Concrete Building Safety Program

Working Group Meeting #6

June 1, 2023

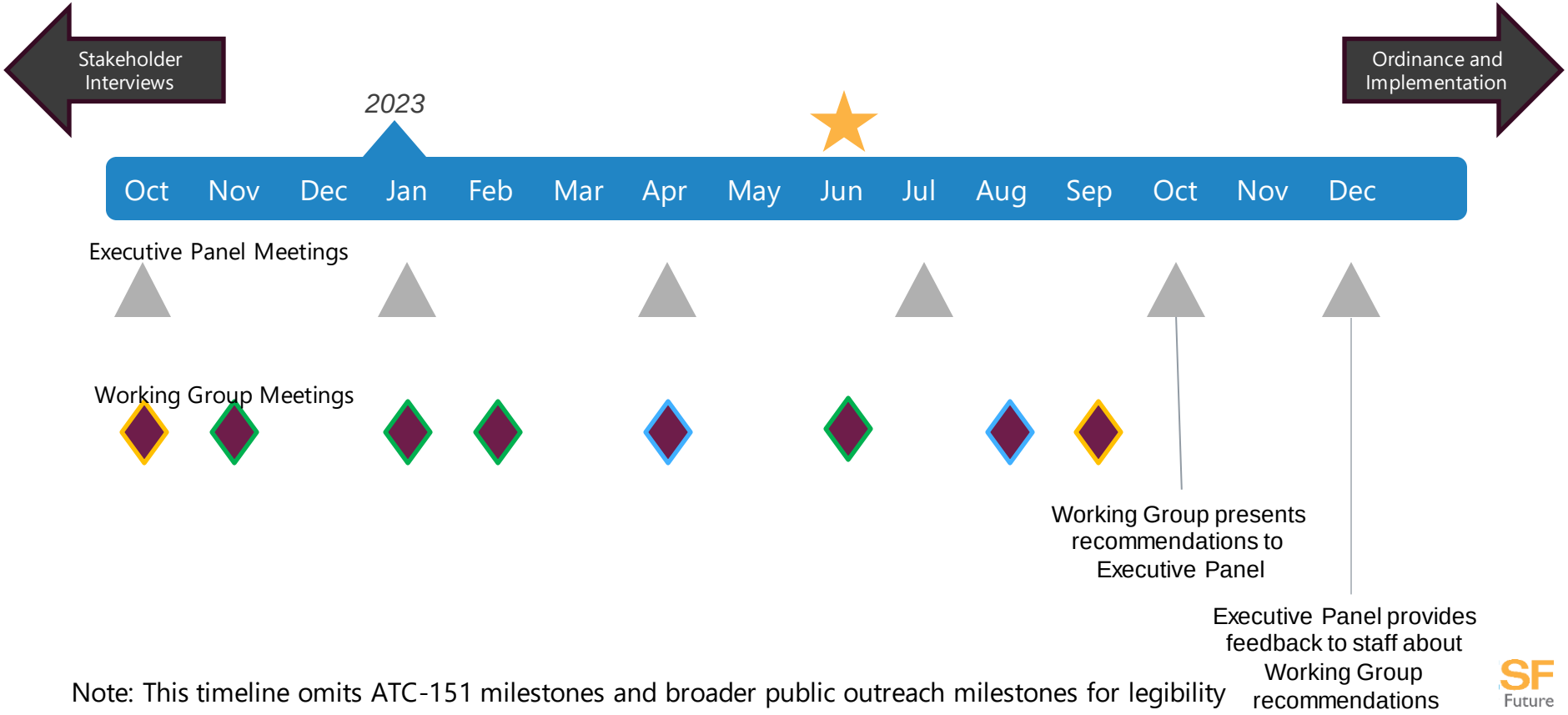
ONESF
Building Our Future

Intro and Prior Meeting Recap

Prior meeting recap

Process Streamlining	Temporary Tenant Relocation
• Lisa Gluckstein and Neville Pereira presented on draft recommendations related to process streamlining. • The Planning Department was identified as an important partner for finalizing and implementing the draft recommendations. • The list of draft recommendations will be distributed back to the process streamlining subgroup for honing and then to the full working group.	• Heather Heppner presented considerations for temporary tenant relocation. • The working group discussed reactions and collaborated on ideas for potential temporary tenant relocation recommendations. • The list of draft recommendations will be distributed back to the temporary tenant relocation subgroup for honing and then to the full working group.

Participatory Program Design Timeline



Note: This timeline omits ATC-151 milestones and broader public outreach milestones for legibility

SF Future

NBC publishing of draft inventory

- NBC attained through a public records request and published the draft inventory we have been using to inform program design.
- We are working on talking points to help you communicate with the stakeholders you represent about what this inventory is and isn't.

Outline

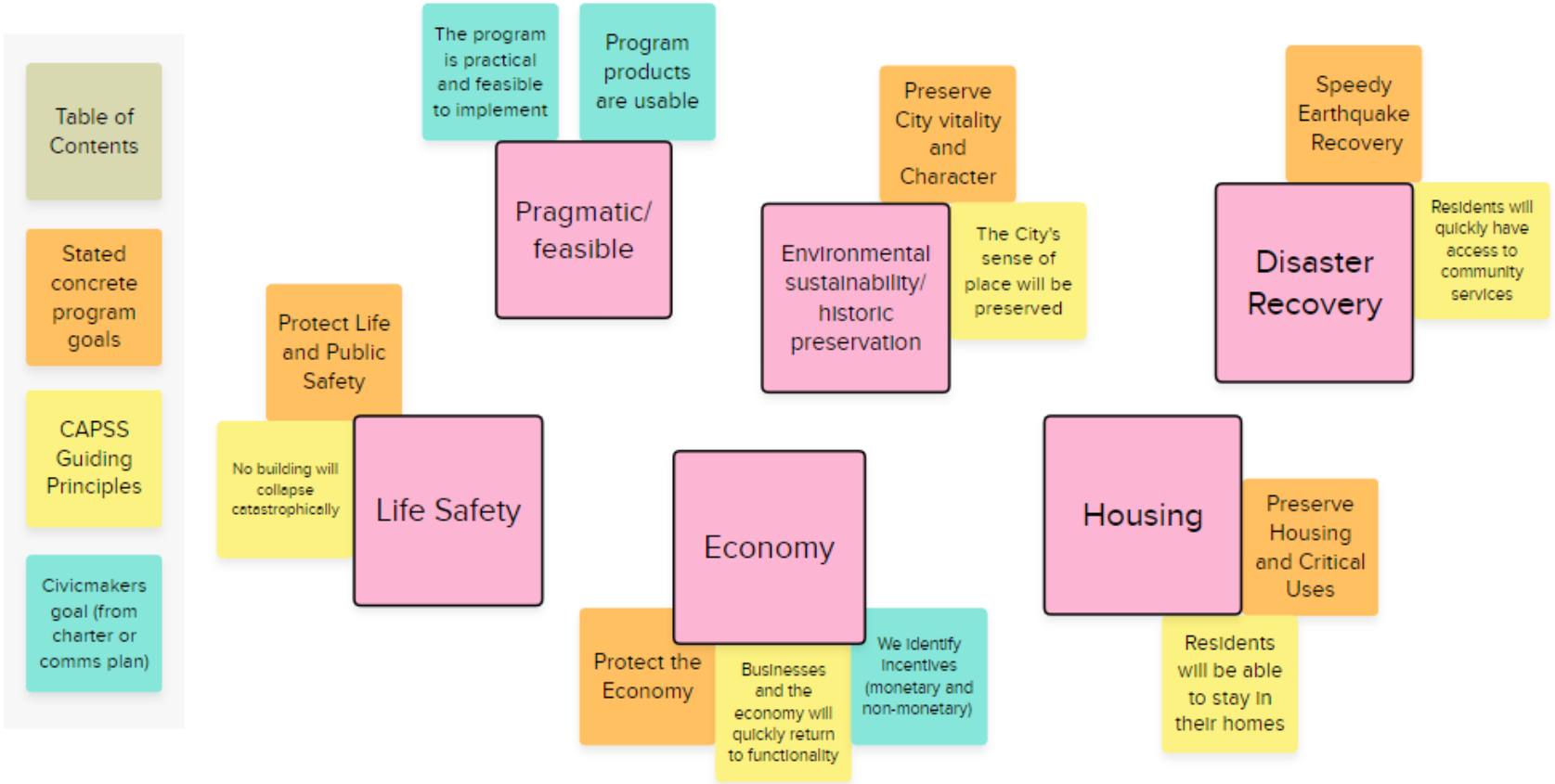
- Prior meeting recap
- Guiding Principles Exercise
- Technical recommendations
  - Technical process
  - What buildings to include (or exempt)
  - What level of retrofit to require, deficiencies to address
- Break
- Technical recommendations
  - Timeline and schedule categories
- Discussion

Covered in today's presentation

	Tilt-up	Non-Ductile Concrete
What buildings are “in” vs exempt?		✓
What level of retrofit?		✓
What is the timeline?		✓
How will we determine schedule categories?		✓
How will we incentivize action?		

Guiding Principles Exercise

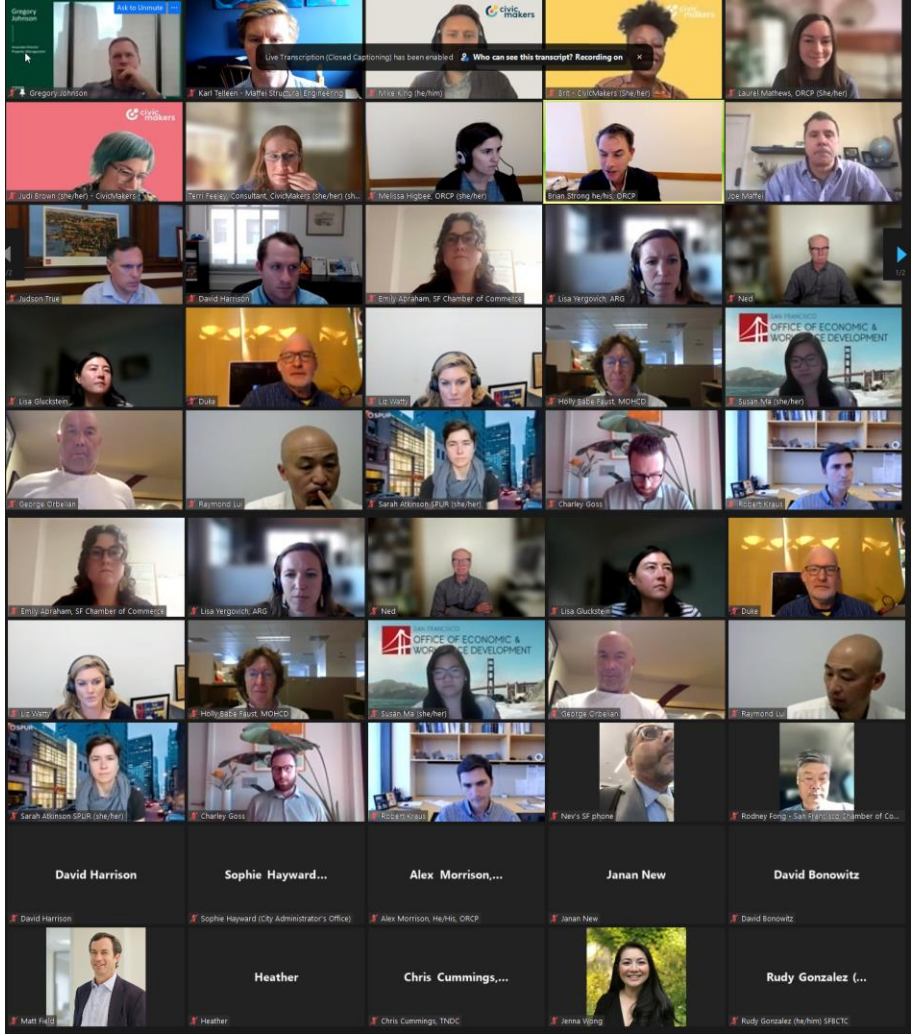
Guiding principles



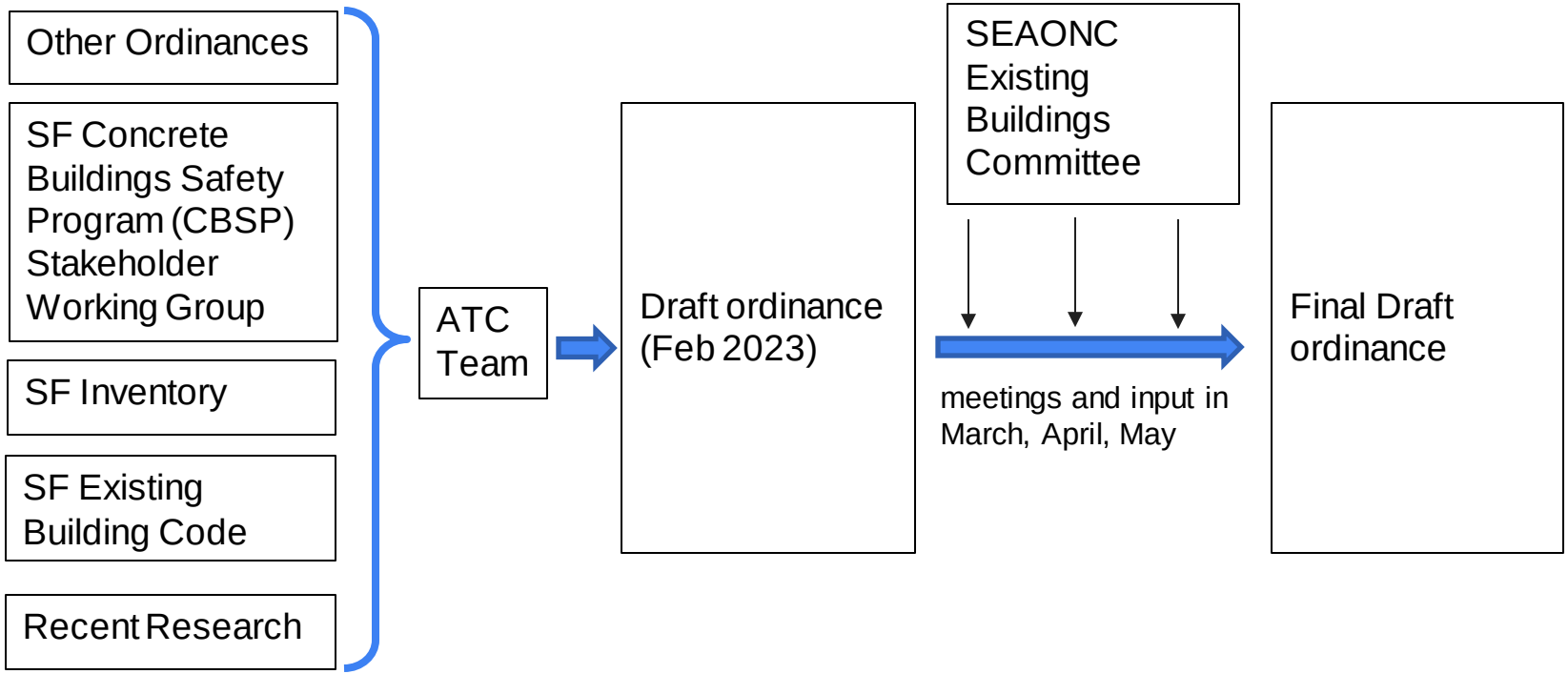
Technical recommendations process

ATC Team gathering input

- Executive Panel
- Stakeholder working group
- Office of Resilience and Capital Planning (ORCP)
- Building Department (SFDBI)
- Structural Engineers Association of Northern California (SEAONC) Existing Buildings Committee (EBC)



Technical recommendation development process



ATC meetings

- Project Technical Committee meetings
  - May 2022: Definitions of Concrete and RWFD, evaluation approaches
  - December 2022: Context from building inventory, other jurisdictions, cost
  - January 2023: Non-ductile concrete buildings to include/exempt
  - January 2023: RWFD buildings to include/exempt, Schedule categories
  - March 2023: Technical items to discuss with SEAONC and ATC draft recommendations
  - March 2023: Seismic hazard levels, key seismic deficiencies
  - May 2023: Draft code language
- Stakeholder working group meetings
  - October 2022
  - November 2022
  - January 2023
  - February 2023
  - April 2023
  - May 2023
  - June 2023
- SEAONC EBC meetings: March, April, May 2023
- ORCP meetings: bi-weekly
- SFDBI meetings: monthly
- Executive Committee meetings: quarterly


Joe Maffei, SE, PhD


Ayse Hortacsu, CE


Abby Enscoe, CE


Steve Harris, SE


Karl Telleen, SE


David Bonowitz, SE


Daniel Zepeda, SE

SEAONC Existing Buildings Committee (EBC) task group

- 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)
- October 2022 to present: Robert reporting to larger Existing Building Committee membership on ATC and stakeholder working group efforts
- March 2023 meeting with ATC (4 hrs): Agreement on technical principles
- April 2023: Gather feedback from the larger Existing Building Committee membership in monthly committee meetings.
- May 2023 meeting with ATC (3 hrs): Review draft code requirements
- May 2023: Provide written comments on draft technical requirements to ATC
- May 2023 meeting with ATC: Address key technical aspects of comments





Review other retrofit programs

- Berkeley retrofit grants program
- Los Angeles concrete program
- West Hollywood
- Santa Monica
- SF soft-story ordinance
- SF private school ordinance

	Berkeley	West Hollywood
Major or critical deficiencies	"Critical Seismic Deficiencies" • Slab punching shear • Column shear behavior • Columns with significant axial load AND large spacing of confining tie reinforcement • Walls with major vertical discontinuities • Buildings with lateral strength below 60% of "shear stress check," unless walls are flexure-governed and satisfy S-5 in BSE-2E • Inadequate seating length for gravity support	"Major Deficiencies" • Load path • Weak or soft story • Vertical irregularity • Torsion • Captive column
Performance target	Minimum Scope: Address "Critical Seismic Deficiencies" Preferred Scope: S-5 in BSE-2E (Same for all Risk Categories)	BPOE: RC1/2: S-3 in BSE-1E, S-5 in BSE-2E RC3/4: S-2 in BSE-1E, S-5 in BSE-2E Also show global stability at 150% of pushover target displacement. Historical buildings may be allowed lower performance per CHBC.
Timeline	Several rounds of grants offered	3 years: Screening report 5 year: Phase 1 plans 7 years: Phase 1 permit 10 years: Phase 1 construction finish 13 years: Phase 2 plans 15 years: Phase 2 permit 20 years: Phase 2 construction finish

Draft ordinance

Concrete Building Safety Program

- Mandatory retrofit
- One ordinance, RWFD and Concrete, separated requirements
- Ordinance language covers changes to SFEBC, Administrative bulletin(s) cover clarification of requirements and commentary

Two new chapters to add to SFEBC

Section 3. The San Francisco Existing Building Code is hereby amended by modifying Chapter 3 and adding Chapter 5G and Chapter 5H, to read as follows:

CHAPTER 3:

PROVISIONS FOR ALL COMPLIANCE METHODS

CHAPTER 5G:

MANDATORY EARTHQUAKE RETROFIT OF RIGID-WALL-FLEXIBLE-DIAPHRAGM BUILDINGS

CHAPTER 5H:

MANDATORY EARTHQUAKE RETROFIT OF NON-DUCTILE CONCRETE BUILDINGS

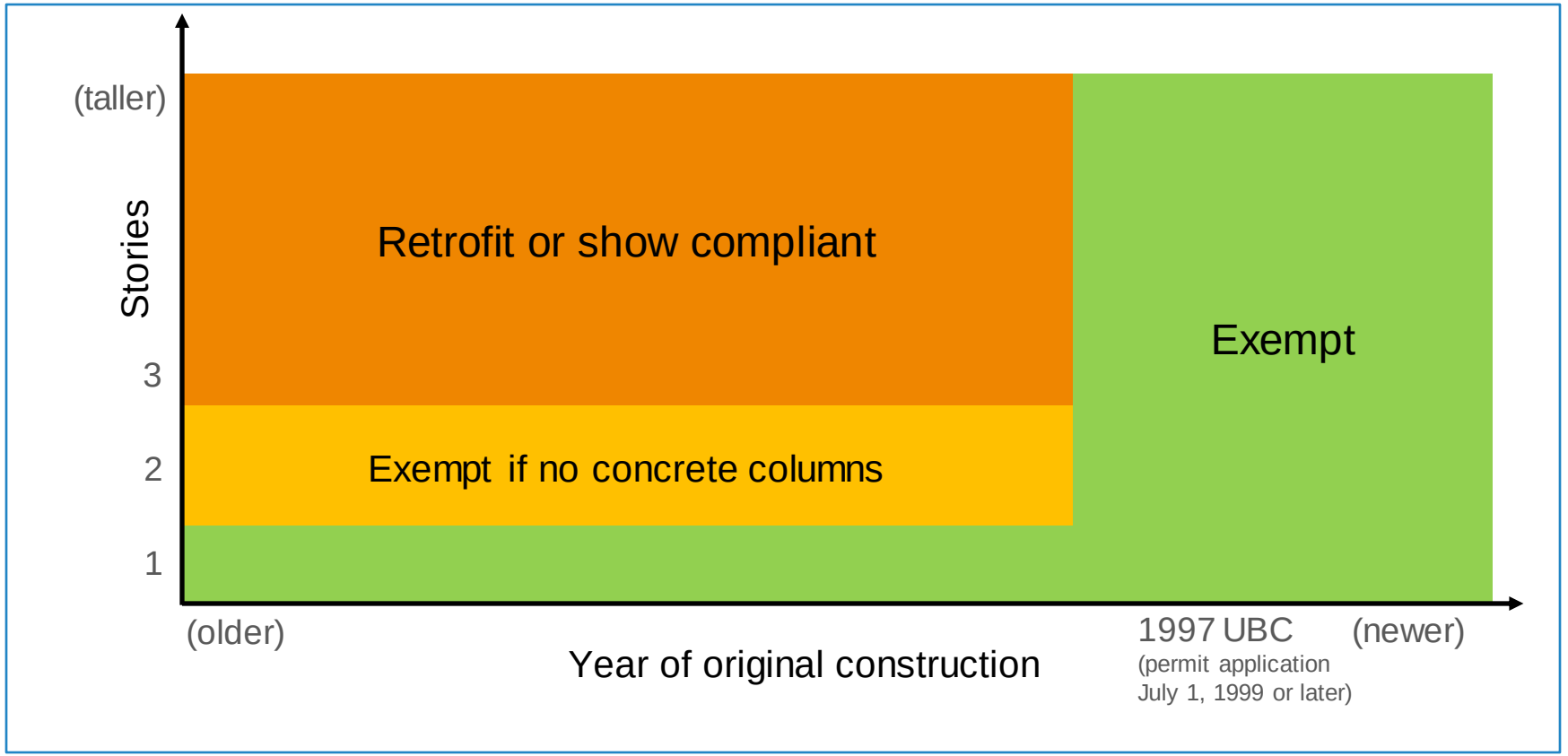
Outline of concrete retrofit chapter

CHAPTER 5H:
MANDATORY EARTHQUAKE RETROFIT OF NON-DUCTILE CONCRETE BUILDINGS

SECTION 501H.	***PURPOSE***	
SECTION 502H.	***SCOPE***	Buildings included, excluded
SECTION 503H.	***DEFINITIONS***	
SECTION 504H.	***COMPLIANCE REQUIREMENTS***	Forms to be completed by CA P.E.
SECTION 505H.	***SCHEDULE CATEGORIES AND DEADLINES FOR COMPLIANCE***	
SECTION 506H.	***ENGINEERING CRITERIA FOR COMPLIANCE***	Performance, deficiencies
SECTION 507H.	***IMPLEMENTATION AND ADMINISTRATION***	Fees, etc.

What buildings are in?

Concrete buildings included in the program



Exemptions

- **Age.** Built 2000 or later, or permit application date 7/1/1999 or later.
- **One story.** Above grade.
- **Two story.** And no concrete columns nor wall piers.
- **Complete steel frame.** Supporting gravity floor load and roof load.
- **Non-concrete building.** Concrete limited to floors, roofs, foundations, basements.
- **Previous retrofit.** Satisfying triggered retrofit requirement in past 15 years.
- **One- and two-family residential.** R-3 occupancy and incidental Group U occupancy.

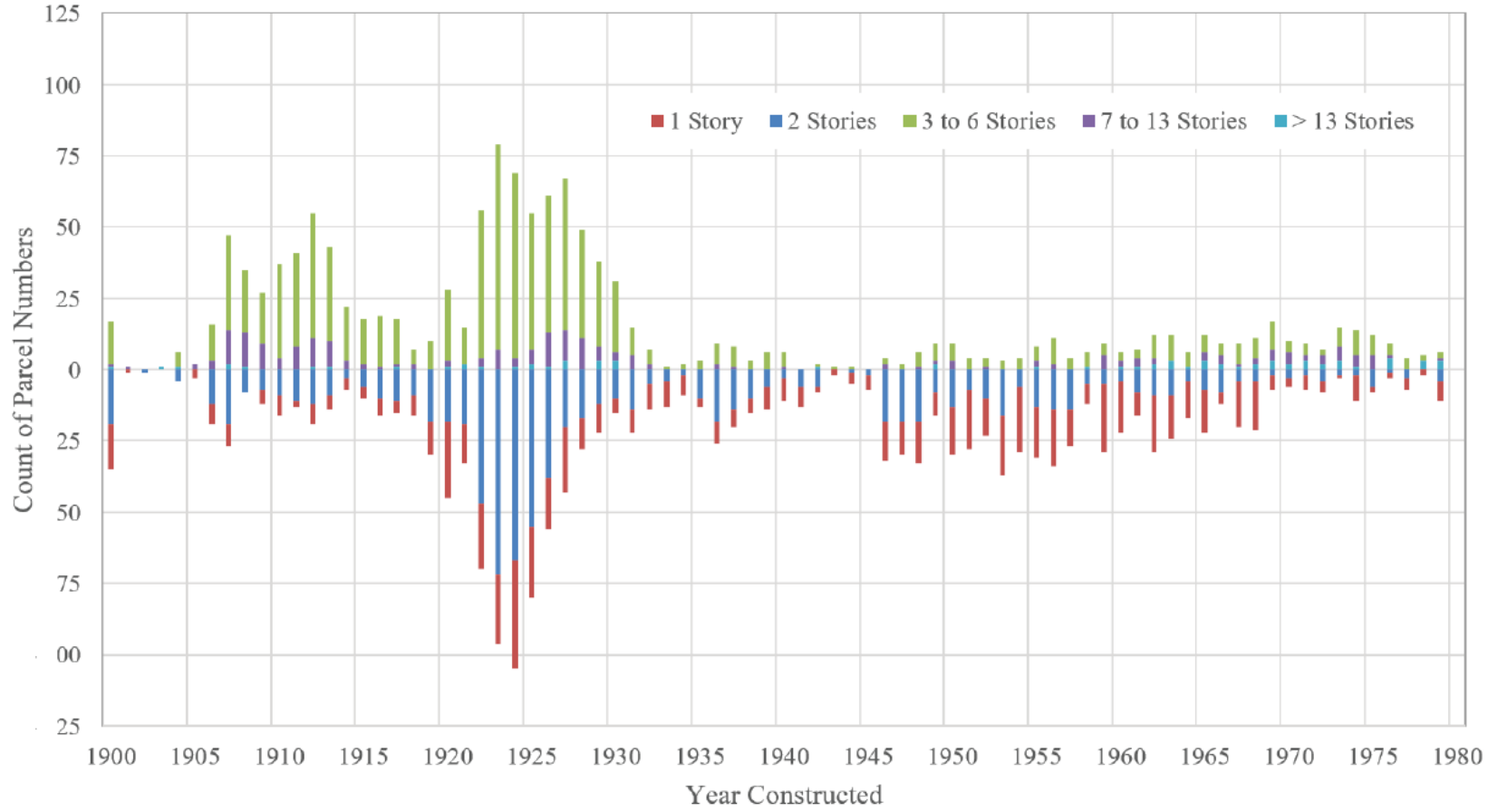
SFEBC benchmark code editions

TABLE 304.4.1 – DATES REQUIRED TO DEMONSTRATE BUILDING COMPLIANCE

Building Type	*Date of Compliance*	*Model Code (for reference)*
Wood Frame, wood shear panels (Types W1 & W2)	1/1/1984	UBC 1976
Wood Frame, wood shear panels (Type W1A)	7/1/1999	UBC 1997
Floor areas greater than 3,000 ft2 per level		
Steel moment-resisting frame (Types S1 & S1a)	12/28/1995	UBC 1994
Steel concentrically braced frame (Types S2 & S2a)	7/1/1999	UBC 1997
Steel eccentrically braced frame (Types S2 & S2a)	1/1/1990	UBC 1988
Buckling-restrained braced frame (Types S2 & S2a)	1/1/2008	IBC 2006
Light metal frame (Type S3)	1/1/2008	IBC 2006
Steel frame w/ concrete shear walls (Type S4)	12/28/1995	UBC 1994
Steel plate shear wall (Type S6)	1/1/2008	IBC 2006
Reinforced concrete moment-resisting frame (Type C1)	12/28/1995	UBC 1994
Reinforced concrete shear walls (Types C2 & C2a)	12/28/1995	UBC 1994
Tilt-up concrete (Types PC1 & PC1a)	7/1/1999	UBC 1997
Precast concrete frame (Types PC2 & PC2a)	1/1/2008	IBC 2006
Reinforced masonry (Type RM1)	7/1/1999	UBC 1997
Flexible diaphragms		
Reinforced masonry (Type RM2)	12/28/1995	UBC 1994
Stiff diaphragms		
Seismic isolation or passive dissipation	7/1/1992	UBC 1991

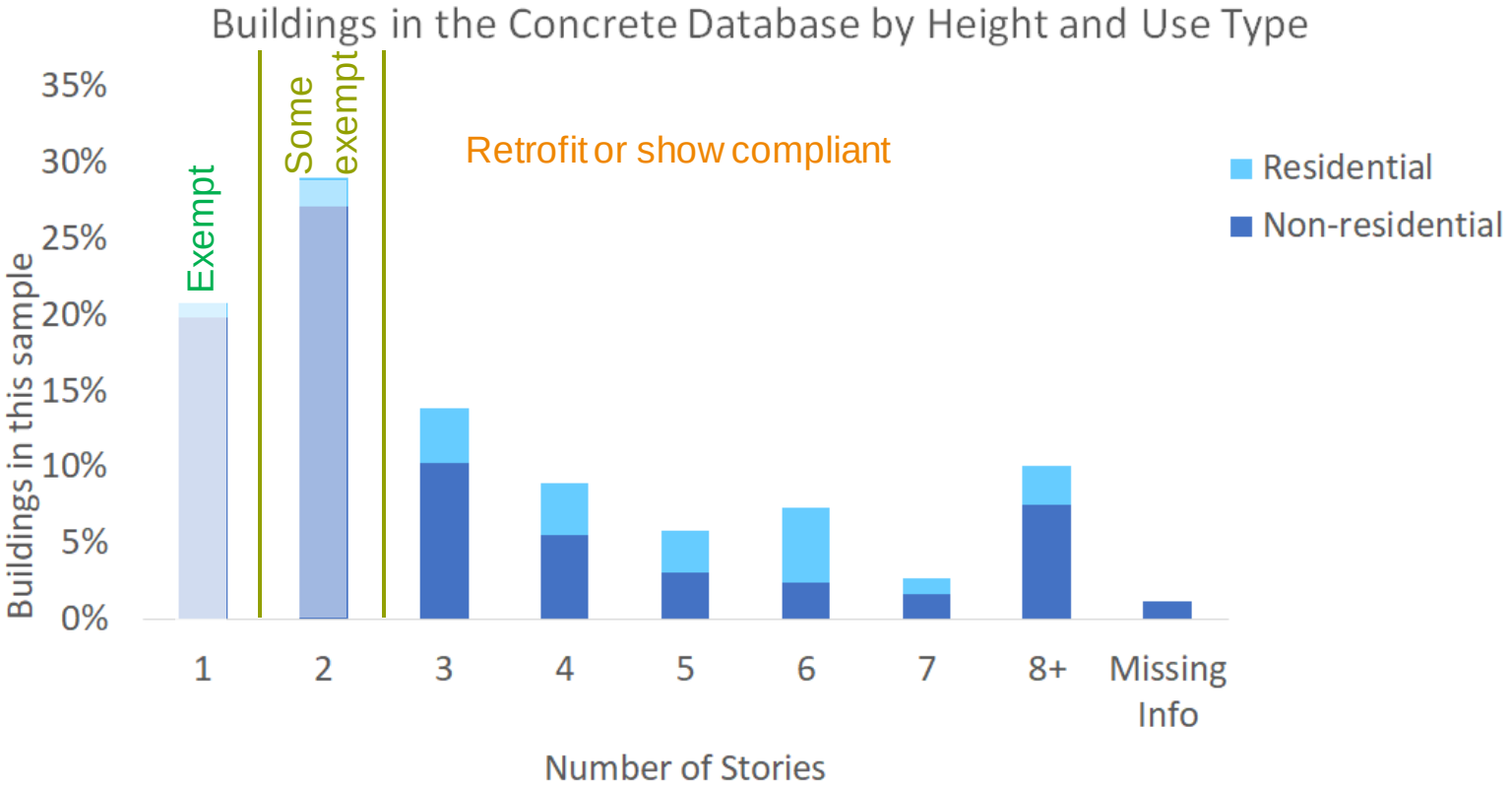
Older concrete buildings

(SEAONC, 2019)



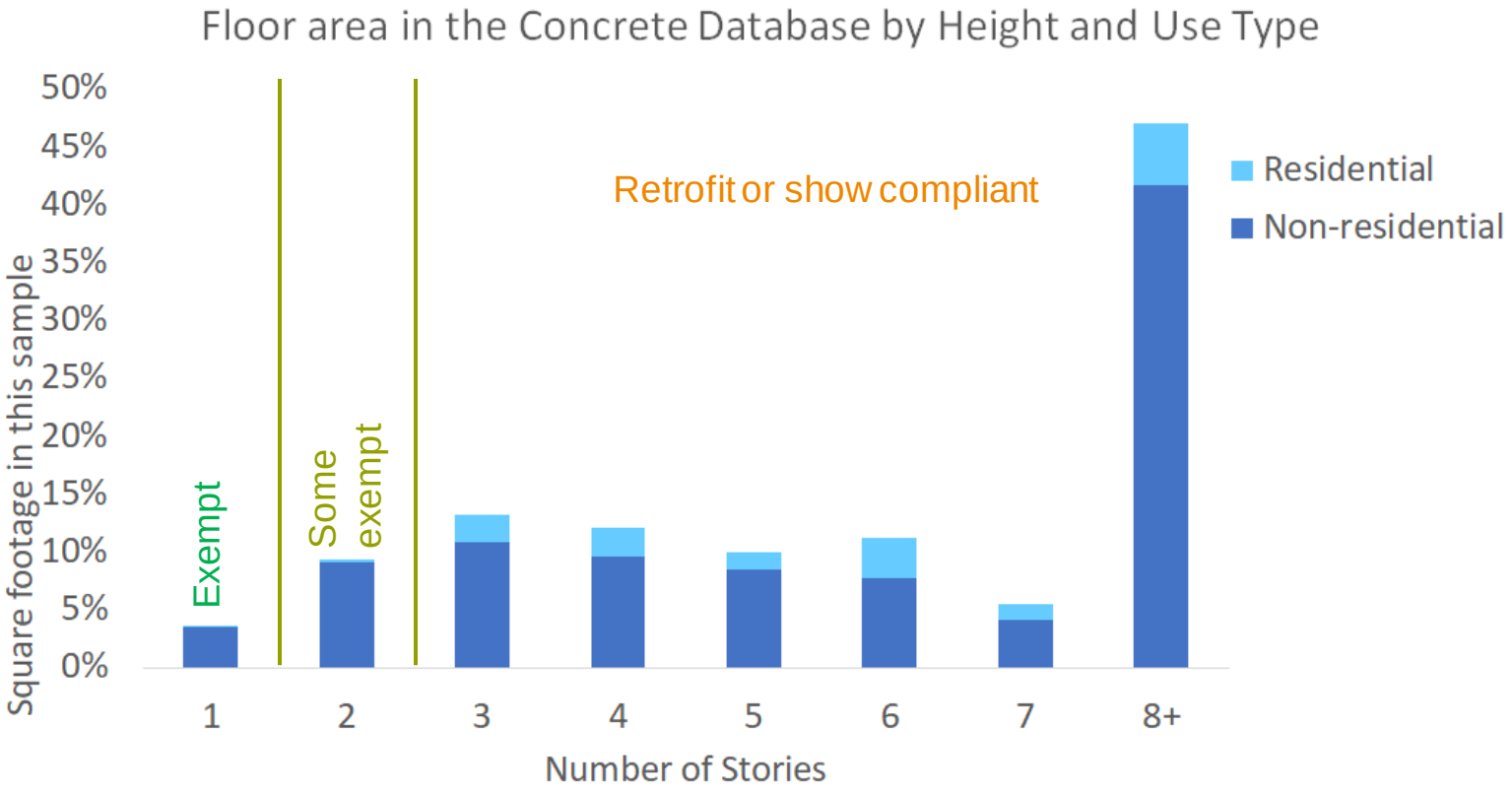
How the draft inventory maps to which buildings are "in" vs exempt

Number of Buildings



How the draft inventory maps to which buildings are "in" vs exempt

Square footage (correlates with retrofit cost)



Q+A

5 minutes

What level of retrofit?

Example criteria for compliance shown in **January**

Requirements	Relative level
Minimum requirement: Collapse Prevention in 475-year earthquake motions	Approximately **70%** of new building standard [**77%** of BPOE structural]
Voluntary higher standard: Collapse Prevention at the BSE-2E level (BSE-2E = 975-year motions in San Francisco.)	Approximately **90%** of new building standard [**100%** of BPOE structural]

Prior comments and questions related to "What level of retrofit?"

Comments and Questions from Working Group (Meeting 3)

Comments:

- Support proposal of providing different levels of incentives for going above the base level of retrofit.
- Exempt from additional building code triggers where possible. Americans with Disabilities Act upgrades will be triggered because it is Federal.
- Prioritize retrofits affecting the outside of the building where possible to avoid losing space in units.

Questions:

- Will pounding of adjacent buildings need to be considered?
- How will soil conditions be accounted for?

Recommended criteria for compliance

Requirements	Relative level
Option (a) Structural Collapse Prevention at the BSE-1E level (225-year earthquake motions), AND address specific deficiencies	Approximately **54%(+)** of BPOE structural objective
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)	**100%** of BPOE structural objective

Additional requirements

- **Non-structural retrofit.** Limited to unreinforced masonry: partitions in primary egress routes, and chimneys.
- **Masonry infill.** Concrete frames with masonry infill walls are included in the program, and effect of the masonry must be considered (not exempt).
- **Concrete podium levels.** For buildings with wood-frame or steel-frame upper stories and concrete lower stories (above grade), the building is included in the program (not exempt), but retrofit is not required at the wood-frame and steel-frame stories.

Additional requirements

- **Flexible floor and roof diaphragms.** Compliance with SFEBC Appendix A2 deemed to comply for wall anchorage and collectors. Potential exception for complete concrete beam systems.
- **Liquefaction or landslide.** Not required to address.
- **Building separation.** Building separation limitations (in SFBC and ASCE 41) need not be considered.

> **304.4.3 Seismic forces.** Buildings and structures shall comply with the reduced seismic forces, as defined in Section 304.3.2. The building separation limitations of Section ASCE 7-16 Section 12.12.3 need not be considered.

Compliance Option (b)

Comply with SFEBC Section 304.4.3 = Collapse prevention in 975-year (BSE-2E) earthquake motions

(Same requirements as SFEBC triggered retrofit,
such as from non-structural alterations on 2/3 of floors)

[BS] TABLE 304.3.2

RISK CATEGORY (Based on IBC Table 1604.5)	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2E EARTHQUAKE HAZARD LEVEL
II	Collapse Prevention (S-5)

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	Use Compliance Option (b)
Discontinuous elements	ASCE 7 irregularity table	Use Compliance 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

Non-ductile: Weak-story moment frame

(a)

(b)

(c)

(d)

(e)

(f)

Non-ductile: Slab punching shear

Non-ductile: Column shear

Northridge Earthquake 1994

Western Honshu Japan, 2007

Non-ductile: Weak-pier story mechanism

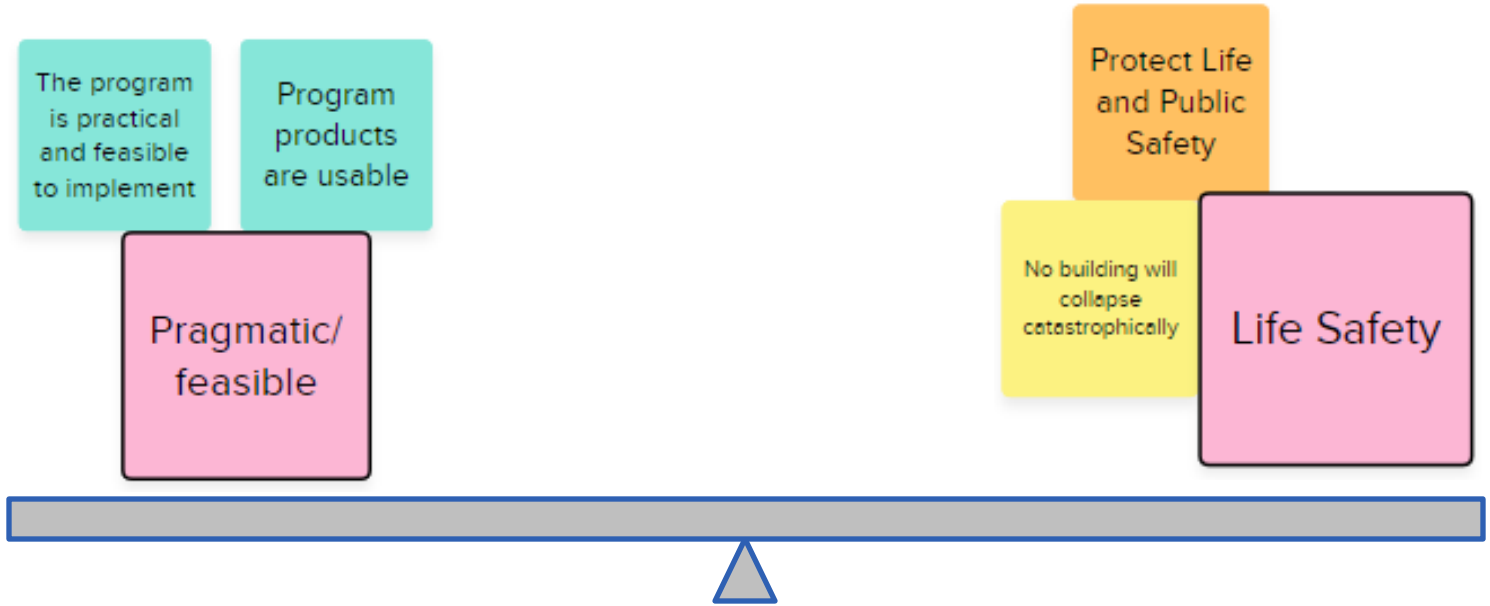
1995 Kobe earthquake

Non-ductile: Weak-pier story mechanism

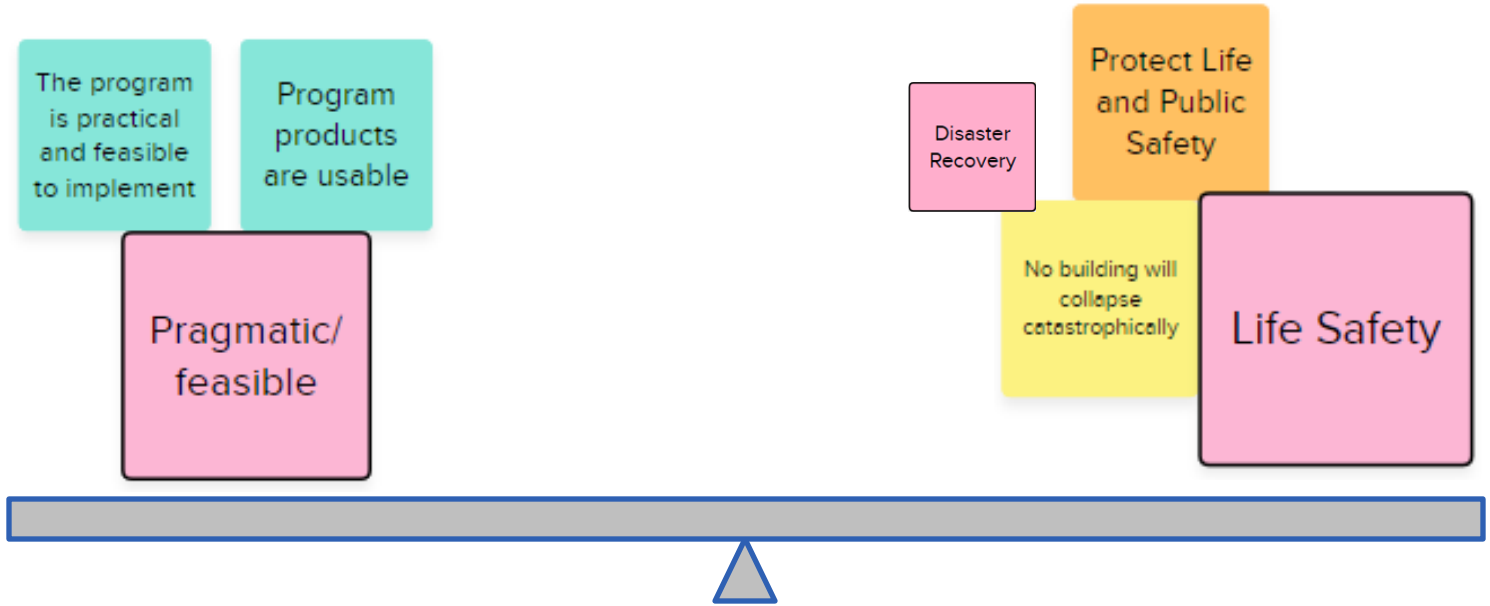
1994
Northridge
earthquake

2010 Chile earthquake

Principles behind compliance criteria

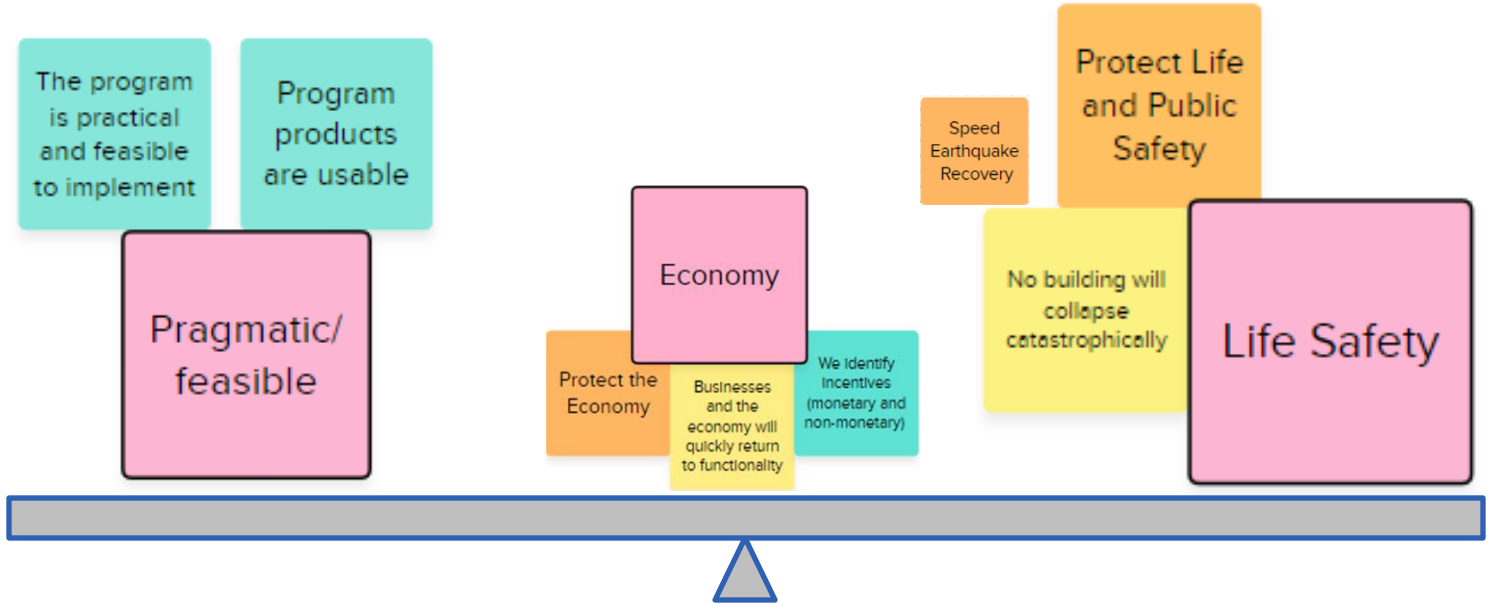


Principles behind compliance criteria

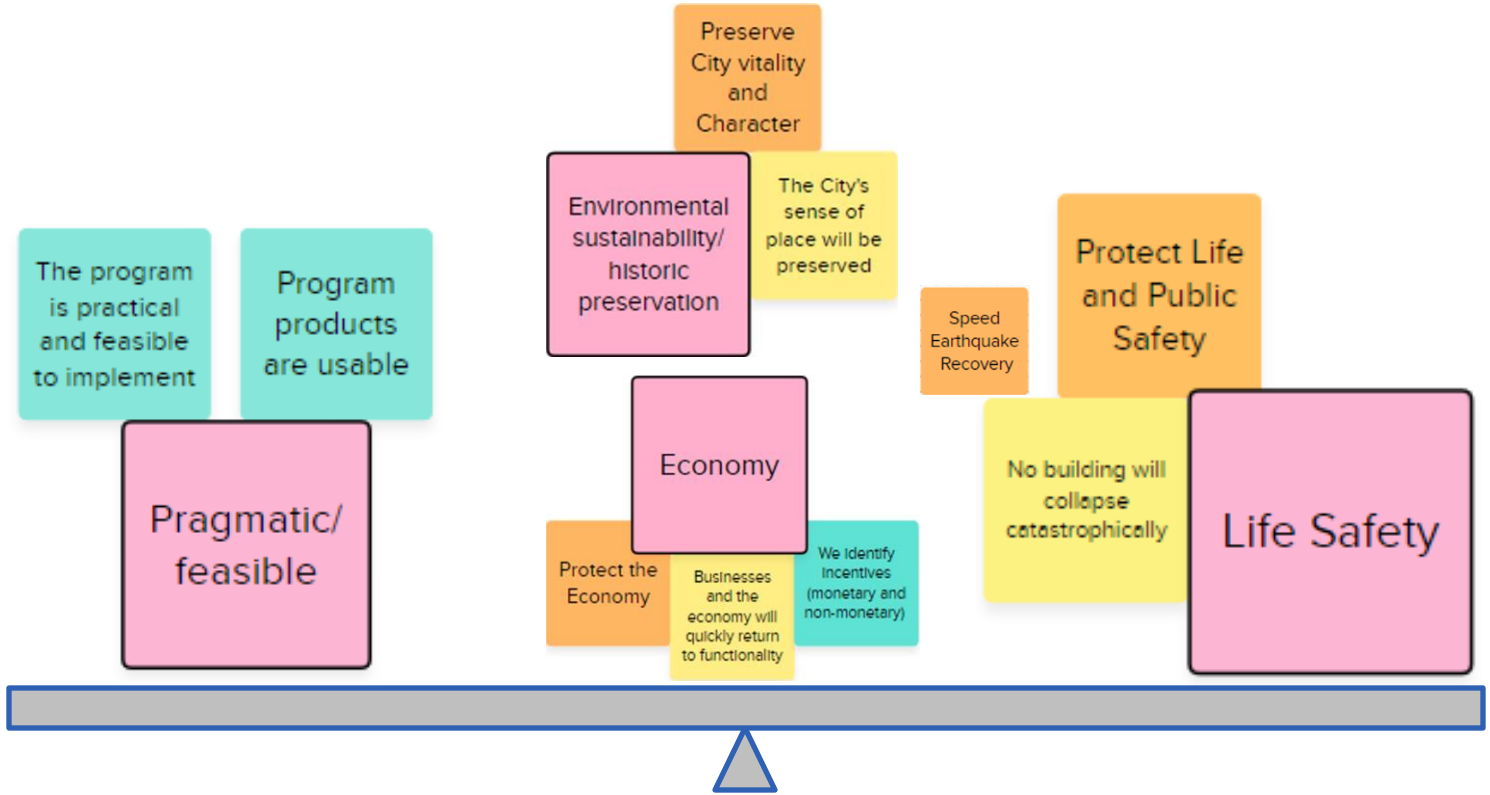


2010 Chile
earthquake

Principles behind compliance criteria



Principles behind compliance criteria



Q+A

5-minute Break

What is the timeline and schedule categories?

Prior comments related to timeline and schedule categories

Feedback from Working Group (Meeting 4)
• In many cases, complex retrofits and high-occupancy buildings are the same buildings. • More complex retrofits should have more time to plan and secure funding (later deadline) • Higher-occupancy buildings should be retrofitted first to reduce risk to life safety (sooner deadline) • Residential retrofits should be spread across multiple deadlines so that the housing market is not hit all at once • Some working group members want to shorten the overall program timeline • A longer program timeline may allow for the return of a more favorable market and interest rate environment • Consider timelines of other City programs

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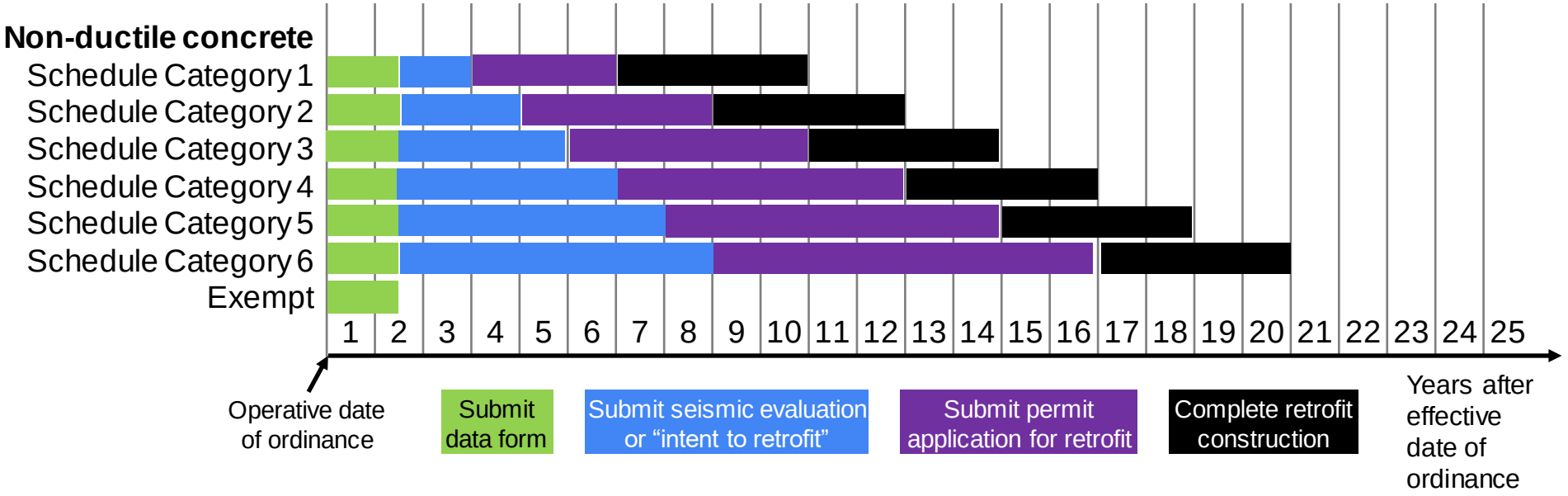
Example timeline for compliance



Most likely superseded

Schedule Categories Proposal A

Schedule Category	Buildings included
1	Non-residential; 1948* or later
2	Non-residential; before 1948
3	Residential; 1948 or later
4	Residential; before 1948

Shown previously as an example to working group

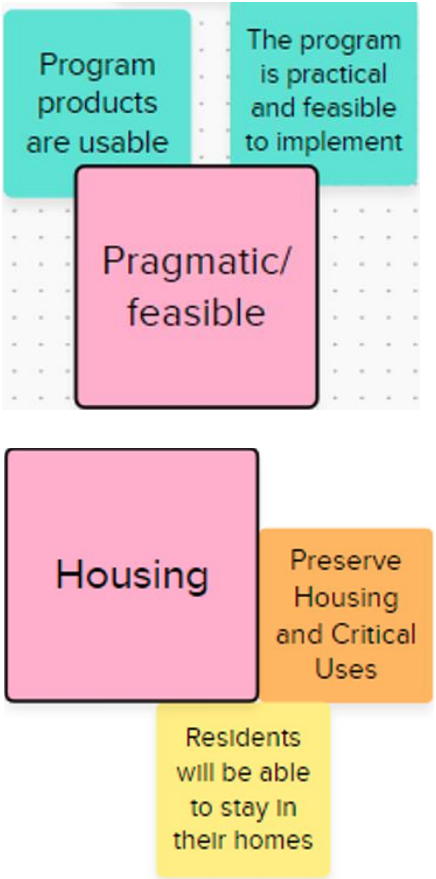
- 4 categories, 1948 year divider
- Residential last

1948 SFBC was completely re-written.

Most likely superseded

Schedule Categories Proposal A

Schedule Category	Buildings included
1	Non-residential; 1948* or later
2	Non-residential; before 1948
3	Residential; 1948 or later
4	Residential; before 1948



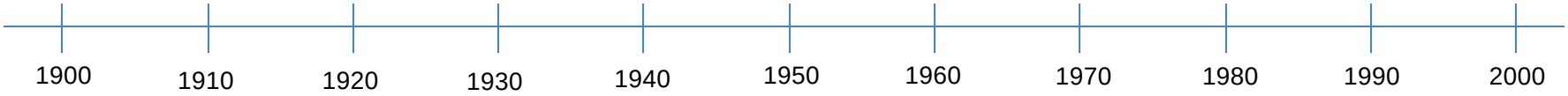
Schedule criteria not recommended

Criteria	Reason(s) for rejection
Occupant load (per SFBC Section 1004)	• Requires calculations. • Not familiar to engineers completing screening forms. • Doesn't typically represent the expected average number of occupants on a daily basis.
Floor area	• Doesn't necessarily represent the number of occupants. • Not necessarily a good idea to retrofit all the bigger buildings first.
Site class (Soil v_{s_30})	• Not yet clear if we have an objective map to define this. (CGS map no longer produced.)

Judgment on average structural vulnerability vs. year of construction

Note: This is an oversimplification of vulnerability , based on engineering judgment, used for the purpose of grouping buildings into schedule categories for the Concrete Building Safety Program. There is building-by-building variation w ithin each of these categories. The only w ay to know an individual building's risk is to by and assessment from a qualified structural engineer.

Vulnerable	More Vulnerable	Vulnerable
"Silent & Greatest Generation" buildings	"Baby Boomer & Gen X" buildings	"Millennial" buildings .
Prior to 1956	1956 - 1984	1985 - 1999



Considerations for Determining Non-ductile Concrete Schedule Categories

Consideration	Measure	Criteria (Year Built / Use)
Risk to Life Safety	Structural vulnerability*	• Built '56-'84: Most likely to be structurally vulnerable • No buildings to be addressed will have low vulnerability.
Feasibility for Implementation	DBI throughput	• Relatively equal numbers in each category • Relatively smaller first tier to allow ramp up • Similar buildings in each category
	Complex conditions	• Older buildings • Residential: Temporary tenant relocation, multiple owners (condos) • Commercial: Downtown economic recovery
Social Vulnerability	Avoid displacement	• Residential: Temporary tenant relocation

*Structural vulnerability is a judgement estimate and will vary from building to building

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Schedule Categories Proposal B

Category	Number of buildings
1. Non-residential 1956-1969	319
2. Non-residential 1969-1984	212
3. Non-residential 1930-1956	603
4. Non-residential prior to 1930	1,513
5. Non-residential 1984-1999 **and** residential 1956-1999	362
6. Residential prior to 1956	624
	3633

Characteristics and rationale:

- 6 categories, multiple year dividers
- Most vulnerable first (assumed to be 1960s and 1970s buildings)
- Smaller first group to allow DBI to ramp up
- Residential last

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Schedule Categories Proposal C

Category	Number of buildings
1. Non-residential 1956-1969	319
2. Residential 1956-1975 **and** Non-residential 1969-1984	306
3. Residential 1975-1984 **and** Non-residential 1930-1956	643
4. Non-residential prior to 1930	1513
5. Residential 1984-1999 **and** Non-residential 1984-1999	228
6. Residential prior to 1956	624
	3633

Characteristics and rationale:

- 6 categories, multiple year dividers
- Most structurally vulnerable first, including some residential
- Residential spread across categories to reduce potential impact on housing market
- Smaller first group to allow DBI to ramp up
- Less structurally vulnerable residential last

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Schedule Categories Proposal D

Category	Number of buildings
1. Residential 1956-1969 **and** Non-residential 1956-1969	385
2. Residential 1969-1984 **and** Non-residential 1969-1984	280
3. Non-residential 1930-1956	603
4. Non-residential prior to 1930	1513
5. Residential 1984-1999 **and** Non-residential 1984-1999	228
6. Residential prior to 1956	624
	3633

Characteristics and rationale:

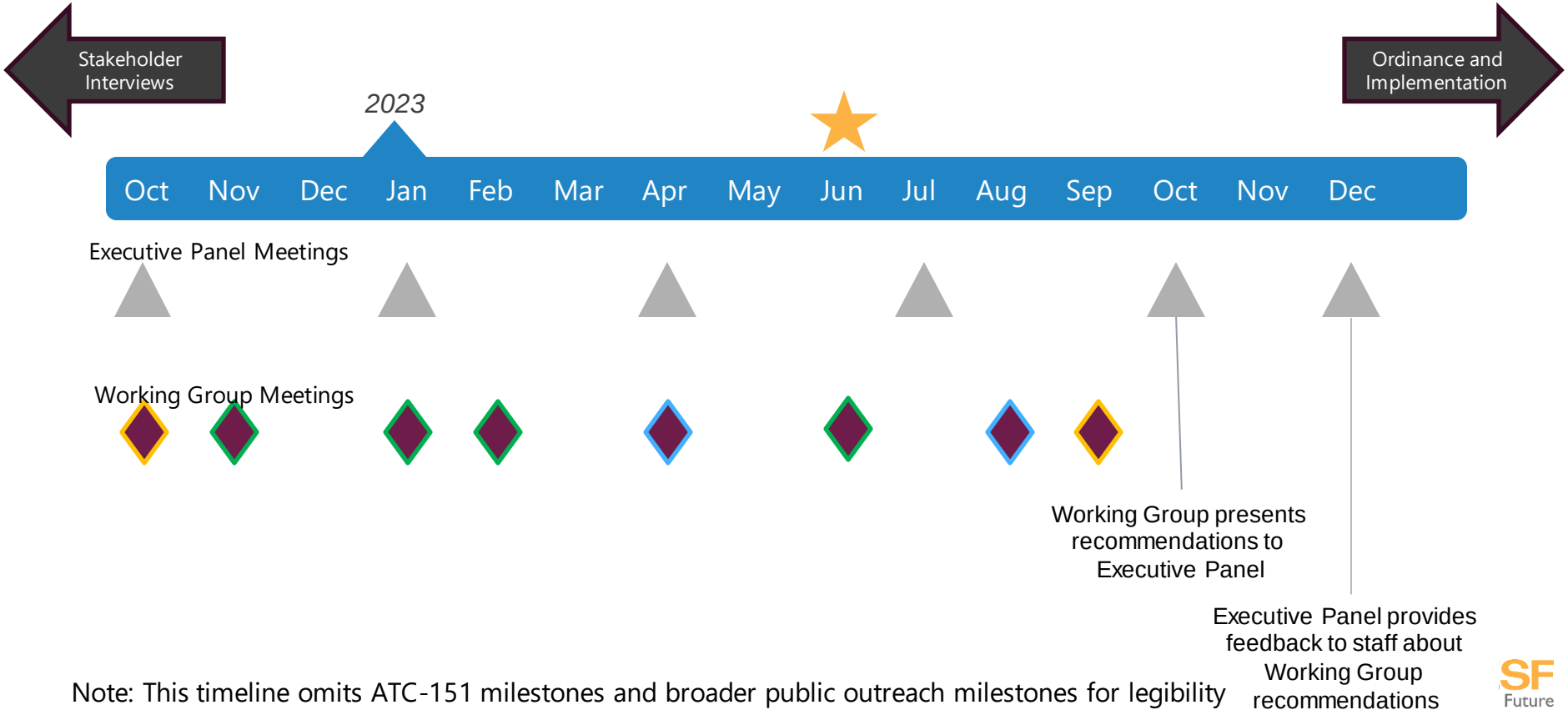
- 6 categories, multiple year dividers
- Most structurally vulnerable first, including some residential in first category
- Residential spread across categories to reduce potential impact on housing market
- Smaller first group to allow DBI to ramp up
- Less structurally vulnerable residential last

Q+A

Discussion

Wrap-up and Next Steps

Participatory Program Design Timeline



Note: This timeline omits ATC-151 milestones and broader public outreach milestones for legibility

SF Future

Upcoming Working Group topics

Meeting 5 ***April***	**Meeting 6** ***June***	**Meeting 7** ***August***	**Meeting 8** ***September***
Non-technical	Technical topic	Non-technical	Final
Process Streamlining **Temporary Tenant Relocation**	**Non-Ductile:** • Share updated program proposal and technical recommendations	**Communication with Building Owners and Tenants** **Financing Information and Resources**	**Final Meeting:** • Finalize Recommendations to executive panel

Proposed topical groups

For discussion April 27	For discussion August 10
Process Streamlining: - Judson True, *MOHCD* - Lisa Gluckstein, *MOHCD* - Raquel Bito, *BIC* - Neville Pereira, *SF DBI* - Raymond Lui, *SF DPW* - Dan Sider, *SF Planning* - Ned Fennie, *CAC* - David Friedman, *SPUR* - Lisa Yergovich, *BOMA* - Gregory Johnson, *CBRE* - Liz Watty, *SF Planning*	**Communication with Building Owners and Tenants:** - Susan Ma, *OEWD* - Jenna Wong, *SFSU* - Charley Goss, *SFAA* - Fred Sherburn/Maria Zamudio, *HRC* - Roisin Isner, *TSFU* - Rodney Fong, *SF Chamber of Commerce* - Patrick Hannan, *SF DBI* - George Orbelian, *Building Owner and CAPSS participant* - Holly Babe Faust, MOHCD - David Friedman, *SPUR*
Temporary Tenant Relocation: - Raquel Redondiez, *SOMA Pilipinas* - Sarah Atkinson, *SPUR* - Alicia Sandoval/Maria Zamudio, *HRC* - Holly Babe Faust, *MOHCD* - Heather Heppner, *CCDC* - David Harrison, *BOMA*	**Financing:** - Chris Cummings, *TNDC* - Janan New, *SFAA* - Alex Bastian, *Hotel Council* - Johnny Jaramillo, *Placemade* - Matt Field, *TMG Partners* - Brian Main, *Plant Construction* - Holly Babe Faust, *MOHCD* - Mary Gassert, *Cathedral Hill* - Susan Ma. *OEWD*

Topical group role:

- Meet to **determine draft recommendations** related to the topic
- Present draft recommendations to full working group for discussion and honing

Please reach out if you'd like to be reassigned!

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Thank you!

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