PERMASTEELISA GROUP

FAÇADE IN FOCUS:
MUSÉE DES CONFLUENCES, LYON, FRANCE

Creating complex free-form architecture



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At the tip of the peninsula where the Rhône and Saône rivers meet, the Musée des Confluences rises as a striking urban gateway into the city of Lyon, France. Completed in 2014, the triumphant cultural landmark set new standards for complex free-form architecture and urban regeneration.

The Musée des Confluences forms part of the Lyon Confluence Project, one of Europe's largest urban regeneration projects, transforming the declining post-industrial transit hub - Lyon's Pointe du Confluent peninsula, into a vital part of the city.

Vienna-based architecture firm COOP HIMMELB(L)AU's project within this was to create a Museum for all fields of human knowledge, to act as both a venue for cultural exchange, and symbolise the rebirth of this part of the city. The overall architectural design resembles a floating crystal cloud of stainless steel and glass.

"A unique place at the confluence of two rivers, the Pointe du Confluent is certainly one of the most beautiful sites to build on and was a significant source of inspiration for our Musée des Confluences project."

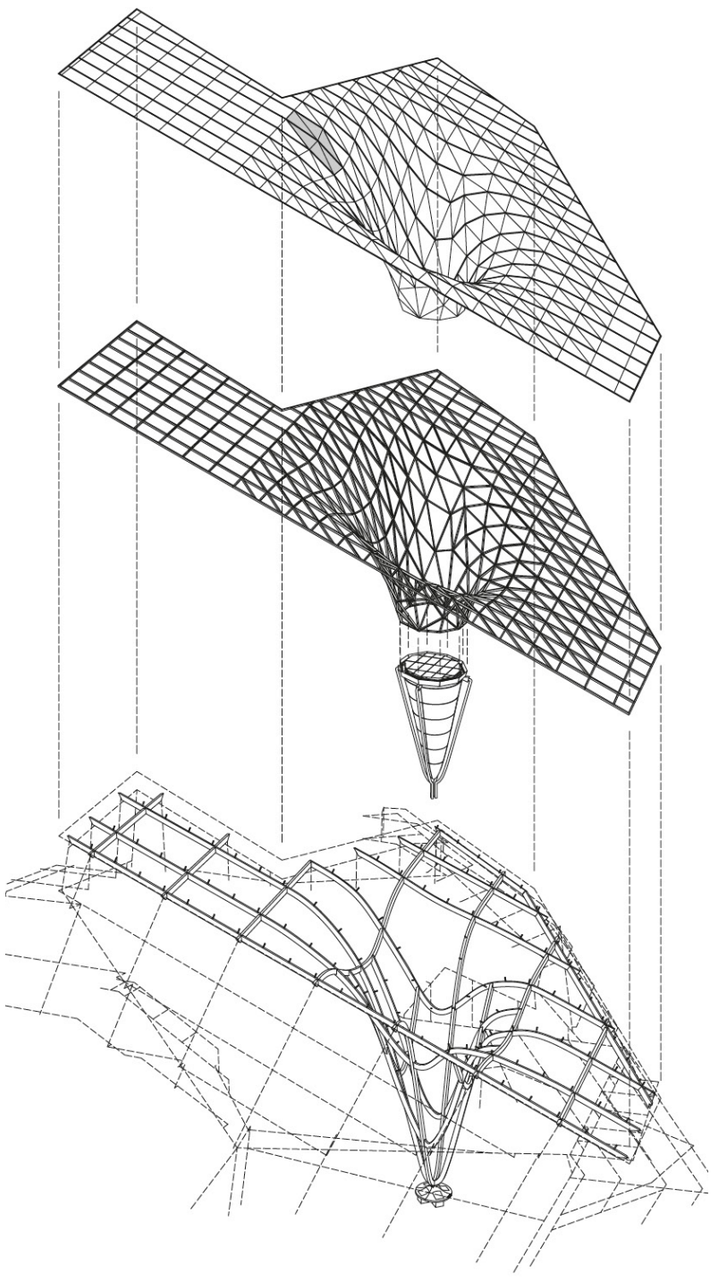
Wolf D. Prix, COOP HIMMELB(L)AU

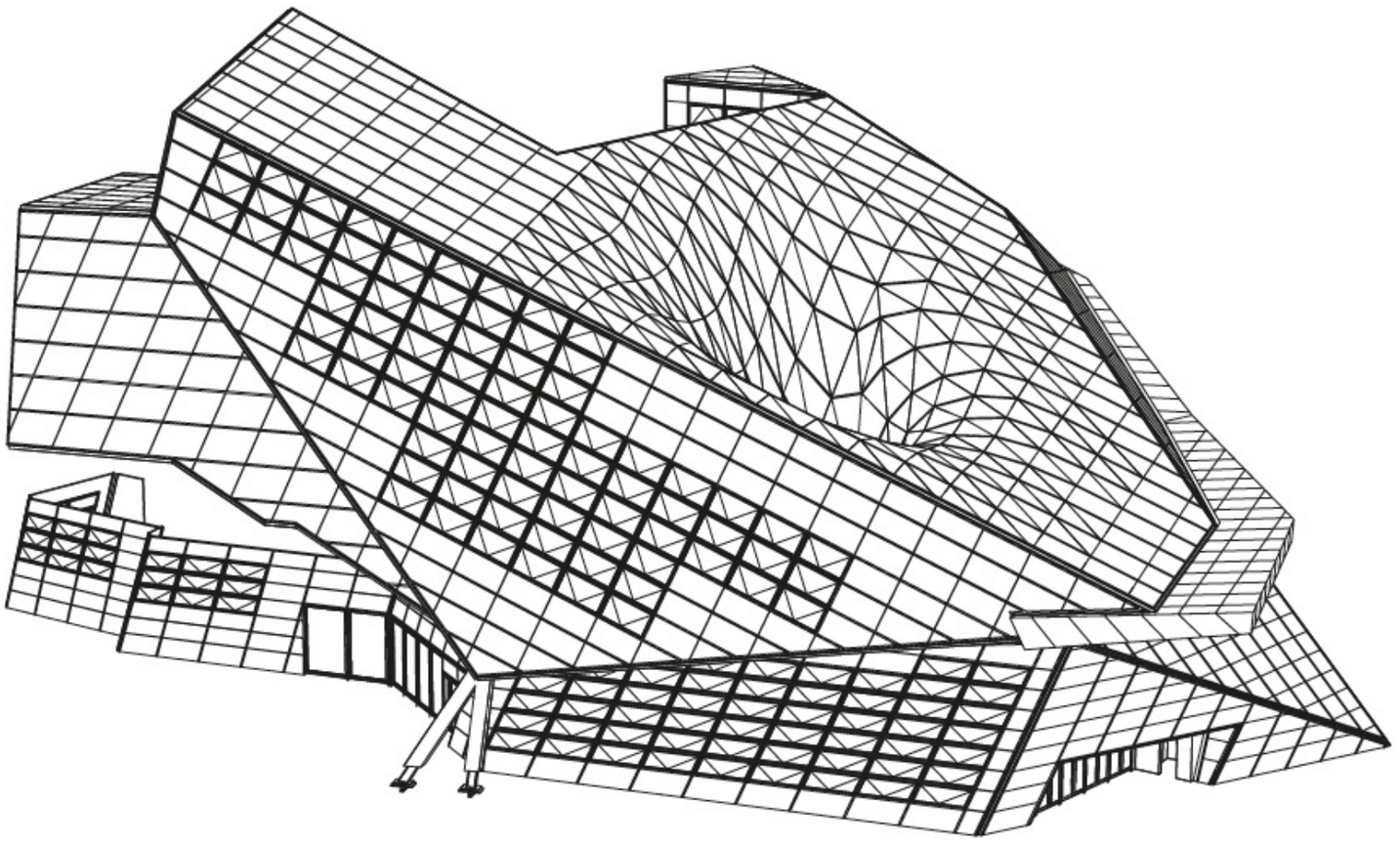


GIVING FORM TO THE FAÇADES

COOP HIMMELB(L)AU conceived two distinctive floating volumes: the ‘crystal’, a highly transparent glass-and-steel structure welcoming the public, and the ‘cloud’, an opaque, sculptural form housing the exhibition halls, both elevated above a reinforced concrete podium.

The giant glass, steel and concrete museum stands at 44m high, with a total area of 22,000 sqm. Our designers used 3D design to create the complex geometry of the steel structure and glazed panels, and working collaboratively, we designed, engineered and manufactured 6,000 sqm of glass and steel façade and over 200 fire and ventilation windows for the crystal’s structure, as well as 11 glass roofs for the ‘cloud’.





DESIGN & ENGINEERING: THE CRYSTAL

The ‘crystal’ features a complex, highly curved glass and steel design that required intricate joint engineering. Its outer shell consists of large laminated glass panes set in steel frames supported by an internal metal framework. It relied on a largely column-free design to maintain an open entrance and showcase the structure’s dramatic angles and curves, and a giant, whirlpool-like feature – the ‘Gravity Well’ - sweeps from the ceiling to the ground.





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“The main challenge was to succeed in developing, and then actually producing the structure from the design of an extremely complex 3D free-form shape”

Project Design Manager, Gartner

“An unprecedented shape for France … it led us very often to reach beyond our limits.”

Project Manager, Permasteelisa Group

CUSTOM DESIGNED COMPONENTS FOR OPTIMISING A FREE FORM

Digital Planning & Primary Framework

Constructing the ‘crystal’ required 650 tonnes of steel across 32 complex sloped sections curved at different angles. To navigate this structural complexity and coordinate independent trades, the engineering team built a unified 3D digital model, allowing them to align static load models and structural tensions, simulate installation sequences, and resolve structural clashes across the entire project.

Seamless Steel Structure

To preserve the architect’s ambition for a seamless, monolithic structure, the engineering team developed an innovative connection system to join the primary and secondary steel structures, using around 300 custom bolted connections hidden inside hollow pipe profiles. High pressure is transferred through the pipe walls via a precise eight-screw pre-tensioning sequence for even stress distribution. Finally, contact points were filled and smoothed on-site.

“Having to have a non-visible connection system that would make the structure appear one single element required an enormous effort on the part of the whole team.”

Engineering Manager, Gartner

Façade Integration & Features

Supported by the primary frame, the outer skin of the ‘crystal’ features glass panels attached to a secondary steel grid (180 x 80mm), using the same concealed bolting system. The main engineering challenge was securing this heavy glass to the steel framework without applying destructive levels of pressure.

For drainage, to prevent water pooling on complex, sloped glass surfaces, the team engineered self-draining joints that channel water into primary drainage paths along the maximum slope of the structure. These were mounted in the factory to guarantee speed and quality during installation.

For ventilation, over 200 custom, flush-mounted ventilation and smoke-extraction windows (2.6mx1.5m) were designed, manufactured, and rigorously tested for air/water tightness, operation, and fire safety.

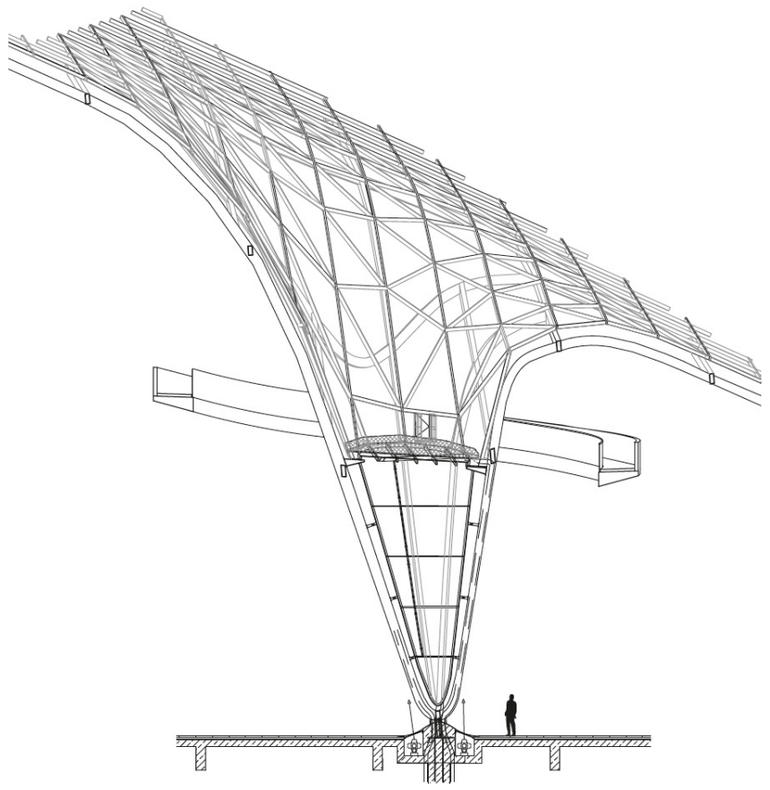
For shading, an automated brise-soleil sun-shading system was installed, concealed, along with all wiring and structural connections, directly inside the steelwork.

Inter-Volume Connections

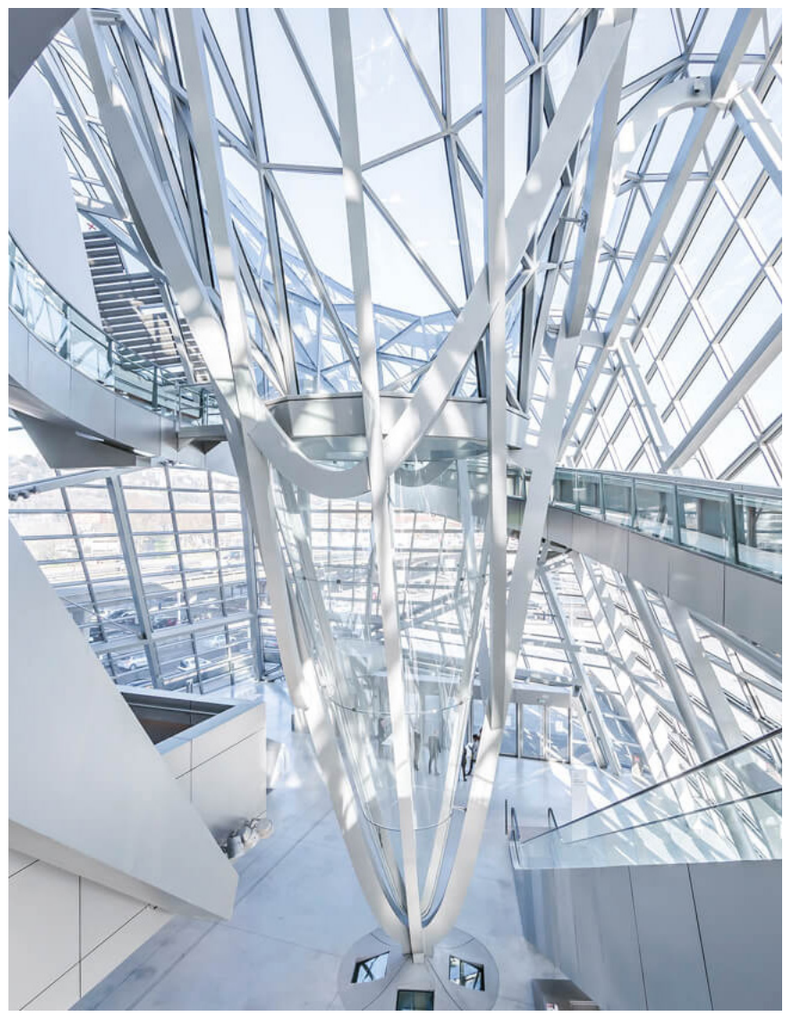
To anchor the two main building volumes, custom double-sided ball joints were engineered for 30 key connection points, allowing installers to fine-tune tolerances in all directions while accommodating multi-directional movement in the main frame.

The Gravity Well

Plunging 33m from the roof to the atrium floor, the 'Well of Gravity' is a tapered glass funnel that serves as both an aesthetic centre-piece and a primary structural column, reducing the load on surrounding steelwork by nearly one-third. It required 160 special knots to connect the glass to the steel of the structure.



Formed from triangular laminated glass supported by an integrated silicone drainage network, its spherically curved segments were heat-bent to extreme limits - with the four lowest units reaching a curvature radius under 500mm. At the base of the cone rests a two-part lens made of 1.5-tonne semi-circular glass panes featuring automated self-heating elements that maintain a surface temperature of at least +5°C to instantly melt away snow.



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"Spherically curved glass panes had to be manufactured for the 'crystal' with curves approaching the limits of what is technically feasible."

Engineering Manager, Gartner

Regulatory Approvals & Compliance

Bringing together experts from across the Group, Gartner collaborated to create bespoke engineering solutions to honour the architectural vision while meeting strict French building codes. The novel internal bolting system achieved formal recognition under European structural steel standard EN 1090, and official Appréciation Technique d'Expérimentation (ATEx) approvals were secured for custom features including the angled self-draining system, the 'Gravity Well' structure, self-heating glass, and VEC-glued smoke-extraction vents.

"The project experience shared with our French colleagues provided new and enriching insights, and consolidated the international character of our Group."

Project Design Manager, Gartner



EXCELLENT ENVIRONMENTAL PERFORMANCE

Honouring the Lyon Confluence project's sustainability goals, the Museum is highly energy efficient, combining renewable energy and passive design features. Large expanses of thermally insulated glazing maximize natural light, and the 'crystal' uses natural air currents to ventilate the space - drawing cool air through east-facing vents and releasing warm air through the roof. Rooftop solar panels generate electricity, and local groundwater powers the heating and cooling systems before being reused for irrigation or returned to the river.

COMPLEX LOGISTICS & PRECISION INSTALLATION

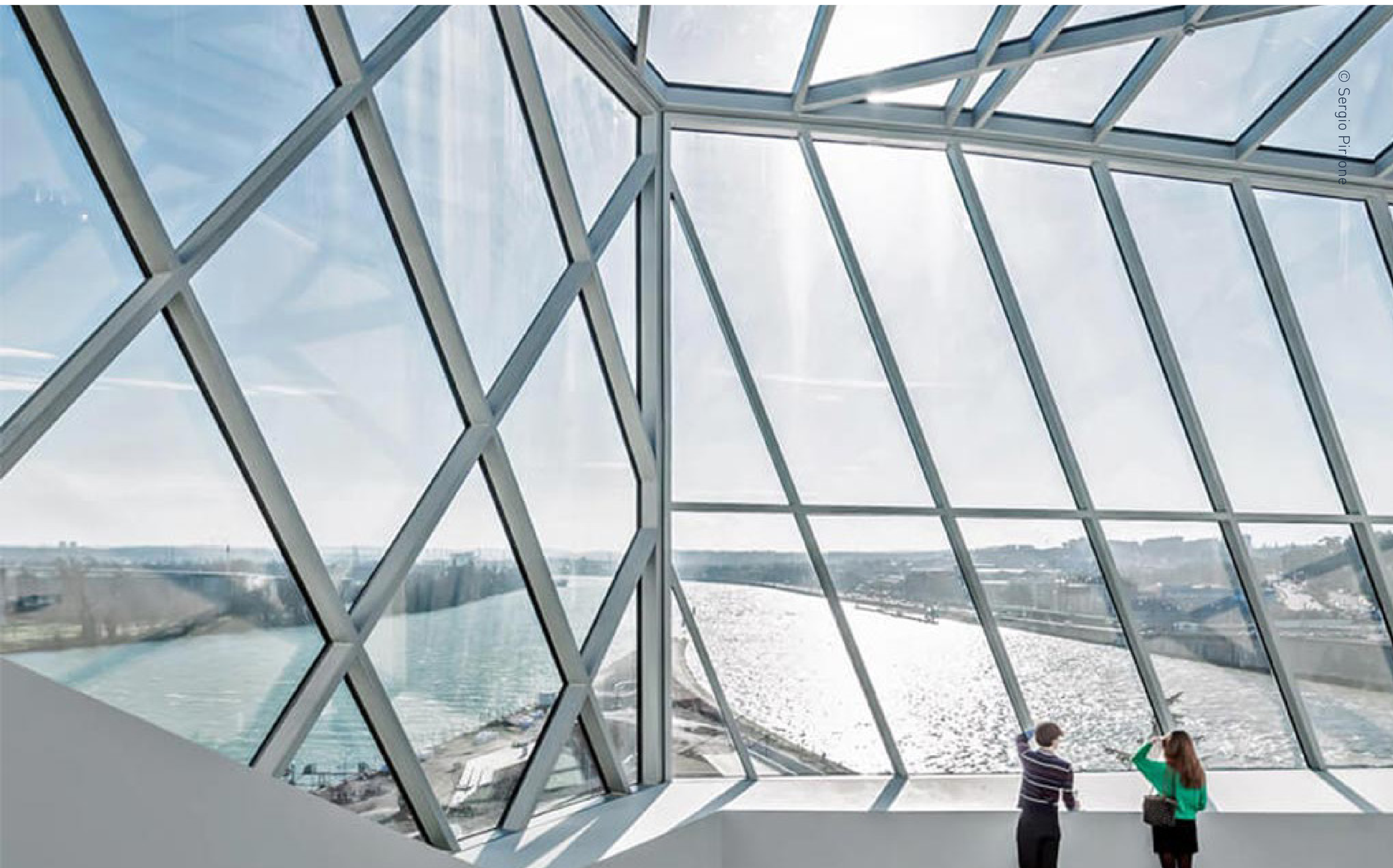
Building on a narrow riverbank between two rivers and an active highway created highly complex logistics. To help address these, steel frames, double-sided ball joints, and glass units were pre-assembled and pre-tested in Gartner's manufacturing facilities prior to transportation, while specialist trucks were used to transport oversize components, above 4.5m wide and 20m long, to site.

On-site installation required custom lifting rigs and high-precision positioning tools, while positioning the heavy, steeply sloped glass segments around the delicate lattice of the 'crystal' demanded meticulous crane operations. A critical moment was maneuvering the lens into position through the 'Gravity Well''s narrow steel framework.

A CULTURAL BEACON

More than a decade after its completion, the Musée des Confluences stands as a bold testament to advanced digital modelling, modern engineering, and architectural courage. Since opening to the public, the iconic building has been visited by millions of people.

By merging transparent public spaces with flexible exhibition halls, the building acts as a vibrant cultural beacon at the entrance to Lyon. Its glass envelope captures changing light reflections from the Rhône and Saône, symbolising the convergence of human knowledge, technology, and nature.



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This issue of Façade in Focus is adapted from the book Complexity and Eternal Beauty, published by Permasteelisa Group in 2017.

PROJECT CREDITS

Owner & developer: SERL (Société d'Equipement du Rhône et de Lyon)

Architect: COOP HIMMELB(L)AU

Main Contractor: VINCI Construction

Façade Contractor: Permasteelisa Group (Permasteelisa Europe / Gartner)



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