



Overview of the California Hospital Seismic Safety Program



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Earthquakes as a Catalyst for Change

- Major advances in the structural engineering art are associated with damaging earthquakes.
 - 1933 Long Beach
 - 1964 Alaska
 - 1971 San Fernando
 - 1989 Loma Prieta
 - 1994 Northridge
 - 1995 Kobe



1971 San Fernando Earthquake

Olive View Medical Center



Godden Collection, Earthquake Engineering Research Center, University of California, Berkeley

1971 San Fernando Earthquake

Sepulveda VA Hospital (magnitude 6.6 – 47 fatalities at SVA)



Godden Collection, Earthquake Engineering Research Center, University of California, Berkeley

The 1972 Hospital Seismic Safety Act (HSSA)

The HSSA established Hospitals as essential facilities and explicitly defined their expected performance.

And gave us the 1st definition of functionality

.... ***that hospitals, that house patients who have less than the capacity of normally healthy persons to protect themselves, and that **must be reasonably capable of providing services to the public after a disaster*****, shall be designed and constructed to resist, insofar as practical the forces generated by earthquakes, gravity, and winds.

The Need for a Statewide Enforcement Agency

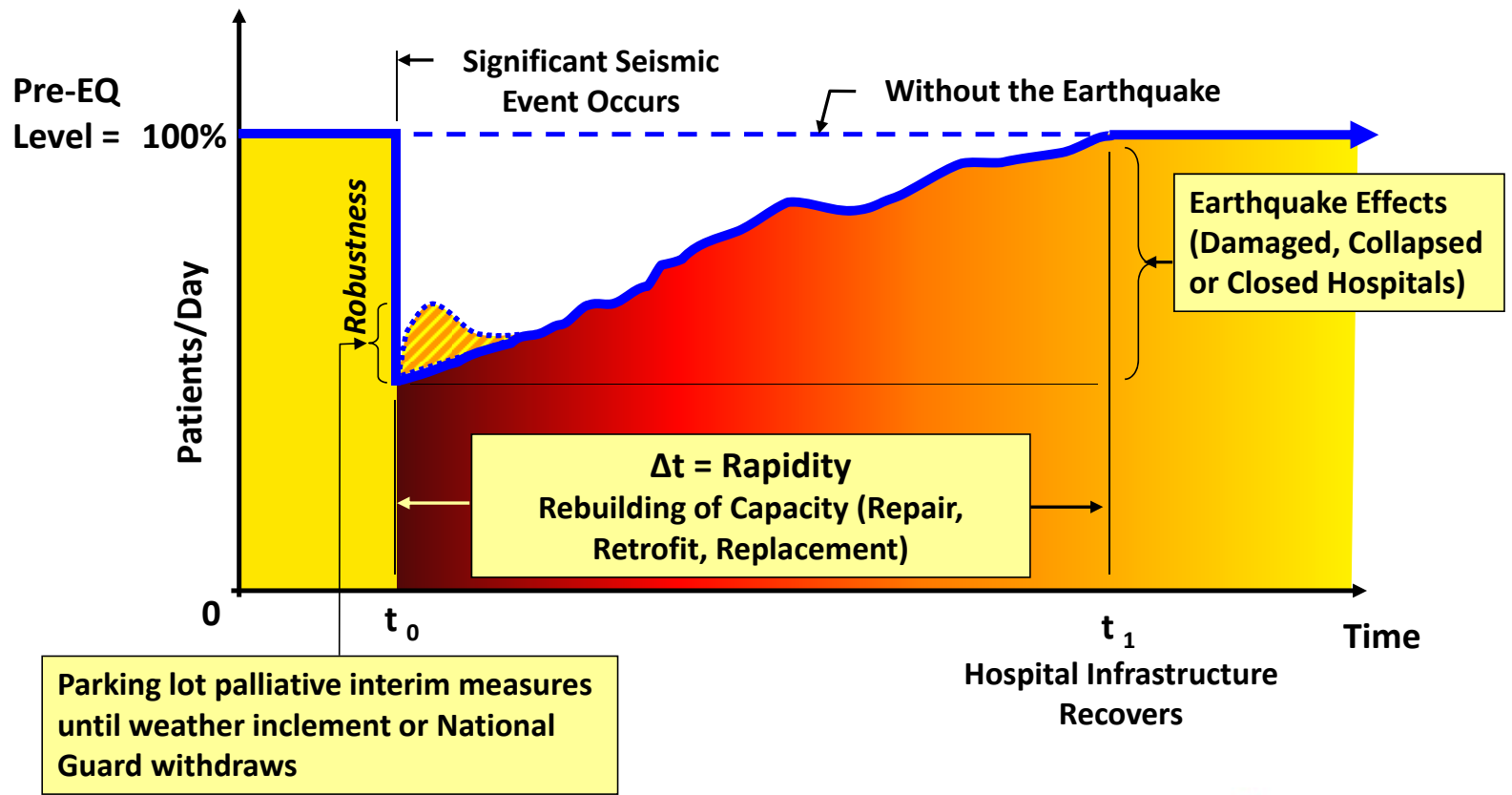
- Laws and regulations w/o rigorous enforcement are ineffective.
- OSHPD/FDD is the enforcement agency of the HSSA.
 - Primary Responsibilities
 - Code and Standards
 - Design Plan Review
 - Construction Oversight

Achieving the Targeted Seismic Performance Level



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Seismic Resilience of General Acute Care Facilities



1994 Northridge Earthquake

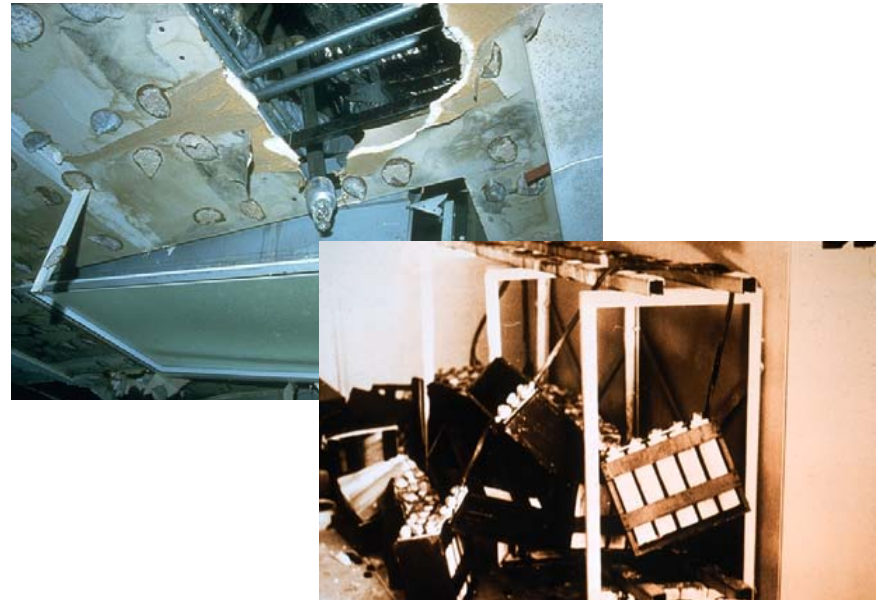
(Magnitude 6.7)



1994 Northridge Earthquake



St. John's Hospital damaged in the 1994 Northridge earthquake

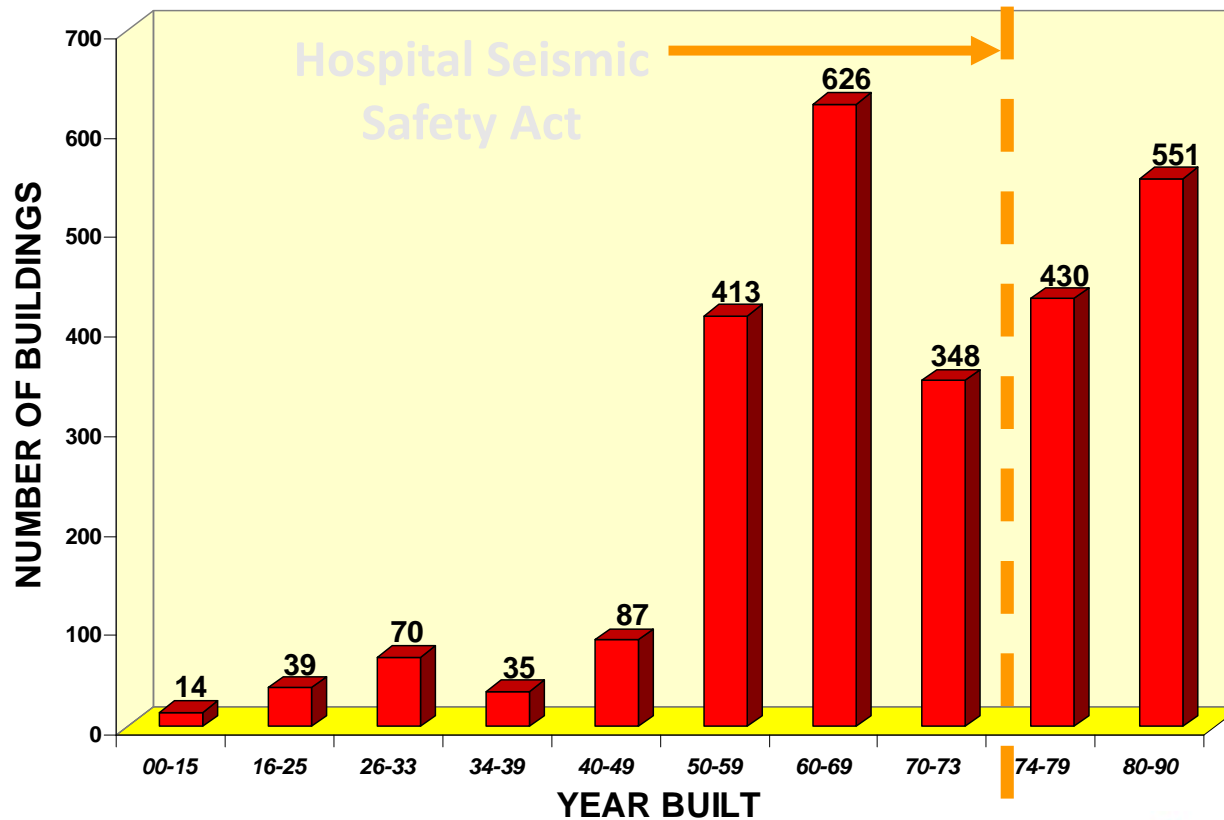


Nonstructural damage

1994 Northridge Performance

Performance of all Buildings at 23 Hospital Sites with One or More Yellow or Red Tagged Buildings		
	Number (%) of Buildings	
Type of Damage	Pre HSSA(1973)	Post HSSA
Structural Damage		
Red tagged	12 (24%)	0 (0%)
Yellow tagged	17 (33%)	1 (3%)
Green tagged	22 (43%)	30 (97%)
Nonstructural Damage		
Major	31 (61%)	7 (23%)
Minor	20 (39%)	24 (77%)
Total Buildings	51	31

Vulnerability Study: Age of Facilities*



* Study performed prior to SB 1953 enacted

Why SB 1953?

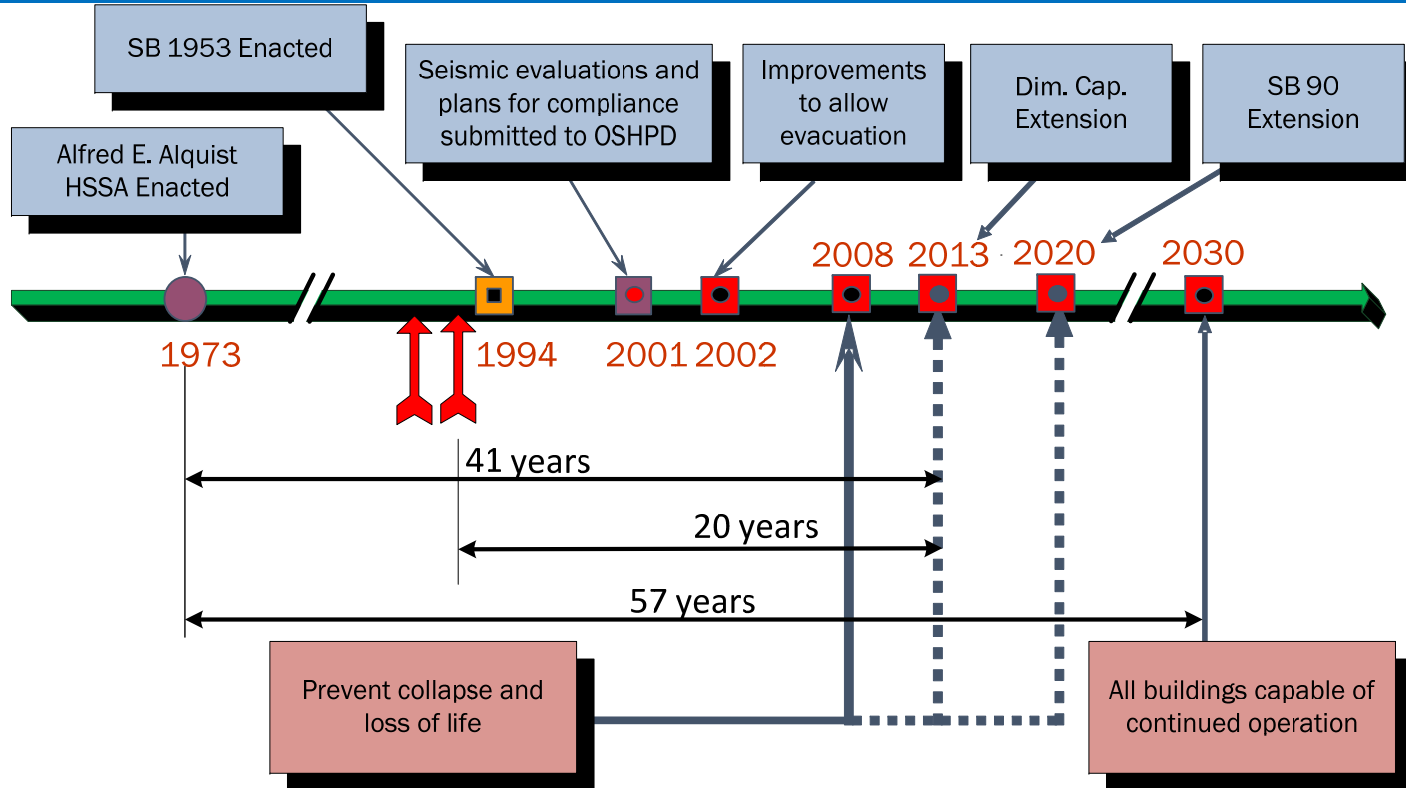
- **1994 Northridge quake critically damaged major hospitals - SB 1953 enacted**
 - Protect life and property
 - Provide for treatment of injured
 - Protect investment
 - Reduce demand on post-earthquake resources



What is SB 1953?

- Evaluation
 - **SB 1953 classifies buildings by risk (1=worst, 5-best)**
 - Structural (SPC-1 to SPC-5)
 - Nonstructural (NPC-1 to NPC-5)
- Database of Hospital Building Stock
- Retrofit to prevent collapse and loss of life
- Retrofit to provide continued operation after an earthquake

SB 1953 Major Milestones



1971 Sylmar, 1989 Loma Prieta, and 1994 Northridge EQs



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Structural Performance Categories (SPC)

SPC Rating	Description and Deadline
SPC - 1	Buildings posing significant risk of collapse and a danger to the public. These buildings must be brought up to the SPC 2 level by January 1, 2008, or be removed from acute care service. Where the Office has performed a collapse probability assessment, buildings with Probability of Collapse greater than 1.20% shall be placed in this category.
SPC - 2	Buildings in compliance with the pre-1973 California Building Standards Code or other applicable standards, but not in compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act. These buildings do not significantly jeopardize life, but may not be repairable or functional following strong ground motion. These buildings must be brought into compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act, its regulations or its retrofit provisions by January 1, 2030, or be removed from acute care service. Where the Office has performed a collapse probability assessment, buildings with Probability of Collapse less than or equal to 1.20% shall be placed in this category.
SPC - 3	Buildings in compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act, utilizing steel moment-resisting frames in regions of high seismicity as defined in Section 4.2.10 and constructed under a permit issued prior to October 25, 1994. These buildings may experience structural damage which does not significantly jeopardize life, but may not be repairable or functional following strong ground motion. Buildings in this category will have been constructed or reconstructed under a building permit obtained through OSHPD. These buildings may be used to January 1, 2030, and beyond.
SPC - 4	Buildings in compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act, but may experience structural damage which may inhibit ability to provide services to the public following strong ground motion. Buildings in this category will have been constructed or reconstructed under a building permit obtained through OSHPD. These buildings may be used to January 1, 2030, and beyond.
SPC - 5	Buildings in compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act, and reasonably capable of providing services to the public following strong ground motion. Buildings in this category will have been constructed or reconstructed under a building permit obtained through OSHPD. These buildings may be used without restriction to January 1, 2030, and beyond.

2013 California Administration Code, Chapter 6, Table 2.5.3



Structural Performance Categories (SPC)

Significant Risk of Collapse in a Major EQ	Low Risk of Collapse in a Major EQ	Reasonably Capable of Providing Services to the Public after a Major EQ		
2008/2013/2020	2030	2030+	2030+	2030+
SPC-1	SPC-2	SPC-3	SPC-4	SPC-5

SB1953 Evaluations

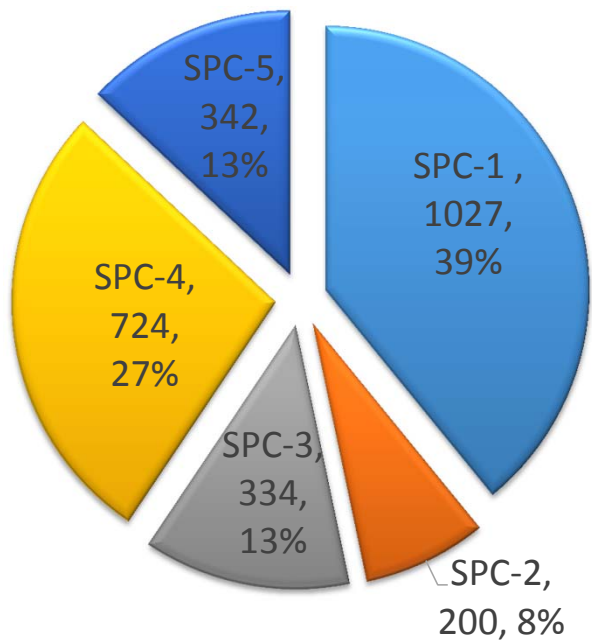
- The SB 1953 evaluation procedure is based on a modified version of FEMA 178, **NEHRP Handbook for Seismic Evaluation of Existing Buildings**. This requires a filling out a checklist with answers verified by existing drawings, material tests, calculations and in some cases, computer models.
- The SB 1953 evaluation procedure resulted in over 90% of these buildings not meeting the minimum life safety standard as specified in the regulations, and hence being classified as SPC-1.
- To encourage hospitals to participate voluntarily in the reassessment and reprioritization program for SPC-1 hospital buildings, a method to calculate probability of collapse via HAZUS is introduced in 2007 (further modified in 2010) .

HAZUS

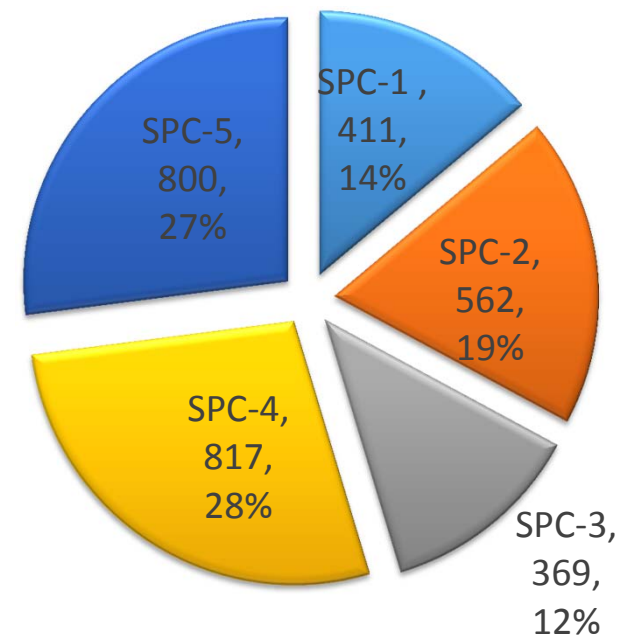
- HAZUS (Hazards U.S.) is a national standardized methodology for assessing potential losses from natural disasters that was developed by FEMA.
- OSHPD uses the HAZUS Advanced Engineering Building Module (AEBM) with modifications of the default properties already in HAZUS to include the effect of significant structural weaknesses where present.
- The HAZUS methodology for estimating the collapse probability of individual buildings is an enhancement/modification of the Capacity Spectrum Method outlined in the *ATC-40* document (ATC-40, 1996).
- Methodology can be programmed into a spreadsheet with procedure and tables published in codes.

Distribution of Hospital Buildings by Structural Performance Category

2001*



12/31/2013**

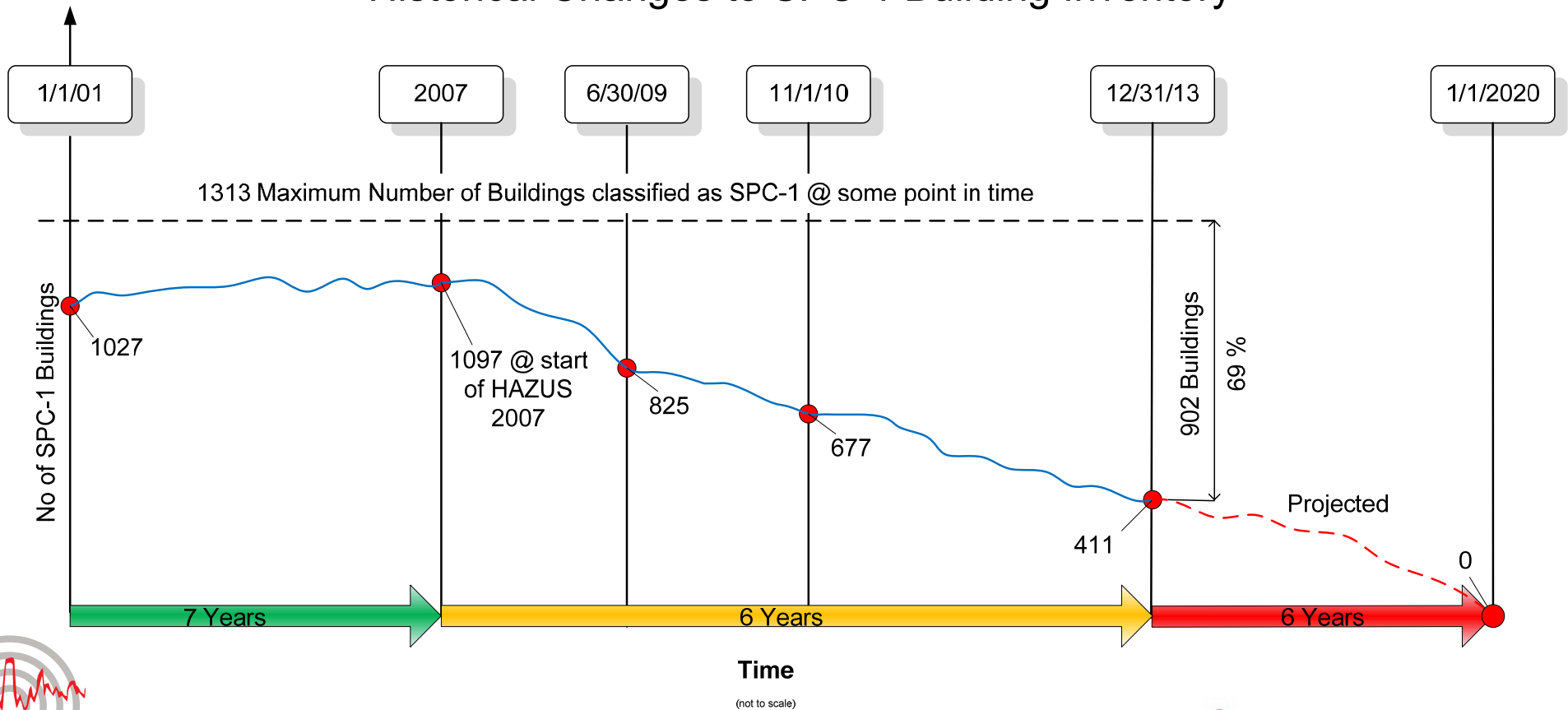


* Based on 2001 Hospital Survey Results based on hospital "self-report" and then "state-of-the-art" FEMA 178 standards from 1996

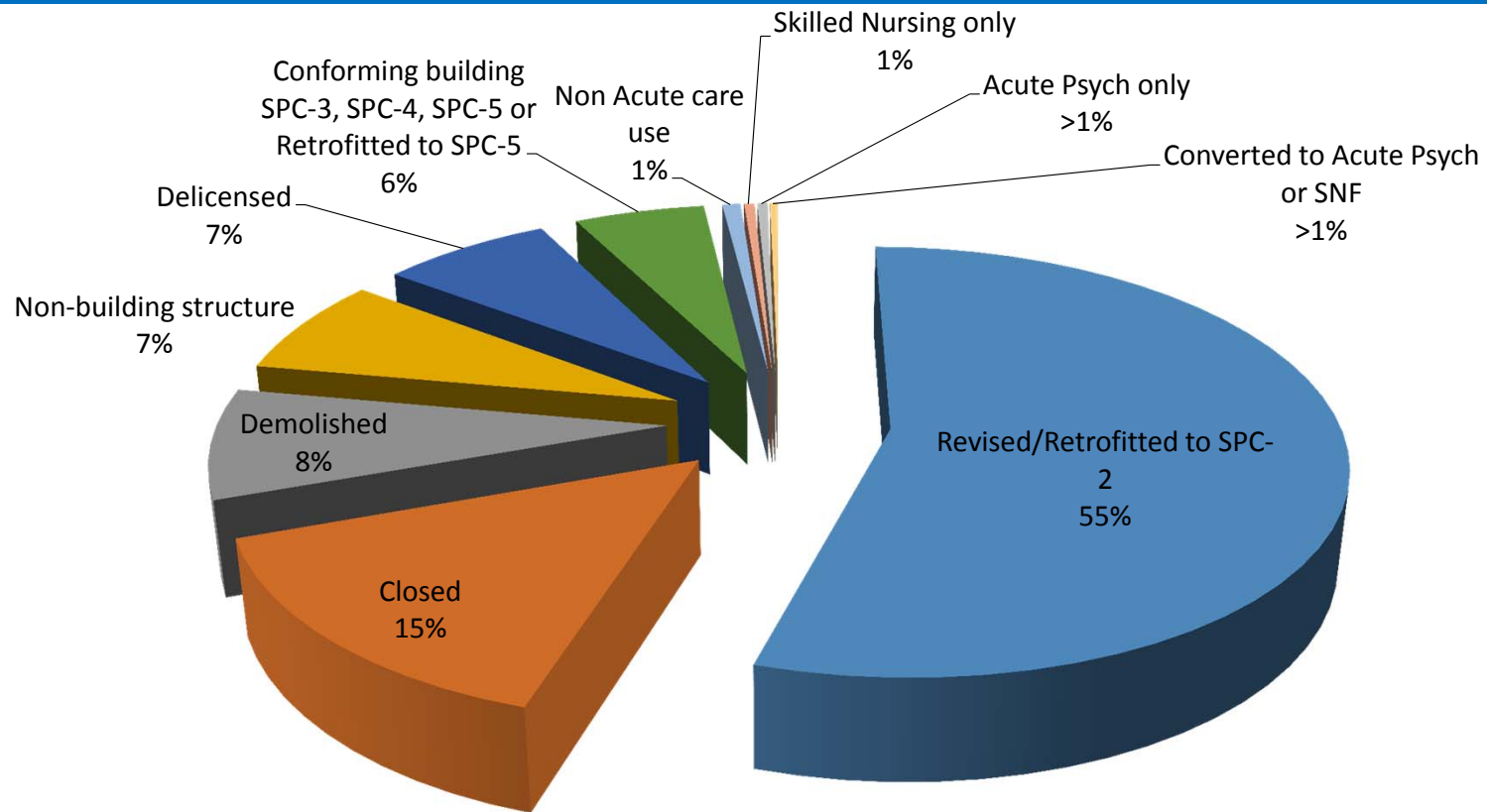
** SPC-5 includes buildings currently under construction

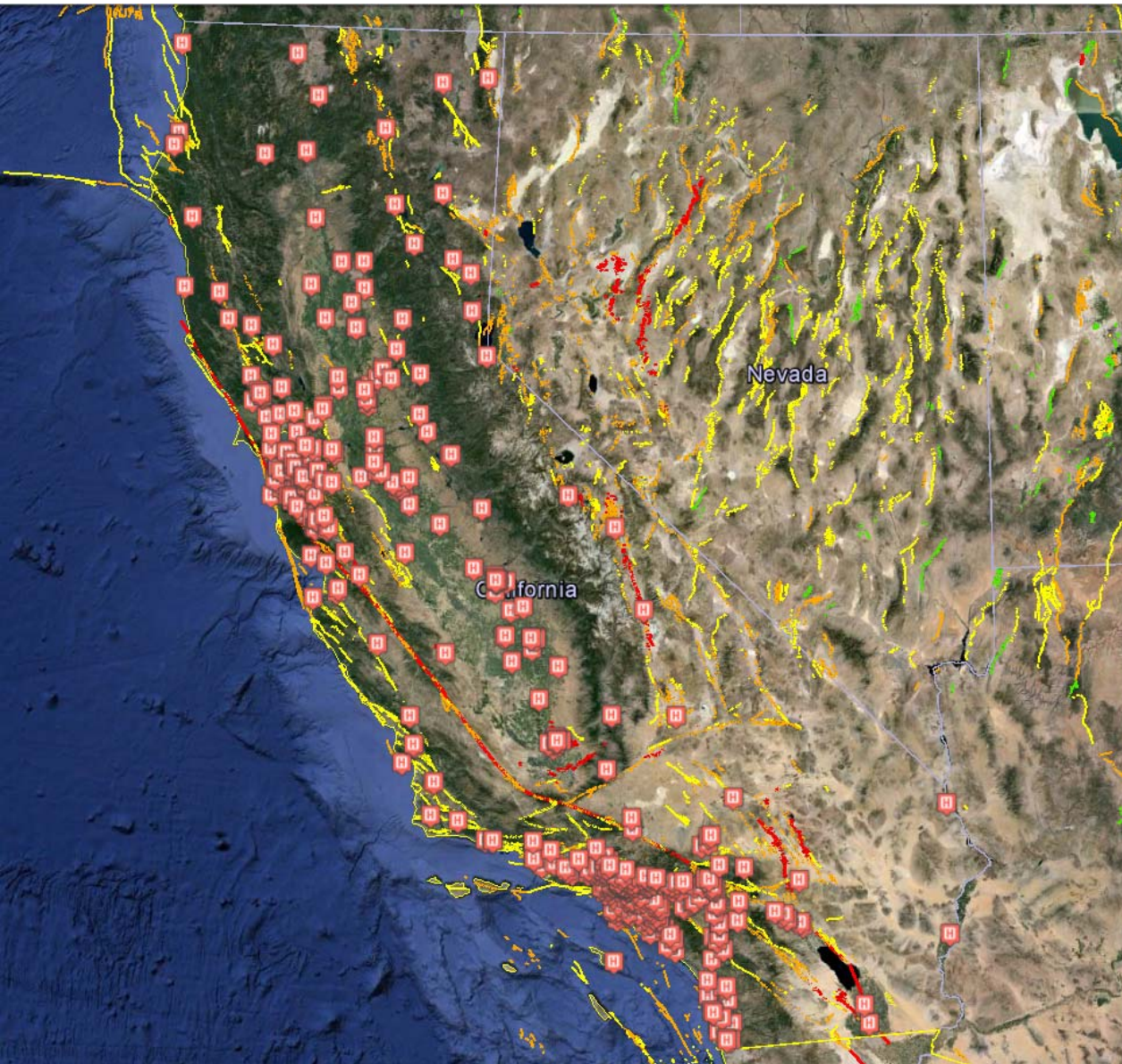
Hospital Seismic Compliance to Date

Historical Changes to SPC-1 Building Inventory



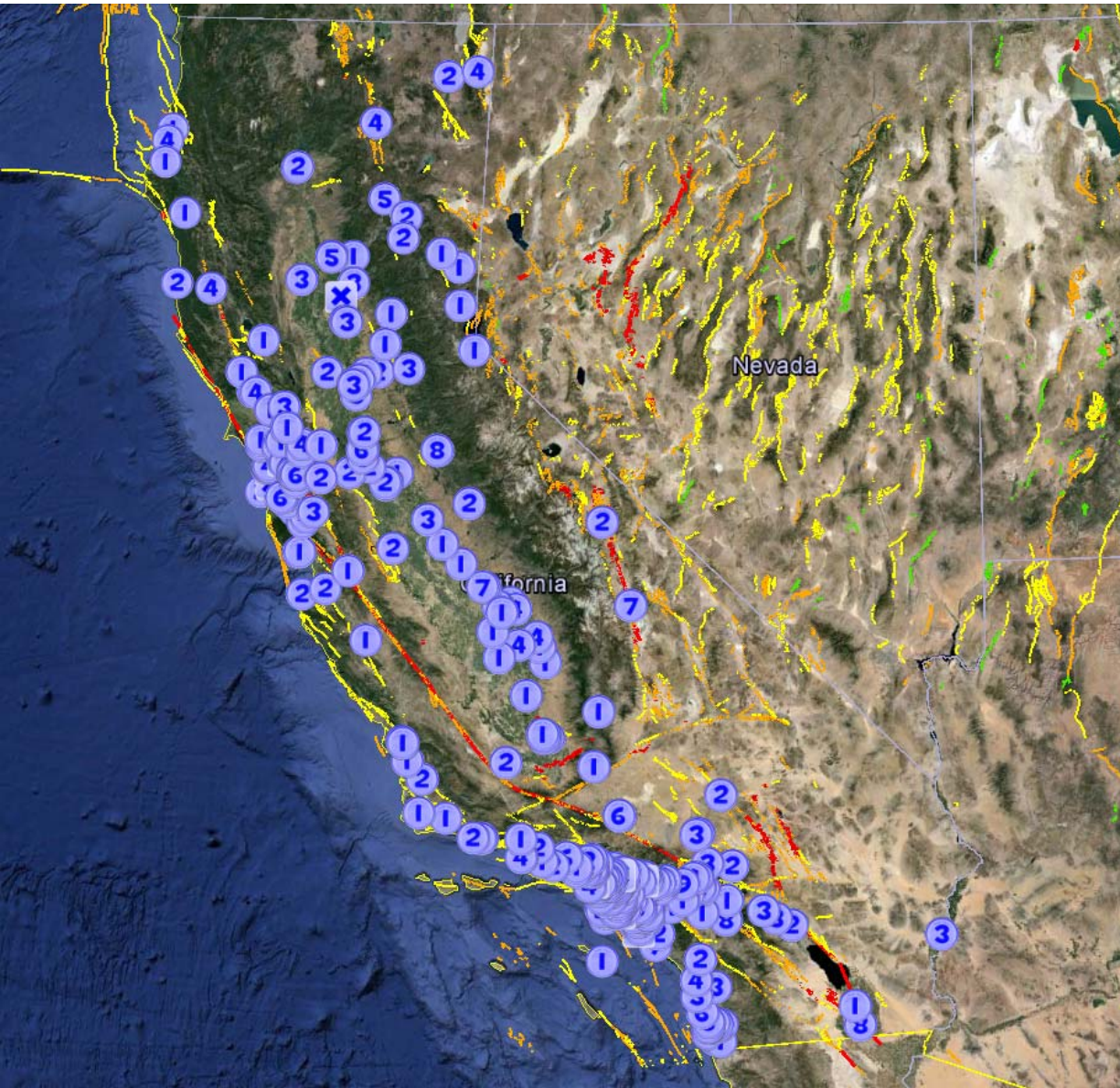
Resolution of SPC-1 Buildings as of 12/31/2013





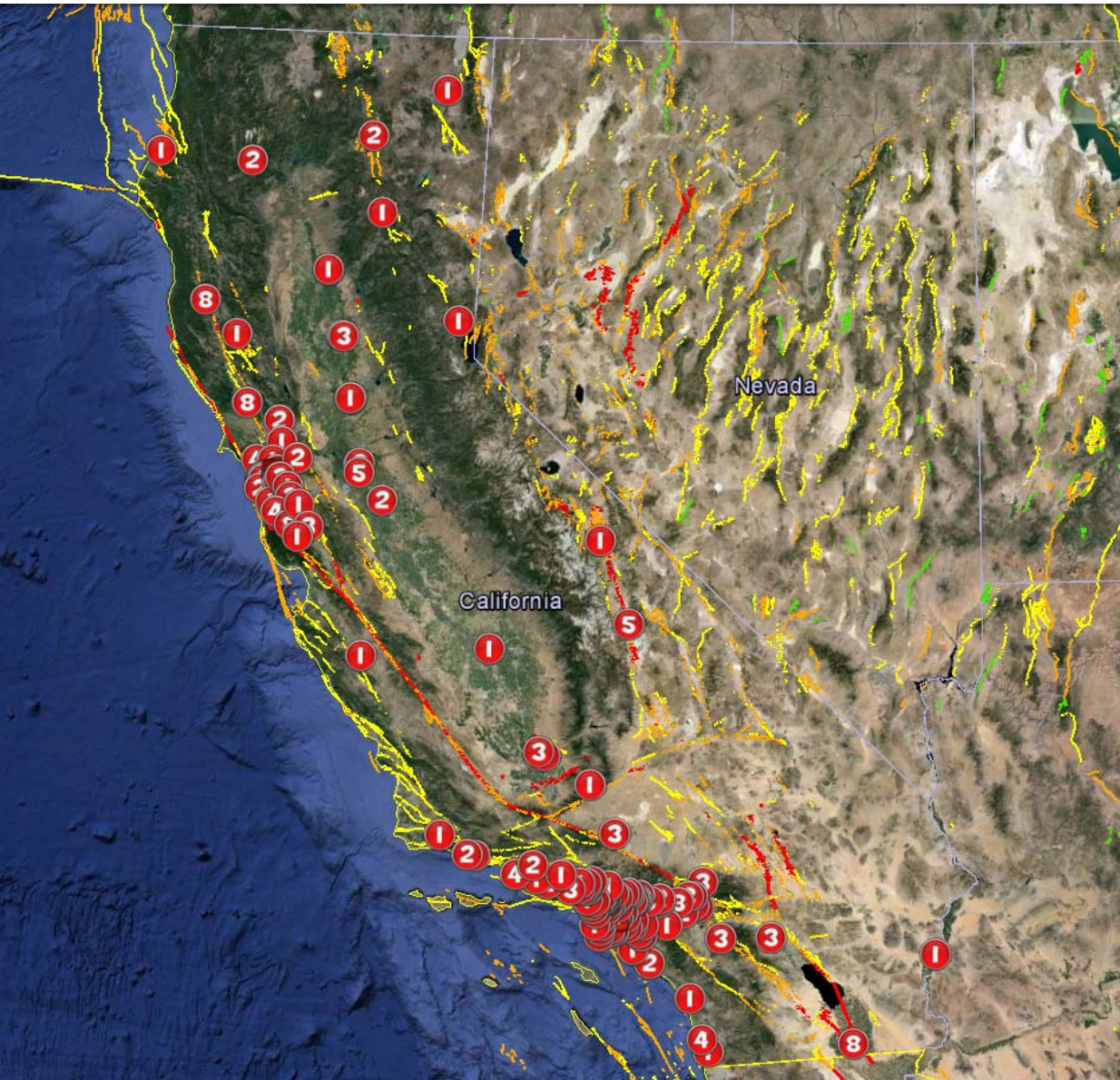
Location of Hospital Facilities Today

- Icons show location of acute-care hospital facilities as of **12/31/2013**.
- Known Historic, Holocene/latest Pleistocene, late Quaternary, mid to late Quaternary faults shown.



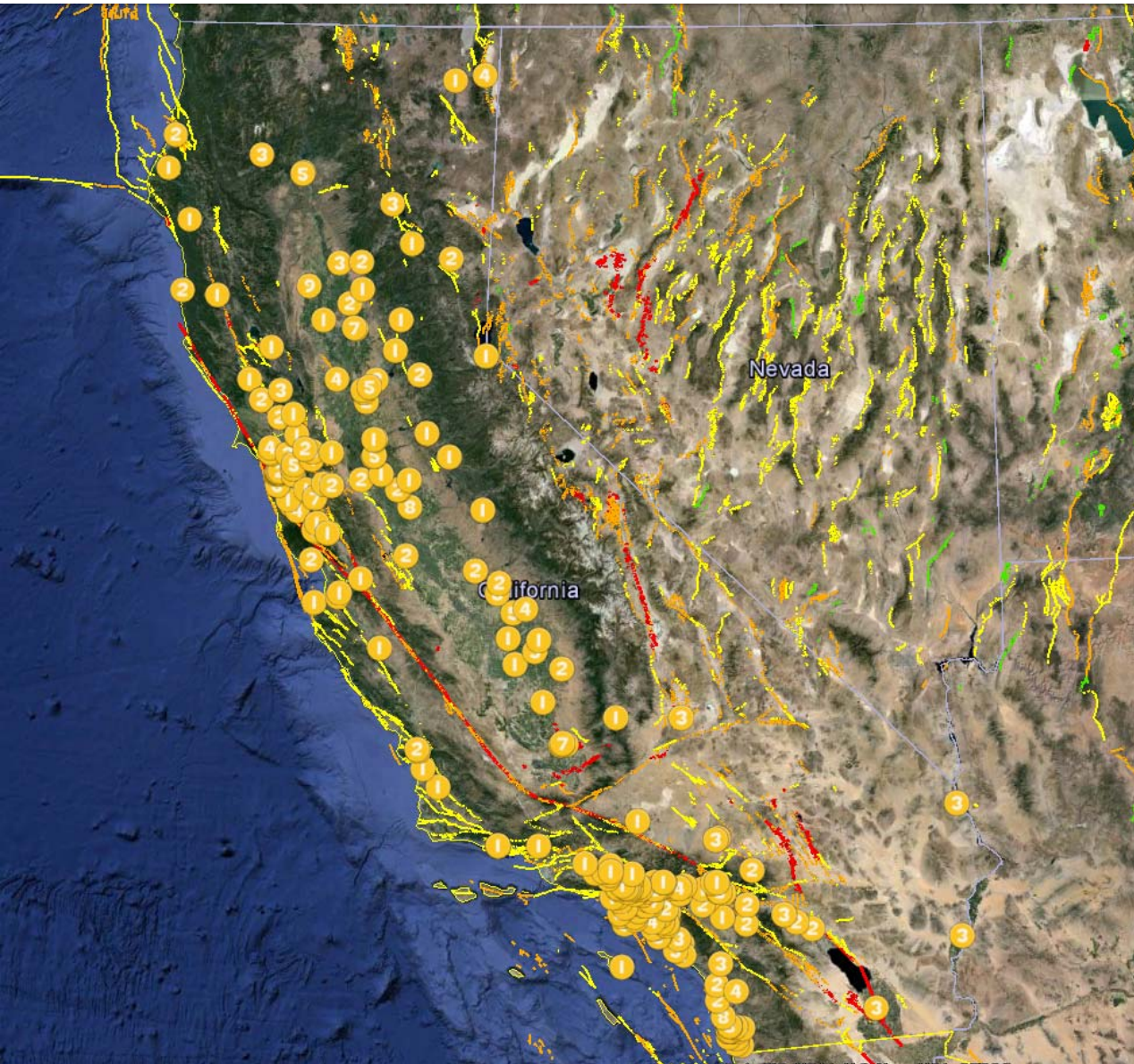
Location of Facilities with SPC-1 Buildings in 2001

- Icon indicates number of SPC-1 buildings at each hospital facility in 2001.
- “X” indicates hospital facilities with 10 or more SPC-1 buildings
- Known Historic, Holocene/latest Pleistocene, late Quaternary, mid to late Quaternary faults shown.



Location of Facilities with SPC-1 Buildings Today

- Icon indicates number of SPC-1 buildings at each hospital facility as of **12/31/2013**.
- “X” indicates hospital facilities with 10 or more SPC-1 buildings
- Known Historic, Holocene/latest Pleistocene, late Quaternary, mid to late Quaternary faults shown.



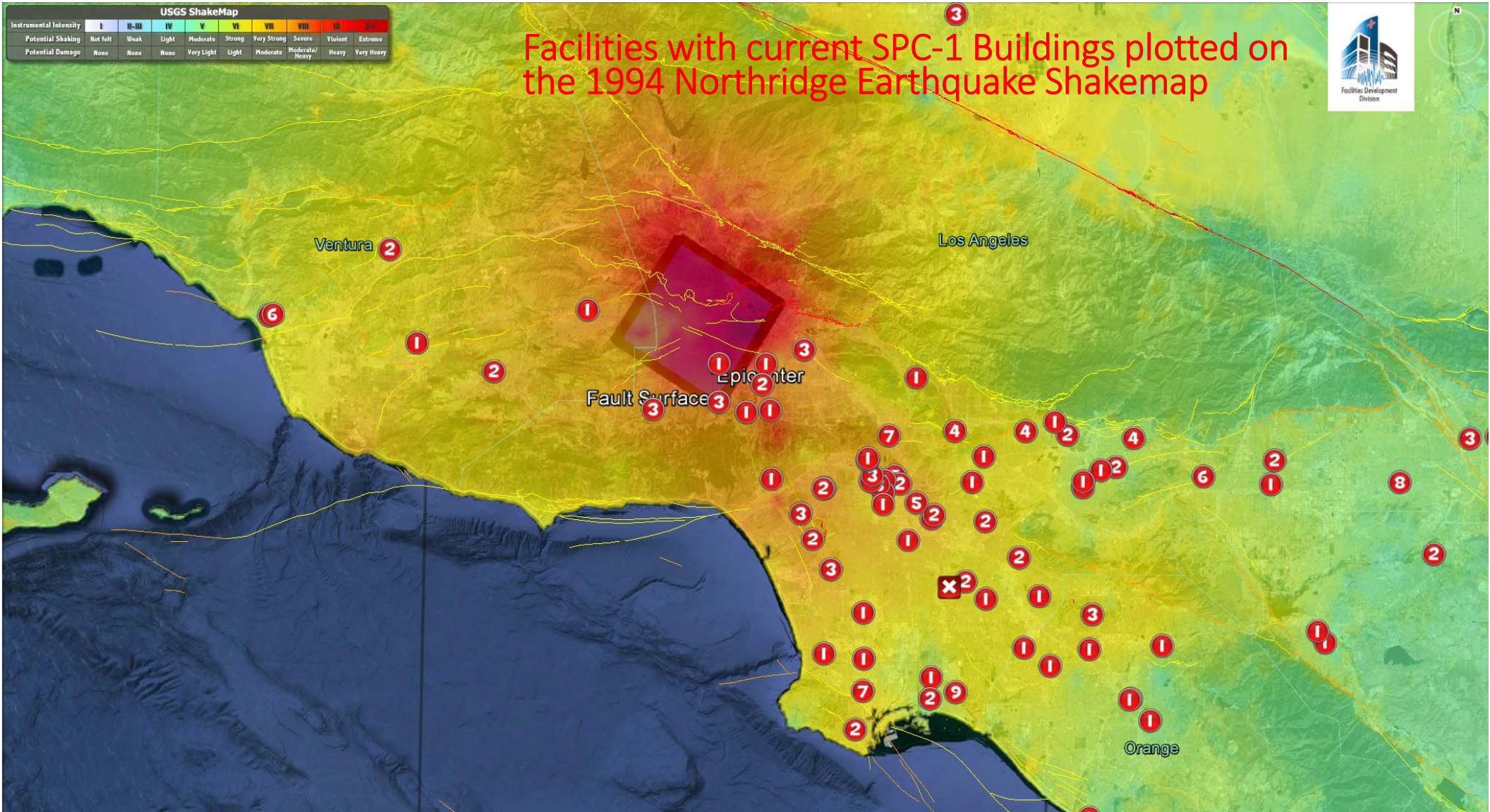
Location of Facilities with SPC-2 Buildings Today

- Icon indicates number of SPC-2 buildings at each hospital facility as of **12/31/2013**.
- Known Historic, Holocene/latest Pleistocene, late Quaternary, mid to late Quaternary faults shown.

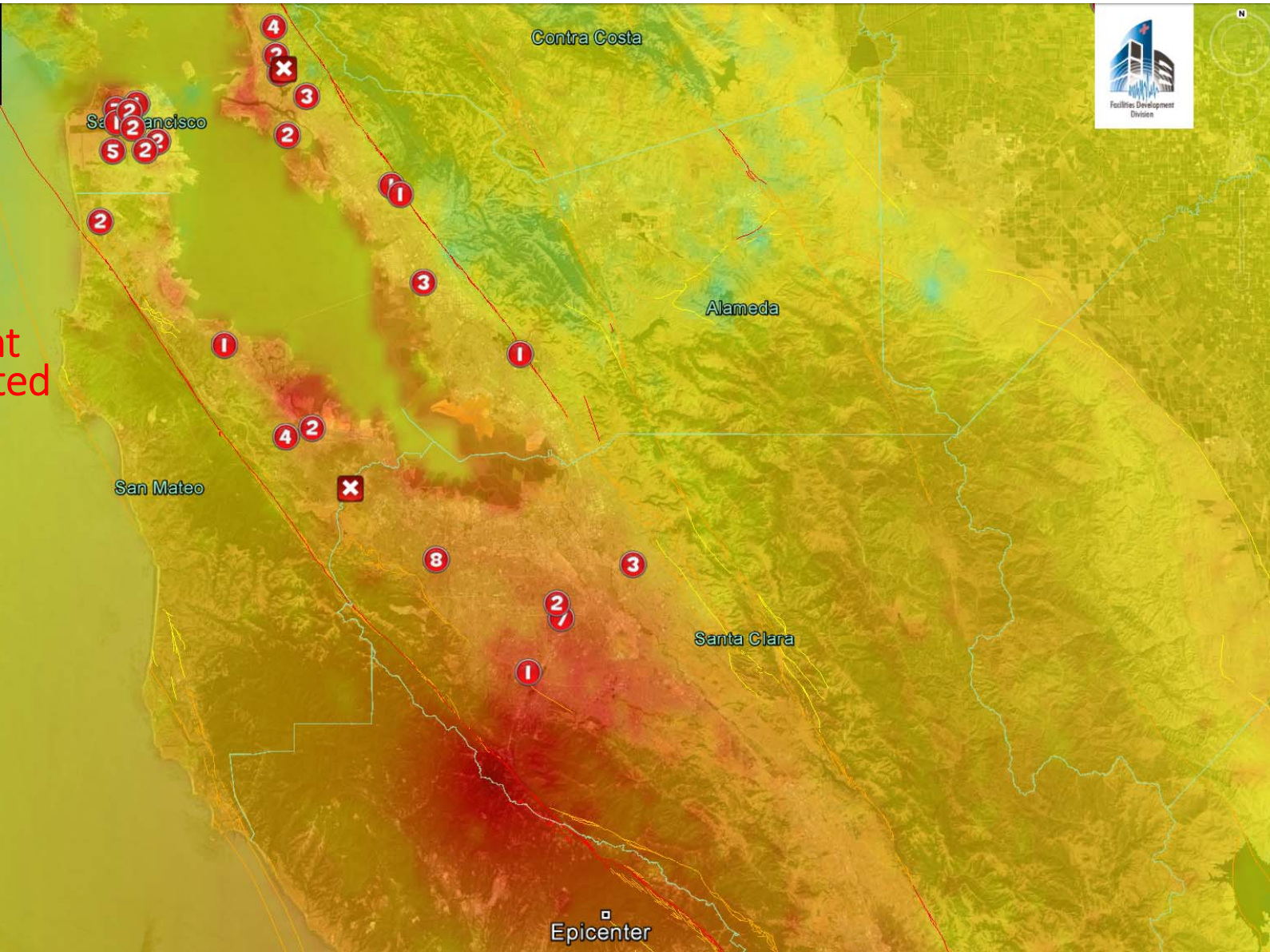
USGS ShakeMap

Instrumental Intensity	I	II-III	IV	V	VI	VII	VIII	IX	X
Potential Shaking	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
Potential Damage	None	None	None	Very Light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy

Facilities with current SPC-1 Buildings plotted on the 1994 Northridge Earthquake Shakemap



USGS ShakeMap: Maps of recorded and estimated seismic ground shaking intensity									
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC. (%g)	<0.1	0.1-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL. (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+



Facilities with current SPC-1 Buildings plotted on the 1989 Loma-Prieta Earthquake Shakemap



Nonstructural Performance Categories (NPC)

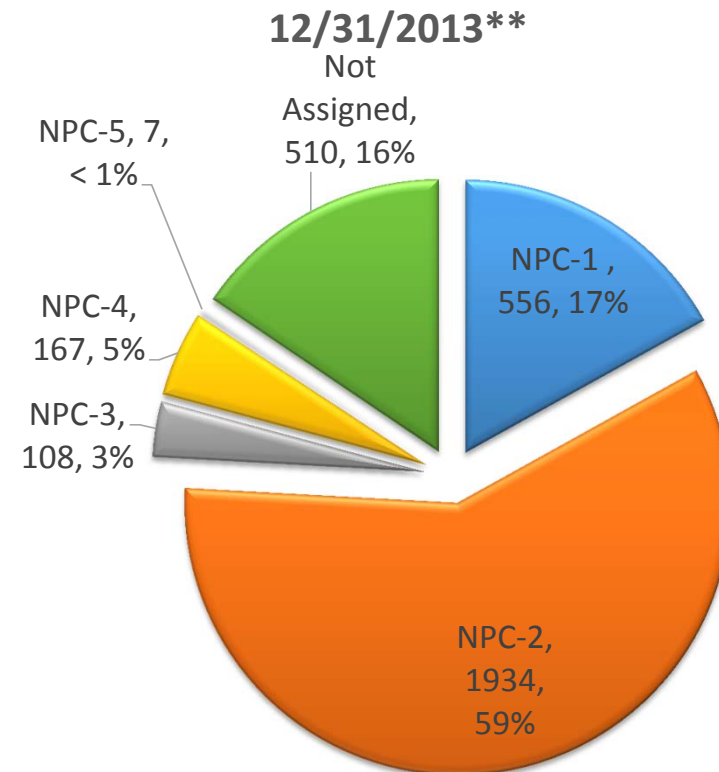
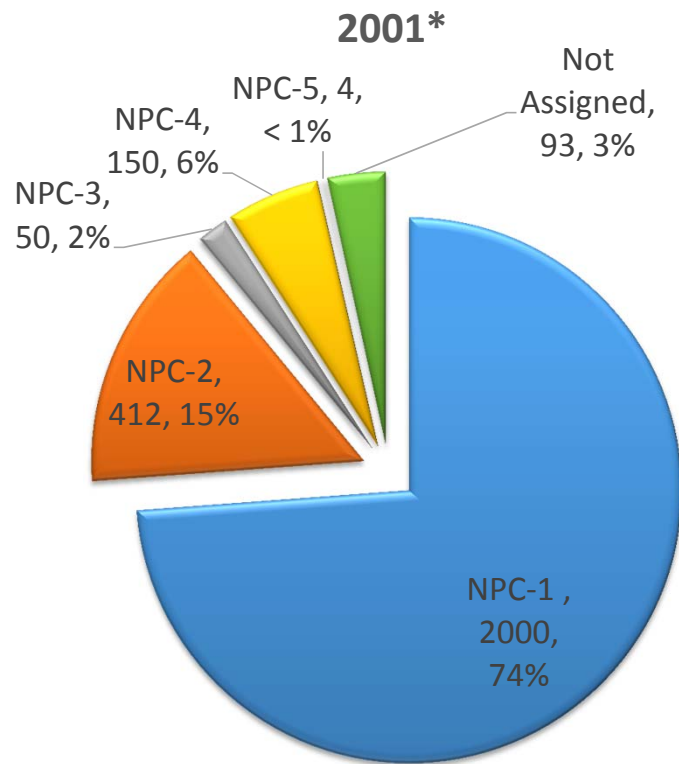
- The NPC's are based on the expected performance of non-structural systems and equipment critical to patient care.
- Buildings ranked from "NPC 1" to "NPC 5".
- Ranking of "NPC 1" indicates critical systems are inadequately braced.
- Ranking of "NPC 5" indicates that the anchorage and bracing meets current Title 24 & no dependence on lifelines.

Nonstructural Performance Categories (NPC)

Rating	Description and Deadline
NPC - 1	Buildings with equipment and systems not meeting the bracing and anchorage requirements of any other NPC. Deadline: January 1, 2002
NPC - 2	Buildings in which essential systems vital to the safe evacuation of the building are anchored and braced to minimum code requirements. Essential systems vital to the safe evacuation of the building include communications, emergency power supply, bulk medical gas, fire alarms and emergency lighting equipment and signs in means of egress. Deadline: January 1, 2002
NPC - 3 / NPC - 3R	Building meets criteria for NPC "2" and non-structural systems are adequately braced in critical areas of the hospital according to Part 2, Title 24 requirements. Deadline: January 1, 2008 unless the building has an approved extension or exemption.
NPC - 4	Building meets the criteria for NPC - "3" and all architectural, mechanical, electrical systems, components and equipment, and hospital equipment meet the bracing and anchorage requirements of Part 2, Title 24. Deadline: By January 1, 2020 or 2030 depending on the Seismic Design Category and extension request requirements.
NPC - 5	Building meets the criteria for NPC - "4" and has onsite supplies of water and holding tanks for sewage and liquid waste sufficient for 72 hours of emergency operations, and provides radiological service and onsite fuel supply for 72 hours of acute care service. Deadline: January 1, 2030

For full definitions, see 2013 California Administration Code, Chapter 6, Table 11.1

Distribution of Hospital Buildings by Nonstructural Performance Category



* Based on 2001 Hospital Survey Results based on hospital "self-report" and then "state-of-the-art" FEMA 178 standards from 1996

** Not Assigned includes buildings currently under construction

There any NPC-5 buildings?

ARROWHEAD REGIONAL MEDICAL CENTER - 17282

osbpd
Office of Statewide Health Planning & Development

General Acute Care Hospital - 17282
400 N. PEPPER AVENUE COLTON CA 92324

For key plans select <http://www.osbpd.ca.gov/FDD/Forms/keyplans/17282.pdf>

Total Construction Value of Projects as of 12/31/2013 = \$1,640,654

Total number of projects and increments as of 12/31/2013 = 9

Acute Care Buildings at facility as of 12/31/2013:

BLD #	BLD Name	Status	SPC	NPC
BLD-00071	Diagnostic Treatment Bldg.	Completed	5	5
BLD-00072	Nursing Tower	Completed	5	5
BLD-00073	Clinics Building	Completed	5	5
BLD-00074	Mental Health Building	Completed	5	5
BLD-00075	Central Plant	Completed	5	5
BLD-00076	MRI Building	Completed	5	5
BLD-00077	Loading Dock	Completed	3	5

Prepared by: Seismic Compliance Unit HB-PR-AS

Directions: [To here](#) - [From here](#)

Yes,
All buildings at
Arrowhead Medical
Center are NPC-5.

Delays in Compliance

- Diminished Capacity
 - Request by 01-01-07
- SB 1801 (no longer Available)
- SB 2006
 - 2030/NPC 3/Zone 3
- SB 1661
 - 2015 Compliance/Under Circumstances beyond hospital's control
- SB 306
 - 2020 Fully Compliant Hospital Buildings sooner
- SB 499
 - 2020 NPC 4/5 sooner for SDC F
 - 2030 NPC3/4/5 for SDC D
- SB 90
 - SPC-2 via HAZUS, Extension to 2020

The Next Compliance Milestone 2020

- SPC-1
 - Decommission/Demolish/Seismic Retrofit/HAZUS Reassessment
- NPC-3/4/5 for SDC = F, where extensions requested under SB499

A side note – GIS information

- Google Earth file with hospital facility information now available at http://www.oshpd.ca.gov/FDD/seismic_compliance/FacGoogle/
- Monetary value of construction projects, SPC/NPC ratings of buildings, site plans links embedded in the Google Earth file.

The screenshot shows the website for the State of California Office of Statewide Health Planning & Development. The page features a navigation menu with links for HOME, PROGRAMS, DATA, SERVICES, PUBLICATIONS, LAWS & REGULATIONS, and PRESS. A search bar is located in the top right corner. The main content area is titled "Hospitals in Google Earth" and includes three links: "Download Google Earth", "Facility Information for Hospitals in Google Earth (KMZ file)", and "Seismic Performance Ratings (SPC/NPC)". Below the links is a map of a coastal area with several orange circles indicating hospital locations. A sidebar on the right lists "FDD LINKS" with various categories such as "FDD Home", "FDD General / About FDD", "What's New?", "Project Status", "eServices Portal Client Access", "Forms, Applications, and Reminder Lists", "Code Application Notices (CANs) and Policy Intent Notices (PINs)", "Regulation Codes, Interpretations, and Policies", "Legislation", "Pre-Approvals", "Construction Observation and Building Permits", "Hospital Inspector Certification Program (HICP)", "Plan Review", "Seismic Compliance", "Hospital Building Safety Board (HBSB)", "Licensed Clinics", "Frequently Asked Questions (FAQs)", "Additional Information/Resources", "Quality of Service Survey", "Email the Ombudsman", and "Site Map".

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Parting Thoughts

- Seismic safety requires advanced compliance planning by hospital facilities.
- The Seismic Safety Program has advanced public safety in hospital facilities by requiring removal of buildings with significant risk of collapse in a major earthquake.
- More needs to be done in realizing goal of continued operation of hospital facilities by 2030.
- Complexity of all extensions/exemptions has become an issue.
- Uncertainty in the healthcare marketplace due to Affordable Care Act has caused changes in compliance strategies for some hospital facilities.

