

Los Angeles Edition

C A L I F O R N I A  
CONSTRUCTION REVIEW

California's Most Challenging & Unique New Construction Projects

value engineering  
site planning  
network sourcebook

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Congratulations  
Aquarium of the Pacific  
*for making a difference in our community*

Adirondack Scenic, Inc.  
Theming Contractor

Custom design development, fabrication and installation of themed environments for retail, entertainment and educational applications

Bali Construction, Inc.  
Underground Utility Contractor

General development and construction firm specializing in the installation of underground utilities; sewers, storm drains and water lines

Hayward Baker Inc.  
Foundation Contractor

Hayward Baker is North America's leading ground modification contractor, providing services related to grouting, soil densification and excavation support.

Hoffman Video Systems  
Audiovisual Display Systems

Full service: distributors; engineering; installation; and integration of professional quality video; projectors, teleconferencing/videoconferencing, control rooms and multimedia presentation systems

Jezowski & Markel Contractors, Inc.  
Concrete Contractors

Since 1953 concrete contractors in Southern California, developing quality concrete construction with innovative design techniques

The Larson Company  
Artificial Rock Scapes & Water Features

For more than 25 years Larson has collaborated with project teams to produce themed environments, exhibits and habitats, on schedule and budget.

M.S. Rouse Company Inc.  
Flooring Contractor

Commercial floorcovering contractor; participated in 10 of the top 50 projects in Los Angeles; quality labor; CAD design capability

Martin Integrated  
Specialty Metal Ceiling & Acoustical Contractor  
Martin Integrated delivers creative solutions for architects, developers and general contractors with cost-effective, cutting-edge technology and unparalleled personal service.

Shaw & Sons  
Architectural Concrete/Structural Concrete  
Shaw & Sons believes in creating the highest-quality concrete in the Southern California region for the best long-term value to the project owner.

Warren Aerial Photography, Inc.  
Progress Photography & Video  
Thank you for the exciting work during construction. It's a pleasure to provide aerial and ground progress photos for you.

**Turner**

## Aquarium of the Pacific

Visible from the harbor to the greater downtown area in Long Beach, the Aquarium of the Pacific was designed as an anchor attraction in the city's urban waterfront revitalization project.

"The owner wanted a building that would be an icon for the city of Long Beach," said Tom Nelson, AIA, vice president for Hellmuth, Obata + Kassabaum, Inc. (HOK), which along with EHDD Architecture, of San Francisco, served as part of HOK/EHDD, A Joint Venture, the project's architect. "Chuck Davis, [FAIA] lead designer for EHDD, provided the curved walls so evocative of the ocean, thereby creating a memorable image for the aquarium."

Dedicated to the education, preservation and study of marine environments, the aquarium's "principal goal is to instill a sense of wonder, respect and stewardship for the Pacific Ocean and its inhabitants," said Warren Iliff, president and CEO of the facility. According to Iliff, the aquarium's Pacific Ocean theme features three distinct ecological zones — Southern California/ Baja, Northern Pacific and Tropical Pacific.

Locating the Southern California/Baja exhibit outdoors shaved money from the budget, and the outdoor environment reinforced the building's connection to the site. Because the creatures in the exhibit are indigenous to the Southern California region, they do not require a climate-controlled atmosphere.

In the lobby the aquarium begins to bring the ocean indoors with three preview tanks of the major exhibits, covered by a trio of wave-like metal roofs. The west wall and entryway feature an aluminum curtain wall system of blue-green glass, reminiscent of waters off the Pacific coast.

### concept to completion

#### The Need:

An aquarium as a landmark facility for the urban waterfront revitalization project

#### The Challenge:

Planning to protect the sea life from future earthquakes and dealing with poor waterfront soil conditions

The aquariums tanks total more than a million gallons, including a 360,000-gallon coral reef exhibit. In the coral reef tank, visitors can watch trained divers feed the colorful fish. The aquarium holds more than 12,000 animals, spanning 500 species of marine life.

This project differed from other projects of a similar nature, since the exhibit design and the architectural design were completed simultaneously. "Many aquariums designed in the traditional style end up looking and functioning like housing for the exhibits only. The architectural character is somehow separate from the exhibits," said Nelson. "[Here] the simultaneous nature of the design means built-in integration of the architecture and the exhibits."

Local families, area schools and tourists benefit the most from the aquarium. "Exhibits are designed for easy accessibility for children," he said. "The acrylic viewing windows into tanks often reach the level of the floor to allow children and all visitors to get an up-close and personal experience."

A whole exhibit designed for children, called Kids Cove, features countless interactive exhibits for a fun and enriching experience. Children can walk through larger-than-life whalebones, learn about sea creatures and experience the touch tanks packed with animals within reach.

According to Nelson, the design of the lighting and acoustics was critical. Interior treatments were selected for their acoustical value and ability to merge into a whole design. The great hall of the main lobby is made of 12-inch-deep metal slats spaced 12 inches apart to create an undulating form that transmits from the curved roofs above, providing acoustical value, he explained.

To carry out the overall design theme of the building the lighting highlights the forms of the building, and animated lighting effects were introduced to enhance the shapes of the curved roofs. Lighting for the exhibits was created by the exhibit designers, and each individual exhibit has a unique lighting design.

The overall building "design minimizes the extent of expensive cast-in-place concrete construction and maximizes the use of steel construction, which allowed the general contractors, which were a part of the team from the beginning, more flexibility in construction sequencing," said Nelson.

One of the biggest construction and design challenges was performing such a complex undertaking in a relatively con-

densed amount of time. The project was funded with the sale of city bonds, which mandated a construction time of 28 months. The Aquarium of the Pacific was completed in half the time it might have taken for the completion of a comparable aquarium.

Due to the seismic zone in Southern California, a major consideration for everyone involved in the project was the possibility of an earthquake. How would the tanks, the glass and the very structure of the building stand up to a large-magnitude earthquake, and would the aquarium crumble from liquefaction?

"To mitigate the marina sites potential liquefaction during an earthquake, the entire structure sits on a thick concrete mat foundation," said Nelson. "The interior concrete tanks, many located on the second floor, are designed to withstand lateral earthquake forces. We used tremendous budget resources and time to resolve the liquefaction problem."

Poor soil conditions at the waterfront location and the issue of potential earthquakes meant conventional methods of construction could not be used. "A method called soil stabilization was employed," said Vincent J. Quinones, project superintendent for Turner Construction Company, which served as the projects general contractor in a joint venture with Kajima Construction Services. "This process entailed forcing 36-inch-diameter rock columns into the ground spaced at eight-foot centers, creating a very compact subsurface condition."

According to Quinones, more than 2,000 rock columns ranging from 45 to 85 feet deep were set during construction, resulting in a facility capable of withstanding a large-magnitude earthquake.

Another project challenge came when the mechanical, electrical and plumbing (MEP); fire protection; and life support systems had to be developed to sustain the animals while enhancing the aesthetics and functionality of the design.

"The systems were developed to sustain the harshness of salt water, so materials not commonly used were introduced, such as stainless steel, schedule 80 polyvinyl chloride (PVC), fiber reinforced plastic and fiberglass," he explained. "With the life support system design we had the challenge of maintaining complete water changes every hour on the hour. This means completely changing 1.5 million gallons of water every hour."

In addition to all the challenges this project held, the team needed to take the animals into

account and work around them. "We had to work closely with the aquarium staff members to allow them to introduce the 12,000 animals in time for the grand opening," said Quinones. To accomplish this, the animals had to begin being introduced seven months ahead of schedule.

As far as future expansion, said Nelson, the north end of the building and the entryway area represent a 30,000-square-foot site set aside for future growth, with knockout panels designed into the northern exterior cast-in-place concrete wall. The panels are aligned with the main circulation corridors to allow continuation of the exhibit path.

"Value engineering was an integral part of the design process," said Quinones. "Evaluation of cost was constant throughout the process to ensure we would not go over budget. We married design, cost and construction."

"The aquarium construction project was such a success that we dedicated an entry plaque that recognizes the names of each of a thousand craftsmen who worked on the project," said Iliff. "We accomplished a very complex operation by great communication and cooperation among everyone involved."

Quinones added, "This building was constructed with great pride." ●

— Judith Stock

## facts & figures

**Name:**

Aquarium of the Pacific

**Location:**

Long Beach

**Owner:**

City of Long Beach

**Type of Project:**

Construction of an aquarium

**Architect:**

HOK/EHDD, A Joint Venture

**General Contractors:**

Joint venture between Turner Construction Company, Los Angeles, and Kajima Construction Services, Monterey Park

**Size:**

156,000 square feet

**Cost:**

\$117 million

**Construction Time:**

November 1995 - June 1998