

SCE's Seismic Resiliency Program

Use Cases for Earthquake Simulations

PEER-LBNL WORKSHOP

UC BERKELEY

JANUARY 18, 2024



Topics

- ▶ Overview of SCE's Seismic Resiliency Program, 2016-2024; \$192M has been invested to date
 - ✓ Substation switchyard work
 - ✓ Building retrofits
 - ✓ Occupied buildings
 - ✓ Critical facilities
 - ✓ Computer equipment racks

- ▶ Tranched approach in 2022 RAMP; most critical assets are prioritized for safety & reliability
- ▶ Strategy for optimizing risk-reduction investments (now at \$35M/yr; set to double by 2028, pending GRC)

- ▶ Use Cases for Earthquake Simulations
 - ▶ Scenarios for use in exercises, e.g., 2024 SCE Full-Scale Exercise (GridEx)
 - ▶ Prioritization of seismic mitigation projects for system-level risk reduction
 - ▶ Site-specific ground motion simulations to analyze risk for critical facilities:
 - ▶ Support system-level risk, potential outcome, and benefit-cost analyses
 - ▶ Assess vulnerabilities of existing facilities & systems (using fault-tree analysis)
 - ▶ Provide site-specific ground motions for use with building models for use in seismic retrofit designs

California is Earthquake Country



Strategy of SCE's Seismic Resiliency Program

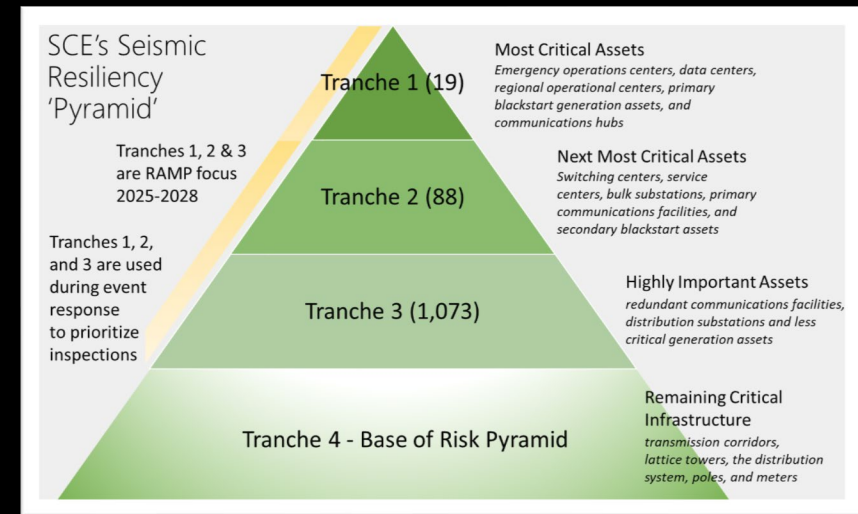
Mission: To provide seismic safety and reliability for SCE personnel and the public, and business continuity for critical operations.

- 1) Intersections; risk is concentrated where fault line & lifelines intersect
- 2) Resiliency Pyramid; tranced approach to prioritization of projects
- 3) Natural system and infrastructure;

scaling and non-linearity

it makes even more sense to concentrate on the most critical assets first (further justifies spending more to harden these assets)

SCE's approach combines safety & reliability



SCE's Seismic Resiliency 'Pyramid;' a tranced strategy

SRP workstreams; samples of 2023 achievements & highlights

- ▶ Electric (see next slide for *Energized* article details & link)
 - ▶ Completion of 50 bulk electric substation switchyard mitigations
- ▶ Non-Electric
 - ▶ Completion of retrofits of a Service Center and welding phase at a HQ Building
- ▶ IT/Comm
 - ▶ Completion of 353 rack mitigations and >500 raised floor bracing installed at a Data Center
- ▶ Generation
 - ▶ Completion of first seismic mitigation project at a peaker facility
- ▶ New in 2023
 - ▶ Emergency Comm's
 - ▶ Completion of 26 screening assessments at remote mountaintop comm sites
 - ▶ Seismic Sensors & Alerts
 - ▶ Selection of 7 potential suppliers of seismic sensors to proceed to RFP
- ▶ Advanced Comprehensive Hazards Tool (CHaT) delivered (a CEC funded project)

* Many more mitigation projects, assessments & screenings have been done (these are only a selected highlight or two per workstream)



SCE Completes Seismic Retrofit of the Grid's 'Backbone'

The five-year project will help keep power flowing in Southern California if a major earthquake occurs along the San Andreas Fault



ENERGIZED

The 5.1 magnitude earthquake that struck Ojai during Hurricane Hilary in August, also known as #Hurriquake, was an excellent reminder to always be prepared. Earth scientists say that a 7.0 magnitude or greater earthquake has a 75% likelihood of occurring in the next 30 years in Southern California.

If a big earthquake happens, some communities may experience severe damage and lose electricity. That's why Southern California Edison has been focused on completing seismic mitigation work on 50 of its largest bulk power transmission substations, including those closest to the San Andreas Fault. They are known as the "backbone" of the company's electric grid and help provide electricity to about 15 million people. SCE engineer Anthony Stone Jr. played a critical role in completing the five-year project as part of SCE's Seismic Resiliency Program.

"Retrofitting substations to ensure the uninterrupted flow of energy during a major earthquake demanded meticulous planning, engineering expertise and substantial resources," Stone said. "However, the satisfaction of knowing that the work has reached a critical juncture is immeasurable."



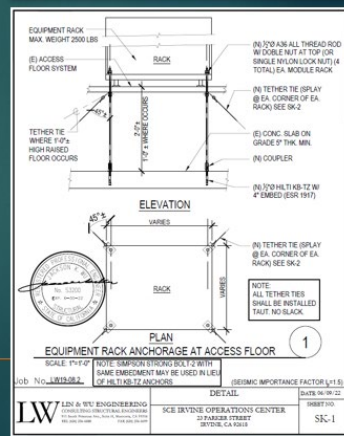
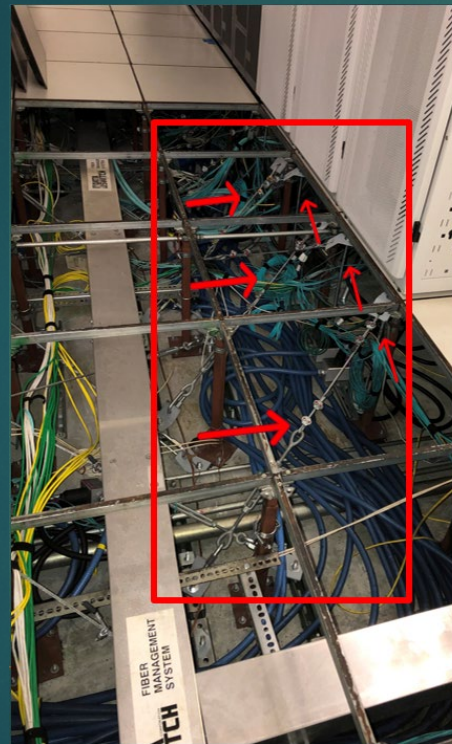
[SCE Completes Seismic Retrofit of the Grid's 'Backbone' | Energized by Edison](#)



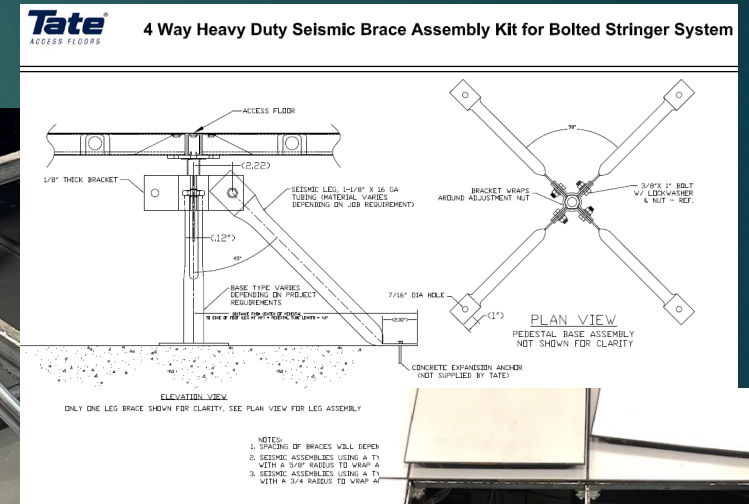
Data Center; non-structural mitigations

▶ Rack Mitigations; 353 completed

- ▶ Each four-post rack receiving four threaded rods and four tether anchors to achieve 1.5 seismic factor rating



▶ Raised Data Center Floor Mitigations; over 500 bracing systems installed & completed



Peaker; facility mitigation



Construction completed;
as-built
validation
& acceptance
walk down
on 12/1/2023



SCE “Use Cases” for EQ Simulations

SUPPORT FOR EARTHQUAKE SCENARIOS, FOR USE IN SCE EXERCISES

- WHAT ARE SCIENTIFICALLY REALISTIC GROUND MOTIONS?

SUPPORT FOR SCE’S RISK REDUCTION INVESTMENT PRIORITIZATION

- HOW CAN SYSTEM-LEVEL PERFORMANCE BEST BE IMPROVED?

SUPPORT FOR SITE-SPECIFIC GROUND MOTION CHARACTERIZATION

- HOW CAN DESIGN BE BEST INFORMED FOR EITHER A NEW CRITICAL FACILITY, OR RETROFIT OF AN EXISTING FACILITY?