LESS THAN $10M

NATIONAL WINNER

Photo by Paul Turang Photography.

Desert Bloom Porte Cochere

Cabazon, CA

With large "petals" stretching into the desert sky, the Desert Bloom Porte Cochere of the Morongo Casino Resort and Spa has become a recognizable landmark for the Cabazon, CA getaway.

The initial concept and geometry of the Desert Bloom structure was developed by The Jerde Partnership as a series of overlapping, truncated double-curved surfaces, or petals, that originate from a central node and spiral outward.

The use of computer modeling and analysis between the architects and structural engineers was integral to the successful completion of the project. The architects' original AutoCAD 3-D structural model was used as a basis for structural design and detailing. Under a design/build contract, structural engineers ASI Advanced Structures developed and presented an innovative structural scheme comprised of four separate petals and a central light tower. Each petal rises 40' and spans 120' on average. The surface area of the entire structure covers approximately 27,000 sq. ft.

The structure had to be as thin, efficient, and light as possible, prompting a single layer steel grid shell frame with a typical structural member depth of 10". The typical shell structure requires a single or double curved surface geometry with rigid boundary restraints to resist in-plane or out-plane loads. All out-of-plane service loads are transformed into in-plane forces within the shell structure with some flexural forces in the ribs. These forces are collected in the 18" nominal diameter pipe edge member, which are eventually resisted by the boundary foundation and building column support structure.

In order to facilitate fabrication and erection, each of the four petals was divided into a series of individual curved wedge shape segments ("ladder" frames). The dimensional division of the petal was limited by the fabrication facilities and transportation logistics of each ladder. The ladders were fabricated using two rolled edge (MC10×8.4) channels forming the main radial ribs of the petal. HSS 4×4 struts laced the ribs together. The complexity of the geometry

JUROR COMMENT

"Excellent execution through collaboration in a design/build process."

Structural Engineer
ASI Advanced Structures Inc., Marina del Ray, CA

Engineering Software
SPACEGASS

Detailing Software
AutoCAD
Mechanical Desktop

Owner
Morongo Band of Mission Indians, Banning, CA

Architects
The Jerde Partnership, Venice, CA (design)
Thalden-Boyd Architects, Tulsa, OK (executive)

General Contractor
Perini Building Company, Inc., Phoenix

Photo by Paul Turang Photography.

meant that all of the HSS struts had to be mitered at different angles, and in some cases with a double-mitered cut.

The division of each of the petals into lightweight ladders made the process of fabrication, shipping, and installation relatively simple and straightforward. The ladders were bolted together in the field with galvanized steel bolts. The 40' sections of rolled, curved pipe were spliced together in the field. The double curvature was achieved by twisting each successive piece of a single rolled section.

A key factor in the erection strategy involved setting up a detailed shoring plan for each of the four petals in the structure. This was required to stabilize the shell until the structure was tied together through the bolted connections and to support the construction loads generated by the complex geometrical shapes. The shoring remained in place until all of the petals were fully assembled, and the combined frames of all four petals were tied together.

The central light tower stands 60' tall. It was fabricated in two sections that were bolted together in the field. Approximately 350,000 lb of custom-fabricated steel, and more than 5,000 bolts, were used for the $2.8 million project. ★

LESS THAN $10M

MERIT AWARD

Davis Conference Center
Layton, UT

Photo by Jacom Stephens.

The Davis Conference Center was designed to provide state-of-the-art convention and reception spaces to the communities of northern Utah. The 42,420 sq. ft conference center, built adjacent to an existing hotel, houses a grand ballroom with movable partitions that can be used to divide the space into eight smaller areas. The facility also includes smaller meeting rooms and reception areas connected by a concourse that runs the length of the facility, terminating at a steel and glass turret.

The ballroom and meeting rooms on either side of the concourse feature conventional steel framing and chevron braces. The concourse was framed separately with 8" square tube columns supporting a barrel-vaulted roof constructed of rolled tubes.

A large component of the vision for the project was to provide open clerestory windows within the concourse that would be unobstructed by the presence of bracing. The main concourse roof diaphragm is significantly higher than the rest of the building. To provide lateral stability without using bracing or moment frames in the concourse, steel slip collar connections were added to each concourse column at the level of the adjacent braced roof diaphragm. The slip collars were designed to transfer lateral shear forces directly from the concourse columns to the braced portions of the building on either side. They were also designed to slip to accommodate anticipated deflections in the adjacent roof structure from snow or live loads.

To prevent undesirable sound transfer through the slip collars, each column was wrapped with an adhesive-backed elastomeric material at the connection to

Structural Engineer
ARW Engineers, Ogden, UT

Engineering Software
RAM Steel
RISA-3D

Owner
Davis County Gov. Dept. of Economic Development, Farmington, UT

Architect
Gillies Stransky Brems Smith, Salt Lake City

General Contractor
Sahara, Inc., West Bountiful, UT

deaden sound transmission. This method of lateral support eliminated the need for any transverse bracing along the length of the concourse. Only minimal bracing was required in the longitudinal direction at the ends of the concourse where the elevation difference between concourse and the adjacent roofs was the greatest.

The architectural design called for two 70'-tall freestanding towers to be constructed at the main entry. The towers were clad in sandstone veneer and support 15'-tall exposed aluminum frames. This presented an engineering challenge due to high seismic forces generated by the weight of the sandstone veneer and the high design wind loads required by city ordinance. To design a stable framing system for the towers, three dimensional computer models were developed and subjected to the design earthquake and wind forces. The results indicated that the towers could be efficiently constructed using 5" square steel tube segments with fillet-welded connections. Metal stud infill framing and plywood sheathing provided the backup to anchor the sandstone veneer. ★

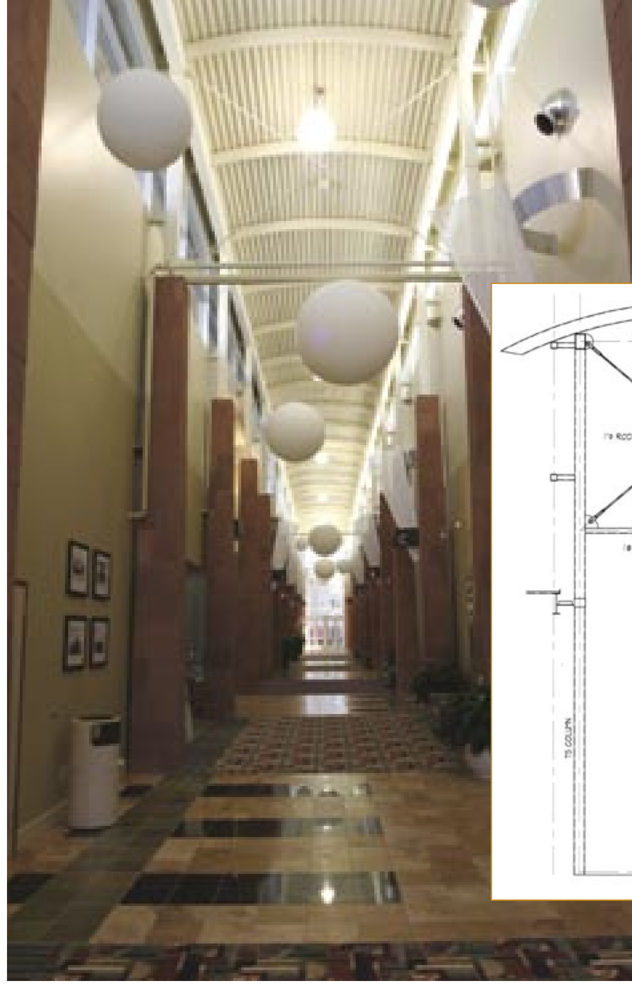
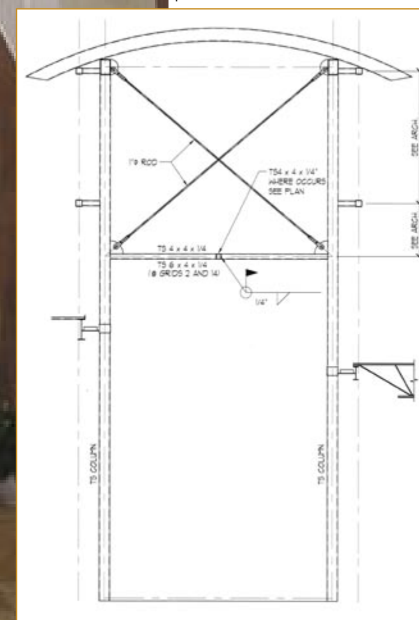


Photo by Jacom Stephens.



Graphic courtesy ARW Engineers.