

# Oklahoma History Center

Oklahoma City, Oklahoma

By Brad Thurman, P.E., CPSM

**W**allace Engineering was presented with an NCSEA 2006 Excellence in Structural Engineering Outstanding Project Award (New Buildings \$30 Million to \$100 Million) for the Oklahoma History Center project.

The Oklahoma History Center is the new home of the Oklahoma Historical Society. Its unique, curving geometry was created in response to its site. The three-story office/library wing is an S-shaped element and forms the entry side of the Center. The C-shaped gallery wings are nested into the office/library wing and face toward the State Capitol. The two wings are joined by a three-story atrium spine and an elliptical-shaped Grand Hall, a soaring atrium space that reaches 88 feet in height and is completely glazed on the exterior, providing dynamic views of the State Capitol.

The floor plan geometry of the History Center created interesting and difficult framing challenges. The structural grid system is laid out on a radial coordinate system, with the radial grids dimensioned angularly and the concentric grids dimensioned using distances. The floor framing consists of composite steel framing and it was desired to create as simple a framing layout as possible. The floor and roof framing are configured so that straight girders run along the concentric grids, creating a segmented curve. Beams were placed perpendicular to the girders, so that all beam-to-girder connections were at 90 degrees. Beams at the radial grids were placed along the grids and the columns were rotated normal to the radial grids, which created 90-degree connections for these beams. This system simplified the primary framing so that the only skewed connections occur at the girder-to-column connections.



Grand Hall with replica of Wiley Post's airplane "Winnie Mae." Photo © Tim Hursley



Exterior of Gallery Wings, showing Grand Hall and backlit onyx lanterns. Photo © Tim Hursley

Exposed structural steel is used throughout the Center and is especially visible in the Grand Hall. The steel tube framing not only had to meet architecturally-exposed steel requirements, but it had to be designed with simple elegant connections that would also brace the slender concrete columns supporting the roof of the Grand Hall. The resulting look is clean and minimizes visible connections.

The structural design of the Oklahoma History Center incorporates creative uses of several common building systems. One of the most unusual involves the use of precast concrete panels. As originally conceived, the exterior skin of the facility was to consist of a combination of cast stone, marble, and backlit onyx. The systems were to be used as veneers, which would require backup framing consisting of metal studs. The gallery wings have a 30-foot floor-to-floor height, which would have required intermediate girts and wind columns to support the veneer framing. Because of deflection limitations required to prevent cracking of the stone, this framing would have been quite heavy, and the geometry of the framing, especially the studs, would be hard to control.

The design team worked with a precast manufacturer who makes high-quality architectural precast panels with a finish that resembles cast stone. The use of the panels eliminated the need for backup framing in the cast stone areas. The panels are also used as shear walls in conjunction with interior moment-resisting frames. At the taller gallery areas, the design team decided to cast the marble tiles integrally with the precast panels to speed erection and reduce framing costs. The panels were designed with two strengthening ribs, creating a shallow double-tee section. Since the galleries are "black box" exhibit areas, the structure was left exposed and the additional panel depth could be accommodated. The panelized system saved erection time and created a beautiful, uniform surface.

The use of the materials cited above significantly reduced the material and erection costs for the facility. Other factors were included in the design to maximize the flexibility of the History Center now and in the future. To provide future expansion and storage space, a future mezzanine was incorporated into the current design, which will allow the construction of the needed space with little or no modification to the current structure. Flexibility was also incorporated into the galleries. The floors and roof of the galleries are designed for an additional suspended load of 50 pounds per square foot. Dovetail-fluted floor and roof deck allow total flexibility in the support of exhibits, lighting, ductwork and scenery.

The Oklahoma History Center is a dynamic and wonderful facility that gives the Oklahoma Historical Society the venue it needs to present the colorful and varied history of this great state. The dedication and grand opening of the History Center kicked off the two-year-long celebration leading up to Oklahoma's 100<sup>th</sup> birthday. The fact that the Oklahoma Centennial Commission selected this event to commence their program demonstrates the History Center's importance to this state.

The design of the Oklahoma History Center was conceived to honor the past while expressing the hope of the future. Through the use of traditional materials in non-traditional ways and by orienting the facility to look out at the State Capitol, the Center honors its context without imitating it. ■

## Design Team

Wallace Engineering provided full-service structural engineering design services for the project. The design team included Beck Design with Hellmuth, Obata + Kassabaum (architects), Smith Roberts Baldischwiler, LLC (civil), ZRHD, PC (mechanical/electrical/plumbing), Kroll-Schiff Associates (security), Pelton Marsh Kinsella (theatrical) and Haley Sharpe Design (exhibits).