

Use of Simulated Motions to Increase Energy System Resilience

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Overall Goal: **To increase the seismic resiliency of California and beyond**

Questions for **Earthquake Scenario** / 'Exercise' Use Case:

In the event of a significant earthquake, SCE will need to answer accurately and promptly:

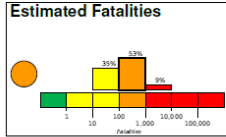
1. How many people and businesses are without power? (and in which areas)
2. When will their power be restored? (for this, we will need information on *interdependencies*)

Questions for **Investment Strategy** / 'Retrofit Prioritization' Use Case:

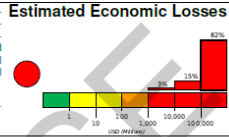
1. What are the best available *sites* for future investment during future grid build-out?
2. Which existing critical facilities may be under-designed (need to guide / prioritize mitigations)?

M 7.2, Scenario NI.AS001 CVMSI
 Origin Time: 2024-10-15 11:00 UTC (Tue 08:11:00 local)
 Location: 33.5300°N 117.8300°W Depth: 10.0 km

PAGER Version 1



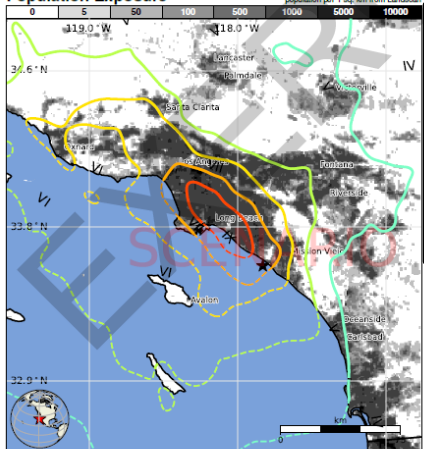
Red alert for economic losses. Extensive damage is probable and the disaster is likely widespread. Estimated economic losses are 1-10% GDP of the United States. Past events with this alert level have required a national or international level response.
 Orange alert for shaking-related fatalities. Significant casualties are likely.



Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k=1000)	--	--	5,332k*	3,283k	2,997k	4,470k	6,129k	3,001k	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	None	None	None	V. Light	Light	Moderate	Mod./Heavy	Heavy	V. Heavy
	None	None	None	Light	Moderate	Mod./Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.



EQ1 M 7.25 NIF
 10/15 at 8:11 a.m.
 3M at MMI IX or X
 'Violent' to 'Extreme'
 (40 times worse than NR'94)

Selected City Exposure

MMI City	Population
IX Seal Beach	25k
IX Westminster	91k
IX Midway City	5k
IX Huntington Beach	199k
IX Carson	95k
IX Rossmore	12k
IX Long Beach	467k
VII Anaheim	345k
VII Los Angeles	12,121k
VII Mission Viejo	589k
VII Oxnard	365k

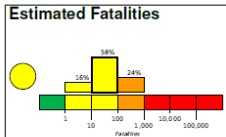
PAGER content is automatically generated, and only considers losses due to structural damage. Limitations of input data, shaking estimates, and loss models may add uncertainty.
<http://earthquake.usgs.gov/data/pager/>

Event ID: m7.25_ni.as001_cvmsi.es

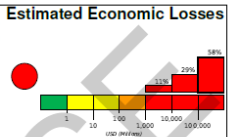
"Doublet" similar to Turkey 2023 and Ridgecrest 2019 sequences
Direct hit on Urban Los Angeles and Port Complex

M 7.0, Scenario PV.AS00 CVMSI
 Origin Time: 2024-10-16 12:07:00 UTC (Tue 17:07:00 local)
 Location: 33.4800°N 118.0800°W Depth: 10.0 km

PAGER Version 1



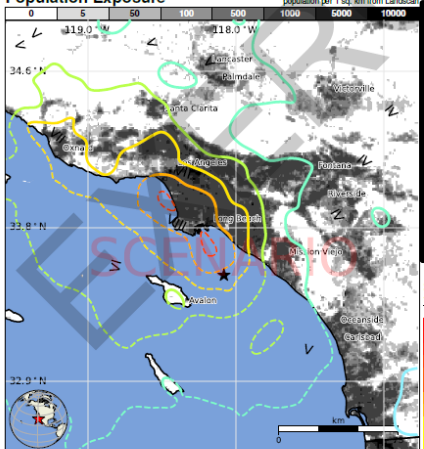
Red alert for economic losses. Extensive damage is probable and the disaster is likely widespread. Estimated economic losses are 0.2% GDP of the United States. Past events with this alert level have required a national or international level response.
 Yellow alert for shaking-related fatalities. Some casualties are possible.



Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k=1000)	--	50k*	8,003k*	3,509k	4,441k	5,314k	2,641k	254k	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	None	None	None	V. Light	Light	Moderate	Mod./Heavy	Heavy	V. Heavy
	None	None	None	Light	Moderate	Mod./Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.



EQ2 M 7.05 PVF
 10/15 at 5:07 p.m.
 250K at MMI IX or X
 'Violent' to 'Extreme'
 (3 times worse than NR'94)

Selected City Exposure

MMI City	Population
IX Loma	21k
IX West Carson	22k
IX Torrance	147k
IX Hermosa Beach	20k
VIII Marina del Rey	9k
VIII Manhattan Beach	36k
VIII Long Beach	467k
VII Oxnard	365k
VI Santa Ana	314k
VI Anaheim	345k
VI Los Angeles	12,121k

PAGER content is automatically generated, and only considers losses due to structural damage. Limitations of input data, shaking estimates, and loss models may add uncertainty.
<http://earthquake.usgs.gov/data/pager/>

Event ID: m7.05_pv.as00_cvmsi.se

**RG XI
 SCE FSE**

Strategy of SCE's Seismic Resiliency Program



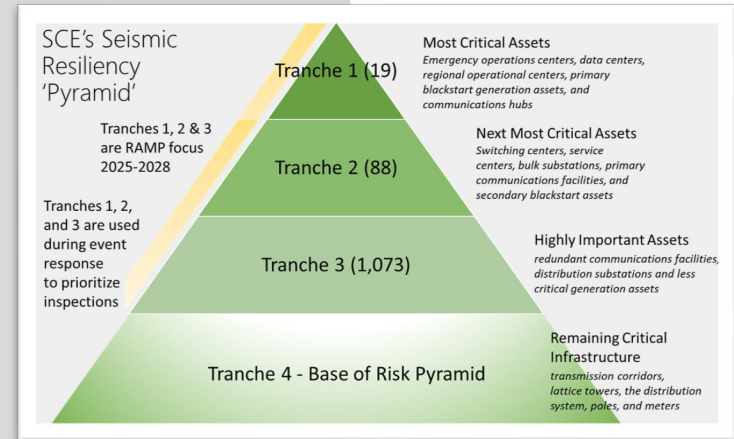
Mission: To provide seismic *safety* and *reliability* for SCE personnel and the public, and business continuity for critical operations.

- 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

What has been accomplished so far?

SCE has invested \$252 M (from 2016-2024) in a diverse mixture of completed mitigation projects

- ✓ Substation switchyard work
- ✓ Building retrofits
 - ✓ Occupied buildings
 - ✓ Critical facilities
- ✓ Computer equipment racks



SCE Seismic - Team Photo

