

In Plain View

BY ROBERT E. STOLLER, P.E., S.E.



©Ralph Cole. Tulsa

A new steel hotel-casino now graces the windswept plains of northeastern Oklahoma.

WHILE MULTITUDES OF PROJECTS are referred to as “fast-track” these days, casino projects add a whole new meaning to the term. Once approved, the desire to quickly open and begin generating revenue is intense, which can be challenging given the enormous scale of most casino projects. The new Downstream Casino Resort project in northeastern Oklahoma is a testament to what can be done using structural steel to fulfill this desire.

Located on a 71-acre green field site near the intersection of Oklahoma, Kansas, and Missouri, the project is owned by the Quapaw Tribe of Oklahoma. The first phase consists of a 183,000-sq.-ft, one-story casino and a 165,000-sq.-ft, 12-story luxury hotel at a combined cost of about \$140 million. Based on a preliminary program, the design team worked with the owner and construction manager to establish a budget estimate for the project. The one-story casino required large open bays with up to 60-ft clear spans, and various floor plans and structural systems were examined, with steel becoming the obvious choice for framing this building. The hotel, however, offered several possibilities.

General contractor Manhattan Construction and its concrete subcontractor were of course very familiar with concrete flat slab construction. Their initial thought was to frame the tower with either conventionally reinforced or post-tensioned flat slabs. But the structural

engineers at Wendel Duchscherer felt that a steel framing system might be more economical and better suited to meet the tight schedule presented by the Downstream Casino Authority. All options were considered and several alternate floor plans were developed to evaluate composite steel framing with either lightweight or normal weight concrete on composite steel deck. Alternate bracing systems included a steel braced core versus a reinforced concrete shear wall core.

Manhattan Construction evaluated all the options and decided that a steel-framed structure with a steel-braced core and lightweight concrete floors provided the best solution to meet both the client’s budget and schedule. The company established a guaranteed maximum price (GMP) based on the preliminary designs, and our structural engineers were authorized to start work on the modified design in early June 2007.

Scheduling the “Impossible”

After reviewing the mill schedules of several steel producers, Schuff Steel—the project’s steel fabricator—informed the team that in order to meet the project opening dates (August 2008, with a preferred early-July opening for the casino and mid-November 2008 for the hotel), a mill order reservation was needed by June 22, 2007



Helicopercrane.com

left: Approximately 2,040 tons of steel were used to complete the 212-ft-tall hotel tower portion of the project.

that would reserve the tonnage of each shape. A complete mill order including actual final designs was needed two weeks later, by July 6.

At first, this seemed like an impossible task. Many of the project's design elements had not been finalized by the architect, JCJ Architecture, nor agreed to by the owner. But the design and construction team was determined to make the "impossible" possible. We studied the state of the design and came back with an idea based on our previous work on other casino projects; it has been our experience that 90% of the framing can be locked in fairly quickly. This requires that geometry and loadings are "frozen" by the design team. The last 10% requires more time in working through design and detailing with the owner and other design team members. JCJ agreed to freeze the design concepts as much as possible at this early stage, and Manhattan agreed with the idea of a 90% complete steel mill order within the desired time frame. Subsequent steel packages would be either mill ordered or bought from service centers as the schedule dictated.

After placing the mill order, Schuff immediately began shop drawings. Their internal team worked with a connection engineer in Michigan and a steel detailer in New Zealand. Given the distances and time zone variations between the parties, all submittals were made electronically. Our structural team turned around most submittals within one or two days rather than the more standard 10-day cycle, and RFIs were usually answered within a matter of hours.

Framing

The casino structure is approximately 450 ft long by 360 ft wide. While only one story, it has roofs at three different levels ranging from 18 ft to 32 ft above ground. The eastern end has several curved surfaces in plan and includes the main casino entrances. The casino also intersects the hotel at the southeast corner, and the hotel geometry is skewed at about a 45° angle from the casino.

The roof framing is a combination of rolled sections and bar joists. Lateral bracing is predominantly provided by braced frames, with some moment frames where braces were not acceptable architecturally; JCJ worked with us to locate braces where they could be integrated within the architectural design. In fact, four chevron braces flank the sides of the central casino floor, where large 60-ft spans and a 32-ft story height made moment frames impractical. These braces were made into part of the architectural expression of the space.

All of the casino framing was designed in time for the mill order deadlines except for the last eastern bay and the interface to the hotel. These more complicated areas required additional time to resolve geometric issues and design options, and the remaining portions were issued in subsequent fast-track bid packages.

The 12-story hotel was framed by composite steel beams clear spanning between the perimeter and the braced steel core. The floor plan is fairly standard, with a pinwheel-type geometry. This symmetry allowed for many beams of the same size and length, greatly improving the ability to quickly design and detail them. The four corner columns of the braced core had large axial forces and required steel wide-flange sections larger than those domestically produced. In order to avoid the time delay of ordering imported jumbo shapes, these columns were designed as composite columns using the largest domestic shape available, and encased in 6,000-psi concrete.

Steel erection of the casino started on October 12, 2007 and was complete by mid-November. In all, 1,100 tons of structural steel were erected in the casino portion. Everything possible was done to expedite construction, including setting whole bays of joist framing at once.

below: Steel supports this continually changing lighting feature.



©Ralph Cole, Tulsa

below: Roofing joists being erected.



Robert Stoller

below: 1,100 tons of steel were erected in the casino portion.



Helicopercrane.com

The drilled pier foundations for the hotel were started in late October and completed in early December. Steel erection began immediately thereafter and was completed by March 28, 2008. Approximately 2,040 tons of steel were used to complete the 212-ft-tall hotel tower. With great fanfare, the casino opened to the public one month ahead of schedule, in early July. Finish work on the hotel was completed in time for a partial opening on October 31 and a grand opening on November 22.

Evidently Steel

The use of structural steel is evident throughout the casino. Many areas have no ceilings, exposing the framework to view. A center bar feature uses a structural steel column with two circular steel rings supporting a visually exciting double-spiral cable structure. Continually changing lighting makes this a distinguishing feature of the casino.

With imaginative packaging of the structural steel elements, this 348,000-sq. ft project went from beginning of design to topping out in just over nine months. Initial occupancy of the casino was achieved just four months later, with the hotel opening its doors four months after that. The design team has since caught its breath and will soon begin a second phase expansion of the property, which will include a spa and meeting room addition, followed by a second hotel. MSC

Robert Stoller is an associate principal with Wendel Duchscherer.

Owner

Downstream Casino Authority (Quapaw Nation), Quapaw, Okla.

Architect

JCJ Architecture, Hartford, Conn.

Structural and Civil Engineer

Wendel Duchscherer, Amherst, N.Y.

Steel Fabricator

Schuff Steel Midwest, Overland Park, Kan. (AISC Member)

Steel Detailer

BDS Steel Detailers, Auckland, New Zealand

Connection Design

Ruby and Associates, Farmington Hills, Mich.

Steel Erector

Peterson Beckner Industries, Richardson, Texas (AISC Member)

General Contractor

Manhattan Construction, Tulsa, Okla.

Software

RAM Structural System, Staad Pro, Tekla Structures