

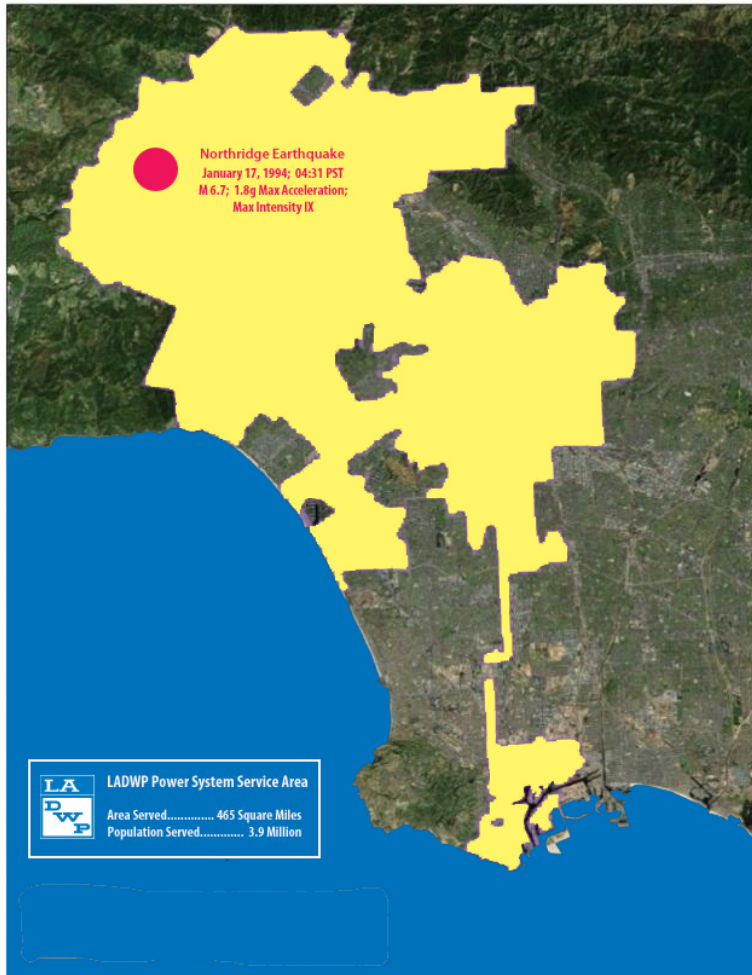


Utilities and Lifelines – LADWP Power System

Brian C. Koch, SE, PE – Manager of Civil, Structural and Engineering Services Section, LADWP

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Overview of LADWP and Impacts to LADWP Power System



Impacts

- 1.4 million customers lost power for 38-minutes
- Within 24-hours, 93% of customers had power
- All areas restored within 2-days

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Impacts – What happened?



- Primary damage at Sylmar Converter Station, Sylmar and Olive Switching Stations and Rinaldi and Receiving Station J (Northridge)
- In general, a lot of porcelain insulator failures in stations near the epicenter.
- Lessons learned from 1971 Sylmar Earthquake helped – **ANCHORAGE DETAILING!**

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Emergency Response – What we did.



- Emergency Response Plan
 - Operating and Maintenance – *Turn the lights back on.*
 - Engineering – *Inspections, prepare Damage Survey Reports, prepare cost estimates*
 - Resources allocated based on priority that included **proximity** to epicenter, and **importance** starting with generation and transmission, then voltage (the higher the voltage station, the higher the priority)

What we learned. What we did.



- Partner and share experiences with other utilities, equipment manufactures, and experts and develop an industry standard – End result, “*IEEE 693 - Recommended Practice for Seismic Design of Substations*”
- Seismic Upgrades – Since 1994, LADWP has invested over **\$300 million** in facility and equipment upgrades. Some of this was partially funded by FEMA’s Hazard Mitigation Grant Program
- Revised our LADWP Seismic Design Criteria to update it based on our experiences from Northridge.

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What's next to make our system stronger?

- Out of sight, out of mind? Budget cuts and competing priorities make it difficult to keep seismic upgrades in the forefront. *After 20 years without a major quake, other mandates seem more compelling.*
- Construction Paradigm – *"When in doubt, make it stout."* For each dollar we spend during construction, \$0.15 is material. Making it bigger does not cost much.
- System Evaluation – Find seismic weak links in the system. Evaluate for time and cost to replace. Possibly go above and beyond accepted codes and standards. LADWP does this with:
 - Transformer bushings and foundations
 - Disconnect Switches, surge arresters, circuit breakers, and Current Voltage Transformers (CVTs) are Sine Beat tested above IEEE 693 requirements
 - Selectively using composite polymer insulators

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