

# Concrete Building Safety Program

## Working Group Meeting #2

*November 16, 2022*

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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

# Concrete Building Tour





# 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

# Tilt-up buildings



Bonowitz



Bonowitz

\* 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

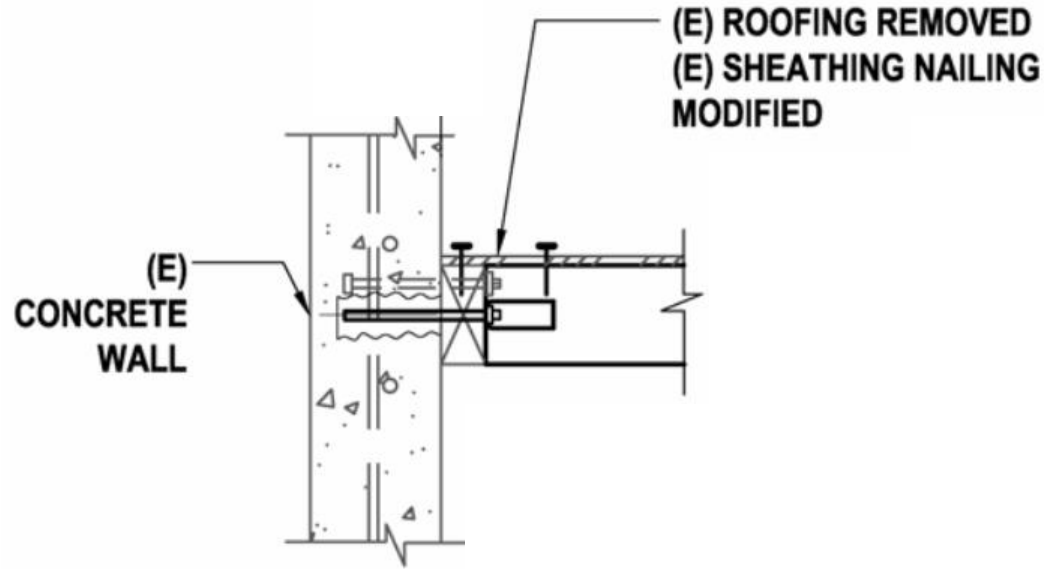
	(today)	(subsequent meetings)
	Tilt-up (RWFD)	Non-ductile concrete
Key vulnerabilities	Roof-to-wall connections	Numerous: Column shear, punching shear, story mechanism, wall shear...
Average cost to retrofit	\$ Tens per sf	\$ Hundreds per sf
Access to do retrofit work	Typically good	Typically poor
Retrofit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



# 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?

## CHAPTER A2

### EARTHQUAKE HAZARD REDUCTION IN EXISTING REINFORCED CONCRETE AND REINFORCED MASONRY WALL BUILDINGS WITH FLEXIBLE DIAPHRAGMS

#### SECTION A201 PURPOSE

[BS] A201.1 **Purpose.** The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury as a result of the effects of earthquakes on reinforced concrete and reinforced masonry wall buildings with flexible diaphragms. Based on past earthquakes, these buildings have been categorized as being potentially hazardous and prone to significant damage, including possible collapse in a moderate to major earthquake. The provisions of this chapter are minimum standards for structural seismic resistance established primarily to reduce the risk of life loss or injury on both subject and adjacent properties. These provisions will not necessarily prevent loss of life or injury, or prevent earthquake damage to an existing building that complies with these standards.

#### SECTION A202 SCOPE

[BS] A202.1 **Scope.** The provisions of this chapter shall apply to wall anchorage systems that resist out-of-plane

#### SECTION A205 GENERAL REQUIREMENTS

[BS] A205.1 **General.** The seismic-resisting elements specified in this chapter shall comply with provisions of Section 1613 of the *California Building Code*, except as modified herein.

[BS] A205.2 **Alterations and repairs.** Alterations and repairs required to meet the provisions of this chapter shall comply with applicable structural requirements of the building code unless specifically modified in this chapter.

[BS] A205.3 **Requirements for plans.** The plans shall accurately reflect the results of the engineering investigation and design and shall show all pertinent dimensions and sizes for plan review and construction. The following shall be provided:

1. Floor plans and roof plans shall show existing framing construction, diaphragm construction, proposed wall anchors, cross-ties and collectors. Existing nailing, anchors, cross-ties and collectors shall be shown on the plans if they are considered part of the lateral force-resisting systems.



Tilt-up buildings in the program

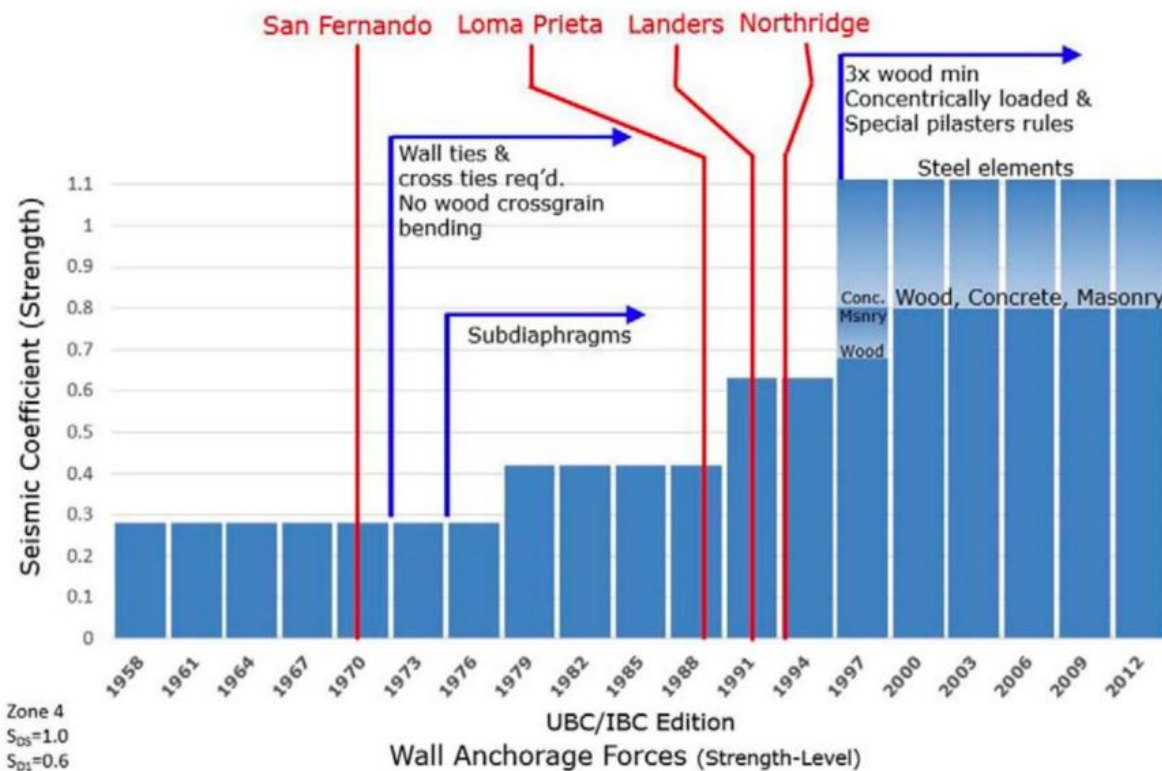
## Breakout Room Discussion Questions

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

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

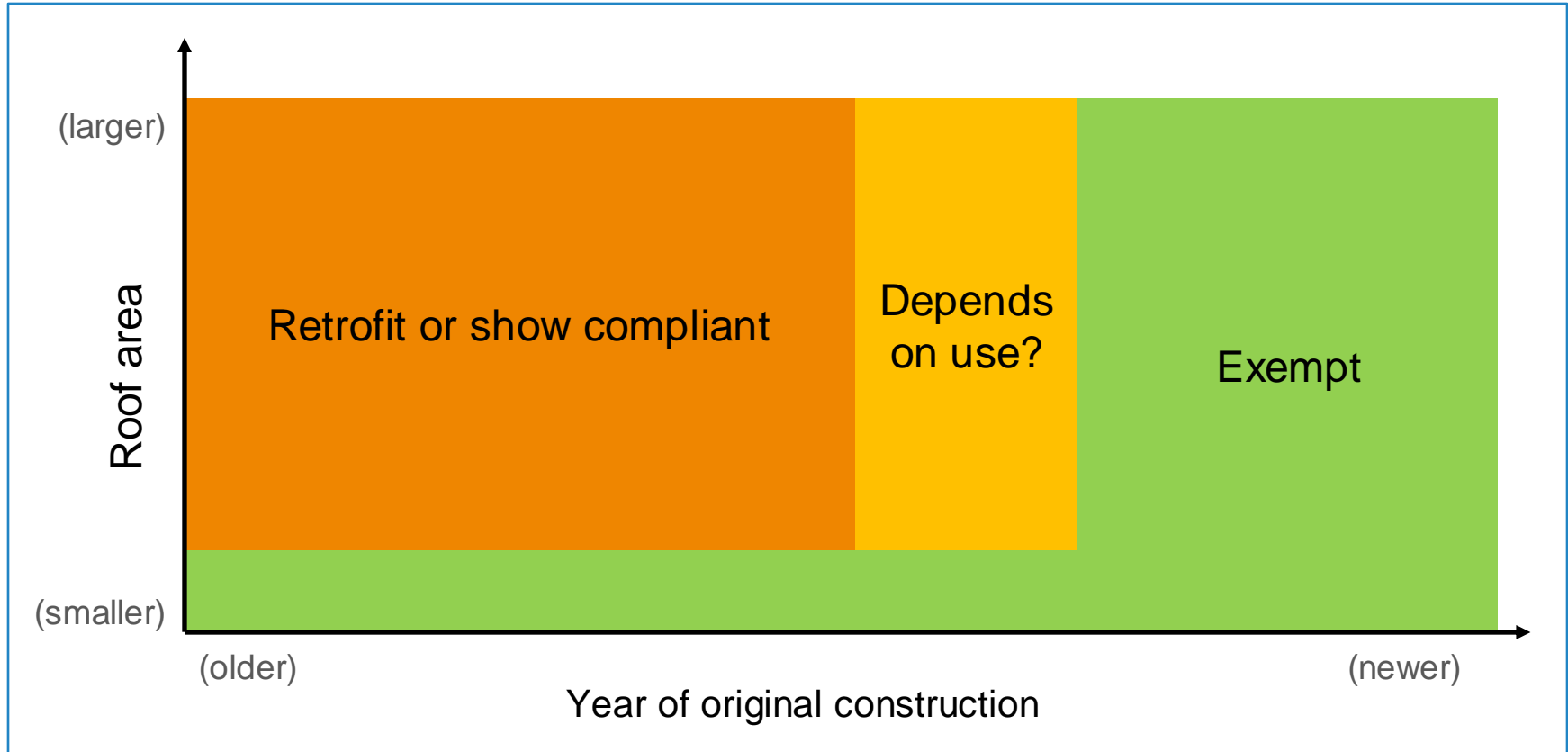
What criteria should the City use to distinguish important Tilt-up buildings?

# Requirements for wall-to-roof connection



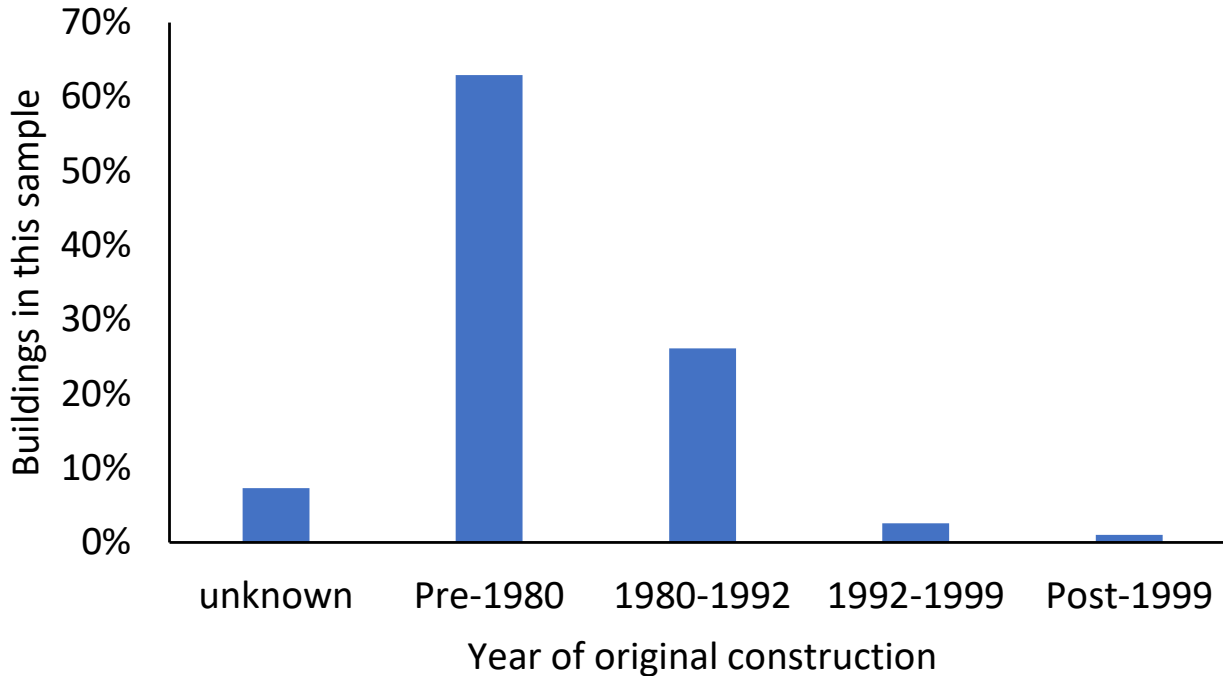
Koliou et al., 2017

## Possible criteria for what tilt-up buildings are IN in the program



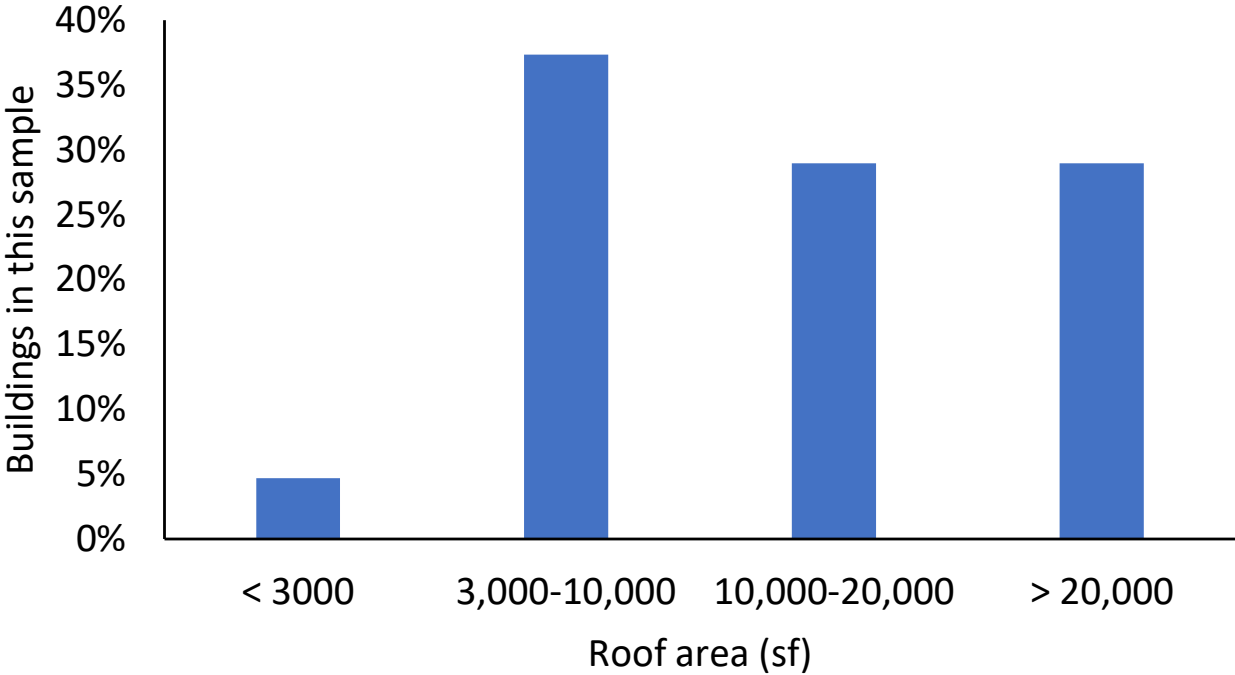
## From RWFD database for a portion of the City (PDR zones)

RWFD buildings by age (PDR zones)



# From RWFD database for a portion of the City (PDR zones)

RWFD buildings by roof area (PDR zones)







Tilt-up retrofit scope

# Possible levels of retrofit scope

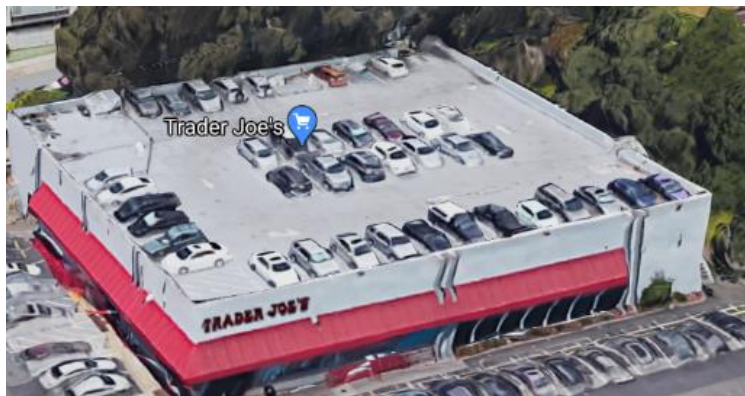
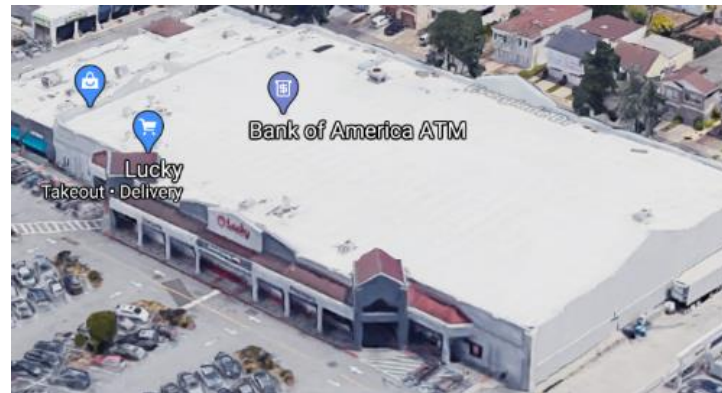
## **Option 1 – Minimum for safety**

- 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



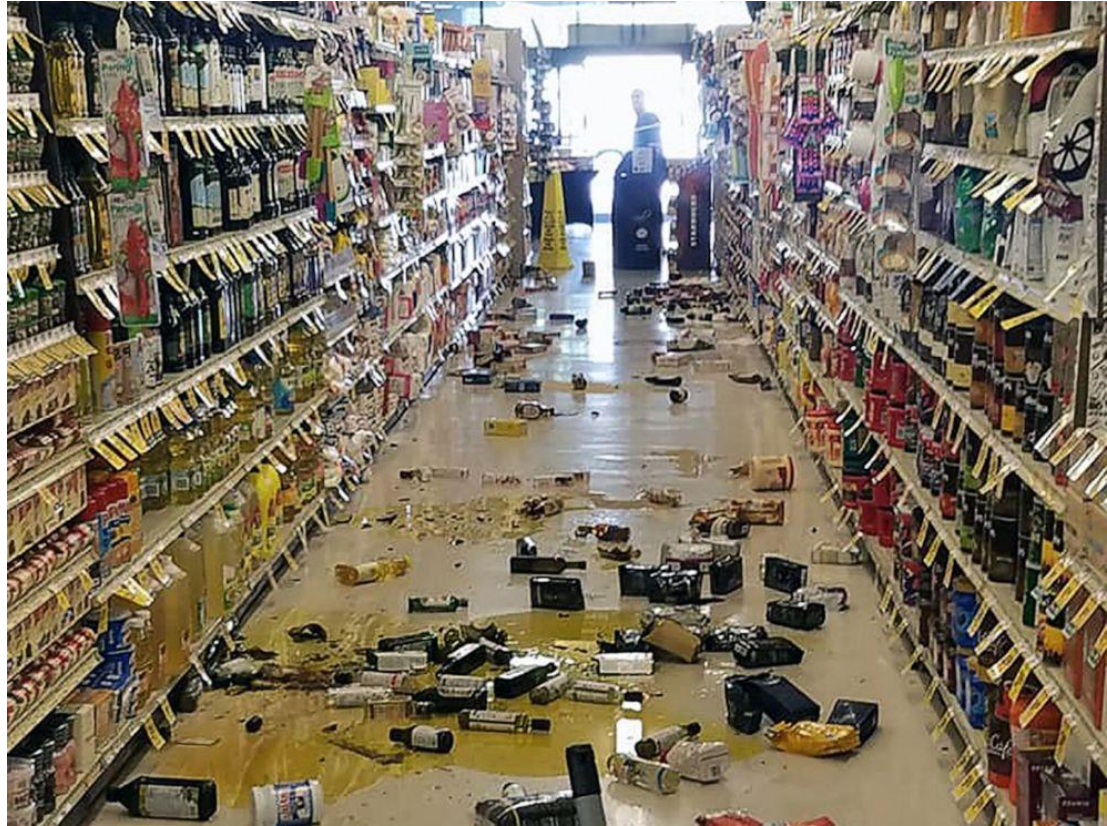
This one is not a tilt-up.



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

## Building information reporting

## Seismic evaluation

## Retrofit design

## Construction

Ordinance enacted

Submit form

Submit seismic evaluation or "intent to retrofit"

Permit application for retrofit

Complete retrofit construction

Exempt buildings are finished. Non-exempt buildings are assigned to a Schedule Category.

Buildings for which evaluation demonstrates compliance are finished (pending review and approval by DBI). Other buildings proceed to retrofit.

# 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

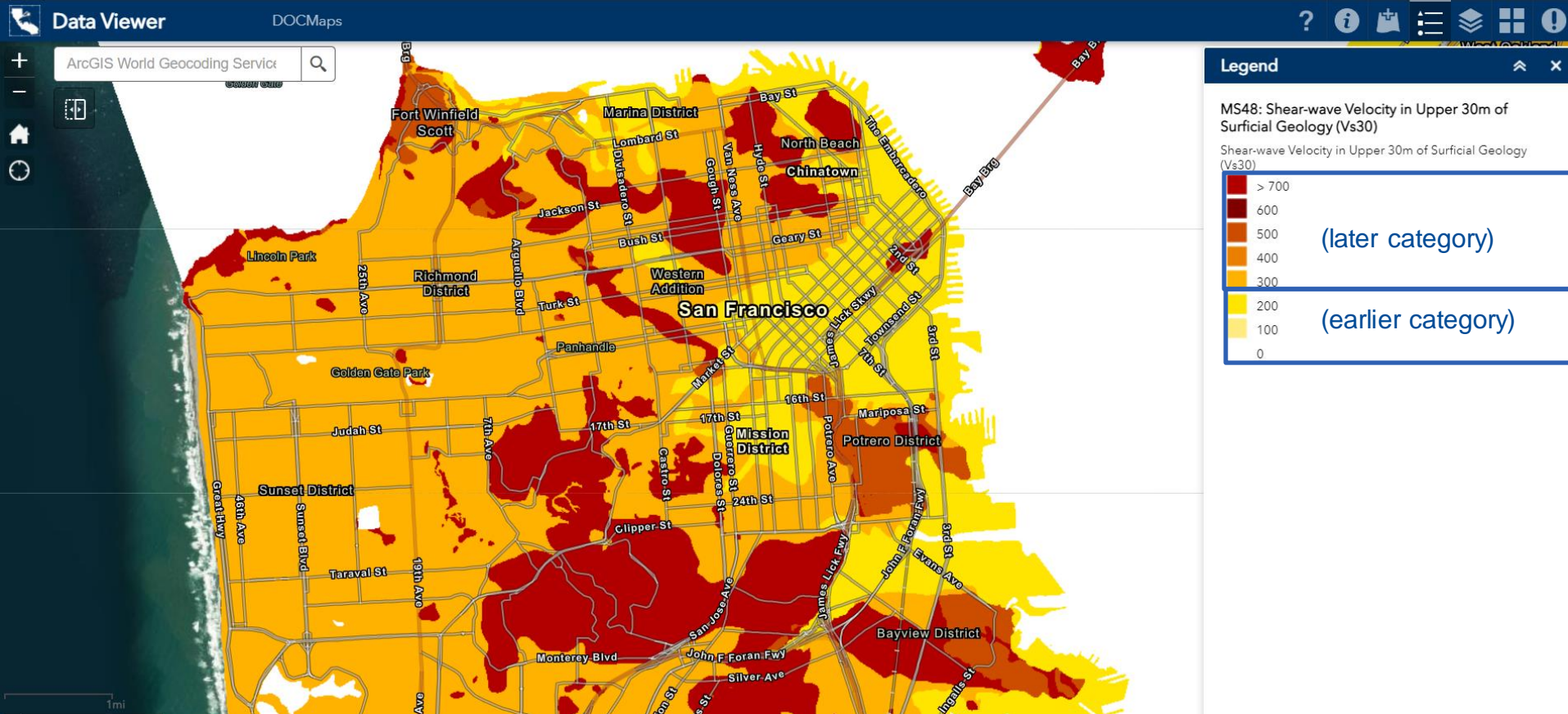
Tilt-up

Schedule Category	Buildings included
1	Buildings for which the last digit of the parcel number is odd.
2	Buildings for which the last digit of the parcel number is even.

Concrete

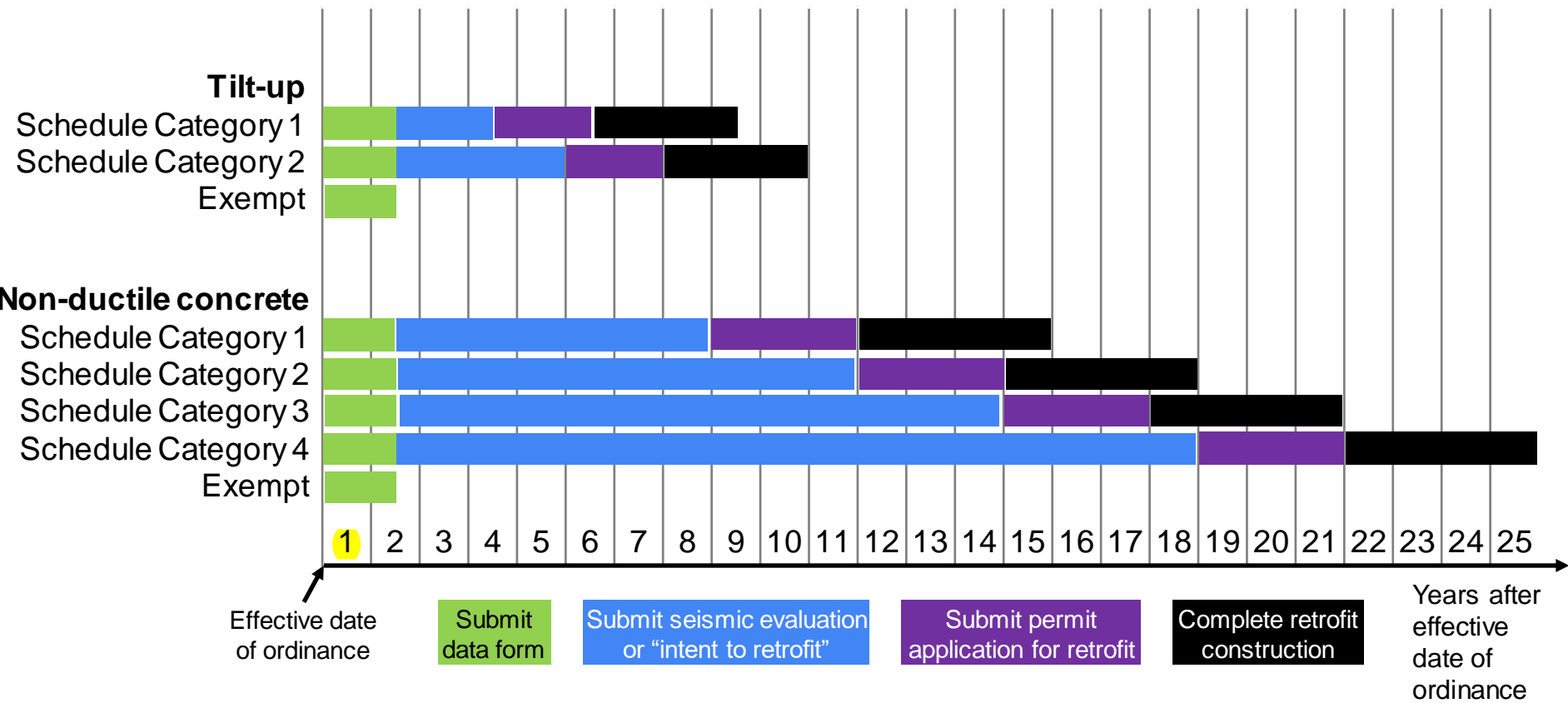
Schedule Category	Buildings included
1	Non-residential-Soils D,E,F
2	Non-residential-Soils A,B,C
3	Residential-Soils D,E,F
4	Residential-Soils A,B,C.

# Site Class



# Example timeline for compliance

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





# Examples from other ordinances

Soft story

Compliance Tier	Buildings included	Screening due	Permit due	Constr. complete
Tier I	Group A, E, R-2.1, R-3.1, R-4 occupancy	1 year	2 years	4 years
Tier II	15 or more dwelling units, except Tier I or IV	1 year	3 years	5 years
Tier III	Buildings not in other tiers	1 year	4 years	6 years
Tier IV	Group B or M occupancy 1 <sup>st</sup> Story or liquefaction	1 year	5 years	7 years
* Due dates are measured from 90 days after the operative date of SFEBC Chapter 5E				

# Examples from other ordinances

Façade inspection

Compliance Tier	Buildings included	Inspection report due date
1	Constructed prior to 1910	2021
2	1910 to 1925	2023
3	1926 to 1970	2025
4	after 1970	2027



## 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

Objective	Notes
"In" vs. Exempt	Form must be sent out <u>after</u> program requirements are determined to accomplish this
Assign to Schedule Categories	<- Discussing this today
Improve the City's database	
Begin engagement with an engineer	

# 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](mailto:laurel.mathews@sfgov.org)

# Thank you!

## Working Group Meeting #2

*November 16, 2022*