Education/Information

Mitigation

1. Public information programs about building hazards and performance
2. Earthquake insurance education for renters and homeowners
3. Homeowner education, demonstration projects, and support for voluntary seismic upgrades
4. Training for contractors
5. Training for design professionals (architects and engineers)

Evaluation

Mitigation

6. Retrofit program for soft-story buildings
7. Retrofit program for older non-ductile concrete residential buildings
8. Evaluation of buildings retrofitted before 1994 or meeting non-conforming performance standards

Incentives

Mitigation

9. Develop funding sources to assist private property owners to pay for seismic upgrades
10. Identify Planning Code and other possible City agency incentives for seismic upgrades
11. Offer technical, permitting, and other assistance
12. Establish overlay zoning districts to help facilitate safe and smart new development
13. Establish a Transfer of Development Rights program to redirect development from high hazard areas to preferred, low hazard areas

Codes, regulations, and ordinances

Mitigation

14. Interpreting and enforcing current building code
15. Retrofit program for soft-story buildings
16. Retrofit of cripple wall homes
17. Retrofit program for older non-ductile concrete residential buildings
18. Retrofit of other building types found to be collapse hazards or otherwise not meeting established performance goals
19. Retrofit program for concrete tilt-up and similar buildings
20. Assign higher seismic importance factor to new large scale residential buildings.
21. Building façade maintenance
22. Trigger retrofits through major building upgrades
23. Enhance minimum design requirements for new small scale residential building foundations in liquefaction zones
24. Restrict use of significant structural irregularities in residential buildings
25. Enhance minimum requirements for non-structural anchorage and bracing of interior partition walls in residential buildings
26. Chimney repair/reconstruction

Response

27. Post-earthquake inspection policy and procedures (ATC-20)
28. Fire-related earthquake resilience

29. Disproportionate damage trigger code change and procedures

Recovery

30. Change codes to support rebuilding of multifamily and affordable housing
31. Revise local plans and development codes to allow temporary land uses to facilitate and expedite post-disaster recovery

Plans and Policies

Recovery

32. Shelter-in-place policies and procedures
33. Neighborhood support centers
34. Create a pre-disaster rebuild and recovery plan

Further Research

Mitigation

35. Repair and retrofit standards for one and two-unit buildings, three-plus unit buildings, and concrete buildings
36. Repair and retrofit standards for all other residential buildings, including steel frame buildings and unreinforced masonry buildings
37. Data collection of performance of retrofitted buildings to evaluate effectiveness of retrofits
38. Develop technical guidelines, standard plans and program to support voluntary seismic upgrades of one and two family dwellings
39. Evaluation criteria and standards for older concrete buildings and other “most hazardous to live” buildings
40. Evaluation and retrofit standards for all building types that conform to desired performance goals (set performance goals?)
41. Code development to update codes for new buildings to reflect desired performance goals and acceptable levels of confidence
42. Develop locally-specific seismic hazard maps

Recovery

43. Explore interim housing solutions that encourage residents to invest in the Bay Area’s recovery

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Adapting to Rising Tides

17. Develop and implement a soft story retrofit program

Develop voluntary of mandatory retrofit program(s) to address soft story housing in areas where it makes up a large percentage of a jurisdiction's housing stock (as a whole or for a specific vulnerable community). Pair programs with financing tools and incentives. Consider different incentives and financing tools for more vulnerable communities, such as low-income residents or renters. The program should consider how to handle compliance and enforcement standards, mechanisms for enacting the program, and which retrofit standards to use.

Lead			**Scale of Benefit**		
State	*Region*	**Local jurisdiction**	*Region*	*Community*	**Resident**
Target Development Type			**Hazard Addressed**		
Existing	*New*		**Ground Shaking**	*Liquefaction*	*Flooding*
Community Vulnerability Addressed				**Vulnerable Housing Type Addressed**			
Age	*Language & Ethnicity*	*Cost Burdened*	*Housing Tenure*	*Access to Resources*	*Single or Two Family*	*Multi-family*	*Cripple Wall*	**Soft story or House over garage**
Action Categories								
Evaluation	**Program/Operation**	**Plans and Policies**	**Codes, Regulations, and Ordinances**	*Coordination*	*Education/Outreach*			
Related Strategies								

Prerequisite Strategies:

- Strategy 17: Create a fragile housing inventory

Other Related Strategies:

- Strategy 19: Develop and implement a cripple wall retrofit program
- Strategy 20: Require hazard disclosure for renters
- Strategy 21: Ensure that major upgrades and repairs to existing buildings address seismic and flood-related hazards

Description

Soft story residential buildings are those that have large openings on the first flood, typically parking or commercial space, with residential units on the upper floors. Most were built prior to 1990. Ground shaking causes such structures to sway and may cause the ground story to collapse, damaging the floors above it as well. A soft-story collapse can have particularly disastrous consequences considering that they can crush cars and kill people occupying the open areas. ABAG modeling has shown that, in both a large earthquake on the Hayward or San Andreas faults, two-thirds of the uninhabitable housing units will likely be in soft-story residential buildings.

Considering the threat to public safety that soft story buildings pose, jurisdictions with high numbers of units in soft story buildings should consider developing a mandatory soft story retrofit program. This type of program generally includes several steps: 1) Developing an inventory of soft story buildings (see strategy XX, Create a fragile housing inventory); 2) Require building owners to have their buildings evaluated by an engineer to confirm their soft story condition; 3) Determine standards for retrofit to give guidance on how to strengthen a weak first story; 4) Develop and adopt a program that includes requirements for timing of the retrofit, which buildings are subject to requirements and at what time, protections for renters, and consequences for lack of compliance; and 5) Provide financing tools for owners to retrofit.

1. Develop an inventory of soft story buildings

Jurisdictions who have already completed Strategy 18: Create a fragile housing inventory, can decide if soft story buildings pose a significant threat to housing in their jurisdictions. Soft story housing was typically built prior to 1970 and is usually multifamily. Not all jurisdictions may have large numbers of soft story buildings. However, if a jurisdiction decides, based on their inventory, that a significant portion of their residents reside in this fragile housing type, a mandatory retrofit program will have significant impact. Furthermore, if a jurisdiction is already aware of a large inventory of soft story housing and has not yet completed the fragile housing inventory, it could conduct a more limited inventory focusing on the fragile housing types known to be present.

2. **Require building owners to have their buildings evaluated**

Initial fragile housing inventories typically rely on visual inspections of the outside of buildings by trained professionals to screen for certain characteristics that could indicate a fragile housing type. However, only an engineer can determine whether a structure is actually capable of withstanding the lateral accelerations we expect in a major earthquake. Building owners who have been flagged in an initial screening as possibly having soft story characteristics should be notified and required to submit engineering calculations to the jurisdiction within a particular time period that either prove that they do not have dangerous soft story conditions and are therefore exempt from the mandatory retrofit, or that they do have soft story conditions and are therefore subject to retrofit.

3. Determine standards for retrofit

Jurisdictions need to decide what level of retrofit is sufficient to fulfill the requirements of the retrofit program. Standards for retrofit increase the likelihood that all buildings will perform to a certain life safety level. Jurisdictions should choose from existing standards or develop their own and develop guidance for engineers to promote even application of the standards. There are several existing standards that address soft story retrofits, including the 2012 International Existing Building Code (IEBC) Appendix Chapter A4; ASCE 41-06; ASCE 41-13; and FEMA P-807 (see more information on each of these standards below in Examples).

4. **Develop and adopt a program**

Mandatory retrofit programs should be adopted by the jurisdiction as an ordinance that amends the local building code. Retrofit programs will reflect decisions on several criteria, including: which buildings will be addressed and when (for example, targeting high occupancy or critical occupancy buildings first, then smaller buildings at a later date); criteria for exemption from the program; timeline for compliance steps (first submitting engineering reports and plans, then completing the retrofit); consequences for noncompliance; and modifications or protections that need to be addressed for renters in buildings undergoing retrofit, including displacement and pass-through of retrofit costs.

5. **Provide financing tools for building owners**

Soft story retrofits typically cost anywhere from $2,000 to $10,000 per unit. In large, multi-unit buildings, retrofitting may be a significant cost. Jurisdictions need to decide if they will provide financing tools to building owners to assist with costs. Specific financing mechanisms are discussed below.

Governance/ Implementation issues:

This strategy will require the adoption of a soft story retrofit ordinance. Once adopted, building officials will have to be educated on the changes, and at least 0.5 FTE of city staff should be devoted to managing and implementing the program. Building owners who retrofit will need to obtain a permit from a building inspector confirming the retrofit was done in accordance with the adopted standard.

Some jurisdictions may have difficulty getting political buy-in to pass this program because of the costs imposed upon building owners. Tenants' rights groups may have concerns about burdens for low-income renters. Jurisdictions should provide several opportunities for the public, tenants' rights groups, building owners, and other stakeholders to provide feedback and ask questions.

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Potential Financing Mechanisms

Retrofits can be paid through many mechanisms. In the case of soft story retrofits, most building owners will take out home improvement loans. Some jurisdictions may choose to provide financial incentives, such as grants, rebates, or low-cost loans. One popular form of financing is similar to PACE, or Property assessed clean energy bonds, typically used for energy retrofit programs. These bonds provide funding to building owners which is paid back over a period of time through an annual assessment on their property tax bill. One advantage of this system is that the financing is tied to the property, not an individual. A more complete description of this process can be found in the examples below from the City of San Francisco.

Implementation Partner(s)

State	Region	Local
There are no state partners needed for this strategy.	Association of Bay Area Governments (ABAG) *ABAG could help coordinate regional standards for retrofit, ensuring that the expected performance of soft story buildings throughout the region is consistent. ABAG could also provide model language for ordinances adopted by local jurisdictions as well as guidance and best practices.*	*Jurisdictions should include local partners such as property managers and renters associations, as well as affordable housing advocates to ensure a transparent and equitable process in developing and adopting this policy.*

Example(s)

City of San Francisco

In 2013 San Francisco passed legislation that requires the evaluation and retrofit of "multi-unit soft-story buildings," defined as: 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.

San Francisco uses compliance tiers to determine the timeline for completing seismic retrofit work. Any building containing educational, assembly, or residential care facilities must be retrofitted first, followed by any building containing 15 or more dwelling units, any building not falling within another tier, and finally any building containing ground floor commercial uses or any building in a mapped liquefaction zone.

San Francisco is offering a PACE-modelled program through GreenFinanceSF for the retrofit of any soft story building.

- Earthquake Safety Implementation Program information page: http://sfdbi.org/mandatory-soft-story-program
- Department of Building Inspection information page: http://www.sfgsa.org/index.aspx?page=6048
- Public financing option information: http://sfgsa.org/index.aspx?page=6570

City of Oakland

The City of Oakland is taking steps to identify soft-story multi-unit buildings vulnerable to collapse in earthquakes. Past earthquakes have demonstrated that these buildings pose a safety risk to tenants and occupants, a financial risk to owners and risk the recovery of the City and region. In 2008 Oakland surveyed its multi-family buildings with five or more units and in 2009 Oakland passed an ordinance that required the owners of these buildings to complete a simple evaluation of the ground floor. The 2013 report documents the data collected thus far as a result of that ordinance and recommends next

steps the City and residents can take to reduce damage to multi-unit wood-frame soft-story buildings in an earthquake.

- Soft Story Screening information page: http://www2.oaklandnet.com/Government/o/PBN/OurOrganization/BuildingServices/o/Permits/DOWD008964
- ABAG Oakland Soft Story information page: http://resilience.abag.ca.gov/projects/oakland-soft-story/

City of Berkeley

The City of Berkeley has a mandatory soft story retrofit program, effective January 2014 that applies to wood frame buildings constructed prior to 1987. The program began with a mandatory Engineering Evaluation Report for all potential soft story buildings in 2005. Owners have until December 31, 2016 to apply for a building permit and must complete the retrofit work within two years of submitting their permit application. Currently there are no financial incentives associated with the program, though the program does allow for a "hardship exception" that allows for extra time to retrofit if building owners are unable to finance a retrofit.

- Soft story information page: http://www.cityofberkeley.info/Planning_and_Development/Building_and_Safety/Soft_Story_Program.aspx