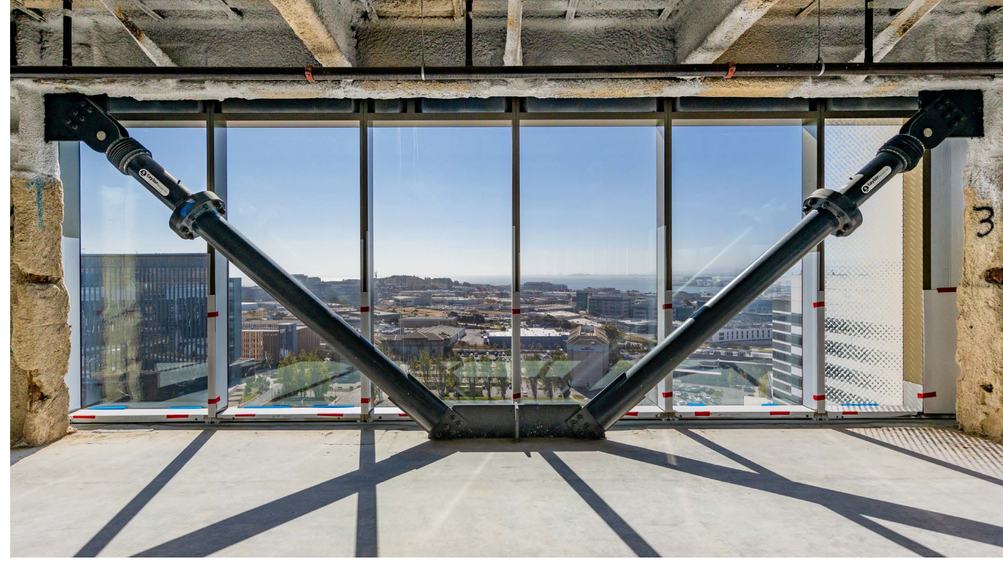
651 Gateway

ADAPTIVE REUSE AND SEISMIC RETROFIT



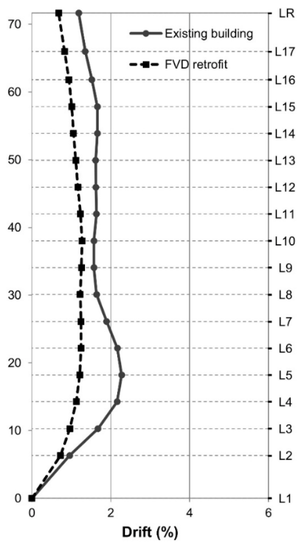
Structural Engineer of Record
IMEG

Subconsultant for nonlinear analysis
Maffei Structural Engineering

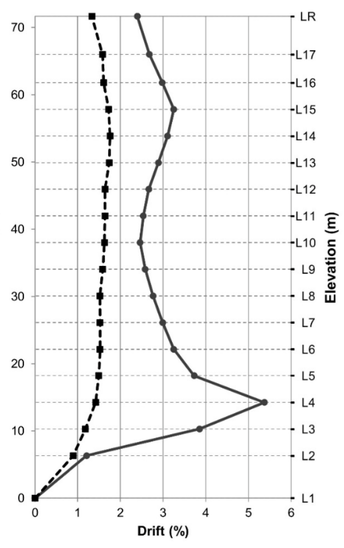
Architect
WRNS Studio

Contractor
Truebeck Construction

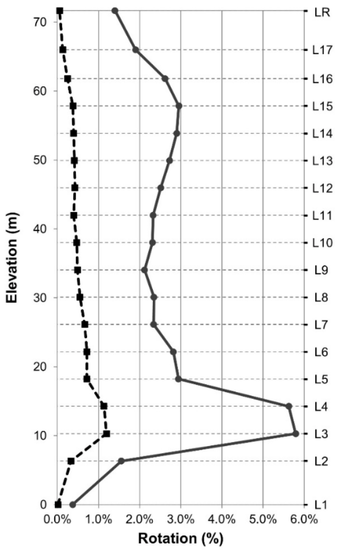
Owner
Confidential



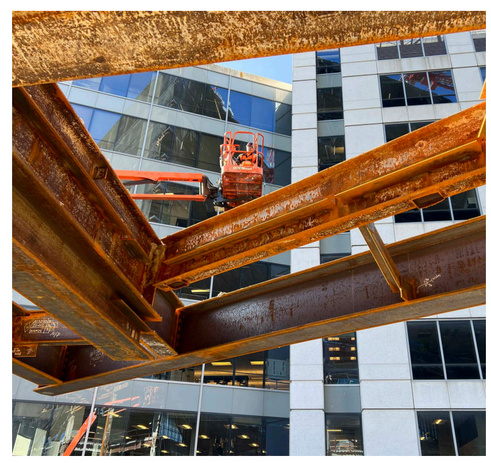
North-south interstory drift.

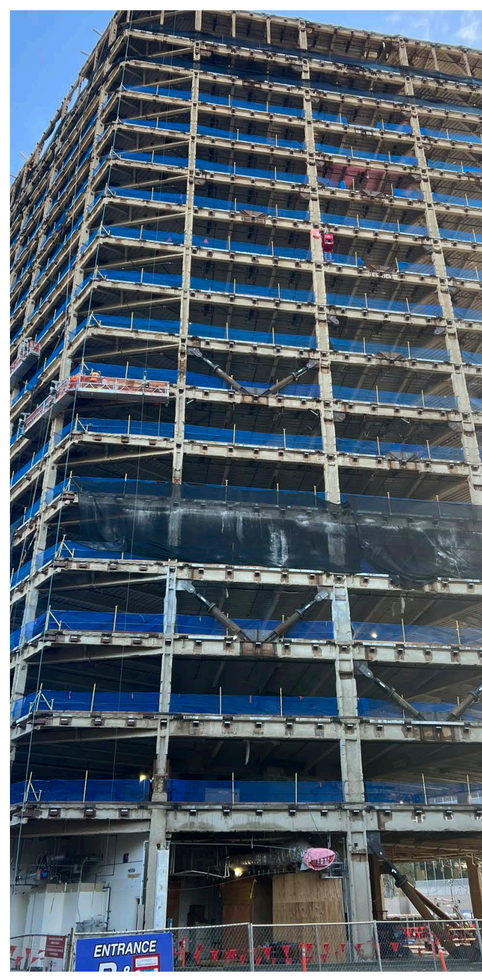


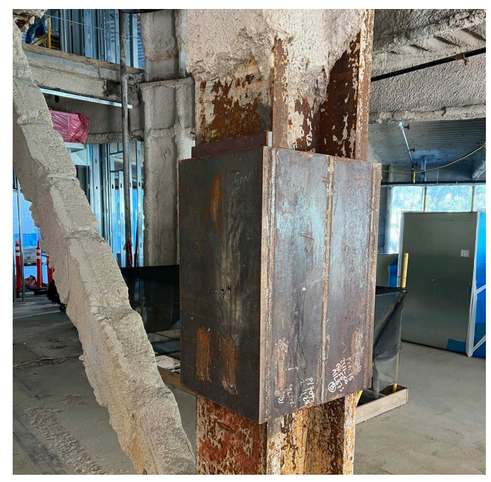
East-west interstory drift.



Plot of beam hinge plastic rotation over the height of the building.







IMEG and Maffei Structural Engineering developed a complete seismic retrofit of a 1980s office structure in South San Francisco, CA, as part of a full renovation and conversion of the building to forward-looking space for life science laboratories. Retrofitting this structure with fluid viscous dampers provided a solution which reduced drift and demands on the pre-Northridge moment frame connections, while avoiding an increased base shear which would have required significant foundation work.

Fluid Viscous Dampers

The existing 17-story structure had brittle pre-Northridge beam-column connections at both the perimeter moment frame and the core with eccentric braced frames. The design team used fluid viscous dampers to reduce story drift, bringing rotation demands on beam-to-column connections within ASCE 41 limits and greatly reducing the potential for connection fracture and consequent safety risk. In addition to reducing deformation, the dampers reduce floor acceleration, mitigating damage to nonstructural systems and critical equipment. The dampers are placed in a staggered configuration around the perimeter of the structure to restrain plan torsion and limit the axial loads on columns and foundations. Additionally, analysis showed that the bottom flange weld was most prone to fail, therefore dampers were placed in an inverted chevron configuration to strengthen select flanges with the new gusset plate - serving a dual purpose.

Column Splice Retrofit

The nonlinear response-history analysis included explicit fracturing models of beam connections and column splices. The team implemented an innovative sleeve retrofit for several of the partial penetration column splices that can be brittle under tension. The detail allows the splices to fracture under large axial tension demands, but to restrain the column against horizontal displacement so that it returns to its initial position and maintains gravity capacity. This solution avoided the need for costly and invasive strengthening of the building's deep foundation system.

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MAFFEI STRUCTURAL ENGINEERING

taylor devices inc.