



*It wasn't long ago, due to high vacancy rates, that owners of commercial properties were sorely challenged to attract and retain premium tenants. In the case of San Francisco's One Market Plaza, this challenge prompted a full-scale renovation of the Plaza's public areas. The resulting design solution, a series of stunning environmental structures in exposed steel and aluminum, required extraordinary levels of collaboration between architect, structural engineer and fabricator.*

## SCUPTURAL STEEL

Exposed steel and aluminum structures find expression as environmental art in a spectacular San Francisco renovation

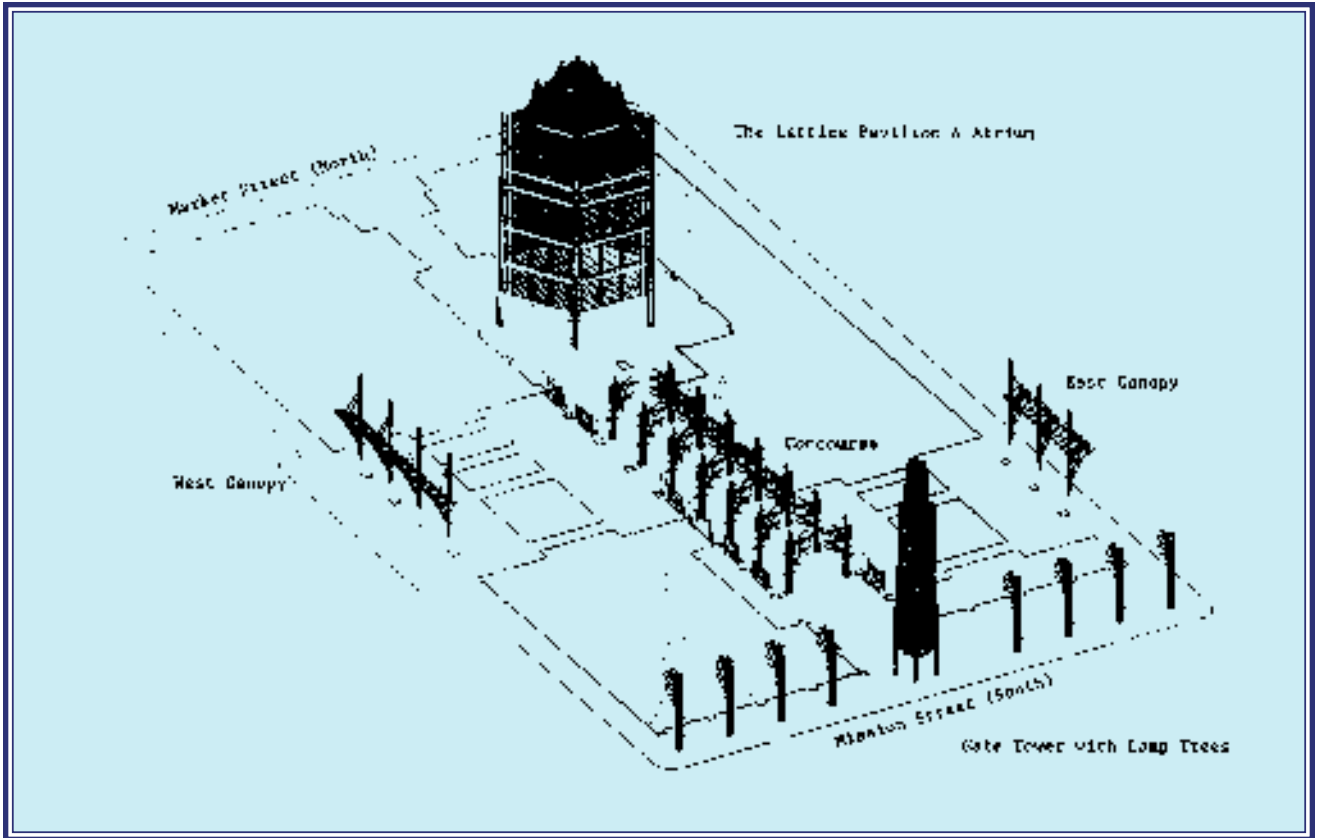
By Jason J.C. Louie, S.E. and Roumn V. Mladjov, S.E.

**D**ESPITE BEING SITUATED ON SCENIC WATERFRONT PROPERTY, One Market Plaza's office towers of 41 and 27 stories are mundane in appearance, typical of buildings of the 1960s and '70s. Adjacent to these modern towers is a third office building: an historic brick building built in a grand palazzo-style. Together, these visually disparate buildings create an atrium and other public spaces. The most practical solution to making the office complex more amenable was to renovate these public spaces.

In the atrium stands the cen-







terpiece of the renovation, an exposed steel and aluminum structure known as The Lattice Pavilion. Expressing the dominant visual motifs for the entire renovation, it rises toward a large hexagonal skylight 11 stories high. Outside, on Mission Street, are other exposed structures: a latticed “Gate Tower” and a row of elaborately detailed “Lamp Trees”. Between the atrium and the Mission Street entrance, two rows of smaller but similar “Lamp Trees” (along with several massive stone clad benches) frame a central concourse. Finally, the east and west entrances to One Market Plaza were graced by cable support steel canopies.

#### THE LATTICE PAVILION

Rising in a series of three hexagonal tiers, the Lattice Pavilion is an 82' diameter moment space frame structure standing 131' high. The Pavilion's vertical framing for the first tier (Level A) consists of 6 pipe columns that rise to a



height of 92'-6". The pipe columns at ground level are 30", then 24", and finally, at the top of this tier, 18". All pipes are 3/8" thick.

The second tier (Level B) is 46'-6" high and connects to Level A by unique pin bearing connections. At this tier, columns are doubled 12" x 3/8" thick pipe.

The third and final tier (Level C) is 34'-6" high, and is also connected to Level B by pin bearings. At this tier, columns are doubled 8" by 1/4" thick pipe. The pipe columns at Levels B and C are angled inward, giving the structure a dome-like appearance.

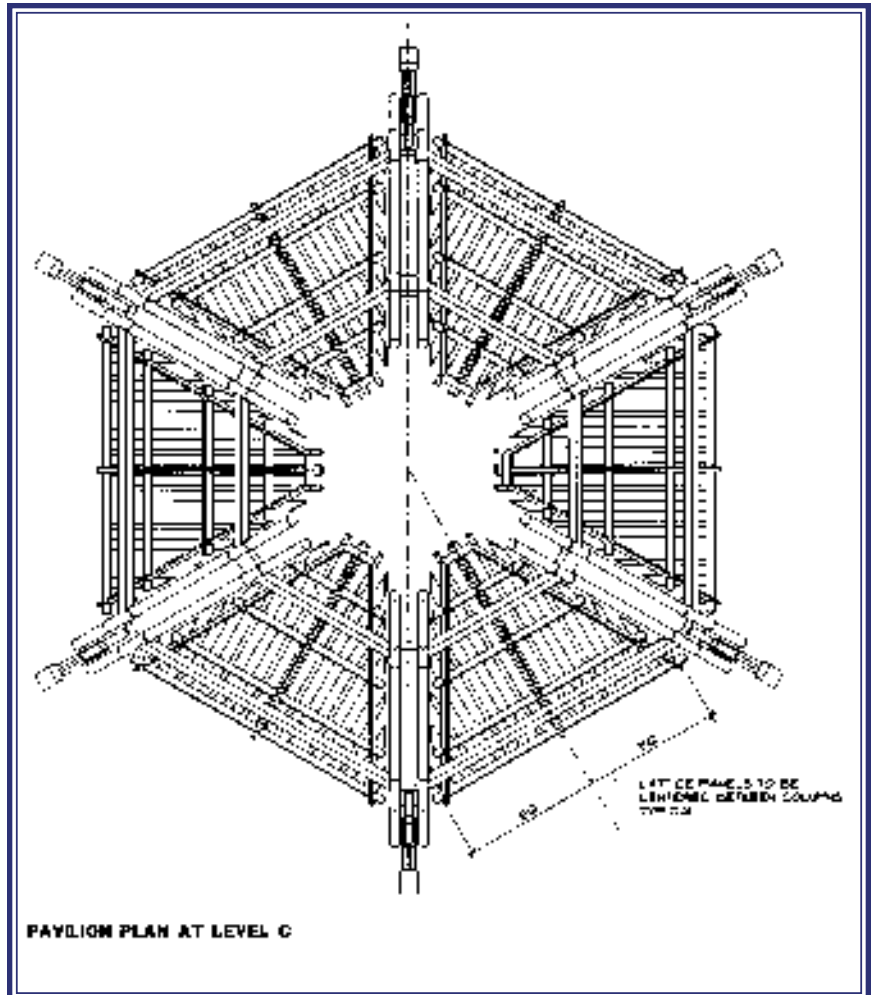
Steel tube beam rings are placed throughout the structure's perimeter. The ring-beam-to-column connection was selected to allow use of thinner steel members, which would strike the right visual balance between lightness and structural strength. Lighter connection details are applied to Levels B and C, to take advantage of lower force levels.

The Pavilion framing supports a series of pre-fabricated panels. These "Lattice Panels" are built up of angled aluminum tube slats. The panels are connected to the ring beams at four points; two bearing connections support the panel framing at bottom, and two push/pull connections complete the panel framing connection at top. The panels range in size from 12' x 20' to 10' x 26'.

The architect was looking for imaginative connection details that would appear graceful and clean. At the same time, the structure would have to be easily erected on site, to keep costs within budget. To this end, connections were designed to maximize pre-fabrication in the shop.

The connection design made it possible to erect whole segments of the structure at the site with very little field welding. Even in the midst of a busy office/retail environment, the pavilion was erected in only five days.

Featured at the base of the Lattice Pavilion is a large acrylic



fountain. Environmental enhancements include a number of lighting fixtures and sound speakers anchored to the Pavilion framework. For the maintenance of the lighting and sound systems, a network of catwalks was incorporated into the overall structure, again with careful attention to the detailing.

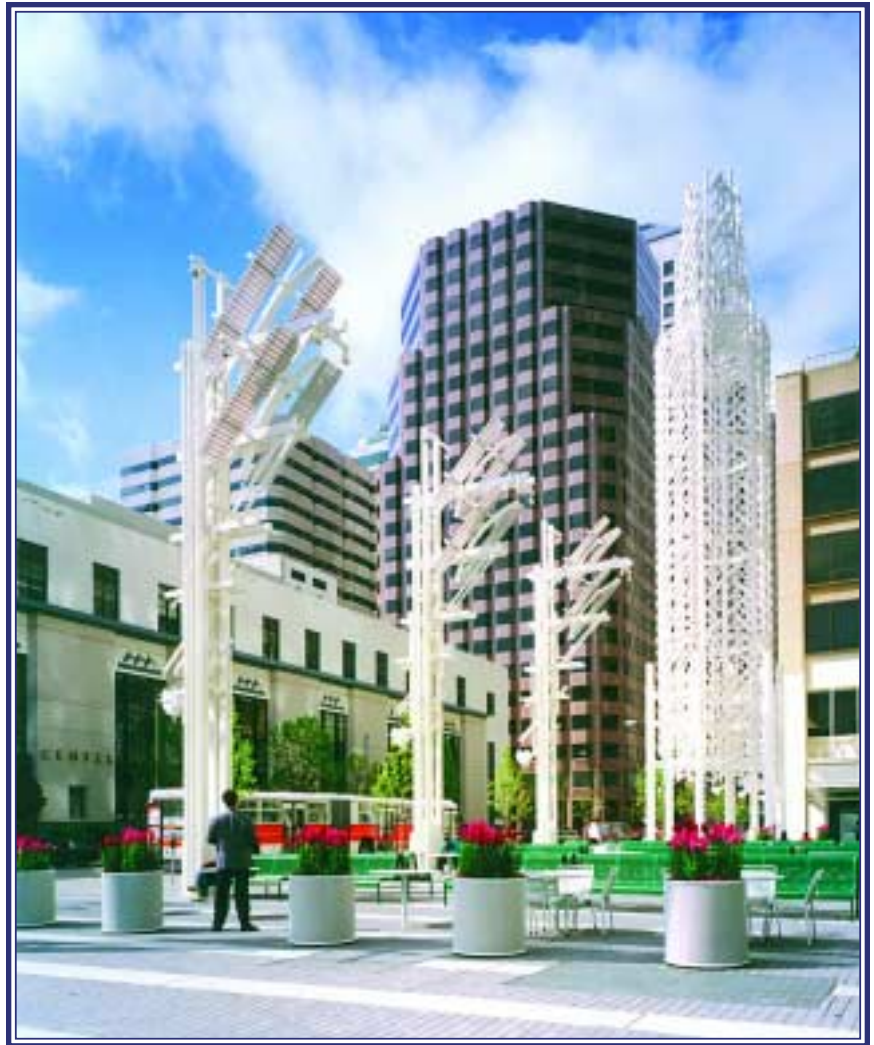
### THE ATRIUM

Before assembling the Lattice Pavilion framing, a pre-existing skylight was removed. The atrium walls were then extended to the 11th level, and a new hexagonal skylight was installed directly above the site of the Lattice Pavilion.

Two aspects of designing the atrium were especially challenging. First, the atrium framing was located between two different L-shaped buildings. The atrium's south and east walls, which formed the edge of an existing 6-story podium between the modern office towers, were extended an additional 5 stories. In contrast, the framing on the west side rests on an existing one-story frame, and at the north end the new framing starts at ground level.

A second challenge was the use of extremely tall, unbraced columns under Zone 4 seismic conditions. The solution at the northern section of the atrium consisted of 140' high steel box columns for the corners (24" x 24") and built-up cruciform columns at the interior bays (W36 + 2WT15). Lateral support perpendicular to the frame plane for the very tall unbraced columns was provided at 88' — again with a cruciform section (using W33+2WT13.5).

The atrium's skylight is a hexagonal glass pyramid. It is 12.5' high, has a diameter of 105', and is framed by exposed steel tubes. To permit the use of relatively light steel sections, a welded tension multi-ring system is used. The framing consists of structural tube ribs (TS 16 x 12 x 1/2) and ring members (TS 16 x 8 x 3/8). The outermost



ring of the skylight is supported on the atrium's steel framing. In addition, the steel members form a track system for a sophisticated window-washing gondola.

### THE GATE TOWER

At the Mission Street exterior of One Market Plaza stands the second tallest structure, the Gate Tower. A cousin to the Lattice Pavilion, this slender hexagonal tower is 114' high. As with the larger Pavilion, the Gate Tower is built in three tiers, with horizontal framing forming the support for a series of lattice panels. These tiers taper in from an initial diameter of 22' at ground level to a final diameter of 8' at the tower's apex.

### LAMP TREES

Alongside the Gate Tower, and lining Mission Street on the southern edge of the complex, are eight steel structures that combine sculptural attributes with lighting functions. Known as Lamp Trees, the bodies of these 33' high structures are composed of 4 welded built-up vertical steel members. Combinations of channels and tube sections serve as front and back "legs". Multiple couples of horizontal and inclined tube or pipe members brace the four vertical legs in the body of the Lamp Tree.

Fourteen Lamp Trees also line the long concourse which proceeds from the southern entrance to the central atrium. Although similar in design to the exterior Mission Street Lamp

Trees, these structures feature slightly different detailing, and are of aluminum.

Thanks to the collaborative efforts of owners, architects and structural engineers, this project demonstrates how exposed steel structures can help create attractive commercial environments. The renovation of One Market Plaza proves that thoughtfully designed exposed steel structures can serve as legitimate architectural expressions.

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## One Market Plaza Project Data

General Contractor:  
Swinerton & Walberg

Architect:  
Cesar Pelli & Associates (New Haven), with Patri Burlage Merker (San Francisco)

Structural Engineer:  
Middlebrook + Louie  
(San Francisco)

Fabricator for Lattice Pavilion and Gate Tower:  
AISC-Member Gayle Manufacturing Company

Steel Erector:  
California Erectors

Erector for Lamp Trees:  
C.E. Toland & Son

Tonnage for Lattice Pavilion and Gate Tower:  
678 tons

Cost:  
\$1,557,796