In the chat, please share your **name**, **organization**, and your **role or title**.
Welcome!
Concrete Building Safety Program

Identify, evaluate, and retrofit the most vulnerable concrete buildings to protect against major structural failure, for the safety of the population and in support of the City’s seismic resilience goals.
Working Group Role

- Help the City understand the concerns of stakeholders, including from vulnerable communities
- Provide useful recommendations for program policy and design that support programmatic goals
- Help ensure program products have a high level of usability among the general public
- Support the program at public meetings or participate in other forms of community education and outreach
Why these topics now; what we have heard from stakeholders so far

Tilt-ups:
• Important for life safety and functioning of the city
• High benefit per dollar spent on retrofit
• Other jurisdictions have enacted concrete tilt-up ordinances

Building information reporting:
• Ideal to have retrofit requirements determined before sending out screening form (from another city)
• Stakeholders recommended potential tiering criteria
Today's Meeting
Today's Agenda

- **Tilt-Up Buildings**
  - Topic Presentation (15 min)
  - Working Group Discussion (30 min)

- **Building Information Reporting**
  - Topic Presentation (15 min)
  - Working Group Discussion (30 min)
Today's Objectives

• All about **idea generation**, not necessarily consensus

• **Surface all ideas** from the group, let’s get it all out on the table

• Let us know **why** you feel, think the way you do

• Reminder: we **discuss with the info we have today**, we can/will revisit topics if/when new info becomes available
Working Group Agreements

- Start and end on time
- Respect the opinions of others
- One person speaks at a time
- Participate (be here now, as much as possible)
- Open and honest communication (as you feel comfortable providing)
- Give space – Take space
- Default is to be on video
Topic #1: Tilt-Up Buildings
We use “tilt-up” in this presentation as shorthand for the engineering term Rigid-Wall Flexible-Diaphragm buildings
Rigid Wall Flexible Diaphragm (RWFD) buildings ("tilt-up")
Walls are concrete or masonry (concrete block).
Roof diaphragm is plywood or un-topped metal deck.

1994 Northridge (EERI in FEMA P-1026)
1992 Landers (CSSC in Lawson, 2017)
Building type: Non-ductile concrete  (Focus of subsequent meeting)
## Building types

<table>
<thead>
<tr>
<th></th>
<th>Tilt-up (RWFD)</th>
<th>Non-ductile concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key vulnerabilities</strong></td>
<td>Roof-to-wall connections</td>
<td>Numerous: Column shear, punching shear, story mechanism, wall shear…</td>
</tr>
<tr>
<td><strong>Average cost to retrofit</strong></td>
<td>$ Tens per sf</td>
<td>$Hundreds per sf</td>
</tr>
<tr>
<td><strong>Access to do retrofit work</strong></td>
<td>Typically good</td>
<td>Typically poor</td>
</tr>
<tr>
<td><strong>Retrofit while occupied</strong></td>
<td>Typically yes</td>
<td>Typically no</td>
</tr>
<tr>
<td><strong>Code years of interest</strong></td>
<td>1991 UBC, 1997 UBC</td>
<td>1976 UBC, 1997 UBC</td>
</tr>
<tr>
<td><strong>Typical uses in SF</strong></td>
<td>Industrial, retail, grocery</td>
<td>Residential, office, public</td>
</tr>
<tr>
<td><strong>Number in SF</strong></td>
<td>700?</td>
<td>4000?</td>
</tr>
<tr>
<td><strong>Average floor area</strong></td>
<td></td>
<td>50,000 sf</td>
</tr>
<tr>
<td><strong>Ease to identify</strong></td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Variability of performance</strong></td>
<td>Moderate</td>
<td>High</td>
</tr>
</tbody>
</table>

*(today)* *(subsequent meetings)*
Tilt-up retrofitting
Tilt-up retrofitting: improve connection of walls to roof

(FEMA 547)

City of Berkeley
Two key points for a retrofit ordinance

- What buildings are IN the program?
- What retrofit standard?
Tilt-up buildings in the program
Breakout Room Discussion Questions

Are some Tilt-up buildings more important to protect in earthquakes?

Should some Tilt-up buildings be retrofitted to a higher standard?

What criteria should the City use to distinguish important Tilt-up buildings?
Requirements for wall-to-roof connection

Koliou et al., 2017
Possible criteria for what tilt-up buildings are IN in the program

- Retrofit or show compliant
- Depends on use?
- Exempt

- Roof area:
  - (larger)
  - (smaller)

- Year of original construction:
  - (older)
  - (newer)
From RWFD database for a portion of the City (PDR zones)

RWFD buildings by age (PDR zones)

- Unknown: 10%
- Pre-1980: 60%
- 1980-1992: 20%
- 1992-1999: 10%
- Post-1999: 0%
From RWFD database for a portion of the City (PDR zones)

RWFD buildings by roof area (PDR zones)

Buildings in this sample

Roof area (sf)

< 3000 3,000-10,000 10,000-20,000 > 20,000
Tilt-up retrofit scope
Possible levels of retrofit scope

Option 1 – Minimum for safety
- SF Existing Building Code Appendix A2
- Roof-to-wall connections + cross-ties (75% of current code)

Option 2 – Possible higher standard
- Design for 100% of current code instead of 75%
- Address hazardous non-structural components: light fixtures, ceiling grids, storage racks.
Grocery stores

This one is not a tilt-up.
2019 Ridgecrest Earthquake
2019 Ridgecrest Earthquake
Tilt-up Buildings Discussion
Breakout Room Discussion Questions

Are some Tilt-up buildings more important to protect in earthquakes?

Should some Tilt-up buildings be retrofitted to a higher standard?

What criteria should the City use to distinguish important Tilt-up buildings?
Report Out

Key Takeaways from each Breakout Room
5-Minute Break
Stages and schedule of a retrofit program
Breakout Room Discussion Questions

What is a reasonable deadline for owners to complete the form?

How should the City define schedule categories (tiers)?
Stages of retrofit program

1. Ordinance enacted
2. Submit form
   - Exempt buildings are finished. Non-exempt buildings are assigned to a Schedule Category.
3. Submit seismic evaluation or “intent to retrofit”
   - Buildings for which evaluation demonstrates compliance are finished (pending review and approval by DBI). Other buildings proceed to retrofit.
4. Permit application for retrofit
5. Construction
   - Complete retrofit construction
Schedule for compliance

Separate buildings into “Schedule Categories” for complying with requirements. A few potential objectives are to:

• Spread out the review work for SFDBI
• Spread out the demand for engineering and construction work
• Complete “low hanging fruit” first

*Note: We will ask you for your thoughts on how to define Schedule Categories in a few minutes.*
## Example Schedule Categories for compliance

### Tilt-up

<table>
<thead>
<tr>
<th>Schedule Category</th>
<th>Buildings included</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Buildings for which the last digit of the parcel number is odd.</td>
</tr>
<tr>
<td>2</td>
<td>Buildings for which the last digit of the parcel number is even.</td>
</tr>
</tbody>
</table>

### Concrete

<table>
<thead>
<tr>
<th>Schedule Category</th>
<th>Buildings included</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-residential-Soils D,E,F</td>
</tr>
<tr>
<td>2</td>
<td>Non-residential-Soils A,B,C</td>
</tr>
<tr>
<td>3</td>
<td>Residential-Soils D,E,F</td>
</tr>
<tr>
<td>4</td>
<td>Residential-Soils A,B,C.</td>
</tr>
</tbody>
</table>
Site Class

California Geological Survey (CGS):
https://maps.conservation.ca.gov/cgs/DataViewer/index.html
Example timeline for compliance

Note: This is an example timeline. The timeline for this program has not yet been determined.

Non-ductile concrete
- Schedule Category 1
- Schedule Category 2
- Schedule Category 3
- Schedule Category 4
- Exempt

Tilt-up
- Schedule Category 1
- Schedule Category 2
- Exempt

Years after effective date of ordinance

Effective date of ordinance
Submit data form
Submit seismic evaluation or “intent to retrofit”
Submit permit application for retrofit
Complete retrofit construction
### Examples from other ordinances

<table>
<thead>
<tr>
<th>Compliance Tier</th>
<th>Buildings included</th>
<th>Screening due</th>
<th>Permit due</th>
<th>Constr. complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>Group A, E, R-2.1, R-3.1, R-4 occupancy</td>
<td>1 year</td>
<td>2 years</td>
<td>4 years</td>
</tr>
<tr>
<td>Tier II</td>
<td>15 or more dwelling units, except Tier I or IV</td>
<td>1 year</td>
<td>3 years</td>
<td>5 years</td>
</tr>
<tr>
<td>Tier III</td>
<td>Buildings not in other tiers</td>
<td>1 year</td>
<td>4 years</td>
<td>6 years</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Group B or M occupancy 1st Story or liquefaction</td>
<td>1 year</td>
<td>5 years</td>
<td>7 years</td>
</tr>
</tbody>
</table>

* Due dates are measured from 90 days after the operative date of SFEBC Chapter 5E
Examples from other ordinances

<table>
<thead>
<tr>
<th>Compliance Tier</th>
<th>Buildings included</th>
<th>Inspection report due date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Constructed prior to 1910</td>
<td>2021</td>
</tr>
<tr>
<td>2</td>
<td>1910 to 1925</td>
<td>2023</td>
</tr>
<tr>
<td>3</td>
<td>1926 to 1970</td>
<td>2025</td>
</tr>
<tr>
<td>4</td>
<td>after 1970</td>
<td>2027</td>
</tr>
</tbody>
</table>
Topic #2: Building Information Reporting
Building information reporting

About the form:

• Requires an engineer (PE or SE) to complete.
• Engineering cost to complete the form is on the order of $275-$2,500 (tilt-up), $475-$3,200 (concrete).
• No calculations are required.

What information is collected in the form:

• Information about building size (e.g. stories, floor area) and age
• Information about building use
• Descriptions of the structural system (building type, gravity system, lateral system).
• Previous seismic retrofit
• Structural elements that may be indicators of critical seismic deficiencies
• Whether existing drawings or seismic reports are known to exist
• Requires uploading relevant existing drawings or reports if they are not already in SFDBI archives
Objectives of building information reporting

<table>
<thead>
<tr>
<th>Objective</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;In&quot; vs. Exempt</td>
<td>Form must be sent out after program requirements are determined to accomplish this</td>
</tr>
<tr>
<td>Assign to Schedule Categories</td>
<td>&lt;- Discussing this today</td>
</tr>
<tr>
<td>Improve the City's database</td>
<td></td>
</tr>
<tr>
<td>Begin engagement with an engineer</td>
<td></td>
</tr>
</tbody>
</table>
Building Info Reporting Discussion
Breakout Room Discussion Questions

What is a reasonable deadline for owners to complete the form?

How should the City define schedule categories (tiers)?
Wrap Up & Next Steps
Next steps

- We will compile your comments into a **Summary Memo**.
- We will use this memo to create a **Draft Tilt-up Program** and continue working on the **Building Information Reporting Form**.
- We will **share back** the Draft Tilt-up Program for your review and comments at Meeting #4.

Please share any feedback or thoughts about the working group structure and format with me: laurel.mathews@sfgov.org
Thank you!

Working Group Meeting #2

November 16, 2022

ONESF
Building Our Future