

Resilience has become a common term among engineers, policymakers, and the national community of construction industry professionals. NCSEA recently formed a Resilience subcommittee to develop positions and recommendations on issues concerning resilience-based planning and design. For engineers engaged in seismic design, the lessons of the 2011 Christchurch earthquake, in which the central business district comprised largely of code-designed buildings was rendered unusable, have impacted the way many engineers think about seismic risk and building performance in earthquakes. This change in thinking has also influenced the way engineers frame conversations with their clients, building owners, and building occupants about post-earthquake expectations of buildings. The seismic life-safety standard has been the design basis for most buildings explicit (or implicit) in building codes for decades. However, this standard has no defined requirements for buildings after earthquakes, such as when they can be reoccupied or how much they will cost to repair. These questions are at the heart of the current resilience conversation.

To address these issues, two pieces of legislation were introduced in the California Assembly in 2018, one for new buildings, and one for existing buildings. Both have the potential for significant long-term impact on how new buildings are designed and whether existing buildings are seismically retrofitted. The Structural Engineers Association of California (SEAOC) has participated in the legislative process for both of these bills, through its Legislative Committee, state-wide technical committees, and regional member organizations, and by working directly with the bills' author and other industry stakeholders.

This article provides a summary of the issues for those interested in potential national trends and for those who work in California.

California Assembly Bill 1857

AB 1857 was introduced in the California Legislature by Assembly Member Adrin Nazarian on January 10, 2018. The proposed legislation addressed performance standards for earthquake safety in new buildings.

The current text of the bill requires the California Building Standards Commission (CBSC) to assemble a working group comprised of certain state entities and members of the construction and insurance industries (including SEAOC). The bill requires the group to consider, by July 1, 2022, whether a "functional recovery" standard is warranted for all or some building occupancy classifications and whether the standard should be mandatory or voluntary. The bill defines "functional recovery

standard" as a set of enforceable building code provisions that provide specific design and construction requirements intended to maintain or restore a building's post-earthquake structural and nonstructural capacity to support the basic intended functions of its pre-earthquake use within a maximum acceptable time.

If the working group determines that a functional recovery standard is warranted, the group must estimate the cost of compliance and advise the CBSC on whether the standard should apply only to specific seismic design categories, or to the entire State. If the group determines that a functional recovery standard is not warranted, the group must assist with producing a guidance document for building owners, architects, engineers, insurance agencies, and local jurisdictions regarding functional recovery after a

Functional Recovery and Seismic Vulnerability

seismic event. The bill authorizes the CBSC to issue regulations based upon the recommendations from the working group for nonresidential occupancies only.

SEAOC took a position of Support for AB 1857 after some critical revisions were made to the original text. The bill passed the Assembly on May 29, 2018, and is now being considered by the Senate. The full text of the current bill is available at <https://bit.ly/2xZbjjW>.

For an opportunity to see SEAOC's work in the legislative arena, a video of the April 11, 2018 hearing on AB 1857 is available at <https://bit.ly/2zRATsv>. Starting at the 37-minute mark until the 53-minute mark, Assembly Member (and AB 1857 author) Adrin Nazarian, SEAOC Legislative Committee Chair Ryan Kersting, seismologist Dr. Lucy Jones, and EERI Executive Director Heidi Tremayne testify in support of this bill.

Since the bill's introduction, SEAOC participated in several rounds of amendments. The current text of the bill represents a significant departure from where it started. As introduced in January 2018, the bill initially required:

...engineered buildings to be built to an immediate occupancy standard regarding seismic safety. Until an immediate occupancy standard is adopted, the [California Building Standards] commission shall adopt ... a strength and stiffness standard for engineered buildings that is one and one-half times the level of the current standard.

The language of this bill, which essentially imposed the same requirements currently in place for California hospitals on all newly-designed buildings, was a concern for many structural engineers. The goals of the bill were not clear;

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California Legislation Moves to Improve Seismic Resilience

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it did not define “immediate occupancy” and did not explain the intent behind an enhanced design requirement. Further, imposing a higher design standard on all buildings has cost implications – not only for the design and construction of the structural system, but for nonstructural systems (such as partitions, mechanical/electrical/plumbing systems, and contents), the functionality of which significantly impacts the post-earthquake recovery of a building. Additionally, it was unclear whether such a standard should apply to all newly-designed buildings, or whether some would be exempt.

California Assembly Bill 2681

AB 2681 was introduced in the California Legislature on February 15, 2018, also by Assembly Member Adrin Nazarian. This bill mandates inventories of “earthquake-vulnerable buildings” or “potentially vulnerable buildings” (as defined and used throughout the bill’s text), with consideration of their recovery functions in providing essential services after an earthquake.

The current text of the bill begins with context about the large expected economic losses after major seismic events, the existence of vulnerable building types, and the need to quantify the vulnerability of California’s building stock as a first step to reduce these losses.

The bill defines “potentially vulnerable buildings” as those within a specific seismic hazard zone (generally where peak ground acceleration is greater than 0.3g in a code-level earthquake, which generally has a 475-year return period), and of certain construction types (such as unreinforced masonry, non-ductile concrete, pre-Northridge steel moment frames, soft/weak/open front light-framed buildings, and designed prior to certain editions of the building code).

Excluded from this legislation are residential properties with one to four dwelling units, mobile homes, hospitals, and schools. (In California, hospitals and schools are regulated by separate state agencies with more stringent design requirements.)

The bill defines “recovery function” as a building occupancy involving one or more of the following: multi-family housing, skilled nursing or residential care, designated emergency shelters, grocery and packaged food stores, pharmacies and medical supply stores, medical provider offices, K-12 schools, essential services provided by a city or county identified in their local hazard mitigation plan, essential services buildings (defined in the California Health and Safety Code), and communications centers or broadcast stations.



New Zealand’s Christchurch aftermath.

The bill requires cities and counties to inventory their building stock before January 1, 2021, to identify potentially vulnerable buildings using publicly available information (such as tax assessor’s record surveys, census data, housing data, building permit records, past or ongoing earthquake mitigation program records, and online searches), and to identify what recovery functions a potentially vulnerable building contains. By June 1, 2021, building departments must notify building owners if their buildings are on the list. Owners notified that their building is potentially vulnerable must obtain a letter from a licensed engineer by June 1, 2022, confirming whether the building is one of the “potentially vulnerable” types as defined in the bill. If the letter states that the building is not one of the potentially vulnerable types, the building department must remove it from the inventory. If an owner does not respond, the building remains on the inventory. By January 1, 2023, building departments must submit their inventories to the State of California. If a building department notifies the state that the building is retrofitted or replaced, the state will remove the building from the inventory.

Before the legislation can take effect, the state is required to identify, by January 1, 2020, funding mechanisms to offset the costs to building departments.

SEAOB has taken a position of Support for this bill after a significantly revised version passed the Assembly. The Senate is now considering the bill. The full text of the bill is available at <https://bit.ly/2OAnKMy>.

The original bill mandated not only inventories, but seismic performance evaluations of “potentially vulnerable” existing buildings performed by structural engineers (with consideration of safety, repair costs, and recovery time). This created a largely unfunded mandate

and was politically controversial, even among engineers. The term “potentially vulnerable” was not as well-defined as in the current bill. Following the bill’s introduction, the SEAOB Board engaged the SEAOB Existing Buildings Committee to develop a list of what SEAOB considered “potentially vulnerable” existing buildings, which was provided to the bill’s authors during the amendment process. SEAOB also worked with the bill’s author to modify the language of the bill to limit it to an inventory-only process.

SEAOB and its Legislative Committee continue to participate in conversations with Assembly Member Nazarian, his staff, and other interested parties as the language of both bills evolve.

These two recent bills in California may impact future legislation across the United States. Concepts such as resilience and functional recovery may become more prevalent across the country as states begin to react to the consequences of the new ASCE 7 seismic and wind requirements, and the national resilience conversation broadens. Engineers, owners, insurers, and other stakeholders are beginning to think about what happens to buildings after natural disasters, and how designing them for performance beyond life safety may cost less over the life of the building (in terms of repairs and downtime) and ultimately help communities recover.■

UPDATE – Since the original writing of this article, both bills passed the California assembly and senate, but were unexpectedly vetoed by the governor in late September 2018. The bills are expected to be reintroduced, and possibly modified, in the next legislative session. SEAOB will continue to work with the bills’ author and conduct outreach to educate the new governor on the relevant issues following the November 2018 election.