



Lifelines & Utilities – Southern California Edison

“Keeping the Lights On”

Florizel R. Bautista, PE – Supervising Engineer, Substation Structural, SCE

Dr. Dennis Ostrom, Ph.D, PE – Retired SCE Engineer

January 16-17, 2014 - University of California, Los Angeles

Impacts – SCE Power System

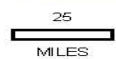
- SCE customers lost power on the Ventura Plane
- Approx. 600,000 – Ventura
- Approx. 225,000 – Santa Clarita Valley
- Ventura Plane outages due to combination of regional power isolation caused by damages at Pardee Substations
- Santa Clarita outages due to damages at Saugus Substation

Southern California Edison Company Territory



Mapping Prepared by:
Operations Support Business Unit
Real Properties Division
Survey and Mapping Section

 Southern California Edison Company Territory



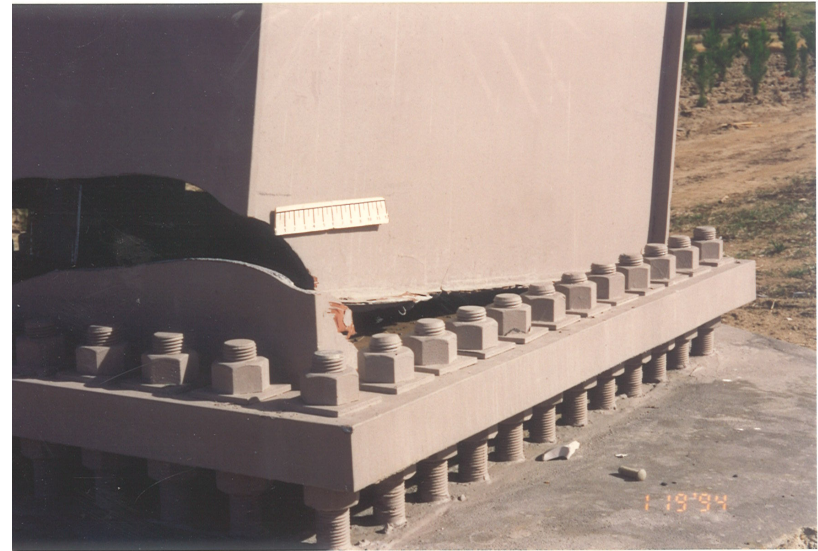
Impacts – Pardee Sub. Damages

- Damaged equipment (Circuit Breakers, Disconnect Switches, Insulators, CCVT, bushings, etc.)
- Damaged steel support structures
- Damaged transmission towers outside of substation
- Damaged foundations for Transmission and Substation equipment/structures
- Presence of cracks in the control building walls and basement

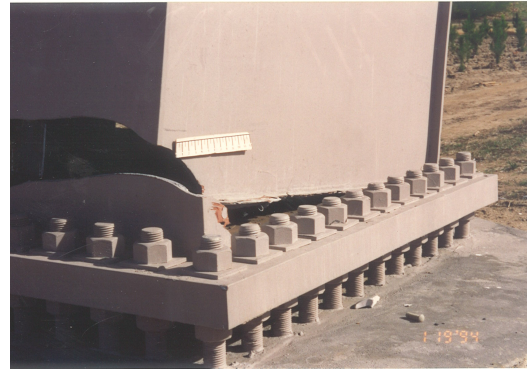
Images of Pardee Sub. Damages



Images of Pardee Sub. Damages



Images of Pardee Sub. Damages



Images of Pardee Sub. Damages



Images of Pardee Sub. Damages



Images of Saugus Sub. Damages



Images of Saugus Sub. Damages



Service was restored within 24 hours by:

- Edison personnel worked under emergency condition
- Bypassing damaged equipment
- Obtaining parts from the Spare stocks located on other SCE facilities/substations to replace damaged components

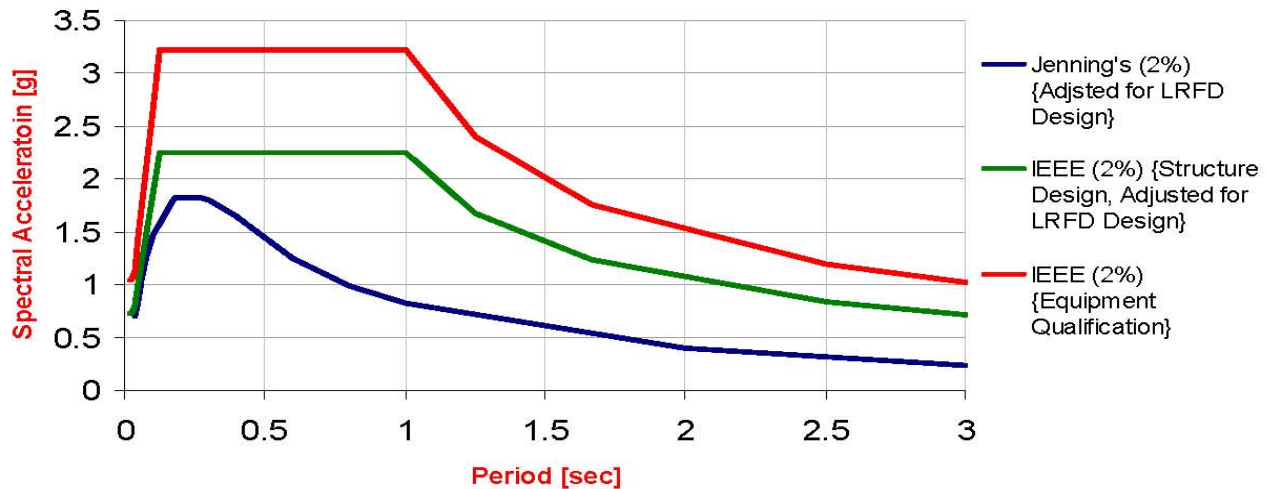
Images of Restoration Effort:



OUTCOMES - Moving forward to Operational Excellence

- Focus to assure equipment performs to a high seismic level using more stringent qualification criteria (IEEE 693)
- Support Structures being designed to accommodate the high seismically-qualified equipment
- Site (fabrication and construction) inspections have been strictly implemented assuring the quality and workmanship of the material and equipment

SCE Equipment Design Spectrum



OUTCOMES - Moving forward to Operational Excellence

- Created a Business Resiliency program to emphasize long-term planning preparation and immediate response to major catastrophic event
- Enhancing the inventory of Spare equipment strategically located within or close proximity to major Substation facilities
- Collaboration with external organization (Caltech, USGS, etc.)

Collaboration with other Utilities to promote uniformity and mutually acceptable procedure

Inter Utilities Working Group (IUWG)

Our E&TS Substation Structural Engineering Group pioneered the Inter Utilities Working Group (IUWG) which is a joint effort among utility companies within the Western region. Since 2011, the IUWG has been the medium in:

- Sharing engineering knowledge
- Discussing and solving common issues pertaining to structures and equipment
- Working toward standardization of electrical utility practices such as the development of a new AISC 113 Substation Structure Design Guide



Recommendations

- Continuous R&D to qualify equipment to high seismic level
 - Shake table testing
 - Improve installation procedure (conductor slack, isolators, etc.)
- Conduct simulation of system earthquake performance
 - Using risk assessment methodology
 - Identify fragilities in the system
 - Formulate counter-measures and recovery strategies