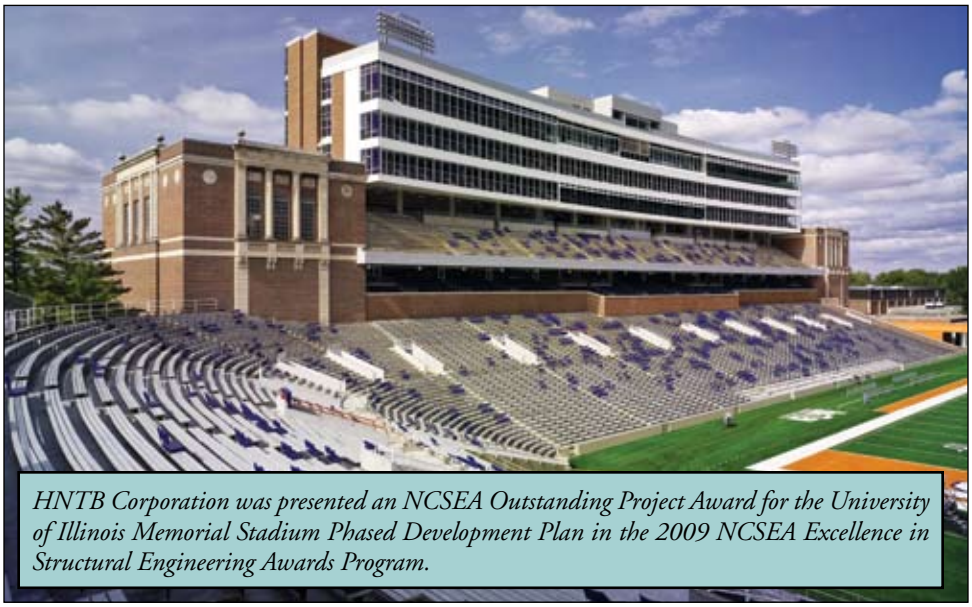
Upholding Tradition

Historic Structure Renovated From the Inside Out

By Brent Bonham, P.E., S.E. and Jeffry S. Adams, P.E.



HNTB Corporation was presented an NCSEA Outstanding Project Award for the University of Illinois Memorial Stadium Phased Development Plan in the 2009 NCSEA Excellence in Structural Engineering Awards Program.

After more than 80 years in use, the historic World War I Memorial Stadium, in Champaign, Illinois, was due for renewal. The mandate to preserve this remarkable assembly of 200 Doric columns and other unique façade embellishments defined the design challenge that distinguished this project. In addition, the work had to be completed while the stadium was occupied. The project began in January 2007, and the facility remained operational for the 2007 football season. It had to be completed in time for the kickoff of the 2008 season in September of that year.

The renovation included: wider public concourses; a portal entryway system; new restrooms and concessions; permanent seating additions in the north end zone; an Illini Hall of Fame; a state-of-the-art press box; luxurious hospitality facilities, including suites; and, additional indoor and outdoor club seating.

While most stadium renovations are approached from the outside, this one required an inside-out solution. The additions were constructed inside, through and above the existing facility to preserve the historic structure.

This design concept posed additional, substantial challenges for the structural engineers, including:

- Adapting, in-place, significant portions of the existing upper balcony steel and precast bleachers below the new suites.
- Limiting the deflections and vibrations of the 25-foot long cantilevered floors to acceptable parameters.
- Dealing with differential settlement between the old and new structures.
- Transferring different bay sizes from the old to new structures. The new structure is based on a radial grid, with columns spaced about 30 feet of center on the arc, and the project team had to transfer that down to the 45-foot spacing of the existing columns. None of the grids aligned.

To further complicate the project, HNTB Architecture and university officials determined that the new construction needed to upgrade the facility to comply with current seismic code requirements; the stadium is located near the New Madrid fault line. This decision proved fortuitous when a 5.4 magnitude earthquake struck southern Illinois in the spring of 2008. The largest in a century for this region, the quake rippled through the bedrock of the Great Plains, the southeast and eastern seaboard and as far north as Canada. The stadium withstood the brunt in shining fashion, while other masonry structures in the region were damaged.

Designers chose structural steel because of the complexity of the design, the height of the proposed structure and the speed of construction. The facility's existing structural steel showed no deterioration and was strong enough to withstand new construction, including modern welding. The path, however, was circuitous.

Project teams phased the project over two sessions to allow for continuous use of the facility.

To demolish portions of the main trusses, resolve differential settlement between the old and new foundations and minimize cracking of the existing masonry, the project team engineered the structure to incorporate a unique jacking system. This required the existing structure to be shored, jacked, selectively demolished, re-jacked and supported while minimizing any movement. The solution was to provide shoring columns and beams to support the existing trusses prior to being supported on new transfer trusses which were erected from below. The foundations were designed to support the shorting columns and temporary loads. The construction team continuously monitored the masonry façade and other brittle elements to ensure they were not damaged.

While the building had to remain occupied during construction, building codes did not address interim construction details. The project team worked with university building officials, who accepted the use of ASCE 37-02, "Design Loads on Structures During Construction," as the source for provisions to guide the interim construction bracing.

Thanks to the creativity of the entire team and the University's leadership, the stadium has retained its eligibility for the National Register of Historic Places and for designation as a National Historic Landmark. The University of Illinois Memorial Stadium is poised to continue honoring the fallen while serving the living for generations to come.▪

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Project Team

Structural Engineer: HNTB Corporation, Kansas City, MO
Architect: HNTB Architecture with Isaksen Glerum Wachter, LLC, Urbana, IL
Construction Engineer: Roecker Consulting Engineers, Inc., Morton, IL
Steel Fabricator: Blattner Steel, Cape Girardeau, MO
Steel Erector: Prairie States Steel, Champaign, IL
Construction Manager: Hunt Construction, Indianapolis, ID
West Stadium General Contractor: Williams Brothers, Peoria, IL