ARCHITECTUREWEEK
THE NEW MAGAZINE OF DESIGN AND BUILDING

California Academy of Sciences

December 17, 2008



by Rachel Grossman

Renzo Piano demonstrates a mastery of light throughout his work. At the new California Academy of Sciences in San Francisco's Golden Gate Park, he exhibits the same care lighting a museum of the natural world as he has in lighting some of the world's finest art collections.

In addition to demonstrating Piano's aesthetic and technical artistry, the new Academy building exemplifies deep sensitivity to site and environment. This great building recently received LEED Platinum certification, and won a silver-level Holcim Award for Sustainable Construction in 2005.

Light Pavilion

In the 1970s, Renzo Piano and Richard Rogers revolutionized how people viewed museums with the Centre George Pompidou in Paris.

Piano again sets a precedent in the museum world with a large-scale project that emphasizes "green" design. This 410,000-square-foot (38,000-square-meter) building, designed by Renzo Piano Building Workshop with local partner Stantec Architecture (formerly Chong Partners Architecture), provides a new home for the California Academy of Sciences — a combined aquarium, planetarium, natural history museum, and scientific research institution.

The new Academy building is an elegant pavilion structure with a living roof that appears to float over skinny steel supports. At the building's center is a glass-roofed piazza. The overall design is marked by open, flexible exhibit spaces with sight lines to the surrounding park. >>>

Using light as a primary element of design, Piano shines away any dark stereotype of a natural history museum with dim musty halls cloistering insular scientists.

Even the glass chosen for the project, with a low iron content to maximize transparency, aptly supports the museum's mission of exploring, explaining, and preserving the natural world. The high-performance glass transmits daylight to most occupied spaces while also minimizing heat gain. Piano's extensive use of glass also serves as a reminder of nature's inherent fragility.



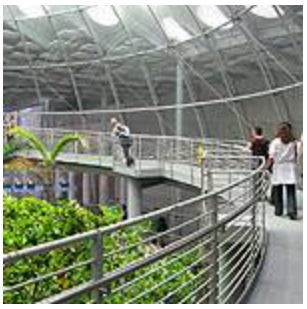
Post-Earthquake Opportunity

The California Academy of Sciences was founded in 1853, the first such scientific institution in the West. It moved to Golden Gate Park in 1916, growing over the next 60 years to encompass an expanding program and a cluster of 12 interdependent structures.

The 1989 Loma Prieta earthquake significantly damaged some of the structures, with Bird Hall and the Steinhart Aquarium suffering the most damage. After considering repair and seismic retrofitting of the complex, the Academy's board of trustees in 1999 decided to instead build a single, sustainable new building on the Golden Gate Park site.

Renzo Piano appeared at the selection interview alone, armed with only a green marker and a sincere desire to understand the organization's mission. After contemplating the existing buildings from the steps of the nearby de Young Museum and taking in the view from the roof of the Academy, Piano sketched a sinuous roofline that echoed the hilly topography of San Francisco. With this design concept he clinched the deal for the project.

To allow for demolition and construction to occur, the Academy moved to a small temporary home near downtown for four years.


Raising the Plane

The Academy project called for integrating the many functions of the previous 12-building facility into a coherent whole.

Piano started with the elegant concept of a pavilion that blends seamlessly into the park setting. He has described the museum as "cutting the ground plane of a park and lifting it 38 feet [12 meters] into the air."

The undulating roof is planted with nine species of native California plants, which are expected to attract native wildlife. Accessible via elevator, the 2.5-acre (one-hectare) roof also serves as a living classroom, providing a forum for educating visitors about sustainable design and California's ecosystems.

The slopes of the "hills" on the roof draw cool air into the central plaza area and then naturally ventilate the surrounding exhibition spaces. Mechanized skylights open and close to regulate the accumulation of heat inside the building over the course of the day. Natural light reaches the living rainforest inside and the coral reef beneath it.

Energy usage at the new Academy is expected to be 30 to 35 percent less than that of a typical building its size. Contributing to that are the six inches (15 centimeters) of soil on the living roof, which insulate the building, keeping interior temperatures ten degrees Fahrenheit (six degrees Celsius) cooler than a conventional roof.

The soil is also expected to absorb 98 percent of stormwater, keeping approximately 3.6 million gallons (13.6 million liters) of runoff annually from flowing into the nearby Pacific Ocean.

The border of the pavilion is covered by 60,000 photovoltaic cells that will generate five to ten percent of the energy needed for the building's operation.

New Structure, Old Elements

In the words of Kang Kiang, the former project manager with Chong Partners, the museum design can be described as a "table" that rests on the "legs" of four similarly proportioned pavilions. In between the pavilions on all four sides of the building are curtain walls that ease navigation through the interior.

A network of tension cables, described by Piano as a spider web, is connected to a ring truss that secures the building structurally. In the event of an earthquake, all the glass pieces of the plaza's ceiling have been designed with patch fitting to move six inches (15 centimeters) in any direction without breaking. The reinforced concrete walls that support the four pavilion "legs" provide shear walls for the transfer of horizontal forces.

The "leg" on the northeast side of the building preserves two limestone walls from African Hall, a Beaux-Arts-style structure built in 1934. Inside, the building's popular dioramas and ceiling details were painstakingly reproduced from the original. A new space at the far end of the hall houses a colony of live African penguins.

Between the pavilions on the south side of the building, new neoclassical columns recalling those of the original Steinhart Aquarium frame the alligator tank, where original tiles and a bronze seahorse railing also preserve some of the character of the previous facility. On the southeast side of the museum, a Foucault pendulum dating to 1951 has been restored to its original glory and stands next to the state-of-the-art planetarium.

Green to the Bones

While only two walls from the old Academy building were integrated into the new structure, little of the demolition waste was wasted: over 90 percent was recycled or reused. And recycled

materials permeate the new building. The structural steel contains 95 percent recycled content; the concrete contains 30 percent fly ash and 20 percent slag, both industrial by-products; and the insulation was made from recycled denim.

At least half of the wood in the new Academy is Forest Stewardship Council-certified as sustainably harvested, and one fifth of the building materials were manufactured within 500 miles (805 kilometers).

Other green features include HVAC heat recovery systems, reverse osmosis humidification systems, operable windows in staff offices, and photosensor-controlled artificial lights. Low-flow fixtures and the use of reclaimed water from the City of San Francisco are expected to reduce overall potable water use by 78 percent.

Lively Exhibits

The design team has skillfully woven history, live exhibits featuring 38,000 organisms, and interactive displays that can change as quickly as scientific knowledge itself.

Two 90-foot- (27-meter-) diameter domes flank the central piazza. To the east is the Morrison Planetarium dome, with a high-definition projection system and the ability to run a live feed from NASA.

To the west is the rainforest dome, in which live exhibits imitate the rainforest ecosystems of Borneo, Madagascar, Costa Rica, and the Amazon. The walkways winding around the interior of the four-story glass dome have such tight curves that a roller coaster company was brought on board as a consultant to perfect the design. From the first floor of the dome, an elevator takes visitors to a tunnel-shaped aquarium representing a flooded forest floor in the Amazon.

Below the ground floor, visitors will find the new Steinhart Aquarium, designed by Thinc and Urban A&O with an emphasis on tactile, sculptural spaces that create the impression of exploring underwater landscapes. The Academy now boasts the deepest coral aquarium in the world, with a 210,000-gallon (795,000-liter) tank that houses a recreated Philippine ecosystem. Part of this exhibit features a crawl hole that leads to a 360-degree bulb, simulating the experience of scuba diving for visitors.

This living museum not only provides a safe haven for the Academy's precious cargo of over 20 million specimens, and modern facilities for its research department, but also places its team of scientists in direct contact with museum visitors. The public can view actual lab research through a glass wall on the building's ground floor, and can see into office spaces above the entry hall to the aquarium.

The museum itself is also used as a teaching tool about sustainability, with displays explaining the behind-the-scenes features and functions of the building.

Renzo Piano says he hopes the new California Academy of Sciences facility will communicate to many generations to come that life on earth is at once beautiful, awe-inspiring, and tremendously fragile.

Rachel Grossman writes about travel, fine arts, architecture, and interior design from San Francisco. She holds a graduate degree in modern art history from the Courtauld Institute.

Project Credits

USGBC's California Academy of Sciences LEED score sheet (PDF)

Architecture: Renzo Piano Building Workshop, Genoa, Italy, and Stantec Architecture, San Francisco, CA (formerly Chong Partners Architecture)
Project Manager and Owner Rep: DR Young Associates, San Rafael, CA
Engineering and Sustainability: Arup, San Francisco, CA, and Teecom Design Group, Oakland, CA
General Contractor: Webcor Builders, San Mateo, CA
Landscape Architecture: SWA Group, Sausalito, CA
Living Roof Consultants: Rana Creek Living Architecture, Carmel Valley, CA
Planetarium Technical Consultant: Visual Acuity, Brighton, England