



SEISMIC RETROFIT: A GUIDE TO ACHIEVING COMPLIANCE FOR CALIFORNIA HEALTHCARE ORGANIZATIONS

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Several significant earthquakes in the U.S. during the past 100 years have resulted in loss of lives and property. The vulnerability of man-made structures to intense ground shaking has been exposed repeatedly with each major seismic event. While the threat caused by earthquakes in the 21st century is the same as it was in the past, rapid urbanization and an increase in population in seismically active regions have multiplied the potential for catastrophe.

For many years, building owners in the western U.S., particularly those in states along the Pacific coast, have been constructing new facilities or retrofitting existing buildings to meet the seismic requirements of ever-more-stringent building codes. This is particularly prevalent in California, which, not surprisingly, has [more earthquakes](#)

[that cause damage than any other state](#), according to the U.S. Geological Survey.

Seismic code requirements apply to all buildings in California but are particularly stringent and a matter of grave concern for healthcare organizations as they must comply with the state's Hospital Seismic Retrofit Program by Jan. 1, 2030.

This guide provides a high-level overview of California's Hospital Seismic Retrofit Program and its requirements, an explanation of seismic evaluation and retrofit, reasons for acting soon, and guidance on the least onerous

and most economical retrofit options for many of the hospitals that have yet to achieve compliance.

Evolving seismic code requirements

Substantial efforts to build earthquake-resistant structures did not begin until the 1930s, with enforcement of seismic design in the U.S. beginning in 1933 after the [Long Beach Earthquake](#) in California. Through the ensuing decades, various and more stringent California laws were established. Following the 1971 [Sylmar Earthquake](#) (also known as the San Fernando Earthquake), the state established the Hospital Seismic Safety Act (SSA).



Hospital damage

This fallen stair tower at a hospital was the result of the San Fernando Earthquake of Feb. 9, 1971. (© U.S. Geological Survey)

The SSA originally required immediate strengthening or replacement of all buildings, but later was amended to apply only to new hospitals and those undergoing major remodels. To advance new requirements, in 1983 the state legislature passed the Alfred Alquist Hospital Seismic Safety Act (HSSA) under the oversight of the California Office of Statewide Health Planning and Development (OSHPD), now known as HCAI (Health Care Access and Information). The HSSA required that all new hospitals be designed and constructed to remain “operational” after an earthquake.

By the 1990s, newly gained understanding of pitfalls and drawbacks of assumptions made in the formulation of the SSA’s prescriptive design provisions revealed that many of the older buildings constructed under this law were not likely to perform as desired or expected during earthquakes. This was demonstrated during the [Northridge Earthquake](#) of Jan. 17, 1994, in which

several pre-1973 hospitals suffered substantial damage. As a result, the California legislature soon passed Senate Bill 1953 (SB-1953), which became a law on Sept. 22, 1994. Commonly known as the California Hospital Seismic Retrofit Program, this amendment to the HSSA established a phased and prioritized program to improve seismic resistance of existing buildings with an eventual goal of full strengthening or replacement.

Reducing Seismic Vulnerability

The primary goal of the Seismic Retrofit Program is to reduce seismic vulnerability of hospital infrastructure in California by ensuring that all acute care hospitals are reasonably capable of providing ongoing services to the public following a large earthquake. This includes buildings that might experience some structural damage inhibiting the ability to immediately provide services. To rate a hospital building’s vulnerability, the retrofit program has defined Structural Performance Categories (SPC-1 through SPC-5) and Non-structural Performance Categories (NPC-1 through NPC-5). (See charts at right.)

Structural Performance Categories

SPC-1: Buildings posing a significant risk of collapse and a danger to the public

SPC-2: Buildings not in compliance with HSSA that do not significantly jeopardize life but may not be repairable or functional post-event. These buildings may get “red-tagged” (unsafe for occupancy) or “yellow-tagged” (authorized for limited occupancy) by structural inspectors after an event.

NOTE: SPC-1 and SPC-2 buildings are considered non-compliant with the seismic retrofit program. Buildings that have achieved the following ratings are considered compliant.

SPC-3: Buildings permitted by OSHPD and in compliance with HSSA utilizing steel moment frames

SPC-4: Buildings permitted by OSHPD and in compliance with HSSA

SPC-4D: Buildings that may experience structural damage that may inhibit the ability to provide services following an earthquake

SPC-5: Buildings permitted by OSHPD and in compliance with HSSA (after 1994)

Non-structural Performance Categories

NPC-1: Buildings with equipment and systems not meeting bracing and anchorage requirements of any other NPC. The deadline to reclassify these buildings to NPC-2 was Jan. 1, 2002.

NPC-2: Communication systems, emergency power supply systems, bulk medical gas systems, fire alarm systems, and egress signs are braced. These buildings must be upgraded to NPC-4D and the campus must achieve NPC-5 by Jan. 1, 2030.

NPC-3: Buildings meeting NPC-2 criteria and bracing and anchorage of selected equipment in critical care areas, laboratories, pharmacies, radiology spaces, and central sterile supply areas

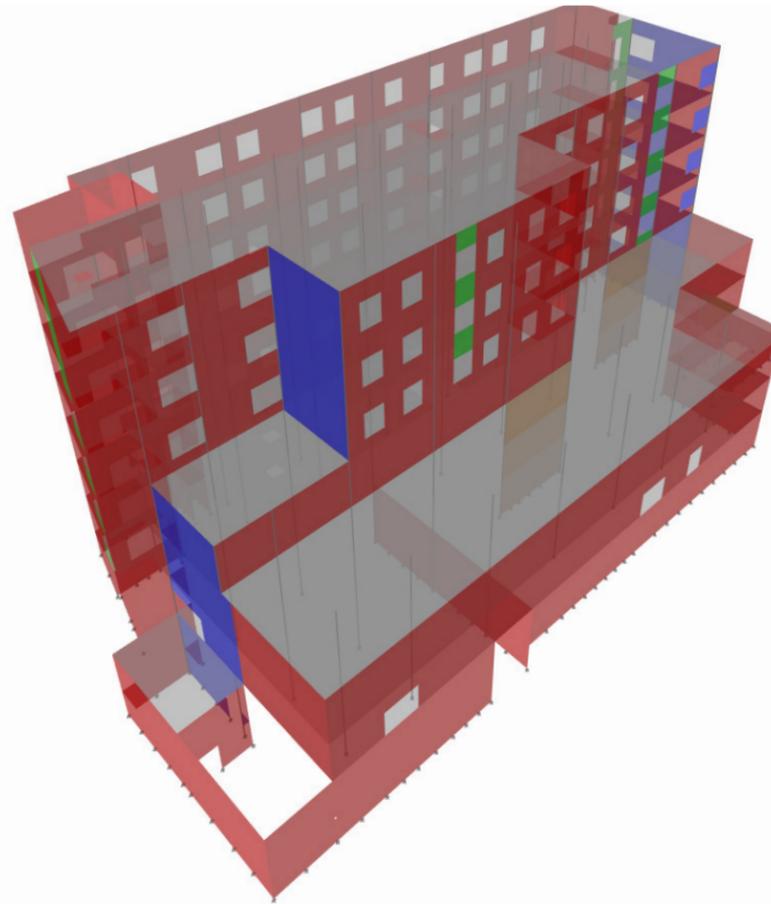
NPC-4D: Buildings meeting NPC-3 criteria and meeting bracing and anchorage requirements for selected systems

NPC-4: Buildings meeting NPC-3 criteria and bracing and anchorage of all architectural, mechanical, and electrical components and systems in the entire hospital building

NPC-5: Buildings meeting NPC-4 criteria and on-site supplies of water and holding tanks for fuel and wastewater sufficient for 72 hours of emergency operations and integrated into the building’s plumbing systems

California healthcare organizations have made significant efforts in the last 28 years to achieve compliance with the retrofit program, which has undergone a few revisions and some intermediate deadline extensions due to the time and expense needed to make the required improvements. Upon receiving an extension based on Assembly Bill 2190, some buildings still rated as SPC-1 had until July 1, 2022, to achieve the SPC-2 rating. All SPC-2 and NPC-2 buildings must be compliant with the retrofit program by Jan. 1, 2030, to be able to continue to offer acute care services beyond that date. With the final deadline less than eight years away, however, fewer than half of the state's 418 hospitals have all their buildings in compliance from an SPC perspective. The others have at least one building on their campus that is non-compliant from an SPC perspective. The number of hospital buildings that are non-compliant from an NPC perspective is significantly higher.

Originally, the existing SPC-1 and SPC-2 acute care hospital facilities could only meet compliance with the retrofit program by either a seismic retrofit to SPC-5 or by constructing a new building. Both options are usually very expensive and time-consuming. Many older, non-compliant buildings are landlocked and usually a part of the overall hospital campus. Having to upgrade or demolish and replace them would result in serious disruption of the hospital's ability to offer acute care services. To address this issue and in an effort to reduce the scope of a building's potential upgrade, HCAI added the SPC-4D rating in 2016. Applicable only to SPC-1 and SPC-2 rated buildings, SPC-4D upgrade offers healthcare organizations and building owners a lifeline to a significantly less-expensive upgrade to keep the building in service past Jan. 1, 2030.



IMEG Corp. has completed several SPC-4D seismic retrofits in California and is working on several other building upgrades. Above is a computer-generated 3D structural analytical model of one of the upgrades.

SPC-4D retrofit program requirements

A retrofit to SPC-4D consists of five steps:

1. **Existing Materials' Testing and Condition Assessment.** This entails determination of "in-place" strengths of construction materials by extracting samples from the building and testing those in a laboratory. Multiple samples, distributed throughout the building, are tested and statistical

analyses are performed to determine in-place strengths. Condition assessment entails field verification of construction details shown on the original construction drawings.

2. **Seismic Evaluation and Retrofit Design.** This step entails detailed analyses of the building to diagnose the structural deficiencies and to estimate seismic demands on elements of the seismic-force-resisting-system (SFRS) by imposed loads and evaluation of adequacy, or lack thereof, of these SFRS elements. The deficient SFRS elements must then be retrofitted. In addition to SFRS elements, this step entails evaluation of the adequacy of a building's overall seismic system.
3. **HCAI Plan Review.** Once the seismic evaluation and retrofit design have been completed, the Seismic Compliance Unit (SCU) of HCAI reviews the overall retrofit concept. Upon SCU's approval, construction details for retrofit are reviewed by HCAI's local region where the building is located.
4. **Retrofit Construction.** SPC-4D retrofit construction can start once the HCAI region issues a building permit. Many times, the construction must be carried out in phases to ensure continuity of hospital operations during construction.
5. **SPC-4D Reclassification.** Once the retrofit construction has been completed and has been verified by HCAI's field staff, the design team requests closure of the construction project. Once SCU verifies closure of the construction project in compliance, they reclassify the building to SPC-4D.

NPC-3/4D/4/5 retrofit program requirements

California Building Codes have added NPC-4D also as a similar lifeline for NPC-2 buildings. However, this is a phased process with intermediate deadlines, the first of which is Jan. 1, 2024.

Each of the NPC-2 buildings must first be upgraded to meet NPC-3 requirements. This entails structural bracing and anchorage of selected non-structural components, equipment, and fire-sprinkler systems in critical care areas, clinical lab service spaces, pharmaceutical service spaces, radiological service spaces, and central and sterile supply areas.

NPC-4D upgrade of buildings in compliance with NPC-3 requires (a) development of an "Operational Plan" (to repair and bring all systems/services back online or to provide them in an alternative manner) and (b) selection, by owner, of one of three "levels," 1, 2, or 3. Level 1 for attaining NPC-4D reclassification requires just an operational plan. Levels 2 and 3 are more involved and, in addition to an operational plan, require anchorage and bracing of additional utilities, services, and equipment. Deadline for obtaining NPC-4D reclassification is also Jan. 1, 2030.

HCAI assigns the NPC-5 category to individual buildings, but, in reality, the rating applies to the overall hospital campus. NPC-5 requires that a building meet the criteria for NPC-4D (or NPC-4) and onsite supplies of water and holding tanks for sewage and liquid waste sufficient to support 72 hours of emergency

operations and integrated into the buildings' plumbing systems in accordance with the California Plumbing Code. An onsite emergency system, as defined in the California Electrical Code, is incorporated into the buildings' electrical systems for critical care areas. Additionally, the emergency system shall provide for radiological service and onsite fuel supply for 72 hours of acute care operation. Deadline for obtaining NPC-5 reclassification is also Jan. 1, 2030.

The table below indicates the HCAI deadlines for NPC-3, NPC-4, NPC-4D, and NPC-5 upgrades:

HCAI deadlines

NPC-3

Date	Seismic Design Category
January 1, 2030	Category D
January 1, 2024	Category F

(See 2019 CAC Chapter 6 Table 11.1)

NPC-4, 4D, & 5

Date	Requirement
January 1, 2024	Submit evaluation
January 1, 2026	Submit construction documents
January 1, 2028	Permit
January 1, 2030	Done

(See 2019 CAC Chapter 6 Section 1.5.2 for details)

Why act now?

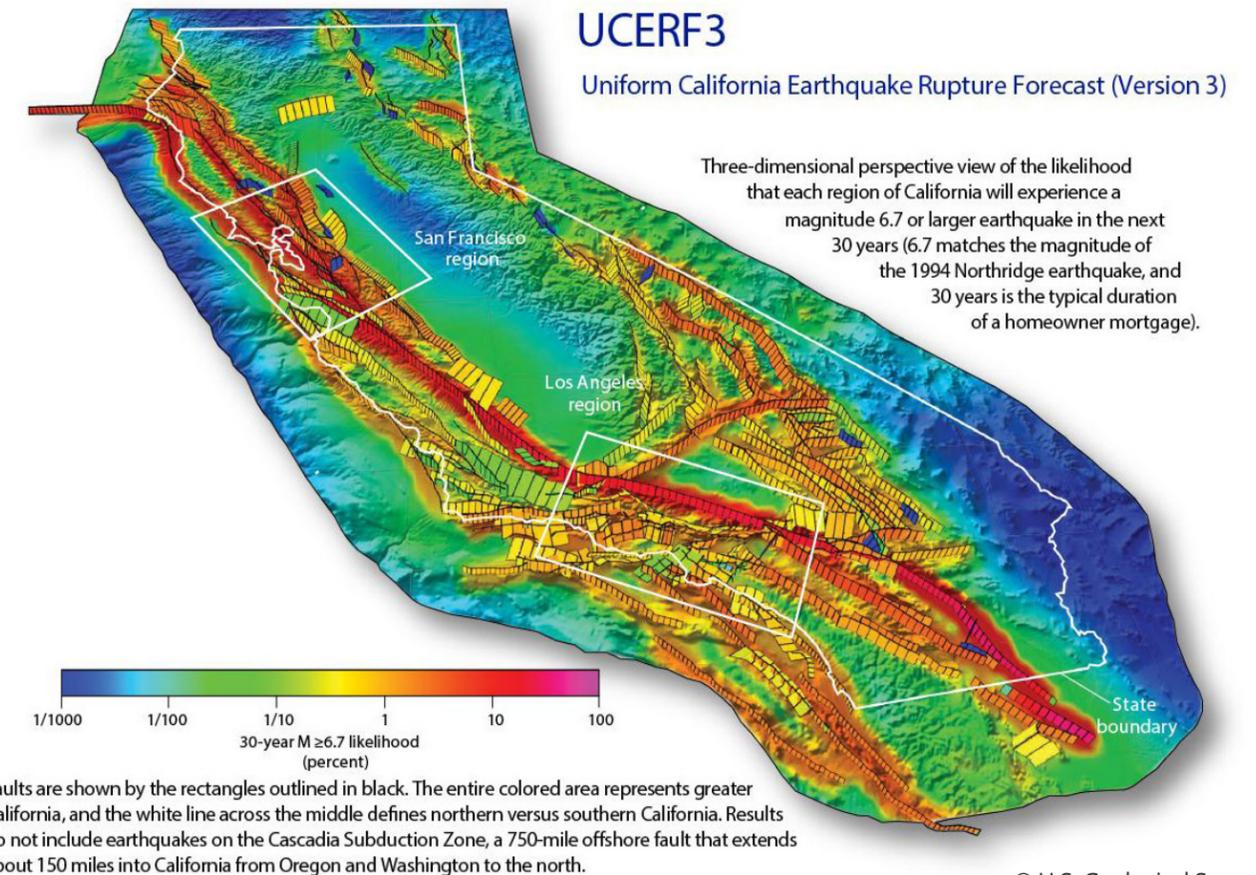
For the foreseeable future, upgrade of SPC-1 and SPC-2 buildings to SPC-4D and upgrade of NPC-2 buildings to NPC-4D are the most cost-effective and least-disruptive options to enable such buildings to continue to provide acute care services past Jan. 1, 2030. Time, however, is of the essence for several reasons.

1. Geologists say Southern California is long overdue for a big earthquake. [According to Business Insider](#), Southern California hasn't had a big earthquake since 1857, putting the region about 80 years past its due date. [The U.S. Geological Survey predicts](#) a 60% likelihood of a major (6.7 or higher)

earthquake in the Los Angeles area within the next 30 years, and a 72% likelihood for the Bay Area.

2. With Assembly Bill 1882 having become law in September 2022, owners of SPC-1 and SPC-2 buildings are now required to notify the public that the hospital is not in compliance with seismic safety regulations and standards. The notice must be posted in the lobby and state that "the State of California has determined that this building does not significantly jeopardize life, but may not be repairable or functional following an earthquake." This could unnecessarily frighten staff and drive away patients; the sooner an upgrade to SPC-4D is made, the sooner the notice can be removed.

3. Design cost for upgrade is a small fraction of the construction cost for upgrade. Budgeting for a big retrofit may feel painful, and owners may be reluctant to consider it, because they can't afford such a big bite in the short term. But getting the



ball rolling for SPC-4D or NPC-4D upgrade designs doesn't mean simultaneously assuming the entire financial burden of the upgrade construction. The design phase is extremely affordable, usually just 5% to 9% of the cost of the upgrade construction.

4. Retrofit construction can be phased. Once SPC-4D upgrade plans have been approved by HCAI, hospital owners can proceed with construction in a phased manner and at their own pace to keep the hospital operational. While there are intermediate deadlines for NPC-4D of Jan. 1, 2024, Jan. 1, 2026, and Jan. 1, 2028, the only deadline for reclassification of a building to SPC-4D is Jan. 1, 2030.

5. Construction costs and earthquake insurance premiums will escalate. If a building owner can shoulder the construction cost for an upgrade in the near term, several possibilities for savings exist. For example, there is less likelihood of facing contractors who exercise their construction escalation clauses, charging more due to the changing prices of material and labor. Doing the upgrade sooner rather than later also means an owner may qualify for lower earthquake insurance premiums for their buildings.

6. It will get harder and more expensive to find a qualified general contractor (GC) to do the work. As of September 2022, 715 buildings in California were rated SPC-1 or SPC-2, a significant number



Construction crews work on the SPC-4D retrofit of a California hospital.

that would require construction for seismic upgrade. The closer it gets to Jan. 1, 2030, the harder it will be to find a qualified GC who isn't booked beyond that date. In addition, the ones who are available will be aware of the limited supply of qualified GCs—and the urgent demand for their services—and might charge motivated building owners a premium.

7. While the deadline to achieve SPC-4D and NPC-4D ratings might get delayed, neither of the requirements are going to disappear.
8. Future code changes cannot, usually, be applied retroactively to projects approved by HCAI unless major flaws are discovered in the building codes pursuant to an earthquake event.

Getting started

Considering the current building code requirements, SPC-4D upgrade of SPC-1 and SPC-2 buildings and NPC-4D upgrade of NPC-2 buildings—both of which focus on “damage control” in lieu of “operational”—are the most cost-effective and least-disruptive options for the foreseeable future to keep hospitals operational beyond Jan. 1, 2030.

Owners looking for a structural consultant to help a hospital building achieve compliance should make sure that the consultant is a licensed Structural Engineer in the State of California and has:

- Experience with seismic retrofit of existing buildings
- Proven track record of saving owners money for seismic retrofits
- Familiarity with California building codes
- Familiarity with national standard ASCE 41 (Seismic Evaluation & Retrofit of Existing Buildings)
- History of working with HCAI

Communities depend on hospital buildings and the acute care services they provide, and no healthcare owner wants their facility taken out of service due to non-compliance with the building codes. By getting out in front of the 2030 deadline and starting the retrofit process now, owners can lock in reasonable costs, save money in the long term, and put their buildings in a position to remain in service to 2030 and beyond.

ABOUT THE AUTHOR



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