

Research Summary

International Best Practices in Seismic Risk Mitigation Policy

**Prepared for DRR Pathways project in support to
the City of Vancouver**

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UNDERSTANDING RISK AND RESILIENT SOLUTIONS

Sage Consulting conducted a literature review of seismic hazard risk reduction policies from around the globe and compiled information in the templates herein. The headers of the seismic policy include information on status, maturity, availability and completeness of information found. These are described in the following manner:

Policy Maturity: Sage’s judgment on the comprehensiveness, evolution and implementation success of the policy. This ranges from Low to High maturity.

Availability of Information: The amount of publically available information reviewed for the particular policy. This ranges from Low to High.

Completeness of Information: Indicates if the publically available information provides sufficient data to populate the template relative to other reviewed policies. This ranges from Low to High.

In-Progress or Proposed indicates current status of policy.

Policy Goals reflected in the template are verbatim language from City websites or official documents. *Policy Objectives* include actions for policy implementation (mandatory, voluntary, etc.) and to which kinds of buildings and number of buildings affected. *Risk Reduction Target* includes type of building and standard of strengthening.

The 10 policy templates were selected based on the seismic risk and consequences of building damage in Vancouver. The templates begin with building-system and construction specific policies, including Unreinforced Masonry Buildings, Wood-frame Soft-Story buildings, and Non-Ductile Concrete buildings. The last three in the policy suite are those with greater scope and inclusion of multiple building systems..

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Policy Maturity: Medium & **In Progress**

Availability/Completeness of Information: High/High

Policy Title: California Unreinforced Masonry Building Program

Jurisdiction/City: State of California

Lead entity: California State Government Code; California Seismic Safety Commission for reporting

Date of Policy Establishment: 1986

Policy Goal: “Requires local governments to inventory unreinforced masonry buildings and establish earthquake hazard mitigation programs for these buildings by January 1, 1990.”

Policy Objectives: **Mandatory inventory, mandatory development** of loss reduction program, and **mandatory reporting** of Unreinforced Masonry (URM) buildings within 365 local governments within the highest Seismic Zone area (SZ4).

Risk Reduction Target: To inventory all ‘potentially hazardous buildings’ and develop mandatory loss reduction program and report to the state. Each local government was allowed to tailor their program to their own specifications.

Types of Buildings:

Potentially Hazardous Buildings defined as

1. Any building constructed prior to the adoption of local building codes requiring earthquake resistant design of buildings and constructed of unreinforced masonry wall construction;
2. Includes all buildings of this type, including, but not limited to, public and private schools, theaters, places of public assembly, apartment buildings, hotels, motels, fire stations, police stations, and buildings housing emergency services, equipment, or supplies, such as government buildings, disaster relief centers, communications facilities, hospitals, blood banks, pharmaceutical supply warehouses, plants, and retail outlets;
3. Does not include warehouses or similar structures not used for human habitation, except for warehouses or structures housing emergency services equipment or supplies;
4. Does not include any building having five living units or less.

Trigger for Policy Development: 1933 Long Beach earthquake which was a moderate, M6.4 earthquake that caused a high level of damage in populated areas with brick and masonry buildings without any internal steel reinforcement.

Policy Implementation Timeline: Since 1986, jurisdictions must enact the inventory of URMs and report to the state by 1990 (4 years).

Approach/Criteria for prioritizing buildings: Timeline for retrofit depends on level of risk, use and occupancy load. A 2004 law required URM buildings to post placards at entrances stating an earthquake warning for the safety of building users.

Short History: URMs are generally brick buildings constructed prior to 1933, predating modern earthquake-resistant design. The brick is not strengthened with embedded steel bars and is therefore called “unreinforced.” In earthquakes, the brick walls (especially parapets) tend to disconnect from the building and fall outward, creating a hazard for people below and sometimes causing the building to collapse. URM failures have been responsible for deaths in California earthquakes since at least 1868, and as recently as Loma Prieta in 1989 and San Simeon in 2003.

Type of Policies/Activities:

The following four categories capture the most common loss reduction programs for URMs initiated by jurisdictions in California:

- **Mandatory Strengthening:** require owners to strengthen or reduce risks in their buildings within prescribed timelines set by each local government. Time schedules vary and generally depend on the number of occupants.
- **Voluntary Strengthening:** establish seismic retrofit standards and require owners to evaluate the seismic risks in their buildings. Owners then write publicly available letters to their local governments indicating when they intend to retrofit.
- **Notification Only:** local governments write letters to owners stating that their building type has been known to perform poorly in earthquakes.
- **Other types:** variations of other programs including placarding only, demolition of URMs

Cost:(if found) Approximately \$175,000 for small URM buildings (USGS, 2018)

Financial Support and Incentives:

Depends on jurisdictions, some include:

- Tax break on real estate transfer tax
- Restructuring existing owner debt/refinancing
- Financial hardship extensions were granted to extend the deadline for all or part of the retrofit work for up to 12 months.
- Federal and local grants
- Small Business Administration Loans
- Special Assessment Districts
- Permit fee exemptions

Retrofit Standards and Guidelines: 1991 Uniform Code for Building Conservation (UCBC) then superseded by 2003 International Existing Building Code and Chapter 1 of the 2000 Guidelines for Seismic Retrofit of Existing Buildings (International Building Code) and prescriptive ‘Bolts+’¹ requirements were also implemented.

Non-compliance penalty: Building placarding statewide that could arise in civil suits against the owner if unretrofitted; jurisdictions may include other types of penalties.

Implementation Status: Since 2006, the level of compliance with this law has been quite high with over 98 percent of the 25,900 URM buildings now in loss reduction programs. But so far, only about 70 percent of the owners have reduced earthquake risk by retrofitting in accordance with a recognized building code or by other means.

Lessons Learned (if any): Jurisdictions should mandate the strengthening of all URMs including state owned buildings in accordance with state’s building code rather than set up voluntary retrofit programs; local governments with little or no retrofit progress should provide additional incentives to encourage owners to retrofit; Notification only programs are the least effective for seismic strengthening.

References:

California Government Code 8875: Building Earthquake Safety, website accessed 8/25/2019

<https://leginfo.ca.gov/faces/codes_displayText.xhtml?lawCode=GOV&division=1.&title=2.&part=&chapter=12.2.&article=>

California Seismic Safety Commission. *Status of the Unreinforced Masonry Law: 2006 Progress Report to the Legislature*. 2006

Structural Engineers Association of Southern California, Dr. Lucy Jones Center. *2016 Safer Cities Survey*.

United States Geological Survey. *Reported Investments in Earthquake Mitigation Top \$73 to \$80 Billion in the San Francisco Bay Area, California, Since the 1989 Loma Prieta Earthquake*, 2018.

¹ Bolts+ Retrofit Requires that 1) the walls are tied to the floors and roof, 2) parapets are braced, 3) weak floor and roof diaphragms are strengthened, and 4) tall brick walls are strong backed to prevent out-of-plane bending failures.

Policy Maturity: High & **In Progress**
Availability/Completeness of Information: High/High

Policy Title: Berkeley Unreinforced Masonry Building Program

Jurisdiction/City: Berkeley, California, US

Lead entity: City of Berkeley

Date of Policy Establishment: October 15, 1991

Policy Goal: “The City of Berkeley established a Seismic Hazard Mitigation Program for Unreinforced Masonry (URM) Buildings... Staff created an inventory consisting of 587 URM buildings based on visual field surveys, investigations and a review of property records.”

Policy Objectives: City-conducted inventory; **mandatory retrofit** of 587 URM buildings.

Risk Reduction Target: To retrofit all potentially hazardous unreinforced masonry buildings to the ‘Standards for the Seismic Analysis of Unreinforced Masonry Buildings’ by Risk Level, dependent on use and occupancy load.

Types of Buildings:

Potentially Hazardous Unreinforced Masonry Buildings defined as

1. A building which was constructed prior to 1956, with masonry bearing walls containing seismic reinforcement at a level less than the minimum prescribed in the City of Berkeley "Standards for the Seismic Analysis of Unreinforced Masonry Buildings," and is approved for commercial or mixed use occupancy, or contains five or more living units; OR
2. A building which is located on a street in a high pedestrian traffic corridor and
 1. Contains at least one brick in-fill wall; OR
 2. Has a brick veneer ten feet in height or greater (measured from the adjoining grade); OR
3. Has an unreinforced parapet that exceeds one and one-half height/depth ratio.

Categorized by Risk Level as Below:

Risk Level 1:

Occupancy/Use	Hospitals, fire and police offices/stations, emergency operations centers, buildings housing medical supplies, government administration offices; Any building with an occupancy load of 1,000 or more
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Berkeley Unreinforced Masonry Building Program

Ownership	Public
Construction Type	URM

Risk Level 2:

Occupancy/Use	Commercial buildings, businesses, assembly buildings, educational and institutional occupancies with an occupancy load of three hundred (300) or more. Residential buildings-Hotels, motels, apartments or condominiums containing more than one hundred (100) living units/bedrooms. Mixed use occupancies-Any building with a combined occupancy load greater than three hundred (300).
Ownership	Private & Public
Construction Type	URM

Risk Level 3:

Occupancy/Use	Commercial buildings, businesses, assembly buildings, educational and institutional occupancies with an occupancy load of one hundred (100) or more. Residential buildings-Hotels, motels, apartments or condominiums containing fifty (50) or more living units/bedrooms. Mixed use occupancies-Any building with a combined occupancy load greater than one hundred (100).
Ownership	Private & Public
Construction Type	URM

Risk Level 4:

Occupancy/Use	Commercial buildings, businesses, assembly buildings, educational and institutional occupancies with an occupancy load of fifty (50) or more. Residential buildings-Hotels, motels, apartments or condominiums containing fewer than fifty (50) living units/bedrooms. Mixed use occupancies-Any building with a combined occupancy load greater than fifty (50).
Ownership	Private & Public
Construction Type	URM

Risk Level 5:

Occupancy/Use	Commercial buildings-Businesses, assembly buildings, educational and institutional occupancies with an occupancy load of fifty (50) or less. Residential buildings-Hotels, motels, apartments or condominiums containing twenty (20) or fewer living units/bedrooms. Mixed use occupancies-Any building with a combined occupancy load of fifty (50) or less.
Ownership	Private & Public
Construction Type	URM

Risk Level 6:

Occupancy/Use	Any nonresidential building that is used less than twenty (20) hours per week, or any building with a masonry veneer of at least ten (10) feet in height or with a masonry parapet exceeding a one and one-half (1-1/2) ratio or masonry in-fill that is located in a high pedestrian traffic corridor.
Ownership	Private & Public
Construction Type	URM

NOTE: Risk categories II through V apply to buildings with masonry bearing walls that contain seismic reinforcement less than the minimum prescribed in the City of Berkeley "Standards for the Seismic Analysis of Unreinforced Masonry Buildings."

Trigger for Policy Development: California State URM Law of 1986.

Policy Implementation Timeline:

Since the establishment of the October 15, 1991 ordinance, owners have two years to a) demonstrate to the building official that the building meets the criteria for use of the prescriptive standard or b) submit a seismic engineering evaluation report on the building prepared by a building professional. All owners of potentially hazardous URM buildings shall complete required retrofit work by:

- Risk Level 1 Buildings: 5.5 years (March 1, 1997)
- Risk Level 2 Buildings: 5.5 years (March 1, 1997)
- Risk Level 3 Buildings: 5.75 years (June 30, 1997)
- Risk Level 4 Buildings: 6.25 years (December 31, 1997)
- Risk Level 5 Buildings: 7.25 years (December 31, 1998)
- Risk Level 5 Buildings: 10.25 years (December 31, 2001)

Note that city could order immediate retrofit in specified circumstances.

Approach/Criteria for prioritizing buildings: Timeline for retrofit depends on level of risk, use and occupancy load.

Short History: Following California Retrofit law of 1989, Berkeley instituted the 1991 URM ordinance and pioneered a tax rebate program. Very high compliance (98%) of URM retrofits as a dedicated staff was hired to apply pressure on property owners in 2000's.

Type of Policies/Activities:

- Inventory (visual/sidewalk survey) of all URMs conducted by the City (Public Record)
- Mandatory Evaluation of URMs
- Mandatory Retrofit of Hazardous URMs

Cost:(if found) Approximately \$175,000 for small URM buildings (USGS, 2018)

Financial Support and Incentives:

- Tax break on city's real estate transfer tax: Berkeley levies a real estate transfer tax at a rate of 1.5% of the selling price of real estate. City offered to refund seismic retrofit expenses up to 1/3 of that tax amount up to a maximum refund of \$2,000. A property owner is eligible for this refund if the owner completes the seismic upgrades within one year of purchasing the building. Every time a property changes hands, each new owner is eligible to take advantage of economic incentive, so the housing stock will be safer over time. \$10 million has been rebated to property owners through the rebate program. Commercial buildings are excluded from the transfer tax rebate program. No permit fee waiver on permit applications.
- No rent pass through of retrofit costs to tenants by owners/landlords.
- Financial hardship extensions were granted to extend the deadline for all or part of the retrofit work for up to 12 months.
- After the 1991 program, City obtained a federal grant in 2018 for various vulnerable buildings; specifically for remaining URMs, the grant offers up to \$5,000 in design fees and \$20,000 for construction grants (cap at 30% of construction cost).

Retrofit Standards and Guidelines: Standards for the Seismic Analysis of Unreinforced Masonry Buildings; Seismic Evaluation and Design Procedures for Repair based on ASCE 31 *Seismic Evaluation of Existing Buildings* or ASCE 41 *Seismic Rehabilitation of Existing Buildings* (both BSE-1 and BSE-2 level hazard). Procedures contained in Appendix A, Chapter A1, A3, and A4 of the California Existing Building Code and Appendix A Chapters A2 and A5 of the International Existing Building Code shall be permitted to be used as specified.

Non-compliance penalty: File notice with property title that transfer of title or refinancing required compliance with retrofit requirements; Properties not retrofitted are public nuisances; Notice of Violation ordering abatement.

Implementation Status: 7 of 587 are yet to be retrofitted as of July 2019

Lessons Learned (if any): Weak enforcement accounted for only 20% mitigation rate during the first decade of the program due to URM owners having much more time to comply without any ramifications for non compliance. City then hired a URM program manager in 2000's which accelerated mitigation pacing.

References:

Berkeley Municipal Code 19.38.060 Risk Classification and Compliance Schedule, website accessed on 8/16/2019

<<https://www.codepublishing.com/CA/Berkeley/?Berkeley19/Berkeley1938/Berkeley1938060.html?f>>

Berkeley Municipal Code Article 6. Repairs to Existing Buildings and Structures, website accessed on 8/16/2019

<<https://www.codepublishing.com/CA/Berkeley/html/Berkeley19/Berkeley1928/Berkeley1928070.html#19.28.070>>

City of Berkeley, Unreinforced Masonry Buildings, website accessed on 8/1/2019

<http://www.cityofberkeley.info/Planning_and_Development/Building_and_Safety/Unreinforced_Masonry_Buildings.aspx>

Funding URM Retrofits: Report to City of Seattle. National Development Council, May 2019.

Reported investments in earthquake mitigation in the San Francisco Bay Area since 1989. Appendix A. United States Geological Survey. 2018

Policy Maturity: **[Proposed]** High
Availability/Completeness of Information: High/High

Policy Title: **[Proposed] Seattle Unreinforced Masonry Building Policy**

Jurisdiction/City: Seattle, Washington, US

Lead entity: City of Seattle

Date of Policy Establishment: N/A

Policy Goal: “The goal for the URM retrofit program [is to] improve life safety by reducing the risk of injury from collapse of URM buildings in the event of an earthquake.”

Policy Objectives: Proposed **Mandatory Retrofit** of approximately 1,160 URM buildings excluding brick veneer and concrete masonry buildings and single-family and two-unit residences.

Risk Reduction Target: To retrofit all URM buildings to an ‘Unreinforced Masonry Retrofit Standard,’ based on number of occupants, the use of building, and risk due to ground hazard and failure.

Types of Buildings:

The Policy Committee recommends that the URM retrofit program apply to all buildings that have unreinforced masonry bearing walls, including residential buildings with three or more units. Exclusions to the proposed program include:

- Brick veneer and concrete masonry buildings
- Single-family and two-unit residences are excluded from retrofit requirements, in part because many single- and double-unit residences are not URM buildings, and because these buildings generally have fewer occupants than multi-family structures.

The recommended policy includes three classes of buildings:

Critical Vulnerability:

Occupancy/Use	Schools and critical facilities (hospitals, fire stations, etc.). This category includes 77 buildings in Seattle
Ownership	Public
Construction Type	URM

Berkeley Unreinforced Masonry Building Program

High Vulnerability:

Occupancy/Use	Buildings greater than 3 stories on poor soil or buildings with more than 100 occupants (regardless of soil type). This category includes 183 buildings in Seattle.
Ownership	Private & Public
Construction Type	URM

Medium Vulnerability:

Occupancy/Use	All other URM buildings. This category includes 902 buildings in Seattle
Ownership	Private & Public
Construction Type	URM

Trigger for Policy Development: Earthquakes in 1949 and 1965 significantly damaged URM buildings in Seattle. The 2001 Nisqually earthquake again underscored the vulnerability of URM buildings, as two-thirds of the buildings the City determined unsafe after the earthquake were URM buildings. Seattle is the only city in the country to have experienced URM building damage from 3 different earthquakes in 73 years.

Policy Implementation Timeline:

- Critical vulnerability, Total time allowed for retrofit completion **7 years:**
 - Notification: Year 0
 - Assessment: 1 year
 - Apply for permit: 1 year
 - Approve permit: 1 year
 - Complete Retrofit: 4 years
- High Vulnerability, Total time allowed for retrofit completion **10 years:**
 - Notification: Year 0
 - Assessment: 2 years
 - Apply for permit: 2 years
 - Approve permit: 1 year
 - Complete Retrofit: 5 years
- Medium Vulnerability, Total time allowed for retrofit completion **13 years:**
 - Notification: Year 0

- Assessment: 3 years
- Apply for permit: 2 years
- Approve permit: 1 year
- Complete Retrofit: 7 years

Approach/Criteria for prioritizing buildings: Building priorities based on number of occupants, the use of building, and risk due to ground hazard and failure. Additional justification of the three classifications include:

- Critical Vulnerability: hospitals, first responders and shelters were prioritized because they directly impact the City's recovery and schools house the most young and vulnerable of Seattle's population
- High Vulnerability: Buildings that rest on soil that is prone to liquefaction increases the risk of damage. Taller buildings in this category are more susceptible to collapse.
- Medium Vulnerability: Any other building with three or more units included in this category.

Currently, the Seattle Building Code requires unbraced parapets on URM buildings to be abated or braced. This requirement is enforced when the Seattle Department of Construction & Inspections (SDCI) receives an application for a building permit for any work in the building. If a developer or owner chooses to construct a major addition or alteration to their building, or if a building sustains major damage in the event, the City building code requires a seismic report to be submitted along with the building permit.

Short History: In the 1970's the Seattle City Council passed several ordinances requiring all URM buildings to achieve a given structural standard, however, the ordinances were eventually repealed due the high cost of implementing the upgrades. The City resumed efforts at creating a citywide policy by forming committees in 2008. In 2011, the City convened a committee of property owners, geological and seismology experts, structural engineers, architects, housing and real estate development representatives, and historic preservation professionals to develop recommendations on URM policies. A recommendation report was published in 2012. A more detailed inventory was conducted in 2014 and a validation report was completed in 2016. Finalized policy recommendations were published in 2017.

Type of Policies/Activities:

- City conducted URM inventory² (Public Record)
- Notification to Owner
- Engineering Assessment: The committee emphasizes the importance of the seismic assessment to the overall success of the retrofit program. It is recommended that SDCI develop standard guidance for completing a building assessment to ensure consistent standards are met during this phase

² The state of Washington's Department of Commerce has also created an Unreinforced Masonry Inventory which was used as a starting point for the verification of Seattle's URM buildings. See references.

- Apply for permit: Using information gained from the seismic assessment, building owners identify which deficiencies will be addressed to comply with minimum requirements of the URM Retrofit Standard and apply for a permit to complete the work
- Approve permit
- Retrofit completion

Cost:(if found)

Construction costs: between approximately \$25-88/square foot.

Construction costs including relocation expenses: between approximately \$33-96/square foot.

The city estimates approximately \$1 billion to retrofit to 'Bolts+' standard. (SDCI, 2017)

Financial Support and Incentives: Proposed Incentives vary based on activity:

- Assessment:
 - City liaison position to work with individual building owners to navigate the retrofit policy and process
 - Reference to vetted list of assessment contractors on the City's website and access to catalog of best practices
 - Standardized assessment protocol
- Permit Application
 - City liaison position to work with individual building owners to navigate the retrofit policy and process
 - Two city-funded hours of pre-submittal coaching to help owners through technical aspects of the permit submittal process
 - Reference to vetted list of retrofit design engineers on City's website and access to catalog of best practices
 - Permit fees waived
 - Interdepartmental and inter-agency permit facilitator
- Permit Approval
 - Interdepartmental and inter-agency permit facilitator
- Completed Retrofit
 - Public disclosure of buildings that have been retrofitted
 - Reference to vetted list of construction contractors on the City's website and access to catalog of best practices

Proposed financial support:

- Public/Non-Profit Ownership:
 - Federal Grants: Grants from FEMA and the Community Development Block Grant (CDBG) through the U.S. Department of Housing and Urban Development
 - General Obligation Bonds: Voter-approved municipal bonds secured with the obligation of the City to use available resources, including tax revenue, to repay debt.

- Levy: Consists of voter-approved increase in the money collected annually from each property owner. Levy is based on a percentage of the value of home and privately-owned land, and only affects properties within the city.
 - 10% Federal rehabilitation tax credit: Existing federal tax credit allows users to write off 10% of eligible construction costs for retrofit. Applies to any non-residential buildings built before 1936 and does not require a formal review process if the building is non-historic.
 - Tax abatement: Consists of the reduction or elimination of property taxes for a designated period of time. URM buildings would be granted a short-term property tax abatement and property owners could use those monies to help fund a seismic retrofit. It would require a change in State law.
 - Revolving Improvement Districts (LIDs): Creates a central fund through which multiple loans are made to borrowers. Through regular repayments of the original loan, borrowers replenish the central fund. Could be funded initially through an endowment or partnership with lending institution.
 - Transfer of Development Rights: Allows buildings in designated areas to sell the potentially developable 'air space' above the building to purchasers who can use the additional floor area to increase the density of their development in another area of the city. Can help owners generate funding for retrofits while maintaining buildings historic character.
 - Architecture and Engineering grants and resources; City can provide funding for owners to access architecture and engineering services.
 - Building owner contribution: Includes low-interest loans from participating banking institutions.
 - Funding to educate building owners: Funded by the city to provide information on the potential consequences of not retrofitting a URM building and encourage building owner action. City may provide grants, bonds, and other revenue to facilitate private lending.
- Private Ownership (see descriptions above):
 - 10% Federal rehabilitation tax credit
 - Tax abatement
 - Revolving loan fund
 - Local Improvement Districts (LIDs)
 - Transfer of Development Rights
 - Architecture and engineering grants & resources
 - Building owner contribution
 - Funding to educate building owners

Retrofit Standards and Guidelines:

Technical Advisory committee recommends the URM Retrofit Standard with is a modification of San Francisco's "Bolts+" prescriptive methodology. It includes:

- Parapets be braced
- Floors and roofs be structurally connected to URM walls

- Framing be interconnected to strengthen floors and roofs
- Weak interior and exterior bearing walls be strengthened.

Additionally, some buildings require a minimum amount of retrofit to connect a building's walls to the floor and roof. Other buildings will require a more rigorous full seismic retrofit.

Non-compliance penalty: Proposed non-compliance penalties vary based on activity and respective timeline:

- If engineering assessment incomplete:
 - Notice of violation to owner with fine of \$500/quarter;
 - Public posting of non-compliance on the City online database;
 - Block on any new permits for the building;
 - City contracts with third party to conduct assessment and bills property owner for assessment fees and associated administrative costs.
- If permit application not submitted:
 - Notice of violation to owner with fine of \$1,000/quarter
 - Public posting of non-compliance on the city online database
- If permit approval delayed:
 - Notice of violation to owner with fine of \$1,000/quarter
 - Public posting of non-compliance at property
 - Sunsetting of incentives, and permit fees are reinstated
- If retrofit incomplete:
 - Notice of violation to the owner with copy to tenants, with civil penalty of \$45,000/quarter
 - Lien on property based on outstanding fines
 - Public posting of non-compliance on-site
 - Block on any new permits for the building
 - Abatement of the property by the City, and/or designation as dangerous building

Implementation Status: Approximately 1,160 URM buildings (excluding single family residences and duplexes) within Seattle are in need of seismic retrofit. The Committee is currently completing the final technical standard with the Structural Engineers Association of Washington.

Lessons Learned (if any): Key takeaways in developing proposed retrofit policy through review of other cities' initiatives:

- Mandatory retrofits and consistent enforcement are critical

- URM's are only the first step: following this building type, soft-story buildings and non-ductile concrete buildings are becoming increasingly common, along with concrete tilt-up and steel moment frame.
- Staff a programmatic effort: important to have internal and external relationships to direct various URM program needs and to streamline retrofitting process
- Federal (FEMA) grants are important resources but challenging to navigate: pre-mitigation disaster grants are project-based and not structured for ongoing programmatic funding. Therefore, gaps may exist between funding cycles and construction delays.
- Private loans or self-financing is common
- Cities tend to prioritize residential buildings
- State-wide financial support: offering owners access to state-based funding increases the progression of seismic retrofits
- Demolition rates vary by locality: in California, there has been little evidence of any coordinated effort to prevent URM's from being demolished unless the building has historical significance. Improving access to financial assistance along with creating reasonable retrofit timelines may reduce the amount of URM's that are demolished
- Philanthropy and impact investing are limited
- Retrofits may promote other building upgrades: it is not uncommon for property owners to pursue other building system upgrades. Seismic retrofits alone do not generate immediate added economic value, it may be achieved through improvements to a building's aesthetics, functionality, energy efficiency or marketability.

References:

Department of Commerce. *Unreinforced Masonry Building Inventory*. State of Washington, 2019. website accessed on 9/4/2019

<<https://www.commerce.wa.gov/about-us/research-services/unreinforced-masonry-building-inventory/>>

Department of Commerce. Washington *Unreinforced Masonry Building Dashboard*. State of Washington, 2019. website accessed on 9/4/2019

<<https://fortress.wa.gov/com/urmasonry/urmasonry/#12/47.6150/-122.3329/>>

Department of Construction and Inspections, *Recommendations from the Unreinforced Masonry Policy Committee to the City of Seattle*. City of Seattle, 2017

<<http://www.seattle.gov/Documents/Departments/SDCI/Codes/ChangesToCodes/UnreinforcedMasonry/URMFinalRecommendations.pdf>>

National Development Council. *Funding URM Retrofits: Report to City of Seattle from National Development Council*. May 2019.

Policy Maturity: High & **In Progress**
Availability/Completeness of Information: High/Medium-High

Policy Title: Wellington Unreinforced-masonry (URM) Strengthening Programme

Jurisdiction/City: Wellington, New Zealand

Lead entity: Ministry of Business Innovation and Employment, New Zealand; Wellington City Council

Date of Policy Establishment: February 2017

Policy Goal: “Securing unreinforced masonry building parapets and facades”

Policy Objectives: **Mandatory retrofit** of street-facing URM building parapets and façades.

Risk Reduction Target: Buildings targeted were those with street facing parapets and facades on busy, high traffic streets, including historic buildings. Buildings on 29 streets will be affected.

Types of Buildings:

“URM building has masonry walls that do not contain steel, timber, fiber or other reinforcement. An unreinforced masonry wall resists gravity and lateral loads solely through the strength of the masonry materials.” Heritage buildings included. The listed streets on which targeted buildings are situated have some or all of the following characteristics: areas where people are concentrated (outdoor cafes, restaurants, bars, theaters, malls); public transport hubs or stops, or where people congregate for public transport; in central business areas or areas of high economic or social activity; arterial routes, state highways or key routes; areas of high foot traffic – for example waking routes to and from central or local public transport centers (e.g., Railway station and car parking buildings); routes likely to be used by emergency services, either in an emergency or because they are the only route to central services such as hospitals.

Occupancy/Use	Any
Ownership	Public & Private
Construction Type	URM

Trigger for Policy Development: November 14, 2016 Hurunui/Kaikōura earthquake, Wellington made an amendment to the Building Act of 2004 to address the risk to public safety from URM buildings in this area; 2011 Christchurch earthquakes.

Policy Implementation Timeline: 12 months from notice, 6 additional months with extension filed. Program ended in September 2018.

Approach/Criteria for prioritizing buildings: Priority given to streets that had high traffic or were important escape routes of the city in the event of an earthquake. Buildings with street-facing parapets and facades on busy, high traffic streets. Only buildings that were identified in this program are required to undertake work during this timeframe were eligible for funding.

Short History: Due to the increased risk of earthquakes following the Hurunui/Kaikōura earthquake on November 2016, the Ministry of Business Innovation & Employment set up an initiative to improve the seismic performance of unreinforced masonry buildings in high-risk areas, including Wellington. In February 2017, the Building Act of 2004 was amended to address risk of URM buildings. In March 2018, the Council was amended in response to practical constraints and the continued heightened risk. The original 12-month deadline for securing work remains in place for all building owners but those who have taken reasonable steps within that period, and complete the work within a further six months, have a defense against prosecution.

Type of Policies/Activities:

- Investigation of street-facing URM by City*
- Notification to Owner
- Mandatory Evaluation
- Mandatory Retrofitting

**Method of identification unknown for Wellington City*

Cost:(if found) Cost to owner [with URM fund applied] \$70,000 for 2 stories over 2 streets; \$150,000 for 3 stories over 2 streets.

Financial Support and Incentives: Council contributed a total of \$3 million to help Wellington building owners achieve the 12-18 month time frame. The fund contributed 50% of costs up to \$25,000 for buildings 1–2 stories, and 50% of costs up to \$65,000 for 3 or more stories. In December 2017, changes to the URM Buildings Securing Fund were made to allow applications for support towards the cost of the engineering assessment. Reimbursements towards these costs were made as soon as the assessment as soon as the assessment had been completed. If building is proven secure, with no remediation work required, you can apply for 50 percent of the engineering assessment costs up to a maximum of \$1,500. If a building is shown to require remediation work, building owners can apply for 50% of the engineering assessment costs before the securing work is complete, and this will be deducted from the maximum funding cap for the building. Funding is also provided to remove URM elements from non-heritage buildings and does not include the demolition of the entire building.

Wellington Unreinforced Masonry Strengthening Program

Retrofit Standards and Guidelines: Provided by the ministry of Business, Innovation and Employment. Building owners have options for a permanent solution, a temporary solution or strengthening the whole building. Permanent solutions use structural connections to secure parapet or façade; temporary solutions may include clamping, strapping or bolting the parapet. Removal of URM elements is afforded to non-heritage buildings. Heritage buildings guided by ICOMOS NZ charter (www.icomos.org.nz) with designated technical support at City. Temporary and permanent approaches of retrofit to achieve 34% of New Building Standard.

Non-compliance penalty: Territorial Authority can apply to the District Court for an order allowing them to carry out the work, at your cost; up to \$200,000 in fines.

Implementation Status: 113 notifications issued to street-facing URM building owners by City. 98 buildings remained on the URM list as of September 2017. Note that implementation period of law from (February 2017- March 2018).

*Current status URM retrofits unknown.

Lessons Learned (if any):

A more structured response by the City evolved from a “light touch” administrative approach in the middle of the duration of program. A customer approach focused ‘one-stop-shop’ cross organizational approach to processes with a more proactive culture by City is recommended. Case managers and involved city leadership transformed the program to have more buy-in and responsiveness by owners. Special consideration and funding options needed for apartment owners and small owners who may struggle to meet costs. Post-program independent review with interviews beneficial to any such rapid seismic strengthening initiative (see ‘Debrief Report’)

References:

Building (Earthquake-prone Buildings) Amendment Act 2016, website accessed on 7/25/2019 <<https://www.feelangstone.co.nz/blog/2018/2/9/a-closer-look-at-building-earthquake-prone-buildings-amendment-act-2016>>

Securing parapets and facades on unreinforced masonry buildings. Ministry of Business, Innovation and Employment <<https://www.building.govt.nz/assets/Uploads/building-code-compliance/b-stability/b1-structure/guidance-securing-parapets-facades.pdf>>

Unreinforced-masonry (URM) strengthening programme, website accessed on 8/16/2019 <<https://wellington.govt.nz/services/rates-and-property/earthquake-prone-buildings/unreinforced-masonry-buildings>>

Unreinforced Masonry Buildings Programme, Debrief Report to Wellington City Council, April 30 2019. <<https://wellington.govt.nz/~media/services/rates-and-property/earthquake-prone-buildings/files/urm/umr-debrief-final-report.pdf?la=en>>

Policy Maturity: High & **In Progress**
Availability/Completeness of Information: High/High

Policy Title: San Francisco Mandatory Soft-Story Retrofit Ordinance

Jurisdiction/City: San Francisco, California, US

Lead entity: City and County of San Francisco

Date of Policy Establishment: March 23, 2013

Policy Goal: "This legislation requires the retrofit for all San Francisco "multi-unit soft-story buildings."

Policy Objectives: **Mandatory screening & mandatory retrofit** of approximately 5,000 buildings required to participate in program.

Risk Reduction Target: To retrofit all San Francisco wood-frame structures, containing five or more residential units, having two or more stories over a "soft" or "weak" story, and permitted for construction prior to January 1, 1978.

Types of Buildings:

Wood frame construction (Type V) with application of permit for original construction was prior to January 1, 1978, and five or more residential units, and two or more stories over a basement or underfloor area that has any portion extending above grade, and soft story condition that has not been seismically strengthened to the standards set forth in the ordinance under *Engineering Criteria for Evaluation and Retrofits*.

Categorized by Risk Level as Below:

Tier I:

Occupancy/Use	Any building containing educational, assembly, or residential care facility uses
Ownership	Private & Public
Construction Type	Wood-frame

Tier II:

Occupancy/Use	Any building containing 15 or more dwelling units
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Ownership	Private & Public
Construction Type	Wood-frame

Tier III:

Occupancy/Use	Any building not falling within another tier
Ownership	Private & Public
Construction Type	Wood-frame

Tier IV:

Occupancy/Use	Any building containing ground floor commercial uses or any building in a mapped liquefaction zone.
Ownership	Private & Public
Construction Type	Wood-frame

Trigger for Policy Development: Loma Prieta earthquake in Bay Area responsible for 7,700 of 16,000 and 34,000 housing units rendered uninhabitable following the Northridge earthquake in Southern California.

Policy Implementation Timeline:

On September 15, 2013, the City issued notices to all wood frame buildings within the scope of the program. All building owners are, and still are, required to submit screening form and option evaluation forms by the following deadlines on September 15, 2014 (1 year after notice). Through the screening process, each building is assigned a tier. All buildings that are screened into the program are required to have permits for work by the below dates:

- Compliance Tier I: September 15, 2015 (2 years after notice)
- Compliance Tier II: September 15, 2016 (3 years after notice)
- Compliance Tier III: September 15, 2017 (4 years after notice)
- Compliance Tier IV: September 15, 2018 (5 years after notice)

The work must be completed in full with a Certificate of Final Completion (CFC) issued by the below dates:

- Compliance Tier I: September 15, 2017 (4 years after notice)
- Compliance Tier II: September 15, 2018 (5 years after notice)
- Compliance Tier III: September 15, 2019 (6 years after notice)

Compliance Tier IV: September 15, 2020 (7 years after notice)

Approach/Criteria for prioritizing buildings: Timeline for retrofit depends on use, occupant load/density, and ground hazard.

Short History: Given the moderate to high seismic risk in California, the Health and Safety Code of CA encourages jurisdictions to adopt seismic retrofit policies. The Association of Bay Area Governments (ABAG) estimates that soft-story residential buildings will be responsible for 66% of the uninhabitable housing following a seismic event on the Hayward fault. The Seismic Safety Commission recommended to the State Legislature that any mandatory mitigation programs adopted significantly reduce unacceptable hazards in buildings by 2020 and that soft-story residential buildings be addressed to reduce the seismic risk in this vulnerable building category.

Type of Policies/Activities:

- Notice by City
- Mandatory Screening by owner
- Mandatory Permit of Work
- Mandatory Retrofit

Cost:(if found) Approximately \$100,000 for soft-story buildings (USGS, 2018)

Financial Support and Incentives:

- Small business support from the Mayor's Office of Small Business to provide assistance for navigating retrofit process
- All work within the scope of the ordinance may be passed along at 100% from building owner to tenant. Tenants facing hardship may use the hardship appeal process for passthroughs. Tenants meeting Rent Board criteria may apply for an appeal based on financial hardship passed through rent increases resulting from the work.
- The City has partnered with AllianceNRG/Counterpointe Sustainable Real Estate to offer Property Assessed Clean Energy Financing (PACE) with provides terms up to 30 years, with fixed interest rates.
- A soft story finance workshop was held in 2013 to help owners with questions about financing their soft story upgrades.
- Retrofit fairs held annually in San Francisco help owners with various aspects of building retrofit procedures.

Retrofit Standards and Guidelines: 2015 International Existing Building Code Appendix A4 and additional requirements from San Francisco Department of Building Inspection; Technical guidelines by the Structural Engineers Association of Northern California; American Society of Civil Engineers (ASCE) 41-13 with San Francisco Department of Building Inspection specification of retrofit strength needing not exceed 1.3 times the strength of story above; FEMA P-807, *Seismic Evaluation and Retrofit of Multi-Unit Wood-Frame Buildings with Weak First Stories*.

Non-compliance penalty: Building upgrades that are not completed in the time required, apply for a permit in the time required and/or do not complete the screening process successfully are/will be in violation. These buildings are placarded with an “Earthquake Warning” placard noticing the building’s owner, tenants and the general public of the risk posed by the building.

Implementation Status: Currently, more than 5,000 buildings are required to participate in the program, amounting to 75% of the screened buildings. More than 1700 buildings have been filed for or been issued a permit and more than 700 owners have completed their retrofit required.

Lessons Learned (if any): Quality assurance of retrofit construction has varied among retrofits completed thus far, resulting in the Department of Building Inspection to begin requiring structural observation based on code official discretion. PACE financing was found to be administratively complex for owners and jurisdictions. Challenges included setting up this complex financing instrument which has heavy involvement of third parties, barriers to the transfer of a PACE-financed properties to a new owner. Owners may not need PACE financing if affordable regular market capital is available. Lenders may resist in allowing an addition lien. Technical clarification needed on mixed structural systems and cantilevered columns which are now under research with future intention of future affidavits from City to inform owners of technical changes.

References:

City of San Francisco, Soft Story Ordinance, website accessed on 8/16/2019 <<https://sfgov.org/esip/soft-story>>
United States Geological Survey. *Reported Investments in Earthquake Mitigation Top \$73 to \$80 Billion in the San Francisco Bay Area, California, Since the 1989 Loma Prieta Earthquake*, 2018.
San Francisco Mandatory Seismic Retrofit Ordinance, website accessed on 8/16/2019
<https://sfgov.org/esip/sites/default/files/FileCenter/Documents/10118-Legislation_Final.pdf>
Zepeda, D. et. al. *Suggested Improvements on Mandatory Wood ‘Soft Story’ Retrofits*. 2019 SEAOC Convention Proceedings, Squaw Creek, CA
Vulnerable Buildings Seismic Risk Assessment Study, City of Palo Alto, October 2017

Policy Maturity: Medium & **In Progress**
Availability/Completeness of Information: Medium/High

Policy Title: Berkeley Single-Family and Duplex Program

Jurisdiction/City: Berkeley, California, US

Lead entity: City of Berkeley

Date of Policy Establishment: July 1991

Policy Goal: “The Seismic Retrofit Refund program is available for all residential buildings for qualifying seismic work within one year of a property sale.”

Policy Objectives: **Voluntary retrofit** of wood-frame residential structures and mixed-use buildings with two or more residential units with incentives such as the Real Estate Transfer Tax.

Risk Reduction Target: Voluntary strengthening of qualifying vulnerable wood-frame residential buildings and mixed-use structures containing two or more dwelling units (duplexes).

Types of Buildings: Qualifying buildings are any structures that are used exclusively for residential purposes, or any mixed-use structures that contain two or more dwelling units. Owners of these buildings must comply with technical guidelines and administrative procedures to improve seismic safety. This includes one or more of the following actions:

1. Repairing or replacing foundations
2. Securing of chimneys or stacks
3. Removing of unreinforced masonry chimneys
4. Anchoring of existing water heaters
5. Cripple wall retrofit
6. Other work demonstrated to building official to increase substantially the capability of these structures to withstand damage in an earthquake.

Trigger for Policy Development: Loma Prieta Earthquake of 1989; Berkeley mandatory program for soft-story multi-unit buildings.

Policy Implementation Timeline: Since 1991, owners of qualifying buildings who complete retrofit work within one year of sale date can claim a rebate.

Berkeley Single-Family and Duplex Program

Approach/Criteria for prioritizing buildings: N/A

Short History: Since the 1991 Transfer Tax Ordinance was adopted, owners of eligible buildings that have undertaken voluntary retrofit within one year of sale can take advantage of the rebate two years before the time of sale through two years after the time of sale. Berkeley offered a rebate of up to one-third of the transfer tax amount for earthquake upgrades on homes. In 2007, the rebate limit changed to one-half percent of the structure's sale price.

Type of Policies/Activities:

- Obtaining Permit
- Voluntary Retrofit
- Completing Inspection (to qualify for rebate)

Cost:(if found) Approximate limit of up to \$10,000 per residence (USGS, 2018)

Financial Support and Incentives:

- Owners who complete voluntary retrofit work within one year of sale date can claim a dollar-for-dollar rebate of their property transfer tax up to one-half percent of the structure's sale price.
- Berkeley residents are eligible for rebates of up to \$3,000 from California's Residential Mitigation Program for making certain seismic improvements to their homes. The Earthquake Brace + Bolt (EBB) program is available to owner-occupied residential buildings containing 1-4 dwelling units.
- Property Assessed Clean Energy financing is available and allows property owners to borrow money to pay for seismic improvements and spread the cost of the upgrade over a period of time. Payments are made through a special assessment on the property tax bill as a long-term, fixed 100% financing and can be combined with rebates.
- Technical assistance is provided for seismic strengthening (see *Retrofit Standards and Guidelines*) below

Retrofit Standards and Guidelines:

- Repairing or replacing of foundations require prescriptive foundation requirements per California Building Code Chapter 18 or engineered plans;
- Securing of chimneys or stacks require engineered plans
- Removing of unreinforced masonry chimneys require plans for replacement work
- Anchoring of existing water heaters per the Department of State Architect Handout
- Cripple wall retrofit requires City-developed Plan Set A (if applicable) or engineered plans:
 - Plan Set "A" is applicable to one and two family dwellings or Appendix A3 (1-4 units) or A4 (5 or more units) of the California Existing Building Code

- OR, plans and calculations prepared by a California registered civil or structural engineer meeting one of the following:
 - a) retrofits must be designed to 75% of horizontal force levels as established by Chapter 16 of current California Building Code or b) 100% of the force levels established by Chapter 23 of the 1976 Uniform Building Code
- Guidelines for inspections following retrofit include information on the number and scope of inspections. Without inspections, an owner is not eligible for transfer tax rebate.

Non-compliance penalty: N/A

Implementation Status: About half of the single-family homes and one-third of the smaller rental buildings have claimed the credit. \$9 million have been distributed as tax rebates for seismic upgrades of single family homes from 2002 to 2014. Approximately 2,237 residences have received tax rebates for undertaking seismic strengthening. Approximately \$1 million per year has been distributed since the 1991 ordinance was adopted.

Lessons Learned (if any): Jurisdiction forgoes tax revenues through such a tax rebate program. Anecdotally in Berkeley, city officials had no easy way to assess the quality of work done. Some experts suspect that some of the funds went to incomplete or improperly done retrofits. This likely influenced the creation of seismic retrofit and inspection standards for the particular strengthening activity. However, this program in Berkeley was popular and influential in creating support for other earthquake policies.

References:

City of Berkeley, Guidelines for Transfer Tax Reductions for Qualifying Seismic Work, website accessed on 9/2/2019
<https://www.cityofberkeley.info/Planning_and_Development/Building_and_Safety/Transfer_Tax_Reductions_For_Qualifying_Seismic_Work.aspx>
City of Berkeley, Transfer Tax Rebate for Seismic Improvements brochure, website accessed on 9/2/2019
<[https://www.cityofberkeley.info/uploadedFiles/Planning_\(new_site_map_walk-through\)/Level_3_-_General/FlierTaxRebateV4b.pdf](https://www.cityofberkeley.info/uploadedFiles/Planning_(new_site_map_walk-through)/Level_3_-_General/FlierTaxRebateV4b.pdf)>
City of Berkeley, Retrofit Grants, website accessed on 9/2/2019
<<https://www.cityofberkeley.info/retrofitgrants/>>
Rutherford and Chekene. *Seismic Risk Assessment for City of Palo Alto*. October 2017
United States Geological Survey. Reported investments in earthquake mitigation in the San Francisco Bay Area since 1989. Appendix A. USGS, 2018.

Policy Maturity: Medium-Low & **In Progress**
Availability/Completeness of Information: High/High

Policy Title: Los Angeles Non-ductile Concrete Retrofit Program

Jurisdiction/City: Los Angeles, California, US

Lead entity: City of Los Angeles

Date of Policy Establishment: October 13, 2015

Policy Goal: “The purpose of the program is to reduce the risk of injury or loss of life that may result from the effects of earthquakes on non-ductile concrete buildings.”

Policy Objectives: **Mandatory screening, evaluation and retrofit** of approximately 1,500 existing reinforced concrete buildings.

Risk Reduction Target: To retrofit all reinforced concrete buildings permitted prior to January 13, 1977

Types of Buildings:

Building has concrete floors and/or roofs, either with or without beams, supported by concrete walls and/or concrete columns, and/or concrete frames with or without masonry infills, or any combination thereof and built pursuant to a permit application for a new building that was submitted to the Department before January 13, 1977. The program does not apply to detached single family dwellings or detached duplexes. Steel frame and concrete tilt up buildings are not included in this program.

Trigger for Policy Development: Poor performance of buildings and especially non-ductile concrete buildings in the Long Beach (1933), Sylmar (1971), Whittier Narrows (1987), and Northridge (1994), Mexico City (1985, 2017) and Christchurch earthquakes (2010-2011).

Policy Implementation Timeline:

Following the date an owner receives an Order to Comply notification, owners must:

- Submit completed checklist (assessment) along with supporting documents within 3 years.
- Submit one of the following within 10 years:
 - Proof that the building was previously retrofit to comply with LA Building Code retrofit code, or
 - Structural engineer’s report/analysis showing the building meets the requirements of retrofit compliance, or
 - Structural analysis and plans for alterations (retrofit) to meet the requirements of retrofit compliance, or
 - Plans to demolish the building.

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- Complete construction and obtain Certificate of Compliance within 25 years.

The property owner must notify the residential tenants of the building in writing prior to issuance of a building permit for the building retrofit. Owners may also be required to submit a tenant habitability plan if temporary relocation of tenants is required during retrofit.

Approach/Criteria for prioritizing buildings: Prioritization by use and structural system. All reinforced concrete buildings permitted for construction before January 13, 1977 included in the program. Program does not include detached single family dwellings or detached duplexes or Steel frame and concrete tilt up buildings.

Short History: The hazard associated with the San Andreas Fault has been recognized for decades, including the potential for the proverbial "Big One," generally assumed to be a San Andreas event of magnitude 8+. Hazards in the southern California region have been highlighted in recent years by the 1987 Whittier and especially the 1994 Northridge earthquakes. The latter M6.7 event claimed 57 lives and caused an estimated 20 billion dollars in property damage.

Type of Policies/Activities:

- Notice by City
- Mandatory Screening by Owner
- Mandatory Permit of Work
- Mandatory Retrofit

Cost:(if found) The estimated cost to retrofit these buildings is high, approximately \$10.00 to \$40.00 per square foot of total building area (MHP, 2015).

Financial Support and Incentives:

- Property Assessed Clean Energy financing is available and allows property owners to borrow money to pay for seismic improvements and spread the cost of the upgrade over a period of time. Payments are made through a special assessment on the property tax bill as a long-term, fixed 100% financing and can be combined with rebates.

Retrofit Standards and Guidelines:

- Proof of retrofit to Chapter 85 of Los Angeles Building Code
- Retrofit to either:
 - Requirements of Los Angeles Building Code seismic provisions, or
 - Meet or exceed the requirements for Basic Safety Objectives established by the Building Department and based on ASCE 41
- Qualified historical buildings comply with California Historical Building Code

Non-compliance penalty: An owner, lessor, sublessor or manager in control of a building within the program that does not meet program requirements is subject to prosecution and/or administrative enforcement.

Implementation Status:

As of September 2019:

- 1,376 (of approximately 1,500 buildings) Order to Comply notifications have been sent by city
 - 158 of these buildings have been exempted or previously retrofitted
- 79 buildings have completed the 3 year compliance checklist
- 34 buildings have submitted retrofit plans
- 1,218 buildings remain to comply with order of completion certificates.

Lessons Learned (if any): Information about the implementation and outcomes of these few programs is very limited. The City may require additional financial incentives and support for compliance at all tiers as evaluation and retrofit of non-ductile concrete buildings will be costly to owners. No information on cost-pass throughs to tenants have been specified which may be problematic because building lease rates, ease of financing, insurance premiums, and building values will be affected.

References:

City of Los Angeles, Non-ductile Concrete Retrofit Program, website accessed on 9/2/2019 <<https://www.ladbs.org/services/core-services/plan-check-permit/plan-check-permit-special-assistance/mandatory-retrofit-programs/non-ductile-concrete-retrofit-program>>

City of Los Angeles, Non-ductile concrete retrofit owner guide, website accessed on 9/2/2019

<<https://www.ladbs.org/docs/default-source/publications/misc-publications/non-ductile-concrete-retrofit-owner-guide.pdf?sfvrsn=8>>

MHP Structural Engineers. *Summary and Overview, City of Los Angeles Ordinance # 183893*

Rutherford and Chekene. *Seismic Risk Assessment for City of Palo Alto*. October 2017

Policy Maturity: High & **In Progress**
Availability/Completeness of Information: High/Medium

Policy Title: New Zealand Building (Earthquake-prone Buildings) Amendment Act, 2016

Jurisdiction/City: All, New Zealand

Lead entity: New Zealand Parliamentary Counsel Office

Date of Policy Establishment: May 13, 2016

Policy Goal: “A new national system for managing earthquake-prone buildings in New Zealand...The new system affects owners of earthquake-prone buildings, territorial authorities (local councils), engineers, other building professionals and building users.”

Policy Objectives: **Mandatory retrofit** of Earthquake-prone Buildings

Risk Reduction Target: Earthquake-prone Buildings strengthened to at least 34% of National Building Code or demolish.

Types of Buildings:

An earthquake prone building is one that is less than one-third of the current structural standard. If the building or part of the building were to collapse, the collapse would likely cause injury or death to persons in or near the building or on any other property or damage to any other property. “Buildings with less than one-third of the strength of a new building will have about 10 to 20 times the risk of serious damage or collapse when compared to a new building.” (mbie.govt.nz). Priority buildings are a subset of earthquake-prone buildings. Priority buildings are prescribed by the code and listed below. Residential buildings are excluded from this Act unless they are two or more stories high, and either contain three or more household units OR is a hostel, boardinghouse or other specialized accommodation. A building is characterized as high-priority based on federal definitions as well as territorial identification:

High-Priority Buildings in Medium or High Seismic Risk Zones^a

Buildings Supporting Emergency Services and Education:

Occupancy/Use	Hospital building that is likely to be needed in an emergency; emergency medical services OR ancillary services that are essential for the provision of emergency medical services; a building that is likely to be needed in an emergency for use as an emergency shelter or emergency center; a building that is used to provide emergency response services (for example, policing, fire ambulance, or rescue services); a building that is regularly occupied by at least 20 people and that is used as any of the following: a) an early childhood
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	education and care center b) a registered school or an integrated school c) a private training establishment d) a tertiary institution
Ownership	Public & Private
Construction Type	Any

Note: a) low, medium and high seismic risk areas are based on a *Z-Factor* which is a seismic hazard factor used to design new buildings, b) if only part of a building meets the criteria, only that part of the building is a priority building.

Buildings on High Traffic Routes:

Occupancy/Use	Any building that has unreinforced masonry elements that could fall in an earthquake onto a high traffic route thereby causing injury or loss of life is a priority building. High traffic routes are identified by Territorial Authority in consultation with the community.
Ownership	Public & Private
Construction Type	URM

Buildings on High Emergency Transport Routes:

Occupancy/Use	Any building that could fall in an earthquake on a emergency transport route and impede an emergency response is a priority building.
Ownership	Public & Private
Construction Type	Any

Trigger for Policy Development: National Earthquake-prone Buildings Act of 2004; Council has been actively strengthening Earthquake-prone buildings since the 1970's; November 14 2016 Hurunui/Kaikōura earthquake; 2011 Christchurch earthquakes.

Policy Implementation Timeline:

Identification of potentially earthquake-prone buildings Territorial Authority:

- Low Seismic Risk Area
 - o All buildings: 15 years
- Medium Seismic Risk Area
 - o Priority buildings: 5 years

- Other buildings: 10 years
- High Seismic Risk Area:
 - Priority buildings: 2.5 years
 - Other buildings: 5 years

Reporting on Identification Progress by Territorial Authority to Chief Executive:

- Low Seismic Risk Area: every 3 years
- Medium Seismic Risk Area: every 2 years
- Any district with a high Seismic Risk Area: every 1 year

Requesting Engineering Assessment of Owner by Territorial Authority:

- Due date for completion of assessment is 12 months after date of request/notice by Territorial Authority
- Application for extension grants an additional 12 months.

Completion of Seismic Retrofit Work by Owner:

- Low Seismic Risk Area
 - All buildings: 35 years
- Medium Seismic Risk Area
 - Priority Buildings: 12.5 years
 - Any other Building: 25 years
- High Seismic Risk Area
 - Priority Buildings: 7.5 years
 - Any other Building: 15 years

Note: Heritage buildings can have timeline extended by up to 10 years for completion of seismic work.

Approach/Criteria for prioritizing buildings:

In addition to priority buildings that are federally characterized (see *Type of Building*, above), a territorial authority with areas of medium or high risk:

- a) **Must** prioritize parts of unreinforced masonry buildings by using a special consultative procedure to identify any part of a public road, footpath, or other thoroughfare in an area of medium or high risk onto which parts of a URM building could fall and that has sufficient vehicle or pedestrian traffic to warrant prioritizing and remediation of the URM building or its part.
- b) **Use its discretion** to initiate prioritization of buildings that could impede a strategic transport route special consultative procedure.

Short History: The Earthquake-prone Buildings act of 2004 was amended in May 2016 when Parliament passed the Buildings (Earthquake-prone Buildings) Amendment Act, under which this Wellington policy falls.

Type of Policies/Activities:

- Identification of earthquake-prone buildings by Territorial Authority
- Public Disclosure of earthquake-prone buildings on a [public register](#) and on the building or part of building
- Notification to Owner
- Mandatory Assessment
- Mandatory Retrofitting

**Method of identification prescribed by Earthquake-building Prone methodology set by Chief Executive of Ministry.*

Cost:(if found): Unknown

Financial Support and Incentives: Unspecified within Legislation

Retrofit Standards and Guidelines: Provided by the ministry of Business, Innovation and Employment. Critical Structural Weaknesses should not be less than 34% of National Building Standards.

Non-compliance penalty: Territorial authority can proceed with assessment and seismic work with cost borne by building owner. Fines of up to \$200,000 for not completing seismic work.

Implementation Status: As of May 2019, more than 2,000 Earthquake-prone buildings are on the public register with most in Auckland, Wellington and Christchurch

Lessons Learned (if any): The Building Act of 2004 which asked to identify and address buildings considered to possess an unacceptable risk in an earthquake left local authorities to develop their own policies which led to inconsistent approaches across New Zealand. The 2016 amendment attempts to avoid a 'one size' fits all approach and focuses on geographic areas, buildings, and parts of buildings that pose the greatest risk. The key to successful implementation of new identifying processes of earthquake-prone buildings required improved guidance for structural engineers undertaking assessments of existing buildings, therefore, new guidelines were developed by engineering practitioners and academics specializing in seismic assessments.

References:

Building (Earthquake-prone Buildings) Amendment Act 2016, website accessed on 7/25/2019 <<https://www.feelangstone.co.nz/blog/2018/2/9/a-closer-look-at-building-earthquake-prone-buildings-amendment-act-2016>>

D. McGuigan et. al. The Continued Response of the New Zealand Government to the Canterbury Earthquakes. 16th World Conference on Earthquake Engineering, Santiago Chile, 2017.

Earthquake Prone Buildings – Priority Buildings, Ministry of Business, Innovation and Employment, New Zealand, website accessed on 8/16/2019

< <https://www.building.govt.nz/assets/Uploads/building-code-compliance/b-stability/b1-structure/epb-priority-buildings.pdf>>

EPB Methodology: The methodology to identify earthquake-prone buildings, Ministry of Business, Innovation and Employment, New Zealand, website accessed on 8/16/2019 < <https://www.building.govt.nz/assets/Uploads/building-code-compliance/b-stability/b1-structure/epb-priority-buildings.pdf>>

Managing Earthquake-Prone Buildings. Ministry of Business, Innovation and Employment, New Zealand, website accessed on 8/16/2019

<<https://www.building.govt.nz/managing-buildings/managing-earthquake-prone-buildings/>>

Policy Maturity: High & **In Progress**
Availability/Completeness of Information: High/Medium

Policy Title: Wellington Earthquake-prone Buildings (EBP) policy

Jurisdiction/City: Wellington, New Zealand

Lead entity: Ministry of Business Innovation and Employment, New Zealand; Wellington City Council

Date of Policy Establishment: July 1, 2017

Policy Goal: “The aim of this legislation is to introduce a nationally consistent approach to the assessment and management of earthquake-prone buildings, along with a standardized notice and national public register of earthquake-prone buildings. This new framework for addressing earthquake-prone buildings is the most comprehensive of any country in the world.”

Policy Objectives: **Mandatory retrofit** of Earthquake-prone Buildings

Risk Reduction Target: Earthquake-prone Buildings strengthened to at least 34% of National Building Code or demolish.

Types of Buildings:

An earthquake prone building is one that is less than one-third of the current structural standard. If the building or part of the building were to collapse, the collapse would likely cause injury or death to persons in or near the building or on any other property or damage to any other property. Priority buildings are a subset of earthquake-prone buildings. Priority levels are determined by a building’s importance level, which reflects the number of people at risk from the building, its value to the community and whether it has a post disaster function; its age and condition, relative to the code to which it was built or previously strengthened; critical structural weaknesses such as identified structural shortcoming, that renders it earthquake-prone. Residential buildings are excluded from this Act unless they are two or more stories high, and either contain three or more household units OR is a hostel, boardinghouse or other specialized accommodation. A building is characterized as high-priority based on federal definitions as well as territorial identification:

Buildings Supporting Emergency Services and Education:

Occupancy/Use	Hospital building that is likely to be needed in an emergency; emergency medical services OR ancillary services that are essential for the provision of emergency medical services; a building that is likely to be needed in an emergency for use as an emergency shelter or emergency center; a building that is used to provide emergency response services (for example, policing, fire ambulance, or rescue services); a building
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Berkeley Single-Family and Duplex Program

	that is regularly occupied by at least 20 people and that is used as any of the following: a) an early childhood education and care center b) a registered school or an integrated school c) a private training establishment d) a tertiary institution
Ownership	Public & Private
Construction Type	Any

Note: a) low, medium and high seismic risk areas are based on a *Z-Factor* which is a seismic hazard factor used to design new buildings, b) if only part of a building meets the criteria, only that part of the building is a priority building.

Buildings on High Traffic Routes:

Occupancy/Use	Any building that has unreinforced masonry elements that could fall in an earthquake onto a high traffic route thereby causing injury or loss of life is a priority building. High traffic routes are identified by Territorial Authority in consultation with the community.
Ownership	Public & Private
Construction Type	URM

Note: The current consultative process for determining High Traffic Routes is in progress.

Buildings on High Emergency Transport Routes:

Occupancy/Use	Any building that could fall in an earthquake on an emergency transport route and impede an emergency response is a priority building.
Ownership	Public & Private
Construction Type	Any

Note: The current consultative process for determining Emergency Transport Routes is in progress.

Trigger for Policy Development: National Earthquake-prone Buildings Act of 2004; Council has been actively strengthening Earthquake-prone buildings since the 1970's; November 14 2016 Hurunui/Kaikōura earthquake; 2011 Christchurch earthquakes.

Policy Implementation Timeline:

Identification and Notification by Wellington:

- Priority Buildings: by December 31, 2019 (2.5 years)
- All other EPBs: by June 30, 2022 (5 years)

Seismic Remediation by Owner

- Priority Buildings: by December 2024 (7.5 years)
- All other EPBs: June 30, 2032 (15 years)

Approach/Criteria for prioritizing buildings:

Priority buildings prescribed in Building Act of 2004

- Hospital buildings that are likely to be needed to provide emergency medical and ancillary services in an emergency;
- Buildings likely to be needed as an emergency shelter or an emergency center in an emergency; OR that enable emergency response services to carry out their jobs in an emergency;
- Buildings used for education purposes that are regularly occupied by at least 20 people.

Public consultative process for determining which routes are considered *High Traffic Routes* and *Emergency Transport Routes* on which URM buildings would fall into the category of Priority EPB.

Short History: The Earthquake-prone Buildings act of 2004 was amended in May 2016 when Parliament passed the Buildings (Earthquake-prone Buildings) Amendment Act, under which this Wellington policy falls. Many building owners in Wellington have already carried out earthquake strengthening or are working to a timeline to remediate their building (as per the URM parapet and façade ordinance, which runs in parallel to this Act). Therefore, the consultative process is important for owners to understand how identification of *High Traffic Routes* and *Emergency Transport Routes* will impact their remediation timelines.

Type of Policies/Activities:

- Identification of earthquake-prone buildings by City
- Public Disclosure of earthquake-prone buildings on a [public register](#) and on the building or part of building
- Notification to Owner
- Mandatory Assessment
- Mandatory Retrofitting

**Method of identification of priority buildings is currently in public consultative process and follows EPB Methodology.*

Cost:(if found). Unknown

Financial Support and Incentives:

Financial:

- If a building is unable to be occupied while it is being strengthened and not be able to generate revenue, the builder owner can apply for rates remission (reduction) for commercial, industrial and business sector, base sector targeted and downtown levy targeted rates.
- Rates remission is also offered for buildings removed from the earthquake-prone list for a period of 3 years. Longer terms for heritage buildings.
- Building consent fee rebate for buildings that have been strengthened and costs for strengthening are significant. The subsidy is 10% of the Wellington City charges up to a maximum of \$5,000 per consent for strengthening the building.
- Build Heritage Incentive Fund provides grants to help owners of earthquake-prone heritage buildings with repairs and maintenance.

Non-financial: Earthquake resilience team provides guidance for planning and discuss options with owners to relieve seismic issues; free seismic strengthening seminars.

Retrofit Standards and Guidelines: Provided by the ministry of Business, Innovation and Employment. Critical Structural Weaknesses should not be less than 34% of National Building Standards.

Non-compliance penalty: If owner does not submit engineering assessment or completes seismic strengthening, City can proceed with assessment and seismic work with cost borne by building owner. Fines of up to \$200,000 for not completing seismic work.

Implementation Status: As of October 2018: 5,320 buildings assessed; 1,027 identified as earthquake-prone building, 356 remediated with 666 Earthquake-prone buildings remaining. 333 buildings are priority buildings and 71 are heritage buildings impacted by reduced timeframe. The Act requires Wellington City Council to identify and notify all earthquake-prone priority buildings by 31 December 2019, and all remaining earthquake prone buildings by 30 June 2022.

Lessons Learned (if any):

Difficulties with getting engineering and other construction industry advice and resources; difficulties in financing remediation work with stricter deadlines; new timelines that will put pressure on residential owners, particularly retired peoples on fixed incomes; need for additional government/council support. private, non-commercial building owners require additional consideration for financing, as well as owners of apartment buildings who have found the URM parapet and façade ordinance and the prospect of retrofit due to building on a high traffic corridor to be prohibitive.

References:

Building (Earthquake-prone Buildings) Amendment Act 2016, website accessed on 7/25/2019 <<https://www.feelangstone.co.nz/blog/2018/2/9/a-closer-look-at-building-earthquake-prone-buildings-amendment-act-2016>>

"What does the new earthquake-prone buildings policy mean?" Wellington City Council, website accessed on 8/16/2019 <<https://wellington.govt.nz/services/rates-and-property/earthquake-prone-buildings/building-amendment-act-2016>>

Resilient Wellington, Date Unknown.

<<https://wellington.govt.nz/~media/services/rates-and-property/earthquake-prone-buildings/files/priority-buildings/priority-buildings-public-meeting.pdf?la=en>>

Policy Maturity: Medium-Low & **In-Progress**
Availability/Completeness of Information: Medium/Low

Policy Title: City of Santa Monica Retrofit Program

Jurisdiction/City: Santa Monica, California, US

Lead entity: City of Santa Monica

Date of Policy Establishment: March 2017

Policy Goal: “The goal of the mandatory Retrofit Program is to reduce structural deficiencies and improve the performance of vulnerable buildings during earthquakes. Without proper strengthening, these vulnerable buildings may be subjected to structural failure during and/or after an earthquake”

Policy Objectives: **Mandatory Retrofit** of nearly 2,000 commercial and multi-family residential buildings and **Voluntary Retrofit** of single-family wood-frame buildings.

Risk Reduction Target: To retrofit vulnerable Unreinforced Masonry, Concrete Tilt-Up, Wood-Frame Soft Story, Non-Ductile Concrete and Steel Moment Frame vulnerable building types to specific structural standards.

Types of Buildings:

- Unreinforced Masonry Buildings (URM) built before January 1, 1975
- Concrete or Reinforced Masonry Buildings with Flexible Diaphragms (Concrete Tilt-Ups) built before January 1, 1994
- Soft, Weak, Open Front Wall Buildings (Soft Story) Where the building was built under building code standards enacted before January 1, 1978, and where the ground floor portion of the structure contains parking or other similar open floor space and there exists more than one story
- Non-Ductile Concrete Buildings (Non-Ductile Concrete) where the building was built under building code standards enacted before January 13, 1977
- Welded Steel Moment Frame Buildings (Steel Moment Frame) where the building was built under building code standards enacted before December 1995
- Single-family wood-frame residential buildings with cripple walls built before 1960.

Building Priority Classification for Mandatory Retrofit with Approximate Number of Buildings in Each Category:

Priority 1:

Occupancy/Use	Any
Ownership	Private & Public
Construction Type	Unreinforced Masonry Buildings (approximately 100) and Concrete Tilt-Up Buildings (approximately 30)

Priority 2:

Occupancy/Use	Any
Ownership	Private & Public
Construction Type	Wood-frame, Soft-story buildings with 3 or more stories and less than 16 units (approximately 400)

Priority 3:

Occupancy/Use	Any
Ownership	Private & Public
Construction Type	Wood-frame, Soft-story buildings with 16 or more units (approximately 150)

Priority 4:

Occupancy/Use	Any
Ownership	Private & Public
Construction Type	Non-ductile concrete buildings(approximately 70) and Steel Moment Frame Buildings (approximately 80)

Priority 5:

Occupancy/Use	Any
Ownership	Private & Public
Construction Type	Wood-frame, 2-story Soft-story buildings with 7 to 15 units (approximately 350)

Priority 6:

Occupancy/Use	Any
Ownership	Private & Public
Construction Type	Wood-frame, Soft-story buildings with 6 or Less Units (approximately 800)

Trigger for Policy Development: 1994 Northridge Earthquake and 1989 California URM Law.

Policy Implementation Timeline:

- Priority 1: Unreinforced Masonry Buildings, Total time allowed for retrofit completion **2 years:**
 - Notifications Sent: August 28, 2017 (Year 0)
 - Evaluation Report Due: November 2017 (3 months)
 - Plans Submitted: February 2017 (6 months)
 - Retrofit Complete: August 2019 (2 years)
- Priority 1: Concrete Tilt Up, Total time allowed for retrofit completion **3 years:**
 - Notifications Sent: August 14, 2017 (Year 0)
 - Evaluation Report Due: December 2017 (4 months)
 - Plans Submitted: May 2018 (9 months)
 - Retrofit Complete: August 2020 (3 years)
- Priority 2: Wood-frame, Soft-story buildings with 3 or more stories and less than 16 units, Total time allowed for retrofit completion **6 years:**
 - Notifications Sent: September 25, 2017 (Year 0)
 - Evaluation Report Due: September 2019 (2 years)
 - Plans Submitted: September 2020 (3 years)
 - Retrofit Complete: September 2023 (6 years)
- Priority 3: Wood-frame, Soft-story buildings with 16 or more units, Total time allowed for retrofit completion **6 years:**
 - Notifications Sent: October 23, 2017 (Year 0)
 - Evaluation Report Due: October 2019 (2 years)

- Plans Submitted: October 2020 (3 years)
- Retrofit Complete: October 2023 (6 years)
- Priority 4: Non-ductile Concrete, Total time allowed for retrofit completion **10 years**:
 - Notifications Sent: October 23, 2017 (Year 0)
 - Evaluation Report Due: October 2020 (3 years)
 - Plans Submitted: April 2022 (4.5 years)
 - Retrofit Complete: October 2027 (10 years)
- Priority 4: Steel Moment Frame, Total time allowed for retrofit completion **20 years**:
 - Notifications Sent: October 23, 2017 (Year 0)
 - Evaluation Report Due: October 2020 (3 years)
 - Plans Submitted: April 2029 (12 years)
 - Retrofit Complete: October 2037 (20 years)
- Priority 5: Wood-frame Soft Story building with 2 stories and between 7-15 units, Total time allowed for retrofit completion **6 years**:
 - Notifications Sent: November 27, 2017 (Year 0)
 - Evaluation Report Due: November 2019 (2 years)
 - Plans Submitted: November 2020 (3 years)
 - Retrofit Complete: November 2023 (6 years)
- Priority 6: Wood-frame Soft Story building with 2 stories with 6 or less units, Total time allowed for retrofit completion **6 years** in 3 waves:
 - Wave 1 (350 buildings)
 - Notifications Sent: February 19, 2018 (Year 0)
 - Evaluation Report Due: February 2020 (2 years)
 - Plans Submitted: February 2021 (3 years)
 - Retrofit Complete: February 2024 (6 years)
 - Wave 2 (200 buildings)
 - Notifications Sent: May 7, 2018 (Year 0)
 - Evaluation Report Due: May 2020 (2 years)
 - Plans Submitted: May 2021 (3 years)
 - Retrofit Complete: May 2024 (6 years)
 - Wave 3 (250 buildings)
 - Notifications Sent: July 20, 2018 (Year 0)
 - Evaluation Report Due: July 2020 (2 years)
 - Plans Submitted: July 2021 (3 years)
 - Retrofit Complete: July 2024 (6 years)

Approach/Criteria for prioritizing buildings: Based on the construction type and age as well as occupant load.

Short History: In 1999, the Santa Monica City Council adopted an ordinance for the same 5 vulnerable building types (URM, Concrete Tilt-Up, Wood-Frame Soft Story, Non-Ductile Concrete and Steel Moment Frame) as a voluntary effort with no enforcement, therefore, insufficient progress was made. In 2017, this ordinance was updated to include mandatory retrofits. Staff has leveraged the work of Los Angeles and San Francisco in developing this ordinance. In 2018, the City enacted a simplified application process for soft-story building owners to encourage retrofit and compliance.

Type of Policies/Activities:

- City conducted URM inventory
- Notification to Owner
- Engineering Evaluation by Owner
- Mandatory Retrofit

Note: Building owner must notify tenants of vulnerable building status. The owner of any building may appeal any decision or order issued by the Building Official and must be filed within 60 days following order. City has 90 days to respond. Extensions may be granted by City for financial reasons or otherwise. Parking requirements may be reduced to the minimum extent necessary to achieve compliance with the Santa Monica Seismic Retrofit Laws. Trash screening and requirements may be waived to the minimum extent necessary by Public Works.

Cost:(if found) Officials estimate between \$5,000 to \$10,000 per unit for wood apartment building. The cost of concrete and steel buildings is estimated to be between \$50 to \$100 per square foot.

Financial Support and Incentives:

Property Assessed Clean Energy (PACE) program financing is an option for owners. The City, by joining a number of joint power of authorities (JPAs) has authorized seven separate PACE programs to operate within the City's boundaries. The California Seismic Safety Capital Access Loan Program (CalCAP) is also recommended by the City. CalCAP was established to assist small businesses and residential property owners with financing in the retrofit of existing qualified buildings. The City does not allow pass-through of retrofit cost via rent increases to tenants of rent-controlled properties.

Retrofit Standards and Guidelines:

Unreinforced Masonry Buildings: California Existing Building Code Appendix Chapter A1

Concrete Tilt-Up Buildings: International Existing Building Code Appendix Chapter A2

Soft-story Wood Frame Buildings: City of Los Angeles ASCE 7

Non-Ductile Concrete Buildings: City of Los Angeles ASCE 41

Steel Moment Frame Buildings: City of West Hollywood ASCE 41

Single-Family Wood-Frame Dwellings: California Existing Building Code Appendix Chapter A3

Non-compliance penalty: Notice sent to owner and case created with Code Enforcement.

Implementation Status: As of July 2019:

- Soft-Story Status: More than 1,000 soft-story buildings have not filed evaluation reports as of September 2019 deadline. 145 have undergone a structural analysis by a licensed professional, 60 have had permits issued and 21 have completed retrofits. 378 buildings have been taken off of the list.
- Unreinforced Masonry Building Status: 30 of 92 buildings have not submitted evaluation reports, with fifty cases closed. Nine are in plan check, two permits have been issued and one retrofit has been completed.
- Concrete Tilt-up Building Status: 13 of 31 buildings have complied evaluation reports, with four cases closed. Six are in plan check, permits have been issued and one retrofit has been completed.
- Steel-Moment Frame Building Status: 3 cases have been closed out of 77 of these buildings. There has been no activity on the remaining.
- Non-ductile Concrete Building Status: 15 cases have been closed out of 62 of these buildings. There has been no activity on the remaining.

Lessons Learned (if any): Limited information from the City on status and progress, however, given the low rate of compliance at first level deadlines due to low or lax enforcement, the mitigation process has been slow thus far. Santa Monica does not have a budget for the program which may also impact management. Lack of City-based financial support also impacts mitigation rates.

References:

Casuso, J. "Santa Monica Building Owners Slow to Comply with City's Retrofit Law as Fear of Major Earthquake Looms." Santa Monica Lookout, article date July 11, 2019, website accessed 9/5/2019 <https://www.surfsantamonica.com/ssm_site/the_lookout/news/News-2019/July-2019/07_11_2019_Santa_Monica_Building_Owners_Ignoring_Citys_Retrofit_Law%20.htmlf>

City of Santa Monica. "City Council Report: Study Session on Proposed Mandatory Seismic Retrofit Program.", Santa Monica City Council, December, 6 2016

City of Santa Monica. "Ordinance Number 2537: An Ordinance of the City Council of the City of Santa Monica Amending Articles IV and VIII of the Santa Monica Department of Construction and Inspections, *Recommendations from the Unreinforced Masonry Policy Committee to the City of Seattle*. City of Seattle, 2017 <<http://www.seattle.gov/Documents/Departments/SDCI/Codes/ChangesToCodes/UnreinforcedMasonry/URMFinalRecommendations.pdf>>

National Development Council. *Funding URM Retrofits: Report to City of Seattle from National Development Council*. May 2019.