

# UC Berkeley California Memorial Stadium: Protecting and Strengthening a Landmark on an Active Fault

*David A. Friedman, SE, Senior Principal  
Mason T. Walters, SE, Senior Principal  
René Vignos, SE, Principal  
Chris Petteys, SE, Associate  
Forell/Elsesser Engineers, Inc.  
San Francisco, CA*

## Abstract

UC Berkeley's California Memorial Stadium, constructed in 1923 and designed by the renowned architect John Galen Howard, sits directly over the northern segment of the active Hayward Fault. Situated at the opening of Strawberry Canyon, with the eastern half of the stadium literally carved into the hillside, the non-ductile concrete frame western stadium bowl will be seismically retrofitted and modernized with new seating bowl framing, a new press box, and with the preservation and restoration of the historic perimeter concrete wall. One of the unique features of the retrofit design is the approach to the sections of the stadium positioned over the north-to-south running, right-lateral Hayward Fault. The planned retrofit design creates separate "surface rupture blocks", gapped and separated by joints from the adjacent sections of the stadium. The SRB's will be reinforced with stiffening concrete shear walls bearing on a mat slab foundation, all bearing on layers of sand and high-density plastic to reduce friction and thus facilitate the independent sliding, twisting, and tilting that may result from the predicted 6 feet of horizontal fault rupture displacement and 2 feet of vertical fault rupture displacement. The other unique feature is the 375 foot long steel press box structure which hovers above the west seating bowl on four core walls and four center columns. These core walls are vertically post-tensioned and designed to rock independently from the surrounding concrete bowl framing except where connected by 16 fluid viscous dampers inserted to control the rocking motion and dissipate earthquake energy.

## Introduction

Since its opening in 1923, the University of California at Berkeley's California Memorial Stadium has been a campus centerpiece and landmark structure of symbolic importance. For 89 years Memorial Stadium has existed directly above the northern trace of the active Hayward Fault, without encountering a major seismic event or being seismically

upgraded. Now, a seismic retrofit scheme has been developed to address the seismic hazards of the structure and respond to the issues associated with both strong ground shaking and earthquake surface fault rupture. Along with addressing the seismic safety of the stadium, the project will also provide updated seating, bathrooms, ADA access, and concessions for the fans, updated locker room facilities, and premium club spaces and seating for the donors that made this project financially possible. A big part of the upgrade to the stadium was to design a new press box structure to restore the functionality of a previous press box that was dismantled in the early 2000's. This new press box structure proved to be nearly as big a challenge to design as the surface fault rupture scheme. This paper will cover the history of the stadium, the fault hazard at the site, background on fault rupture design, a summary of the fault rupture scheme for Memorial Stadium and associated studies, a description of the West Bowl framing and unique damped rocking-wall press box support system, the design of the press box structure, the preservation and support of the historic wall, and some discussion of construction challenges.

## History

When John Galen Howard was looking for a site for the new California Memorial Stadium, to commemorate fallen heroes from World War I, it was important that the site be closely connected to the campus. But back then, as now, there were many different local opinions on where the new stadium should be located. When some sites on lower campus were ultimately abandoned for different reasons, the favored site became a small valley at the mouth of Strawberry Canyon. This valley had Strawberry Creek meandering through its base and had become a popular spot for neighborhood gardens (see Figure 1).