued the fabrication works after the insolvency application under control of the insolvency managers. The project director of Mero GmbH, Josef Rossmanith, was hired by NPF to manage the project until its completion. All subcontractors were paid after the insolvency application directly by NPF.

In the meantime, the management team at Mero Structures Inc. of Menomonee Falls, Wis., the U.S. subsidiary of Mero GmbH for 20 years, decided to buy all the shares of Mero Structures Inc. with the help of Corporate Financial Advisors LLC of Milwaukee. The three managers and owners are Ian Collins, president; Kent Anderson, vice president of finance; and Terry Peterson, vice president of sales. The key to the purchase was the introduction of the glazed free-form technology in the United States, Peterson says. Mero Structures Inc. had always been a financially stable, high-performing business unit, he says. This, combined with the opportunity to provide glazed free-form technology to the U.S. market, made the company an attractive investment to the management team.

"My partners and I were committed to maintaining the rapidly evolving glazed free-from technology," Peterson says. "Part of executing that strategy was hiring Soeren Stephan, the chief engineer from the Milan project."

The rigorous building codes in the United States present challenges to implementing free-form structures, but Stephan has found a way to modify the system for domestic use, Peterson says. Company officials are optimistic about the rapid acceptance of this technology in North America, he says.

"We expect the success of [the] Milan [New Fair] to really promote glass and its use in free-form," Peterson says. "Mero Structures Inc. has already been contracted to build such a glazed structure on the Regatta Condominiums in Chicago, scheduled for completion in early 2006."

"The Vela took on the shape of the God-given tapestry represented by the Alps mountain range."

... In a moment of very few 'visions' looking to the future, and the mere running of quotidian life and of existence, this project seems to be part of the more dynamic European scenery."

Two beautiful glazed structures grace the New Fair: the Logo and the Vela. The Logo, Italian for symbol, marks the entrance to the fairground and is part of the building envelope, says Terry Peterson, vice president of sales for Mero Structures Inc. of Menomonee Falls, Wis., the U.S. subsidiary of Mero GmbH, the engineering firm for the project. "It consists of a double-curved, free-form surface that appears like a volcano," he says. The 26,000-square-foot surface is clad with glass and metal panels with overall dimensions of 70 feet by 110 feet and 340 feet in length.

The Vela, Italian for sail, forms a canopy that links the individual exhibit halls. It consists of a glazed surface with "an architectural form that took on the shape of the God-given tapestry represented by the Alps mountain range in the background," Peterson says. "The ability to create a single-layer fully glazed structural grid in the form of the Alps pushes the technological boundary out well beyond current standards." The Vela is nearly 1 mile long, 100 feet wide and clad with approximately 500,000 square feet of glazing.

Free-form structures such as these defy the rules of common shapes—flat in-plane, pyramidal, barrel vault, dome or hyperbolic surfaces—and take on shapes totally free in form. "The edges can bend up and down with the frequency of a mountain range, obviously with material limitations that prevent complete flexibility," Peterson says. Free-form structures are typically metal clad, usually stainless steel. The Jay Pritzker Pavillion in Chicago's Millennium Park, designed by Frank Gehry of Los Angeles, is a good example of metal-clad free-form architecture. "The steel support structure is hacked out and welded up in creating a bizarre shape," Peterson says. "Then the hacked-up and ugly steel is clad over and completely concealed by the stainless steel cladding material. However, with a glass free-form structure, you cannot hide the steel underneath, because glass doesn't offer the opacity of metal cladding. Therefore, it is much more challenging, because the steel support structure is completely exposed and must work with the glass

200,000 square meters
Glass surfaces

16
Skylights

Rapid pace of work

July 2003: Award of contract

July 2003-October 2003: Approval of planning and programming works

November 2003: Full-size mock-up for Vela

November 2003-June 2004: Fabrication planning

November 2003-October 2004: Fabrication of columns, nodes and struts

December 2003-November 2004: Glass fabrication and delivery

February 2004-December 2004: Installation and hand-over.

$16 million
Cost of the roof

$968.7 million
Cost of the complex

2,500 kilometers
Cables—
could cover the entire peninsula of Italy twice

77,000 tons
Steel structures—
enough to build 10 Eiffel Towers

cladding in creating beautiful architecture."

For the New Fair, Chief Engineer Soeren Stephan of Mero developed an elegant structural system to support the completely transparent glazing material. He joined straight T-section struts to individually machined "double-disc" nodes to create the surfaces, Peterson says. Nearly all structural components are bolted, enhancing field operations and allowing the structure to be factory-finished with minimal welding. Virtually every double-disc node on the project was custom-machined to create the special angles of the free-form surfaces, Peterson says. Straight strut elements had fewer part numbers due to some repetition. The nodes were designed to receive two fasteners at each strut connection to generate moment capacity at the joint—or to resist bending—with a single layer. "Basically, we invented a structural system to create the totally free form desired by the architect," Stephan says. "Metal-clad structures have been used previously. However, a fully glazed, single-layer form, where the structure becomes an aesthetic element, creates a much higher requirement. That made this project very difficult."

There are 4,000 struts and 1,500 nodes in Logo and 38,000 struts and 16,500 nodes in Vela. BGT Bischoff Glastechnik AG of Germany, supplied the clear, laminated, heat-strengthened glass for both structures. The glass for the Vela is a single sandwich unit consisting of two lites of 8-millimeter glass laminated with a 0.76-millimeter polyvinyl butyral interlayer. The Logo uses insulating glass units consisting of an inner lite of the laminated single sandwich, a ½-inch air space and an 8-millimeter outer lite. The glass was glazed directly to the structure in both Logo and Vela. The thin "skin-glazing" system uses ethylene propylene diene, or synthetic rubber, profiles, Peterson says.

"When glass is attached directly to structure in this way, steel tolerances become critical," Stephan says. "However, we were confident the bolted elements and high-precision fabrication would get the job done. The results speak for themselves."

Both roof surfaces have a complex spatial geometry with a quadrangular mesh arranged diagonally relative to the main axes of the buildings, according to 2005 Glass Processing Days Conference Proceedings. For the Logo, the basic grid pattern consists of even square meshes; for the Vela, the meshes are rhombic. In the transition to the curved regions, the torsion of the quadrangular mesh units exceed the limit of glazing and divide into triangular mesh units by means of diagonals.

"It was surprising that no frit was used on the glass surface to enhance shading or mask dirt," Peterson says. "On the positive side, they now have a completely unencumbered view of the sky."

Mero engineers ensured that the Vela roof could be drained without a perimeter gutter or any visible downspouts. They used an internal drainage system in the columns that required precambering of the flat roof areas as hypar, or skewed saddle-shaped, surfaces, Peterson says. As a result, the square glass panels in some areas had to be installed with a certain amount of predeformation. The glass supplier had to undergo long-term tests to ensure that this pre-deformation did not cause the delamination of the panels.

"Solving the drainage on a surface this complex without edge gutters or down spouts represented an incredibly tough challenge for our engineering group and glazing supplier," says Josef Rossmanith, project director, Ingenieur-Buro, Germany.

The time line

The New Fair, said to be the largest fair complex in the world, was built a square meter per minute for a total of 10 million hours, according to its Internet site. Construction was scheduled to be completed in 30 months, but Nuovo Polo Fieristico S.c.r.l of Rome, the general contractor, took 24 months to complete the project from the first foundation pole to the opening, the site says. Fifty-five percent of the structure was produced outside of the site, in Italian and other European workshops, and assembled on site in a "large open-air meccano." More than 9,000 workers from 62 countries lived and worked together in what may be among the largest construction sites in Europe. More than 300 companies were involved. Workers from foreign countries lived in a village created for them in Mazzo di Rho that had approximately 1,000 beds. They ate at a canteen with 450 seats.

"The initial 12-month scheduled site duration for a glazed structure this complex represented a nearly impossible accomplishment," Rossmanith says. "This was later shortened to 10 months because of delays from other trades. At that point, my team [members] really became concerned. Fortunately, through proper planning and excellent execution, we prevailed." At the peak of installation, Rossmanith had more than 170 installers and 14 supervisors from his company at the site. "Assembling so many custom parts, installing nearly 525,000 square feet of cladding and sealing more than 50 miles of joints in such a condensed time frame was a monumental achievement," he says.

A green project

For the construction of the New Fair, the landowner, Fondazione Fiera Milano, a private company, cleaned up a brownfield area of 1.5 million square meters that had been a burden on residents of the surrounding territory for years, according to the Internet site. The Agip gas refinery previously occupied the site. The cleanup took a little more than a year. Of the reclaimed area, 180,000 square meters is green, with 2,500 trees in the fairgrounds and a 9-hectare park in the northwest side of the complex. The complex uses ground water for cooling heat pumps, thereby saving drinking water. It is heated by a heat-valuator plant in nearby Figino that runs on urban waste from Milan. The plant also produces electricity, and an emergency electricity line from Figino to the New Fair will be set up to provide power in case of a blackout, according to the site. Special photo catalytic titanium-based paint used in the complex oxidizes or decomposes the pollutants present in the atmosphere or produced by combustion. The paint work on more than 100,000 square meters of treated surface area in the complex can neutralize the pollution from 30,000 vehicles, the site claims.

Mero engineers used double-glazed units with high-performance coatings in the Logo to limit the solar-heat gain during summer and the energy loss during winter. More than 40 percent of the Logo roof surface was covered with insulated aluminum panels, further enhancing the physical properties of the envelope and influencing the energy efficiency of the building, Peterson says. The engineers also conducted climatic studies to analyze the temperature conditions during summer days under the Vela canopy. They did lightening-protection and smoke-evacuation studies and performed bending, shear and compression tests.

The end product represents a sublime creation composed of sunny glass in unusual geometric patterns, shiny steel and reflecting pools that wow visitors and exhibitors alike.

PROJECT SCOPE

40,000 pieces of glass
make up the sail

440,000 cubic meters
Structures in concrete

9,000 tons
Weight of sail structure

38,000 square meters
Glass surface area of the sail

50 tons
Weight of each skylight

40 meters
Diameter of each skylight