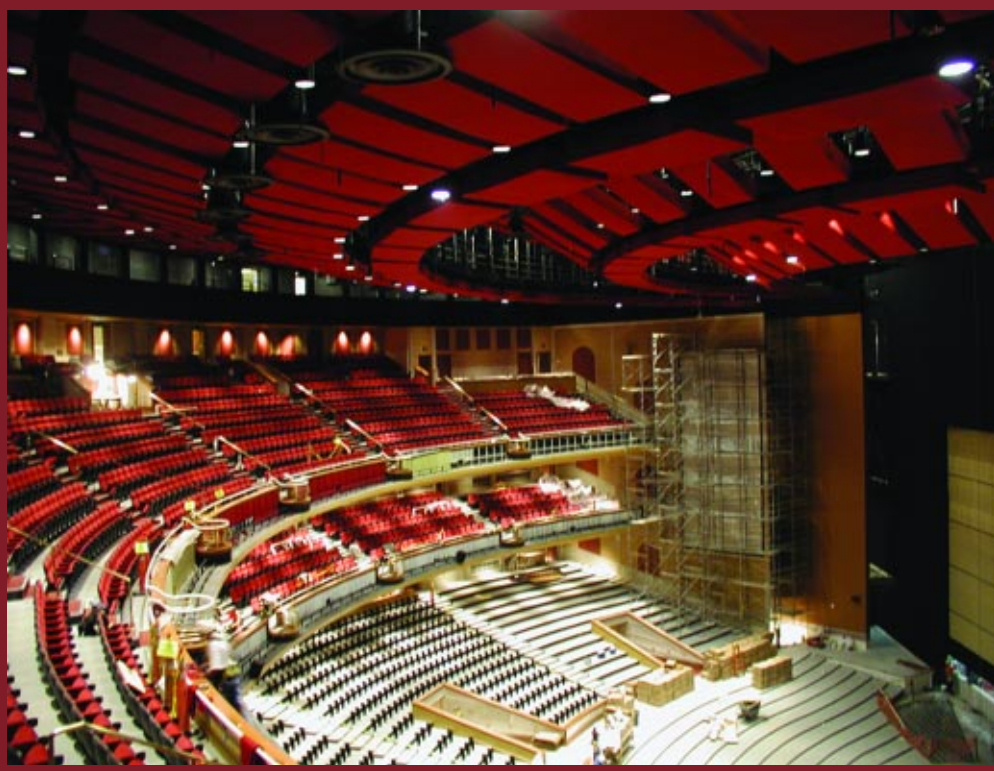
Steel Wins **Big**

Wayne Searle

Located in the heart of Las Vegas, the Colosseum at Caesars Palace used structural steel and teamwork to swiftly recreate an historic landmark on a grand scale.



To build a 4000-plus seat theater in Las Vegas that will feature one of the world's top vocal performers, Celine Dion, is no small task. The new Colosseum at Caesars Palace Casino required one the best sound systems in the world, the world's largest video display, one-of-a-kind stage lifts and theatrical equipment—all to be built within 20 months. Part of the building had to be erected directly above an existing box culvert, a concrete structure covering a canal that runs directly under the Caesars Palace casino. A fire-truck-rated mezzanine level had to be installed above an existing road for egress/emergency exit. New steel had to be tied into the existing casino without disturbing the thousands of guests that gather at the slot machines each day. Added to all of this was a challenging project location, directly off of Las Vegas Blvd., with only one entry and one exit.

THE ONLY CHOICE

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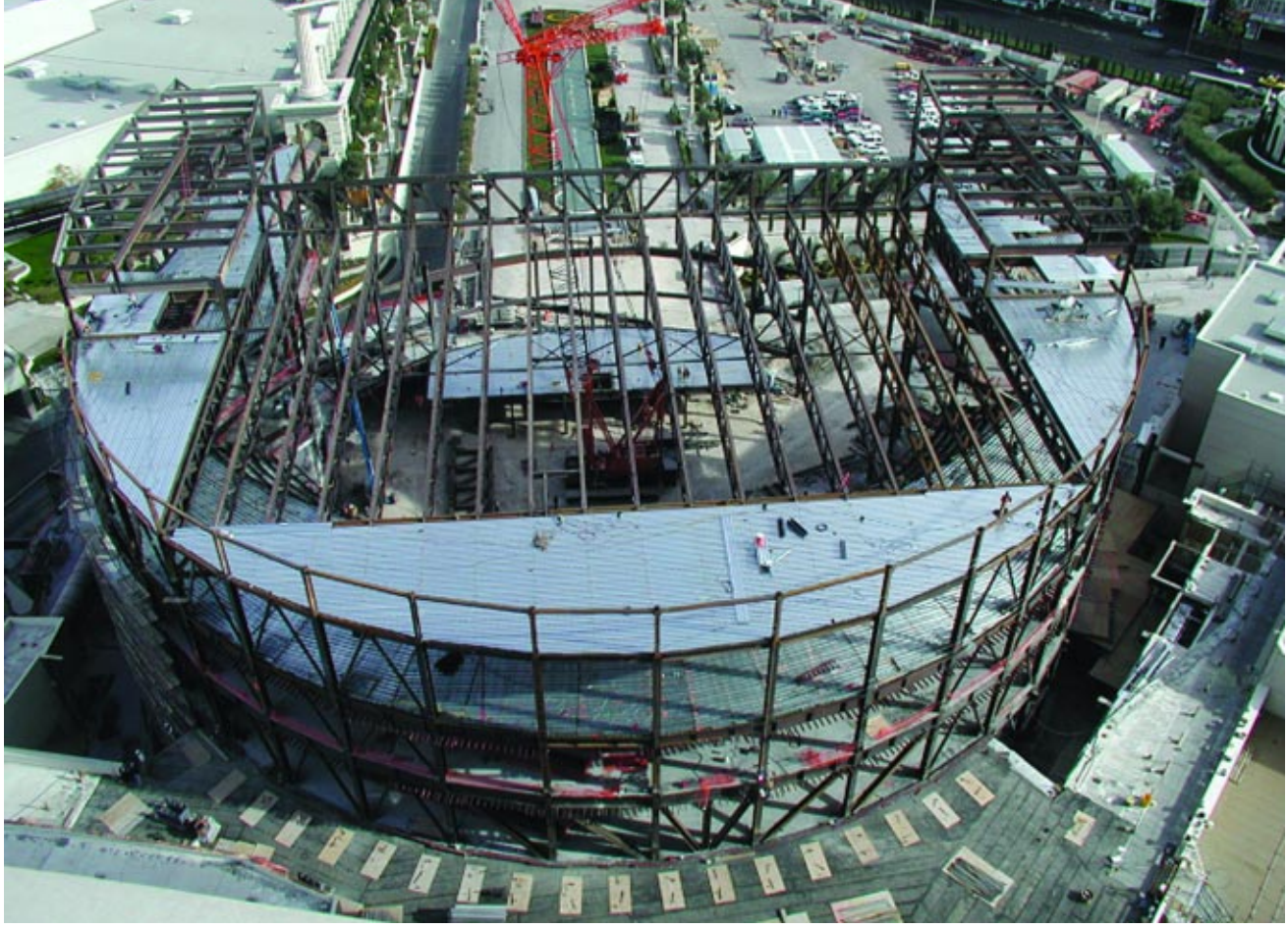

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open space for the theater. It was also the optimum choice to support the seating at the balconies, because of the difficulties of maintaining non-obstructive lines of site for all 4000 seats in the theater.

A 180′-by-120′ "box-truss" system was used for main framing at the low roof. The high roof was developed using a combination of W30s and 180′ trusses. The shape of the building is a cylinder with 128′-radius-by-120′-high columns, ranging from W14×398s to W14×730s, with hardly a square corner in the building. RAM Structural System and RISA-3D were the software programs used to create the braced-frame design.

The 22,450-sq.-ft stage (120′ across) is an example of the flexibility of steel and its advantages for an ever-changing system. The stage is composed of wide-flange members that can be moved, removed or relocated for upcoming shows. Steel supports the many stage lifts, elevators and spiral stairs that are part of the show. GSB Architects of Oklahoma City required the largest proscenium arch in the world, a 44′-high opening at the front of the stage, and structural steel was the best choice for it.

DESIGN ASSIST SPEEDS IT UP

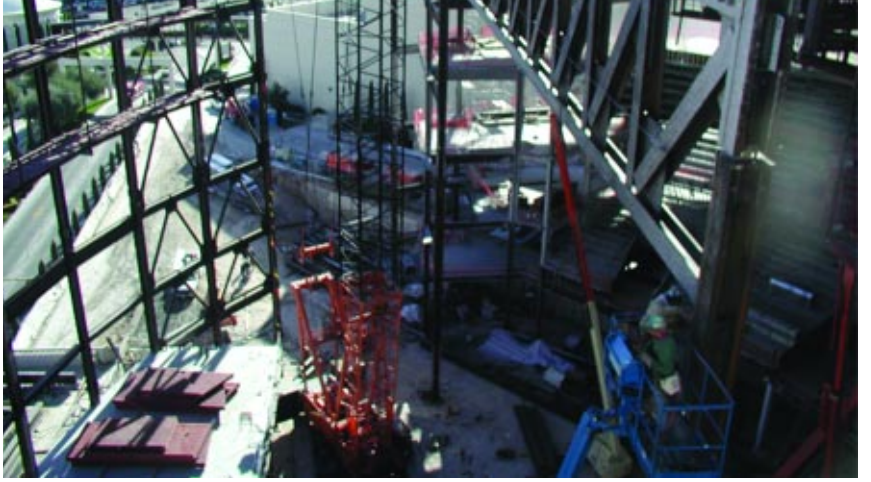
The Colosseum had a demanding schedule, 10 months from the start of design until topping out. During the bid process, the owner required the bid to include a design team from the fabricator/erector. SME Steel was selected as the steel fabricator, and provided more than 5000 tons of steel for the project. 7800 erectable pieces of steel had to be designed, detailed, fabricated, and erected within the 10-month period.

The general contractor, Perini Building Company, held weekly design meetings to help facilitate the communication/coordination required to complete a project of this stature and complexity. Extensive geometry was involved in the basic setup of the job, including a number of layouts for the sloping girder beams (made up of W40×398s) at the balconies, openings for stairs and elevators, and an extensive catwalk system for lighting and sound. In addition to these items, there were constant changes from the owner–including moving escalators, stairs and theatrical equipment–up until the last minute.

The teamwork atmosphere meant problems could be solved before or as they surfaced. The team prevented or avoided unnecessary errors as a result and saved money for the owner. In a process of establishing a line of trust between the architect, engineer and the detailer, solving the idiosyncrasies of the project became a daily event. It wasn't uncommon to receive a request for items such as a 90′-long W40×593 that had to be designed, purchased, detailed, fabricated, and delivered to the jobsite in less than two weeks. A proactive approach from all team members, from the owner down to the erection team, created circumstances for success. The use of steel and the design-assist approach allowed the team to efficiently handle last minute changes, and to finish the project ahead of schedule and under budget.

GET IT THERE NOW!

Fabrication started in September 2001, was completed in January 2002, and took more than 51,000 hours. There



The crane was placed in a hole 25' below ground level and below the area of steel delivery. Trusses were sent to the jobsite in three pieces and assembled in the "hole" while the raising gang was erecting steel in the rest of the building.

were 27 trusses that had a combined weight of 600 tons. The biggest was 180' long by 13' deep and weighed 118 tons. It was comprised of W14×426 top and bottom chords. One of the earliest fabrication challenges, were the "box-girders," made from two W40×397s welded together, with continuous 2½" plates on the top and the bottom flanges. There were nine of these, weighing approximately 1100 lb per sq. ft. The box-girders spanned the existing box culvert and allowed part of the Colosseum to be built over the top of it.

The sloping seating girders were W40 beams with full-penetration welds and double-bevel connection plates for the intermediate beams. An intricate, removable-grating system above the stage consisted of channel frames with W12 filler beams. These frames had to be removable to allow for the stage-rigging equipment to be lifted from below. The fabrication was timely, accurate, and flexible, and due to the use of steel, any mistakes could be fixed quickly and accurately in the field.

ERECTION: "FAST AND FURIOUS"

With only one entry and one exit, the erection of the 7,800 pieces was challenging. The crane was placed in a hole 25' below ground level and below the area of steel delivery. Steel was delivered in 189 loads. Because of the lack of lay-down area, the deliveries had to be made precisely according to the erection sequencing. Members of Ironworkers local #433 would remove the steel from the truck and erect it, and they put in more than 28,000 hours to complete the project ahead of schedule.

The trusses were sent to the jobsite in three pieces and assembled in the "hole" while the raising gang was erecting steel in the rest of the building. The first truss to be erected was segmented, and had to be assembled at the jobsite, both on the ground and in place. The chord members were W40×397s with W14 diagonals/verticals. After completion, the truss measured 125' wide by 44' deep and weighed more than 125 tons.

THIS MUST BE VEGAS

The building was loaded with extra items to give it a Vegas flair. Steel located at the back of the stage supports the world's largest video-display unit, furnished by Mitsubishi Diamond Vision. The structure supporting the screen is 51' high and 110' wide, and is segmented to match the radius of the video display. There are six levels of catwalks behind the display, made of checkered plate for maintenance and adjustment of the units. The decision to install the video display came after the entire structure had been erected and closed off. The stage floor could not support the weight of a small hydraulic crane, so air-tuggers and winches were used to erect more than 500 pieces for the framing.

Several stair towers, miles of handrails, and hundreds of feet of catwalks were part of the new theater. Weekly meetings and the design/assist approach enhanced the coordination and timing of both the structural and miscellaneous packages. Above the stage was an intricate grating system composed of 1½" grating in 3' square panels. Each panel was removable and secured by a customized clip created specifically for the grating system. Amico-Klemp supplied the grating and the clip, which is used now in many other theaters. The removable system allows for all of the theatrical and rigging equipment to be raised into place and then secured afterwards.

MAKING IT ALL COME TOGETHER

The only way that this job could have been completed ahead of schedule and under budget was through the teamwork philosophy and approach. The owner, architect, engineer, general contractor, detailers, fabricator, erector, and all sub-contractors made extra efforts to keep the communication/coordination process as simple and fluent as possible. This was a complex project with an extraordinary schedule, and despite the long hours and hard work, the result was gratifying and exhilarating. ★

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Park Place Entertainment, Las Vegas

GENERAL CONTRACTOR
Perini Building Company, Las Vegas

ARCHITECT
GSB Architects, Oklahoma City

STRUCTURAL ENGINEER
Martin and Peltyn, Las Vegas

ENGINEERING SOFTWARE
RAM Structural System, RISA-3D

STEEL FABRICATOR/ERECTOR
SME Steel Contractors,
West Jordan, UT (AISC member)

STEEL DETAILER
SMECad/CalWest (NISD member),
Pleasanton, CA

STEEL DETAILING SOFTWARE
STRUcad, AutoCAD