

Concrete supports aquarium expansion

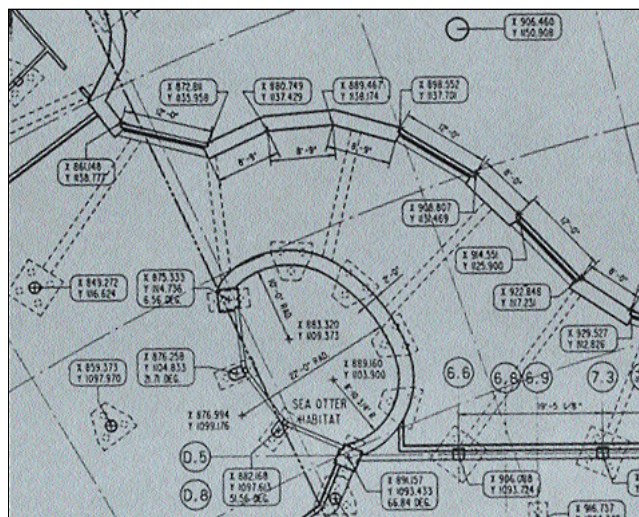


Portland Cement Association

Shedd Aquarium has expanded into Lake Michigan with multi-level concrete work that includes curved whale pools and a lakeside retaining wall.

World's largest indoor saltwater pool on land reclaimed from Lake Michigan

It's home to Pacific black whales, white-sided dolphins, three beluga whales, and countless seals, penguins, and sea otters. The cold-water marine mammal pavilion, completed recently for the John G. Shedd Aquarium on Chicago's lakefront, is the largest project undertaken by the aquarium since it opened in 1930. Referred to as the Oceanarium by its owners, the project included 170,000 square feet of new building space, a landfill of nearly 2 acres in Lake Michigan, and five saltwater pools. The 2-million-gallon main pool, the world's largest indoor body of salt water, is surround-



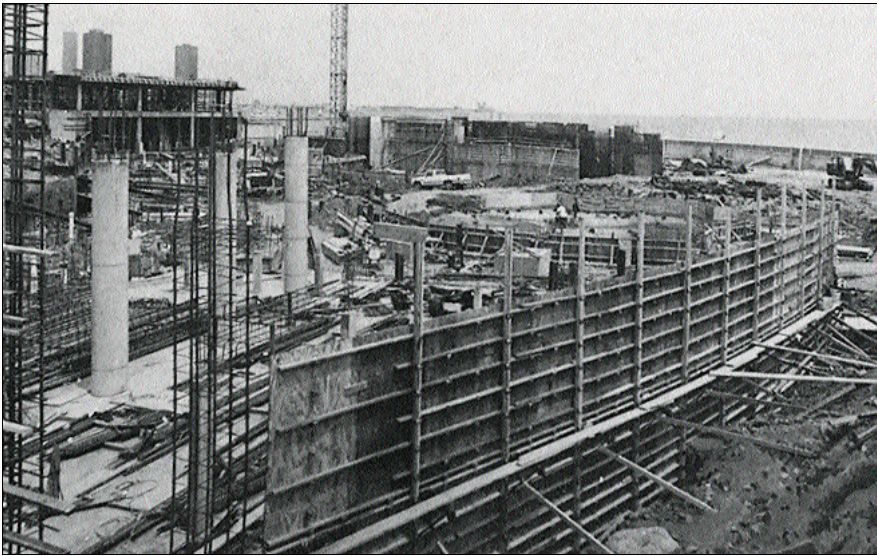
This segment of one of the architect's drawings shows the complex curves and coordinates that had to be used to lay out formwork for the many irregular walls.

ed by rockwork, nature trails, and seating for 1,200 people.

The new building consists of three levels of steel and reinforced concrete construction, placed immediately east of the old aquarium building. A 35-foot-high, 550-foot-long glass curtain wall offers a panoramic view of Lake Michigan.

Seawall and foundations

Workers started construction by building a 1,300-foot-long cutoff wall using 35- to 50-foot sheet steel piling driven into clay of the lake bed to encircle the site. Working around the clock, they drove the piling by day and filled on both sides at night to



Pepper Construction Co.

Formwork for one of the long curved walls, all built onsite. Forming subcontractor erected long runs of one side of the forming, then came back to close up the form in sections as required for each pour. Horizontal construction joints were prohibited in the 27- to 30-foot wall.

support the sheet piling. Two- and three-ton stones were placed on the lake side and slag on the inside.

A secondary line of steel sheeting installed adjacent to the east side of the existing building interlocked with the lake water sheeting. Thus a sheet pile wall completely encircled the site, creating in effect a giant bathtub from which the crew pumped more than 30 million gallons of water before the fill and foundation work could begin.

About 24,000 steel piles were driven 60 to 80 feet below the lake to support the facility. Concrete work presented one of the biggest challenges for the contractor, Pepper Construction Co., of Chicago. On a site with limited access and storage space, more than 25,000 cubic yards of concrete had to be placed in complex curved shapes and multilevel work. A reentrant concrete wall and horizontal concrete run-up apron on top of the sheet pile wall make up the permanent seawall. The 1,400-foot-long seawall is supported on approximately 530 vertical and battered (sloping) steel H piles to prevent settlement of the seawall.

Authentic habitats

Architects took on the design challenge of integrating the needs of marine mammals with a piece of Chicago's civic architecture that's a registered national landmark. Painstaking attention has provided

authentic habitats for the marine residents. The Oceanarium re-creates the rocky coastlines and habitats from such Pacific areas as the coastlines of southern Alaska. Rockwork was made in molds taken from natural rocks. Fortunately there were rocks in the Arizona desert similar to those on the Alaska coast, saving the builders time and money.

Salt water in the pools passes through a filtration system that changes water in the

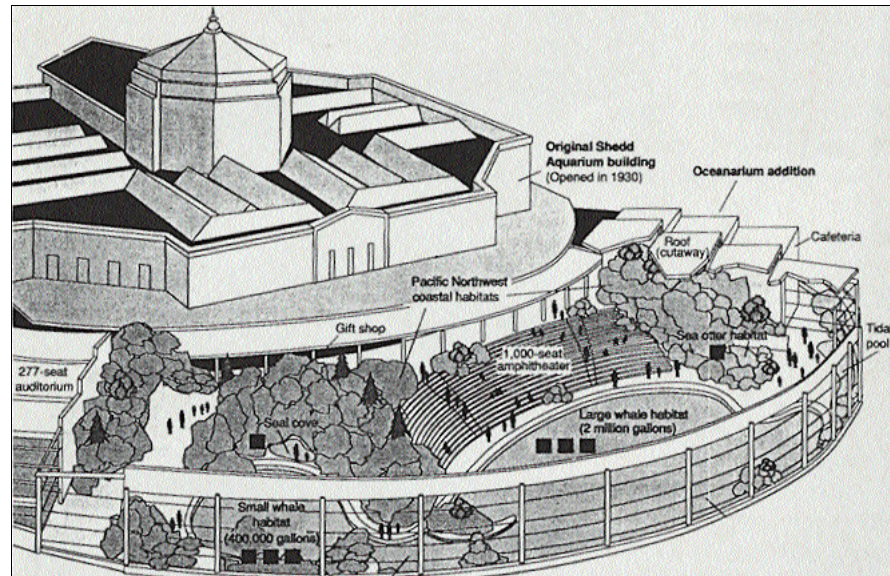
pools every 1½ hours; this amounts to a capacity of 18 million gallons per day, or the equivalent of the daily water needs of 180,000 people.

Formwork challenges

Principal walls for the large- and small-mammal habitats were large curves, many defined by the architect in terms of straight segments 10 to 12 feet long, with their end points located by sets of X- and Y-coordinates (see drawing). Smaller habitats for sea otters and seals had walls with true circular curves.

Triad Form Erectors, hired to handle these problem walls, is officially qualified as a Women's Business Enterprise, the only one in concrete forming in the Chicago metropolitan area. Work awarded to Triad helped the general contractor meet the minority business enterprise quotas governing the aquarium job and other public works.

Having over 25 years of field experience, Triad specializes in vertical forming, handling as much as a million square feet in a typical year. With few straight runs, construction joints prohibited, and no repeating elements, it was impractical to use ganged form systems. Responding to the complexities of the job, Triad built all forms in place, using stainless steel ties throughout. The ties ranged up to 42 inches in length. The 30-foot-high walls were placed at 4 feet per hour, using a superplasticized concrete mix.




Cutaway view shows Oceanarium in relation to original aquarium building. Principal marine habitats are concrete-walled pools filled with salt water. Natural trails, flowing streams, waterfalls, and 50,000 square feet of man-made rockwork add

Many of the long curves were designed as a series of straight segments and could be formed with flat plywood sheathing, but the walls of seal and otter pools called for plywood bent to radiuses of 10 and 12 feet. On the tightest curves, they used curved walers sawed from plywood.

Wins AGC award

Some 90% of the trades involved had to work with materials they had not previously handled on a construction project, according to Fred Galati, Pepper superintendent. "We had to impress upon the tradesmen and subcontractors that we were building a museum and the quality had to go beyond any job they had ever done before." The quality objectives were met via what the contractor described as a "gargantuan communications effort," and construction was completed in 1991. The aquarium made news again

this year when the Associated General Contractors of America (AGC) presented its premier Build America Award to the Pepper Co. for achievements in building the Oceanarium. 

Credits

Owner: John G. Shedd Aquarium, Chicago

Architect: Lohan Associates, Chicago

Structural Engineer: Rittweger and Tokay, Park Ridge, Ill.

General contractor and construction manager: Pepper Construction Co., Chicago

Forming subcontractor: Triad Form Erectors Inc., Hinsdale, Ill.

DID YOU KNOW . . .

that on average, road paving decision makers think they will pay a 52% premium for concrete pavement, according to a

1991 Portland Cement Association survey of 370 state, county, and city highway engineers? Other survey findings: 16% of decision makers responding *always* do life-cycle cost analysis for pavements and 16% *never* do life-cycle cost analysis. On average, decision makers expect concrete to last 26 years and asphalt to last 15.5 years before resurfacing is needed. They also agree that concrete has better night visibility, better skid resistance and drainage, less rutting, and lower long-term maintenance costs than asphalt. Respondents split 50/50 on which pavement material looks best.

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