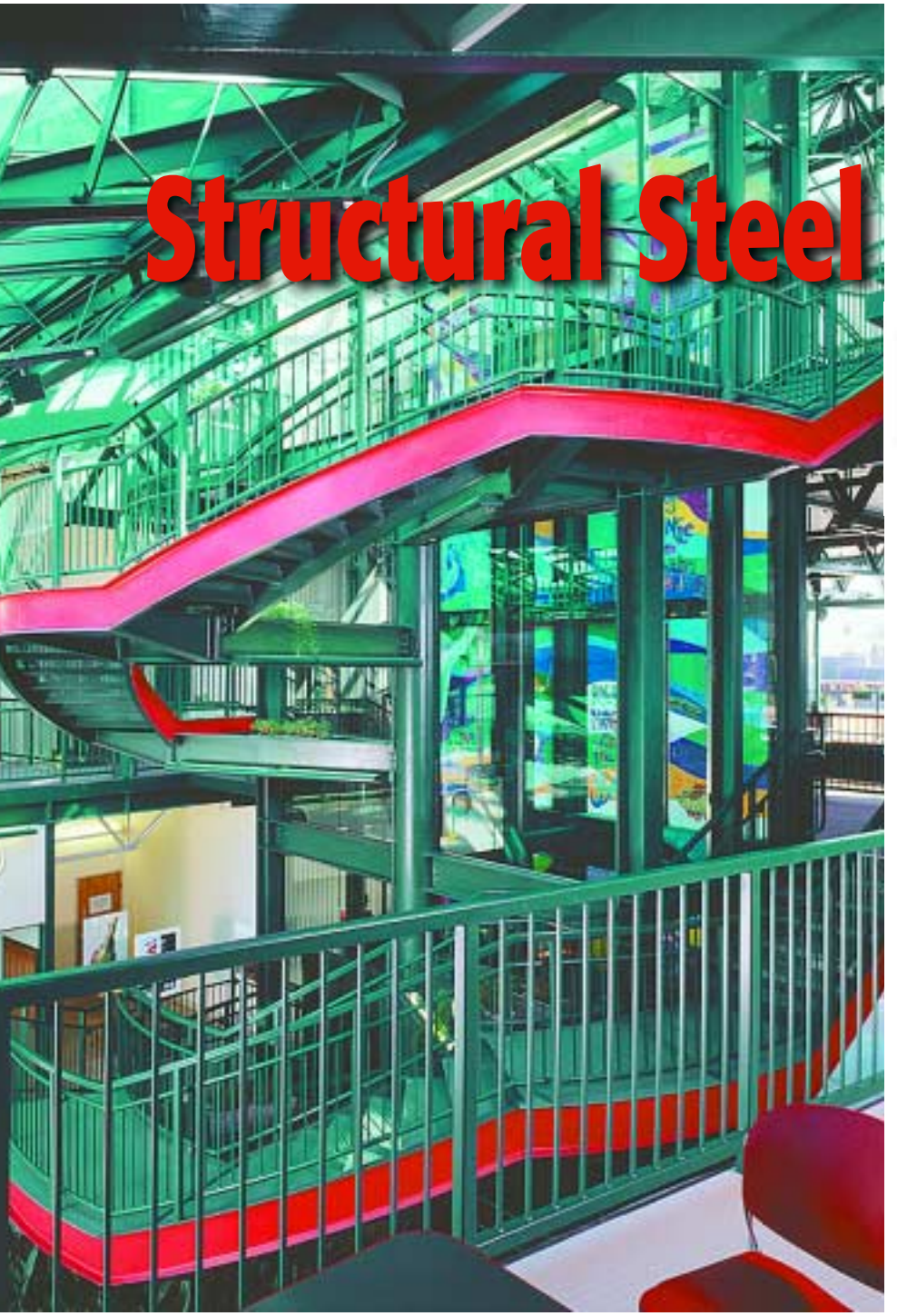

# Structural Steel Exposed

By Robin Wendler, S.E., and Deirdre Van Olden

Cantilevered beams support the spiral staircase in the lobby of the Pittsburg, CA Civic Center. The structure of the finished stair is painted and left fully exposed.

The Pittsburg Civic Center is a dramatic example of the beauty of structural steel. With exposed steel framing the interior and exterior, the structural system supports the weight of the entire building with lightness and elegance, while allowing its users the opportunity to see a steel skeleton in action. The three-story, 70,000 sq. ft. civic center was completed November 1999 for a cost of $19,600,000.

## Integrating History

From the earliest conception, steel was the chosen structural material. The architect, Fani Danadjieva Hansen (Hansen Associates Architect and Planners, Tiburon, CA), researched the city's history as a regional center for steel production and fabrication. Hansen photographed steel warehouses and manufacturing facilities in the area and incorporated elements from these buildings into her design. The most obvious example is the extensive use of trusses, both for floor and roof joists and girders. The vaulted third floor roof was modeled after the U.S. Steel Columbia-Geneva plant (built circa 1926), with gable steel trusses spanning 43' at eight feet spacing and a continuous clerestory.

## The Design

The building forms a semicircular curve around the center lobby. Each floor is stepped back from the inside curve of the floor below and is aligned on the outside curve. This design allows for exterior roof decks and walkways as well as creating interior light wells. At the lobby, stepping glass roofs and walls leading from the one-story entry height to the 56' ridge encase the building while allowing all of the elements to be open to viewing. Manufactured steel joist by Vulcraft with metal decking by Epic form each floor. The girders are trusses welded from tube steel, configured to match the joists. The girders span along the circumference of the curve to full height tube steel columns. Inverted chevron braced frames are blended into the structure in each direction.

The structural engineer, ZFA Structural Engineers (Santa Rosa, CA) and architect worked closely to develop a framing system that would both create the desired curved form and be economical to build. A regular, symmetrical grid was established with straight segments forming the curve. Within each segment, framing is orthogonal, avoiding the need for any individual curved members. The segments consist of steel joists at eight feet spacing spanning 32' to steel girders. Each segment is skewed by 3.2 degrees from the adjacent segment. Economy is achieved though repetition, reducing the number of custom fabricated trusses required.

## Proportion, regularity and simplicity

Given that the structure is the essence of the architectural design, every element of the steel system was reviewed and coordinated with the architect. Proportion, regularity and simplicity were all considered in developing the structural details; for example, the girder to column connection, with sandwiched plates extending from the tube steel column to form a simple corbel connection. This detail repeats at the roof with smaller corbel plates. In addition, architectural elements such as window and skylight mullions were designed to blend with and be supported by the structural steel, requiring closer than customary coordination between the engineer and architect.

## Custom Fabrication

Structural drawings were prepared with fabrication requirements in mind. Each girder truss had an identification number and detailed elevation showing dimen-

*Inverted chevron braced frame foundation connections utilize embedded shear lugs.*

*Tube steel girder trusses span along circumference of the building, with joist top chords extending to form exterior walkways.*

*Exposed steel joists and girders are on display at the 3rd floor council chamber.*

sions and member sizes. Repetition of member sizes and dimensions was used as much as possible. For the manufactured joists, a detailed schedule showed loading requirements, joist depths, panel point dimensions and cantilevers for each individual joist. Each joist and girder had an identification number that related to the floor and wing where it was located. Communication and coordination between the steel fabricator and design team was streamlined by this system of ID numbers and schedules.

The use of an entirely exposed steel structure also required special attention to the protection of the steel, both from weather and fire and the finish appearance of the steel. Most of the steel on the project was finish-painted per a special written specification. The specification included commercial blast cleaning of the exterior steel in the fabrication shop prior to primer application and an exterior-use primer. Fire protection of the exposed steel was also a concern, especially in the City Council Chambers Assembly Room on the third floor, where large groups of people are expected to gather. To accommodate both safety and aesthetics, intumescent paint (a thin, fire resistive coating) was used in lieu of the unsightly fireproofing spray that would traditionally be hidden by walls.

## Tied to the Community

It was important to the city government to have all of its facilities gathered under one roof in order to offer more efficiency and convenience to the residents of Pittsburg. The community wanted the center be a place where a visit would be memorable and where they could be informed about the programs, history and activities that the City offers. The architectural design accommodated both parties. The structure houses many of the city's departments under one roof, including the various administrative offices, council chamber and the police facility. The glazed steel entry hall functions as an educational mall, exhibiting elements of the city's history. The dramatic curved form of the building and exposed steel structure creates a focal point for the community.

## Close Collaboration

The design team worked together to determine the requirements for the floor and roof decking. Epic Metals deck was chosen for several reasons: it satisfied engineering requirements for vertical and lateral load capacity, the decking could be supplied with acoustical perforations where necessary, and it could be used with an electrical duct distribution system in a topping slab. Since it is exposed to view from below, the clean, smooth appearance was an advantage. The same decking profile is used at the floors and the sloped roof.

Vulcraft, the joist manufacturer, was an integral part of the design of the project. They were present at early design team meetings to help determine joist depths, member sizes and coordination with mechanical systems. "This project was a splendid example of meeting architectural and structural requirements utilizing steel joists," says Darrell Marchell of Vulcraft. It is unusual for joists to be exposed and care was taken to ensure that the finished joists would be acceptable architecturally.

The project had 50 pieces of shortspan joists comprising 11 tons and 153 pieces of longspan joists weighing 139 tons for a total of 150 tons. The project had a number of

*Front view of Pittsburg Civic Center.*

special joist profiles highlighted by forty-three scissor type joists with six different depths and panel configurations. The accommodation of the mechanical equipment and ductwork sizes was identified on the contract drawings and incorporated into nearly every joist on the project. The floor joists had special deflection criteria in selected areas. A number of roof joists were designed for the skylights, recognizing the increased unbraced length for the top chords on these joists.

## The Rewards of Teamwork

While it was challenging to design every structural element of the building to be exposed to view, it was rewarding to have a finished project that displays the versatility and structural beauty of steel. The building required extraordinary cooperation between the design team, as well as builders. The effort spent producing clear, well-coordinated construction documents was essential to the success of the project.

This building is a testament to the ability of steel to move beyond structural support toward the architectural essence.

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**Owner:**
City of Pittsburg

**Architect:**
Hansen Associates Architects. (Tiburon, CA)

**Structural Engineer:**
ZFA Structural Engineers. (Santa Rosa, CA)

**Contractor:**
Lathrop Construction (Benicia, CA)

**Software:**
RISA 3D