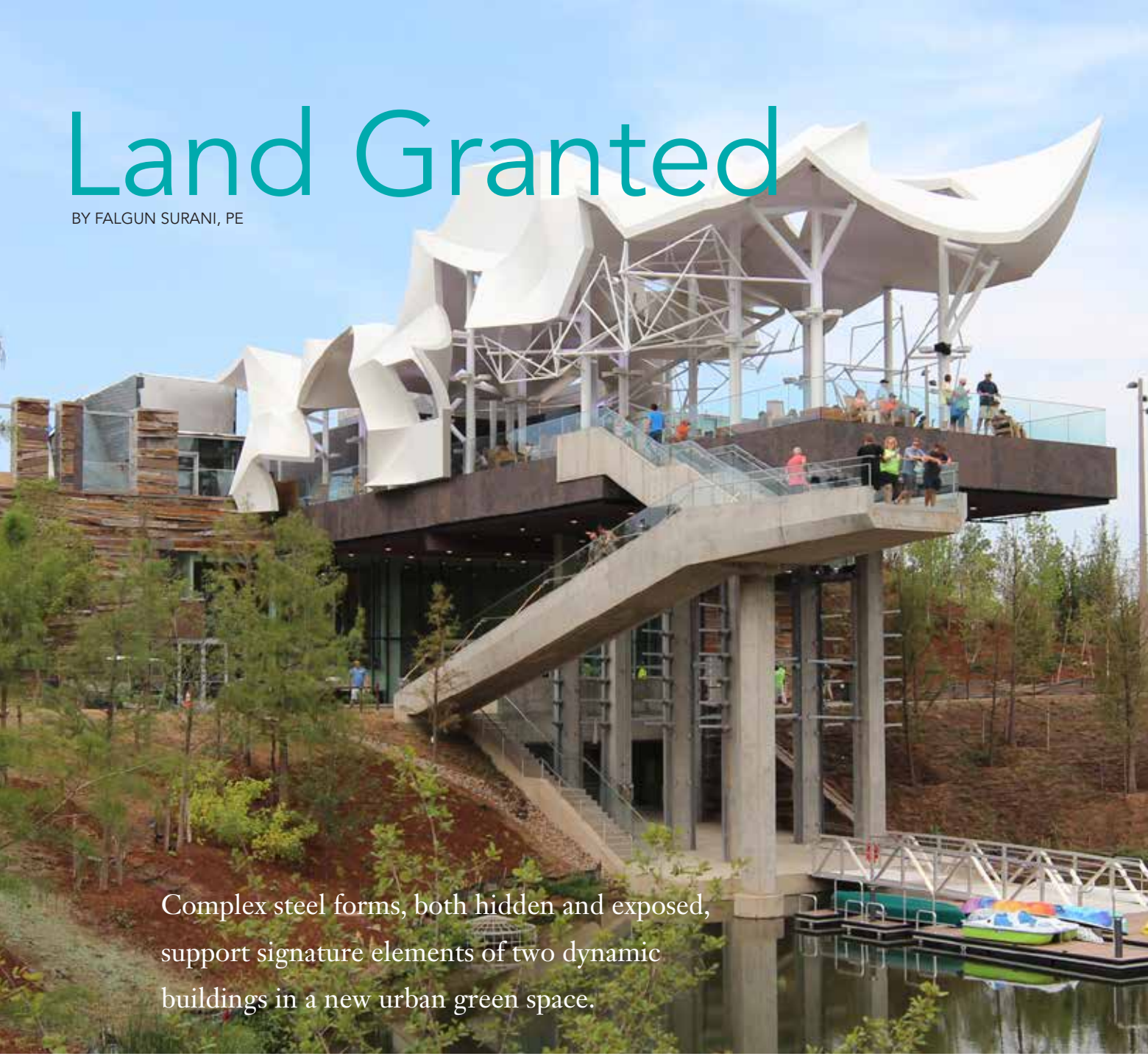
Land Granted

BY FALGUN SURANI, PE



Complex steel forms, both hidden and exposed, support signature elements of two dynamic buildings in a new urban green space.

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THE GATHERING PLACE in Tulsa, Okla., is more than just that.

Designed to transform Tulsa's downtown waterfront along the Arkansas River into a dynamic, interactive environment, the $465 million, 66-acre green space is the largest private gift to a public park in U.S. history.

In addition to the vast open space, the park contains two dynamic steel-framed buildings (incorporating a total of 460 tons of structural steel) that anchor its services and activities, each structure embracing the powerful park landscape via a combination of traditional modernist strategies incorporating the rich, natural material palate of Oklahoma.

Williams Lodge

The first is Williams Lodge, which offers restrooms, a cafe, a two-story fireplace, indoor lounge spaces and educational activity rooms. Primarily made of stone floors, wood ceilings and full-height windows, the underlying design theme for the lodge was to provide an enclosed space that appears to be part of the landscape and also provides shelter during inclement weather. While the team chose steel as

The ONEOK Boathouse is one of two unique steel structures in Tulsa's new Gathering Place park.

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The stone-clad, three-part fireplace provides an attractive focal point inside and outside of the Williams Lodge and is supported by an intricate steel frame.

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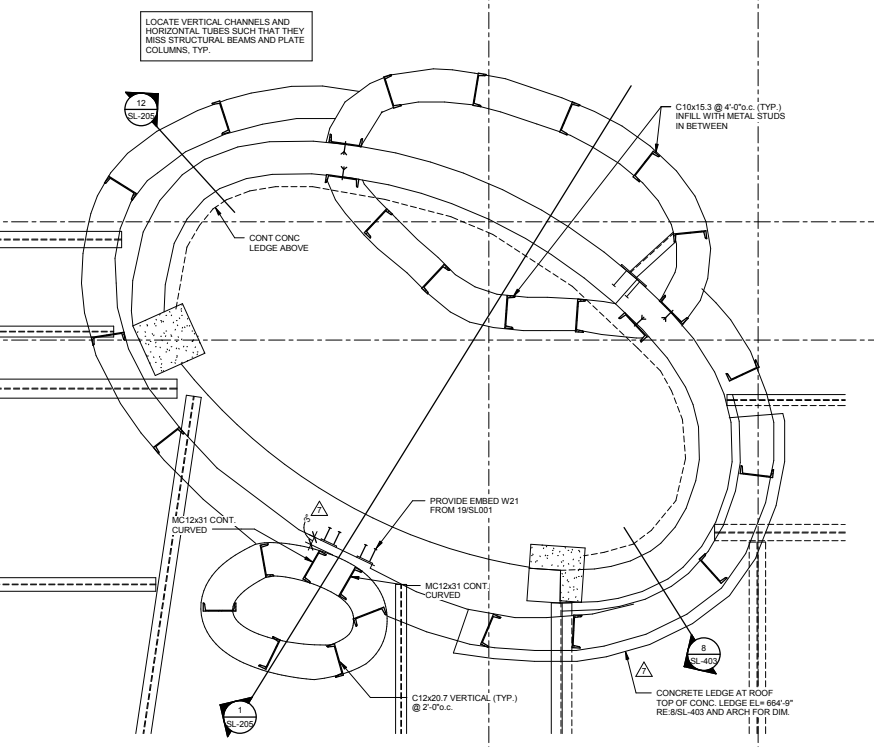
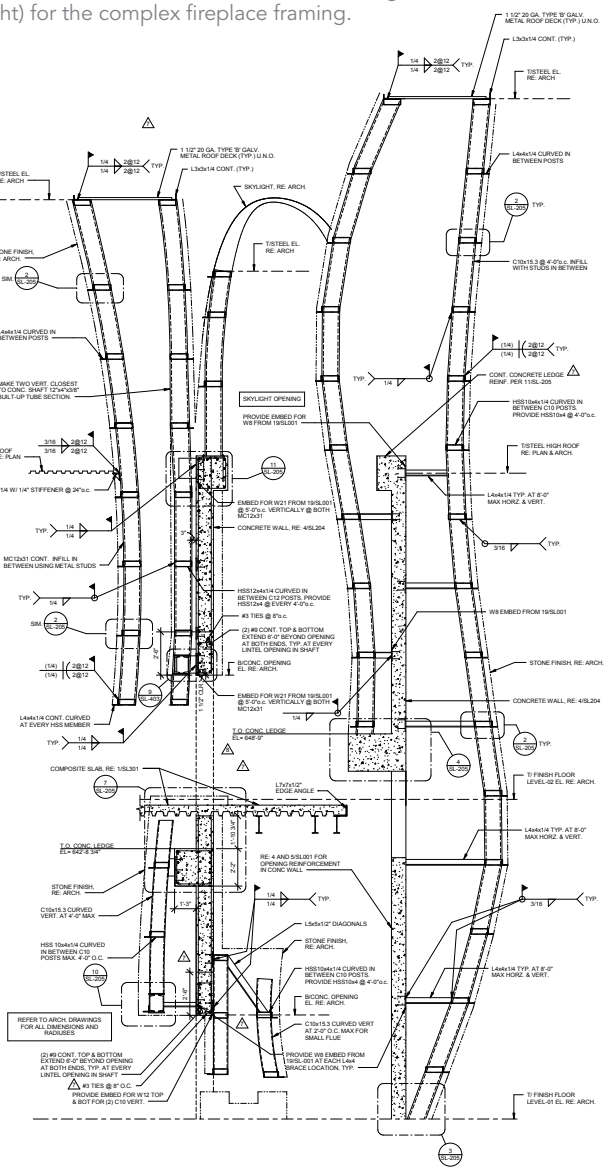
the framing material, the design goal of providing unobstructed views of the park ruled out larger hollow structural section (HSS) or wide-flange columns at the perimeter. Instead, closely spaced solid vertical steel plates (2½ in. by 8 in.) were implemented as columns to support the steel floor and roof beams—and also perform double-duty as window mullions. Nearly half of the plate columns are two stories tall, about 40 ft high. With concerns about losing plumbness during fabrication, shipping and erection, AISC member Unique Metal Fabrication proposed splicing the plate columns at floor level. However, the exposed nature of these columns as window mullions demanded a clean finish, rendering the splice unacceptable to the design team. Instead, the plate columns were erected first and temporary braces were provided during construction. Plate plumbness was repeatedly checked during construction, and the steel

Unique Metal



Details (above and below) and actual framing (right) for the complex fireplace framing.

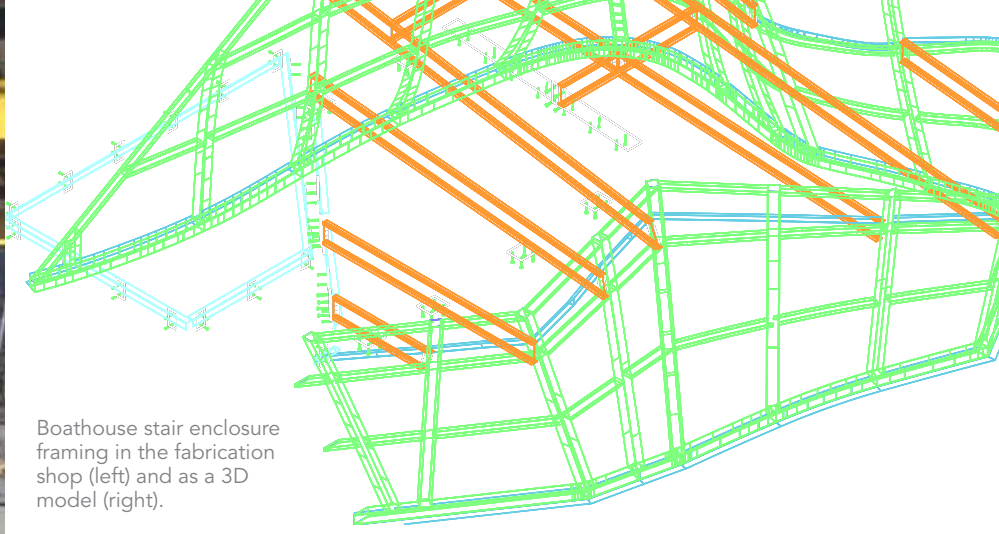


floor and roof beams framing into the plate columns and glass windows were fabricated per final field dimensions.

The centerpiece of the lodge is a massive, two-story stone fireplace that's large enough for a group of people to walk in and around. The intricate shape of this structure meant that the skin would have to be supported by a curved steel structure since cast-in-place concrete forming was not feasible. A uniform oval concrete shaft was used as a shear wall as well as the core structure supporting the two-way steel grid that contains curved wide-flange members as verticals and curved HSS members as horizontals, both spaced roughly 4 ft on center. A SAP 2000 3D model was created to analyze and design this complex steel structure for out-of-plane wind loads as well as weight and moment coming from shelf angles supporting the stone façade eccentrically.

The chimney of the fireplace splits into three limbs that climb through the building. The first serves as the flue for the fireplace at level 1, the second supports the skylight in the center of the fireplace and the third serves as the flue for the fireplace at level 2, and also hangs from the face of the oval concrete shaft. It was nearly impossible to produce construction drawings for this steel structure, which had varying radii in every direction. Therefore, a 3D Rhino center line model was used as construction documentation, incorporating 2D details and sections with the structural drawings. Unique Metal extruded this 3D center line model to make a Tekla 3D model, which was then used to produce shop drawings. The traditional way of curving steel was not feasible since the steel grid structure changed shapes with non-uniform radiuses throughout its height and width. Additionally, shipping and erection of the roughly 60-ft-tall by 30-ft-wide steel structure wasn't possible. Unique Metal and general contractor Crossland proposed creating roughly 12-ft-tall ring grids that could be fabricated and shipped in quarter segments to be field welded to make the final shape of the structure. Each vertical and horizontal member was made by cutting ¼-in. or $^{3}/_{8}$-in. plates to its radiused shape from the 3D Tekla model and then welding it in the shop to achieve the correct structural shape. All shapes made with plates were stich-welded alternatively on both sides to avoid any local distortion or warping effect from the welding heat.

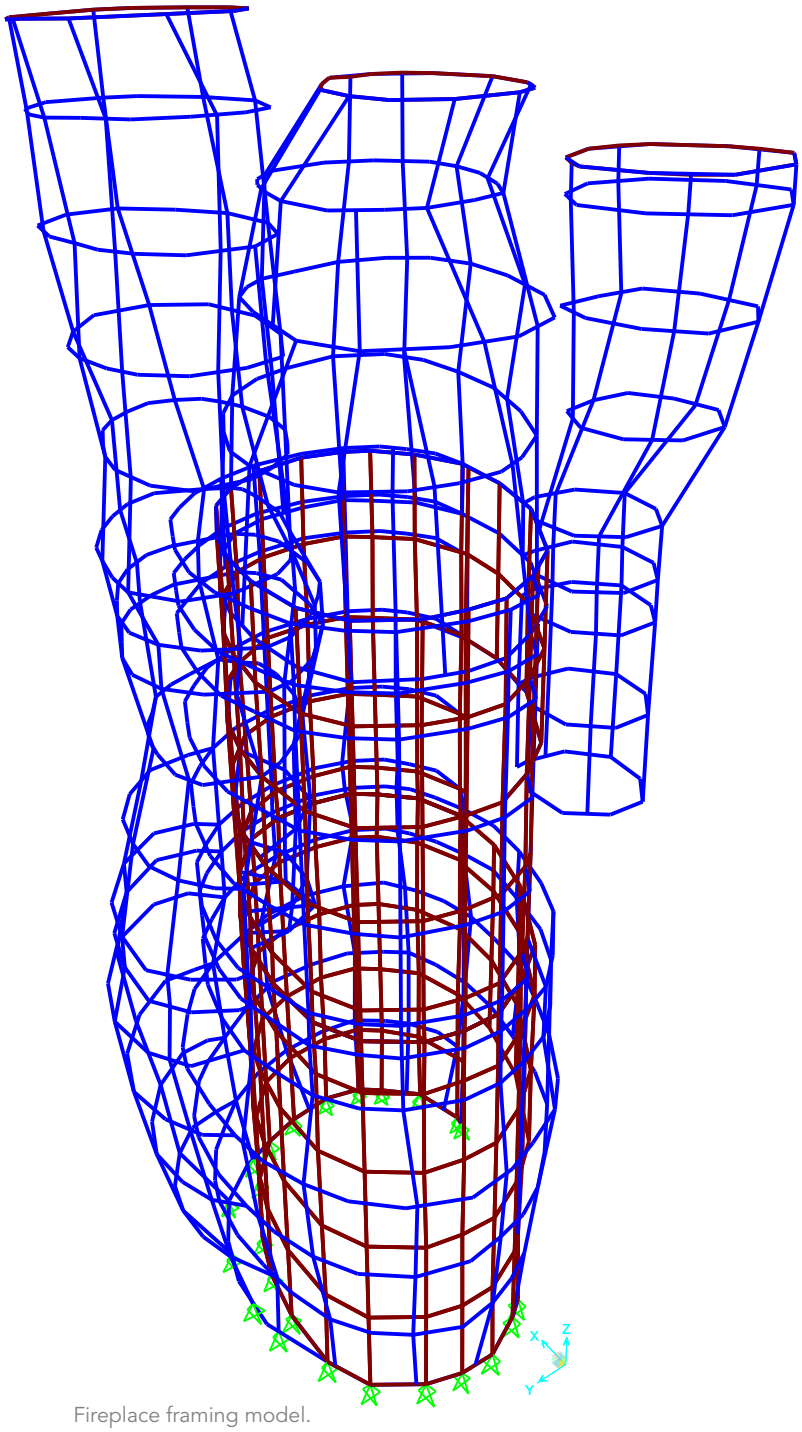
In addition, the original design was to have the continuous wide-flange verticals supporting the HSS horizontals at every 4 ft, but this



Boathouse stair enclosure framing in the fabrication shop (left) and as a 3D model (right).

was not feasible due to shipping and erection limitations mentioned above. Instead, the horizontal HSS were made to run continuous, and vertical wide-flanges were made discontinuous at every intersection with horizontals. Since the 3D Tekla model was extruded from a center line Rhino model, this meant that all or a portion of the flanges of the wide-flange verticals would not receive a continuous weld on the HSS below due to the local twist in the overall shapes of the members. This issue was resolved by introducing a larger base plate at every vertical wide-flange top and bottom, and then these base plates were welded to the HSS horizontals at the top and bottom to achieve continuity. The design team of Mack Scogin Merrill Elam Architects and Structural Engineering Associates used a 3D model to coordinate the locations of several floor and roof beams that penetrated the steel grid structure of the fireplace and framed into the oval concrete shaft. Shelf angles supporting the stone façade at the fireplace was also made by welding two plates together to achieve the shape of the fireplace, and Fero brackets were used to connect shelf angles with the steel grid frame to provide the cavity for insulation.

The building also includes three stairways designed and fabricated using steel plate. The grand stair uses glass handrails and walls and was designed to cantilever between two floors, and the other two steel plate stairs use stone flooring. One of these is supported on a radiused channel stringer on one end, with the other end



Fireplace framing model.

being supported on a concrete foundation wall where plate trades are notched around the plate-column base plates to avoid conflicts.

ONEOK Boathouse

The second building, the three-story ONEOK Boathouse, houses a restaurant on the pavilion outlook deck, offering views of the Arkansas river and downtown Tulsa, as well the Cabinet of Wonder, an educational and social gathering space. The centerpiece of the boathouse is a fiberglass canopy supported via HSS that serves as the roof for the uppermost pavilion level.

The steel stair enclosure covers the center floating stair serving all floors and is made with of HSS members placed in 4-ft by 4-ft grids. The enclosure is supported on composite steel beams on level 3, which in some cases cantilevers and also changes shape with varying radii in every direction. Like the support structure for the Williams Lodge fireplace, it was difficult to produce construction drawings for this structure. Hence, the same method of 3D modeling to produce shop drawings, as well as cutting and welding of plate, was used to achieve the desired built-up structural shapes. Metal studs are used as infill between the steel grid structure to support the stair enclosure's slate façade.

The level 2 mezzanine is made of composite steel beams, steel deck and glass walls, and hangs from the level 3 floor beams via four HSS hangers. The level 3 beams also support the entire roof structure for the restaurant, which includes another HSS hanger to support a floating stair landing.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The centerpiece of the boathouse is a fiberglass canopy supported by HSS, that serves as the roof for the upper-most pavilion level.


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Whether exposed to view in the boathouse canopy or hidden within the three-pronged fireplace in the lodge, complex steel framing elements are at the center of the Gathering Place's two signature structures. These structures in turn demonstrate how the built environment can mesh well with natural surroundings to enhance a riverfront experience in an urban setting. ■

Owner
City of Tulsa, Okla.

General Contractor
Crossland Construction Company

Architect
Mack Scogin Merrill Elam Architects

Park Designer
Michael Van Valkenburgh Associates, Inc.

Structural Engineer
Structural Engineering Associates, Inc.

Steel Team

Fabricator
Unique Metal Fabrication, Inc.,
Pittsburg, Kan.

Detailer
International Design Services, Inc.,
St. Louis

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The fireplace (above) and south stair (below) of the lodge.

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