UC BERKELEY LOWER SPROUL REDEVELOPMENT PROJECT

Revitalizing A Community Space

The Lower Sproul Redevelopment Project was a student based initiative to reinvigorate an outdated existing central campus space in UC Berkeley. The project encompasses a site area of approximately 184,000 square feet and included work on the following structures:

Strengthening of Existing Buildings

- Martin Luther King Jr. Student Union: The existing 117,000 square-foot, five-story MLK building underwent two major additions (west and south), adding 29,333 square feet of student mixed-use space to the existing building. The existing shear walls in the building were selectively strengthened at Levels 3 and 4 with fiber reinforced polymer (FRP) overlays to increase their shear capacity and convert shear-controlled elements to more ductile flexurally-controlled elements.
- Plaza/Parking Garage: Accessibility improvements to Lower Sproul by adding new stairs throughout the plaza with accessible ramps, upgrading of landscape features, and strengthening the 1958 concrete parking garage structure with FRP for additional gravity loads.
- Anthony Hall: One-story, 1,900 square-foot wood frame structure retrofitted to correct seismic deficiencies.

Replacement of Outdated Eshleman Hall

- The existing 1965 student center was demolished and replaced with a new building that consists of a 64,800 square-foot, five-story (plus basement) concrete structure with special reinforced concrete shear walls as lateral force-resisting system. The gravity load-carrying system uses concrete slabs supported on concrete beams and columns. There was also extensive use of post-tensioning to control long-term creep deflections at the cantilever floors, which overhang the plaza at the upper levels on the north façade of the building.

RUTHERFORD + CHEKENE

Our Team

Structural + Geotechnical Engineer: **Rutherford + Chekene**

Architect: **Moore Rubel Yudell**

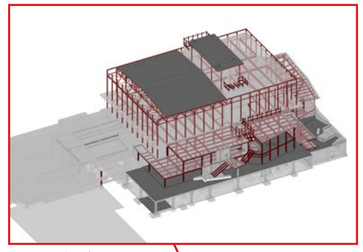
Owner: **Regents of the University of California**

General Contractor: **McCarthy Building Companies, Inc.**

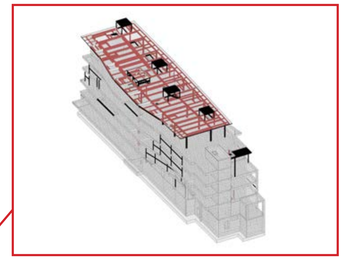
Project Complexities

The Lower Sproul Plaza project redeveloped one of the busiest areas on the UC Berkeley campus, and included work on multiple adjacent structures that were separated from each other by seismic joints. New construction, retrofit of existing structures, use of different construction materials, desire for a higher seismic structural performance for the buildings, reduction of impact on the existing structures, and the close proximity among these different buildings in a limited construction site—including the adjacent Zellerbach Hall and Cesar Chavez Student Center, which remained open during construction—all added layers of complexity to the project.

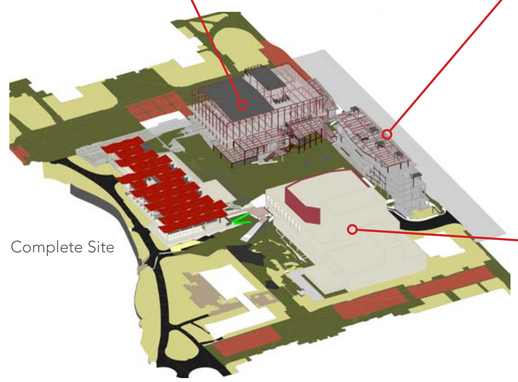
Given the different structures involved in the project, three different complete Revit models (for MLK, Eshleman Hall, and the Plaza/Garage) were required for coordination with the architects and MEP engineers, as well as for coordination of the interface between the different structures.



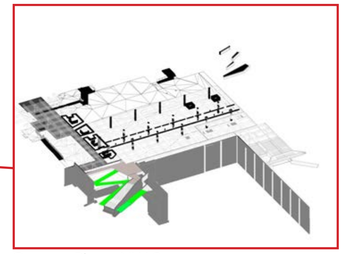
MLK Jr. Student Union



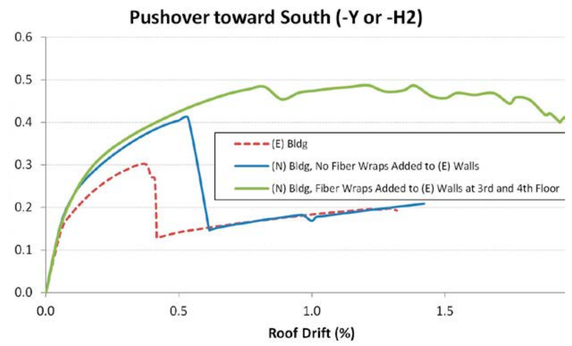
Eshleman Hall



Complete Site



Garage, Plaza, NW Stairs



Performance-Based Design

Performance-based design of the Eshleman and MLK buildings included both nonlinear static (pushover) analysis and nonlinear response history analysis, utilizing PERFORM-3D models to evaluate their seismic behavior under seven pairs of ground motions. The near-fault ground motions were scaled to the site specific response spectrum for two different seismic hazard levels, and were adjusted for the site average shear wave velocity, for foundation embedment and base-slab averaging effects per FEMA 440. The analysis objective in MLK was to optimize the new shear wall layout while minimizing the impact of the additions on the existing structure. For Eshleman Hall, the objective was to have a more efficient concrete shear wall layout and sizing resulting in more reliable seismic performance of the building.

Strengthening of Existing Elements with FRP

Extensive use of fiber reinforced polymer (FRP) was implemented to strengthen existing structural elements in MLK and the underground garage.

Connection of Existing MLK Structure to New Additions

The connection between existing and new structures required very complicated detailing that dealt with various existing conditions, which in several instances differed significantly from the as-built information available.

Building Seismic Interaction

The structures also need to accommodate their relative displacement through their perimeter seismic joints. The bridge connecting MLK with Eshleman was designed with an articulated end to accommodate the movement between the two buildings under a seismic event.