



Composed of jumbo-sized steel wide flange members, yet retaining a light and open feel, the Skywalk at the Atlantis Casino and Resort combines a unique shape with structural ingenuity

By Kent Jensen

**M**ONARCH RESORT, INC. FACED A CHALLENGE: How to provide a safe passageway for pedestrians from a parking lot to the Atlantis Casino Resort across the busy Virginia Street/U.S. Highway 395 in Reno, NV. Although a crosswalk and traffic signal are located nearby, jaywalking was prevalent. Several options were considered, including an underground tunnel and a conventional box-shaped bridge. But security was considered a problem for the tunnel, and long-term street closures were not allowed. Likewise, the box-shape did not provide the grace nor image desired for the Atlantis complex.

"This was an opportunity to create both a sign and a gateway to Reno—a landmark," according to Peter Wilday of Peter Wilday Architect, Inc., the concept architect for the project. Wilday's solution was to create a diamond shaped, glass shrouded pedestrian bridge to span the required 160' clear distance. To tie the futuristic appearing bridge to

the theme of the Atlantis Resort, at each end the bridge supports are hidden within a 24' diameter tapered Hellenic style column. Each column tower rises 90' high, and is topped with a 15' diameter flame bowl that will periodically spout flames up to 30' into the air.

The bridge tapers outward from its base width of 38' up to 55' wide before tapering back to a peak at its centerline some 30' above the floor line. The bridge, 45' wide at the pedestrian level, also holds casino space and bars. The sloping sides are clad entirely with glass, giving the bridge both an elegant and light feel.

#### STRUCTURAL STEEL FITS THE BILL

"Structural steel was the best solution for this bridge," according to Kent Jensen, project engineer for Jessen-Wright Structural Engineers. The desired openness did not allow for the large members that a reinforced concrete structure would need, and supporting the



extra weight of a concrete structure would add to construction costs. In addition, the short window of time available for street closure demanded a structure that could be erected quickly.

The structural solution for the bridge required some ingenuity. The unique shape of the bridge, which included sloping sides tapering to a point, did not allow for perimeter truss framing. To obtain depth for the main trusses, they had to be located near the center of the bridge. This placed the trusses within the usable space, where the open design did not allow for any diagonal members. After studying several configurations, a solution consisting of a pair of 180'-long-by 28'-deep Vierendeel trusses spanning between support towers was chosen.

Conventional trusses use tension and compression axial loads in the bottom and top chords to develop flexural capacity. The axial loads are delivered to the chords via diagonal web members. Shear capacity is also

developed by axial loads in the web members. Therefore, the design of both the chords and the web members are dominated by axial loads, with very little shear or flexure on the individual truss members.

In contrast, Vierendeel trusses have no diagonal members, so the axial loads must be delivered to the top and bottom chords through shear and flexure in the vertical members. Unlike conventional trusses, this places a large flexural demand in both the vertical members and the chords.

Jumbo structural steel wide flanged members were the only members capable of handling the large design loads. The top chord of each truss is composed of up to W27x217 jumbo members as part of a 10'-deep subtruss, and the bottom chord is composed of up to W44x335 jumbo members. The vertical columns are as large as W36x527 members.

The main trusses support 5'-deep cross trusses to support the

floor framing. The cross trusses are spaced at 20' on center, and cantilever out 16' beyond each of the main trusses. Conventional wide flange framing between the cross trusses supports a concrete fill over metal deck slab. Arising from each end of the cross trusses are sloping bents framed of tube steel members to support the glass roof.

#### **STRUCTURAL DESIGN CONSIDERATIONS**

Controlling deflection and vibration of the bridge were of primary importance in the design. Extra thickness was added to the concrete slab to provide additional mass as a damper against vibration. Deflection limits were coordinated with the glass roof supplier, but the controlling deflection criteria turned out to be driven by design wind forces. Overturning forces generated by wind loads perpendicular to the bridge cause upward loading on one main truss, and downward loading on the other main truss.

