Concrete Building Safety Program

City and County of San Francisco
Code Advisory Committee
May 8, 2024

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Refresher: Concrete Building Safety Program

Program Goal: Identify, evaluate, and retrofit the most vulnerable concrete buildings to protect against major structural failure.

Context

This program is part of the Earthquake Safety Implementation Program, the City's 30-year, 50-task strategy to improve seismic safety of buildings.

Building types affected

Concrete Tilt-up
(technical term: rigid-wall-flexible-diaphragm)

Non-Ductile Concrete

Who is involved

Project team

- SF Office of Resilience and Capital Planning
- SF Department of Building Inspection
- Applied Technology Council
- Civicmakers

Stakeholder Working Group

Executive Panel

Refresher: Concrete Building Safety Program

Damage to CTV building following Christchurch earthquake. Source: 1 NEWS

Non-Ductile Concrete

- Typically housing, industrial, commercial, and offices
- Retrofit can be complicated and expensive

1994 Northridge (*EERI in FEMA P-1026*)

Concrete Tilt-up (aka Rigid-wall-flexible-diaphragm)

- Typically grocery stores, warehouses, auto-body shops
- Retrofit more straightforward

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Stakeholder Working Group

- Stakeholder working group met 8 times between September 2022-October 2023
- Included representatives of: residential and commercial building owners, tenants, businesses, technical and policy experts, city and county staff
- Stakeholder working group developed 9 recommendations to the City about the development of this program, summarized in report released April 2024

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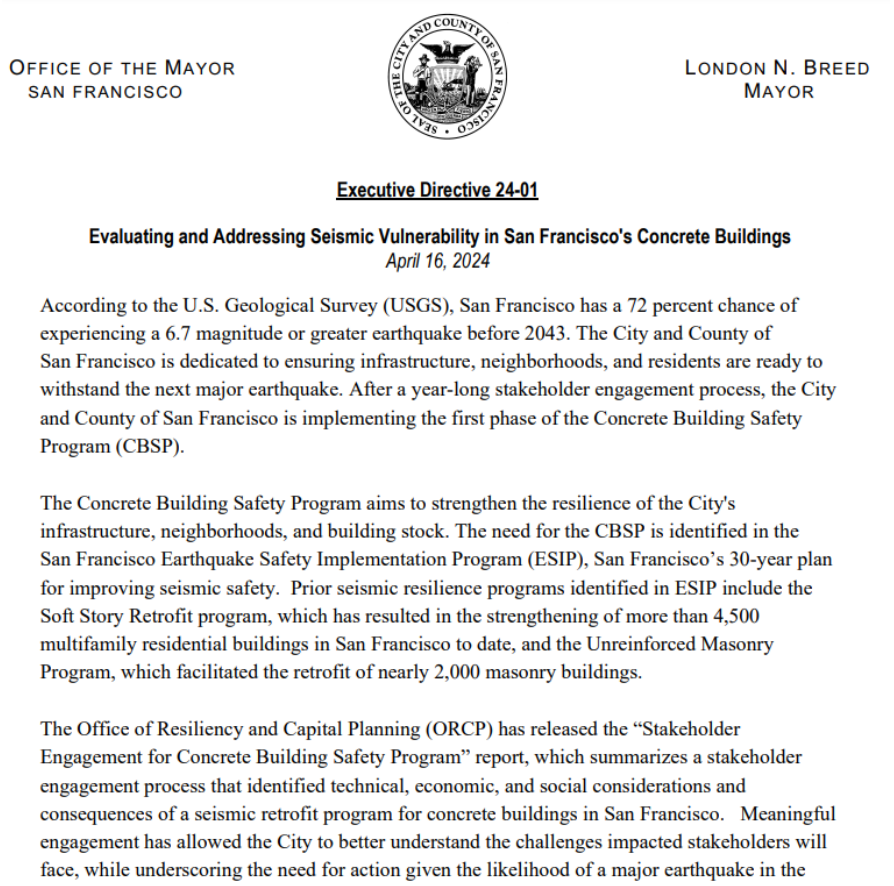
Executive Directive 24-01



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SAN FRANCISCO

LONDON N. BREED
MAYOR

Executive Directive 24-01

Evaluating and Addressing Seismic Vulnerability in San Francisco's Concrete Buildings
April 16, 2024

According to the U.S. Geological Survey (USGS), San Francisco has a 72 percent chance of experiencing a 6.7 magnitude or greater earthquake before 2043. The City and County of San Francisco is dedicated to ensuring infrastructure, neighborhoods, and residents are ready to withstand the next major earthquake. After a year-long stakeholder engagement process, the City and County of San Francisco is implementing the first phase of the Concrete Building Safety Program (CBSP).

The Concrete Building Safety Program aims to strengthen the resilience of the City's infrastructure, neighborhoods, and building stock. The need for the CBSP is identified in the San Francisco Earthquake Safety Implementation Program (ESIP), San Francisco's 30-year plan for improving seismic safety. Prior seismic resilience programs identified in ESIP include the Soft Story Retrofit program, which has resulted in the strengthening of more than 4,500 multifamily residential buildings in San Francisco to date, and the Unreinforced Masonry Program, which facilitated the retrofit of nearly 2,000 masonry buildings.

The Office of Resiliency and Capital Planning (ORCP) has released the "Stakeholder Engagement for Concrete Building Safety Program" report, which summarizes a stakeholder engagement process that identified technical, economic, and social considerations and consequences of a seismic retrofit program for concrete buildings in San Francisco. Meaningful engagement has allowed the City to better understand the challenges impacted stakeholders will face, while underscoring the need for action given the likelihood of a major earthquake in the

As a first step, Mayor Breed directed staff to complete the following:

- Draft legislation mandating completion of screening checklist
- Publish retrofit standards in SFEBC

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Earthquake Awareness Focuses The City On Buildings And Networks

April 16, 2024

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Apr 17, 2024 - News

San Francisco wants to seismically retrofit some concrete buildings

Megan Rose Dickey

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SF targets more than 3,000 concrete buildings for seismic retrofits

Mayor Breed issues directive to find and fix them before the next major earthquake

San Francisco Chronicle e-Edition Account

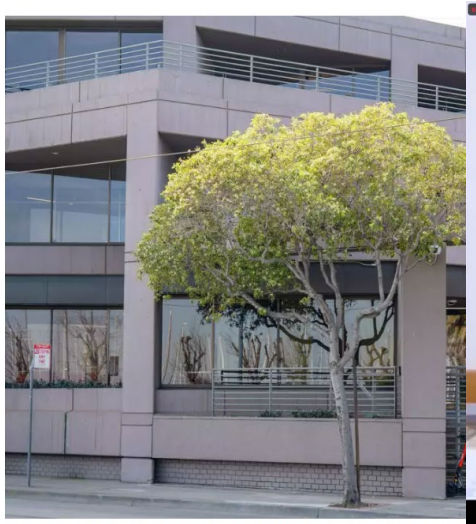
BAY AREA // SAN FRANCISCO

One type of S.F. building is especially at risk in earthquakes. The city is launching an effort to find them

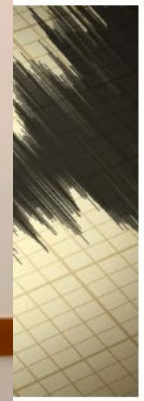
By Megan Fan Munce

Updated April 16, 2024 9:04 a.m.

Gift Article



Seismic upgrades have been completed on this San Francisco building, seen in 2023. The city is creating



vill hit, San Francisco city officials are working to seismically retrofit the

San Francisco Examiner

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SPOTLIGHT

SF Mayor wants to protect concrete buildings from major earthquake damage

By James Salazar | Examiner staff writer | Apr 16, 2024 Updated Apr 17, 2024

SF ture

Screening Phase

- **Goal**:
  - Improve inventories of concrete and tilt-up buildings
  - Give owners who are incorrectly included on the published inventory an opportunity to remove themselves
- **Process**:
  - Owner hires licensed engineer to complete and submit short checklist to specify building composition.
  - DBI reviews submitted checklists, tracks compliance

Publish Retrofit Standards

- **Goal**: Publish technical retrofit criteria in the building code to support “early adopters” and provide a pathway to owners who choose to retrofit
  - We expect that this retrofit criteria will be pointed to by the Adaptive Reuse Housing Information Sheet

Review of technical criteria

Technical Peer Review by SEAONC Existing Building Committee:

- Participants:
  - Robert Kraus, SE (EBC Chair, stakeholder working group member)
  - Keith Palmer, SE, PhD (EBC past-Chair, concrete inventory studies)
  - Wayne Low, SE (SEAONC incoming President)
  - Jonathan Buckalew, SE (Soft-story ordinance)
  - Duke Crestfield, SE (Concrete studies, stakeholder working group)
- ~8 hours of meetings over 3 months + written technical feedback on retrofit criteria

Stakeholder Working Group:

- Discussed and provided non-technical input on retrofit criteria

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Tilt-up Recommended Criteria

(Rigid-wall-flexible-diaphragm)

Retrofit Criteria

CEBC* Appendix A2: 75% of code, safety-based

- Scope includes wall anchorage system only
- Scope excludes other structural, nonstructural deficiencies
- Allowed alternative: ASCE 41** w/ similar limited scope

***CEBC**: California Existing Building Code*

***ASCE 41**: National standard for seismic evaluation and retrofit*

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Non-Ductile Concrete Recommended Criteria

Retrofit Criteria
Option (a) Structural Collapse Prevention at the BSE-1E* level (225-year earthquake motions), AND address specific deficiencies (next slide)
Option (b) Comply with Section 304.4.3 Collapse Prevention at the BSE-2E** level—975 year motions (Same requirements as SFEBC*** triggered retrofit, such as from non-structural alterations on 2/3 of floors)

**BSE-1E* = Basic Safety Earthquake-1 for use with the Basic Performance Objective for Existing Buildings, taken as a seismic hazard with a 20 percent probability of exceedance in 50 years*

***BSE-2E* = Basic Safety Earthquake-2 for use with the Basic Performance Objective for Existing Buildings, taken as a seismic hazard with a 5 percent probability of exceedance in 50 years*

****SFEBC* = San Francisco Existing Building Code*

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Compliance Option (a)

Collapse prevention in 225-year (BSE-1E) earthquake motions,
AND show that the following deficiencies do not exist or address them by retrofitting:

Deficiency	Criteria for Identifying	How to address
Weak Story	ASCE 7 irregularity table	Retrofit to eliminate deficiency or use Option (b)
Discontinuous elements	ASCE 7 irregularity table	Retrofit to eliminate deficient or use Option (b)
Moment frame	Seismic system definition	Retrofit to meet selected requirements of ACI concrete code
Slab punching shear at columns	Lacks floor beams and integrity reinforcement	Retrofit for punching shear (e.g. column collar).
Shear governed columns or wall piers	ACI code requirements	Retrofit with shear strengthening (e.g. FRP) or supplemental supports, or show existing supplemental load path or moderate stress in wall piers.
Inadequate bearing supports for beams or slabs	ACI code requirements	Retrofit to increase bearing length
Flexible floor or roof diaphragms	Flexible diaphragm definition	Attachment of diaphragm to wall for Appendix A2 forces

Next steps

Next Steps:

- Draft legislation for screening ordinance
- Draft code language and legislation for publishing technical criteria

Thank you

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