Luminous pastel-colored, movable glass panels cover the facade of the new headquarters for the city of Rouen, France, creating diagonal lines that serve to lighten the visual weight of the waterfront structure.

STRUCTURES

Waterfront Building Pays Homage to Claude Monet

THE NEW HEADQUARTERS for France's city of Rouen—the Métropole Rouen Normandie—offers an unusual twist: its soaring facade has been designed and detailed in an homage to impressionist painters, in particular Claude Monet. Luminous pastel-colored, movable glass panels cover the facade, creating diagonal lines that serve to lighten the visual weight of the waterfront structure while offering a playful contribution to the city's skyline.

The 8,300 sq m building was completed in July 2017 at a cost of €25,000,000 (U.S. $29.4 million). The design was created by Jacques Ferrier Architecture with structural engineering by C&E ingénierie des structures, both of Paris. The footprint of the six-level building is a rectangle split lengthwise down the center, creating the sense of two separate, rectangular building sections. Multilevel terraces bisect this center line to increase the reach of daylight into the interior. A visually separate facade splits at the building's midpoint to stretch diagonally above the building sections in opposing directions, providing cover to the rooftops and terraces and acting as a thermal barrier for the building. A single-level parking garage is beneath the building.

Although it is located inland, the city of Rouen is a major port for the area because of its location along the Seine river. "The site of the new Rouen Métropole is incredibly spectacular: It is on the site of a port, and there are still cranes, the grand Gustave Flaubert [vertical lift] bridge [which opened in 2008], and big ships [that] occasionally pass by," noted Jacques Ferrier, an architect, urban planner, and founder of his eponymous studio, which has locations in France and China. Ferrier wrote in response to questions posed by *Civil Engineering*. "The main idea of the project is to unite all the energy that is found in these port sites."

The design team made an extensive study into the shape of the building before selecting one that resembles the bow of a boat and the port-side hangars that the building was replacing, according to Ferrier. But the true star of the design is its colorful glass-paneled facade.

"The multifaceted, transparent architecture of the headquarters plays with the changing light of the Normandy sky, reflections from the water, and the colors of the climate," Ferrier said. "The glass is covered with a layer of metal oxide, creating a colorful iridescent reflection from the outside but disappearing on the inside, leaving the light in work areas unaffected." The constantly changing colors are intended to blend with those of the sky and river as a modern twist on Monet's 1890s study of the Rouen Cathedral, which explored the chromatic variations caused by changing seasons, weather, and light through a series of paintings. Diachronic solar panels on the roof of the facade structure have the same changeable characteristics.

The building is composed of three main materials: concrete, steel, and glass. The majority of the interior is concrete, which is used for the concrete piles on which the building is founded, its one-level basement, and about two-thirds of the above-ground building, according to Jean-Marc Weill, an engineer, partner, and manager at C&E ingénierie. Prestressed concrete with hollow-core slabs was selected to optimize the thickness of the concrete as a structural material while taking into consideration its necessary thermal and acoustic performance, according to Weill.

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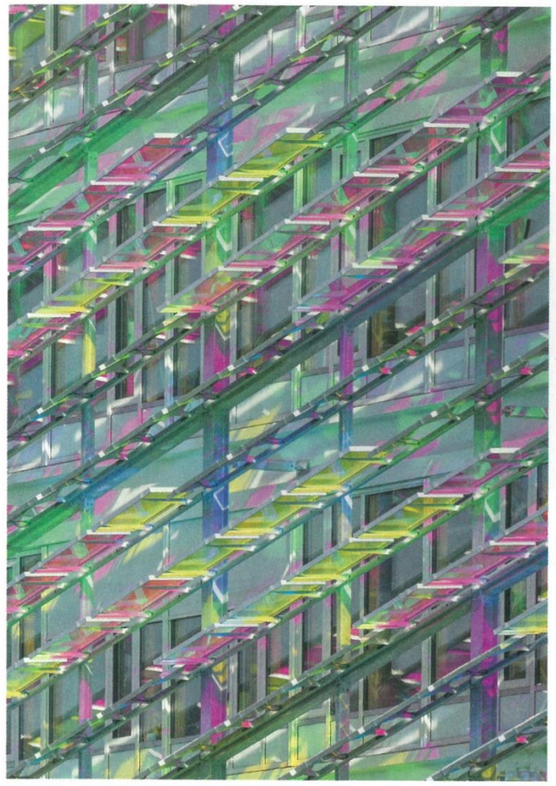
A steel frame forms the remaining third of the building and is used to create a cantilever along one full side of the building, according to Weill. Steel was selected for this section as a better option than concrete because of its ability to support heavy loads in such a design without cracking or deformation, he notes. The structural design was incorporated into the global architectural design of the building early in the process so that the cantilever would not introduce tension forces into the concrete piles under the building, according to Weill. Because of this, expansion joints and the necessary dead loads were incorporated into the design from the beginning to manage the cantilever's tendency to rotate. Doing so saved the project unnecessary expense and ensured the cantilever only introduces compression forces to the piles, he says.

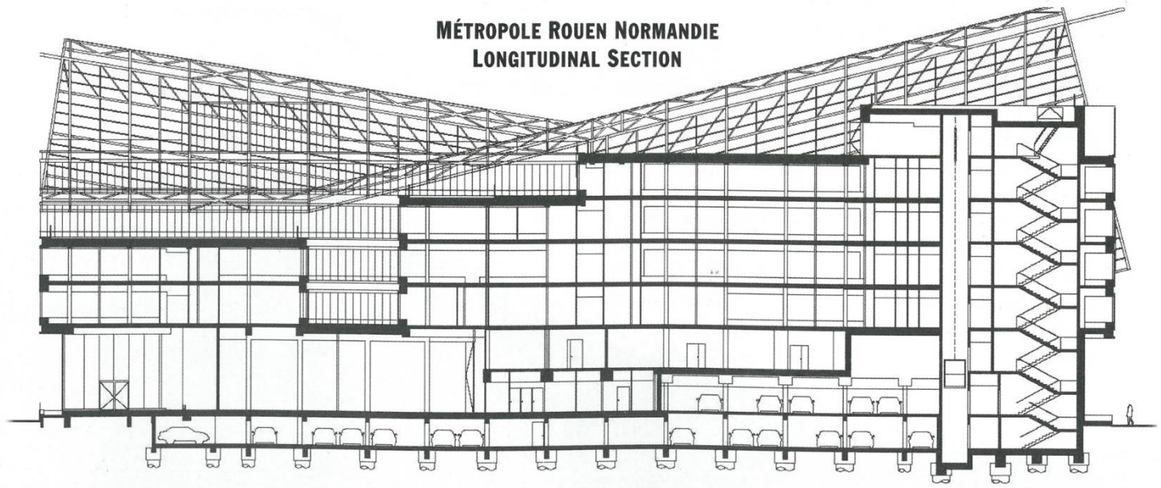
The steel-and-glass facade encases the sides and top of the building. The facade protects the interiors against heat gain and has been designed to limit the thermal bridges between itself and the building. The facade's cross bracing also serves as a secondary structural system for the building, according to Weill. Columns—300 in total—that extend from the building's rooftop support the facade roof. These are attached by hinged connections, rather than fixed ones, to minimize the thermal gain transferred from the facade to the main building, he notes. Triangular columns on the rooftop give transverse stability to the facade's roof structure, which then becomes a curtain wall facade extending down the building's sides.



The glass is covered with a layer of metal oxide to create a colorful iridescent reflection from the exterior without affecting the light in the building's interior.

Incorporating the structural design early in the design process also enabled it to become a nearly invisible part of the architecture, so that the interplay of light, sky, and river on the glass panels could be the visual highlight of the building, according to Weill. —CATHERINE A. CARDNO, PH.D.

MÉTROPOLE ROUEN NORMANDIE LONGITUDINAL SECTION



LUC BOEGLY/V2COM, *TOP*; JACQUES FERRIER ARCHITECTURE/V2COM, *RIGHT*