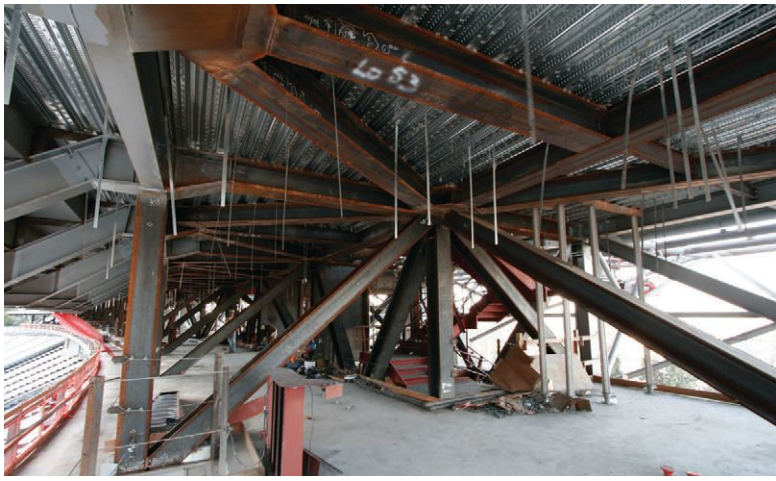
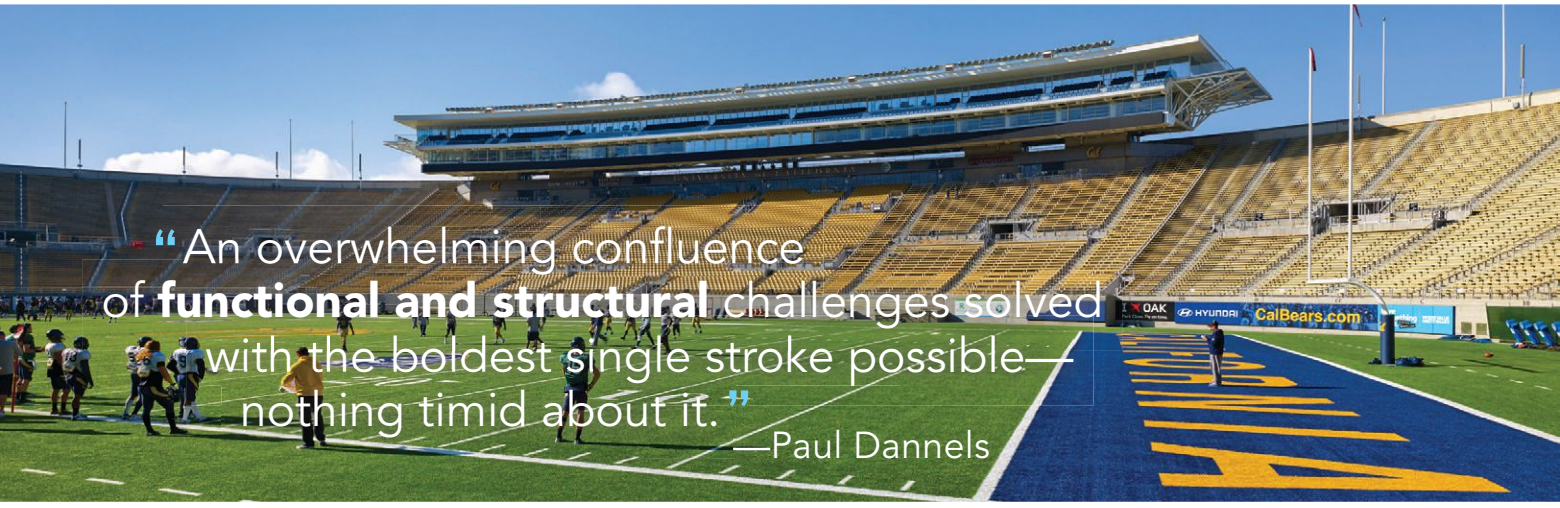


Merit Award—$15 Million to $75 Million

UC BERKELEY CALIFORNIA MEMORIAL STADIUM PRESS BOX, BERKELEY, CALIF.



Built as a memorial to fallen alumni of World War I, the University of California, Berkeley's Memorial Stadium has endured as one of the most picturesque venues in college football from its opening in 1923 for the "Big Game" versus Stanford to the present day. After it was discovered that the stadium was at particular risk in the event of an earthquake, which is further exacerbated by the fact that it sits above the Hayward Fault, the university undertook a large project to seismically retrofit as well as modernize the stadium. As a part of this project, the western stadium bowl was seismically retrofitted and modernized with new concrete seating bowl framing while keeping the existing historic perimeter concrete wall in place.

The "crown jewel" of the project, however, is the new long-span two-story structural steel press box that floats atop the new west portion of the stadium. One of the main architectural design goals was to achieve a floating effect to the press box by reducing the number of supports to a bare minimum. The resulting structure is 375 ft long with two 100-ft-long main spans and end-span cantilevers of 33 ft. The press box arches to follow the curvature of the existing exterior wall and is supported by four concrete cores (two at each end) and four center structural steel columns. The press box is two stories, with the first floor housing print, radio and TV media functions and the second floor housing a club space with views and seating facing the field, as well as a dramatic 25-ft cantilevered balcony with a glass deck that faces the campus and provides panoramic views of San Francisco Bay and the Golden Gate Bridge. The areas of the levels are 10,200 sq. ft and 12,500 sq. ft, respectively. The main structure of the press box consists of a story-deep space truss that is comprised of radial trusses that are supported by primary trusses that span between the concrete cores and center columns. The occupant load for the entire press box is approximately 1,700 people, and more than 1,350 tons of structural steel were used in its construction. The overall construction cost for the project was $215 million, with the press box portion being $40 million.

Due to the stadium's location above the active Hayward Fault, the design of the press box and supporting concrete cores used several design innovations to allow for increased seismic performance. The concrete cores that support the press box provide the main vertical access to it. These tall, slender support elements, with the lumped press box mass at the top, create a dynamic incompatibility with the surrounding bowl structure. If this incompatibility had not been properly addressed, a major seismic event could potentially cause substantial damage to the concrete cores directly below the support points for the press box. To avoid this scenario, the cores and press box structure were seismically separated from the surrounding bowl and allowed to move completely independent of the main bowl structure. The concrete cores were designed to rock at their bases to alleviate the seismic demand on the cores, which were also vertically post-tensioned to provide stability and a restoring force when rocking. Fluid viscous dampers (shock absorbers) that link to the cores were added within the bowl structure, providing a mechanism to dissipate seismic energy and to control movements and accelerations in the press box. Sixteen dampers were used in the design of the stadium, each with 220-ton axial force capacity.

Merit Award—$15 Million to $75 Million

UC BERKELEY CALIFORNIA MEMORIAL STADIUM PRESS BOX, BERKELEY, CALIF.

As the core wall system rocks in the event of an earthquake, the large drift angle of the cores would cause large bending and shear forces in the press box above. In order to alleviate these forces and economize the design, the press box was supported on steel pins at the center of each core. These pins allow the press box to pivot on the cores and minimize damage to the steel structure. Each 7-in.-diameter high-strength steel pin is sandwiched by five 100-ksi steel gusset plates. The entire press box structure is supported on twelve of these high-strength pin assemblies.

The top-level cantilevered balcony is also a space truss comprised of numerous small-diameter pipe sections. This balcony truss system, which includes seismic and out-of-plane bracing, has several multi-member joint connections with some joints connecting up to eight pipe members. Due to the complexity of these joints, coordination had to take place in a 3D platform (Revit and Tekla) between the fabricators and design team.

Thanks to the complex nature of the site and surrounding neighborhood, there was limited space on-site to allow for erection and construction of the press box. To address this issue, fabricator Herrick and general contractor Webcor Builders enlisted the help of one of the largest crawler cranes in the country (a 750-ton Liebherr crawler crane with a 276-ft boom and 65-ft counterweight extension) to erect the main press box truss in five large segments. The main space truss of the press box was assembled and welded on the playing field, adjacent to the seating bowl. Carefully selected splice locations were determined to ensure each of the five truss segments would be within the crane's capacity for weight and reach. Each of the five segments exceeded 75% of the crane's capacity and therefore were considered critical picks. The largest pick of the five segments was 165 tons at a 160-ft reach, which took the crane to over 95% of its capacity.

The stadium reopened on time for the 2012 football season.

Owner
The University of California, Berkeley, Calif.

Architects
HNTB Architecture, Inc., Los Angeles
STUDIOS Architecture, San Francisco

Structural Engineer
Forell/Elsesser Engineers, Inc., San Francisco

General Contractor
Webcor Builders, San Francisco

Consultant
Hassett Engineering, Inc., Castro Valley, Calif.

Steel Fabricator and Erector
The Herrick Corporation, Stockton, Calif. (AISC Member/ AISC Certified Fabricator and Erector)

Steel Detailer
SNC, Compton, Calif. (AISC Member)

Photographs
Tim Griffith