Seattle Draft URM Retrofit Technical Standard

Photo by John Skelton

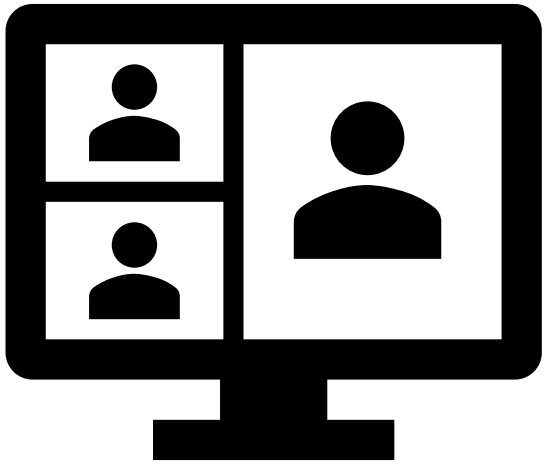
Seattle Department of
Construction and Inspections

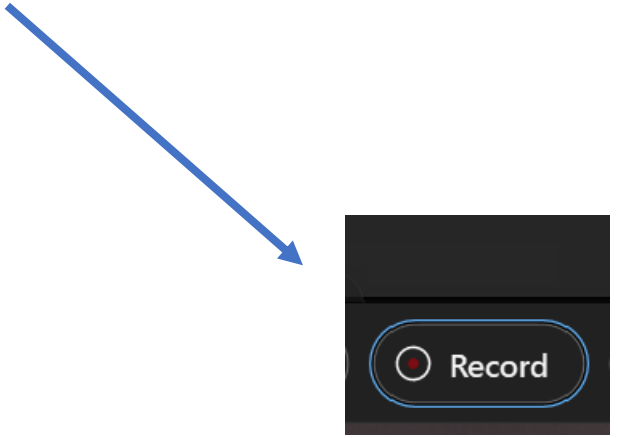
-Amanda Hertzfeld, URM Program Manager
-Kevin Solberg, Structural Engineer Supervisor

June 12, 2023

Presentation Recording

Please note this Presentation is being audio and video recorded by The City.





Questions for Presenters

Open the chat window to ask a question or make a comment.

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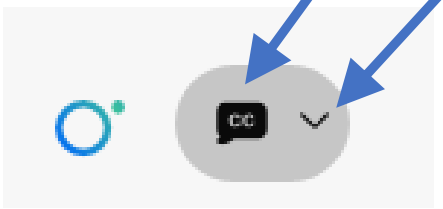
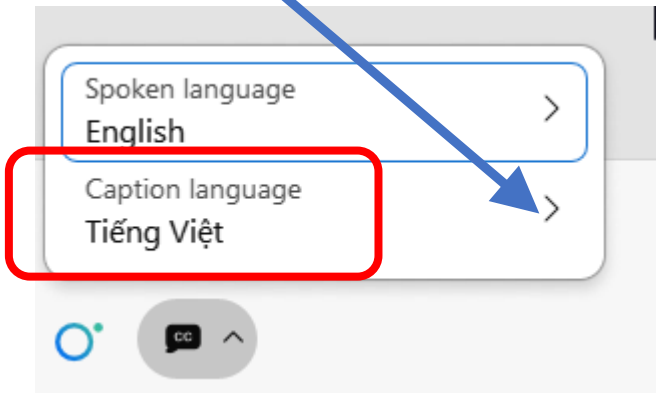




Agenda

Meeting Goal:

- Review Draft Technical Standard for URM retrofits and provide opportunity for questions.

Topics for Discussion:

- Background on the URM issue in Seattle
- Why a Technical Standard?
- History and Future of the Technical Standard
- Review of the Draft Technical Standard
- Questions and Answers

Introductions

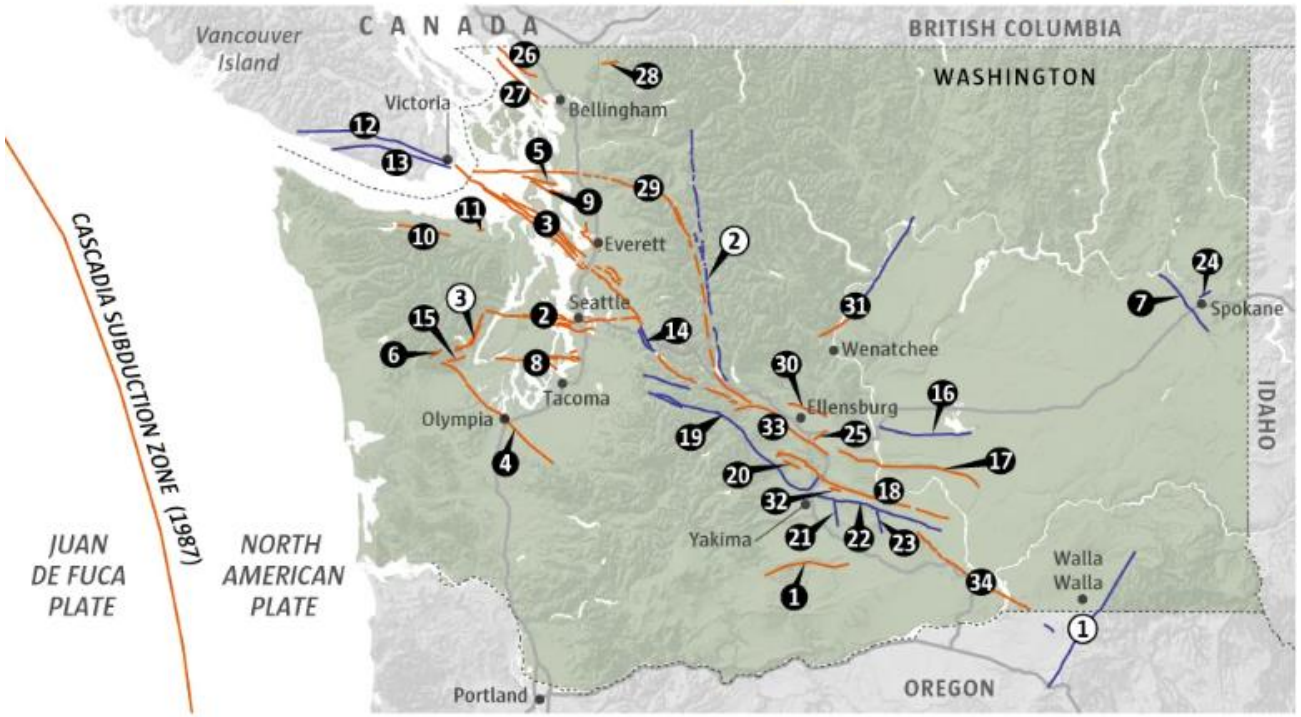
Seattle Department of Construction & Inspections:

- Amanda Hertzfeld, URM Program Manager
- Kevin Solberg, SE, Structural Plans Engineer

Earthquake Hazards

Earthquake faults of the region

Since the late 1980s, geologists have discovered evidence of active quake threats on more than two dozen faults across Washington.



PRE-1980 FAULTS

1	Hite	1940s
2	Straight Creek	'50s
3	Saddle Mountain	'79

FAULTS SINCE 1980

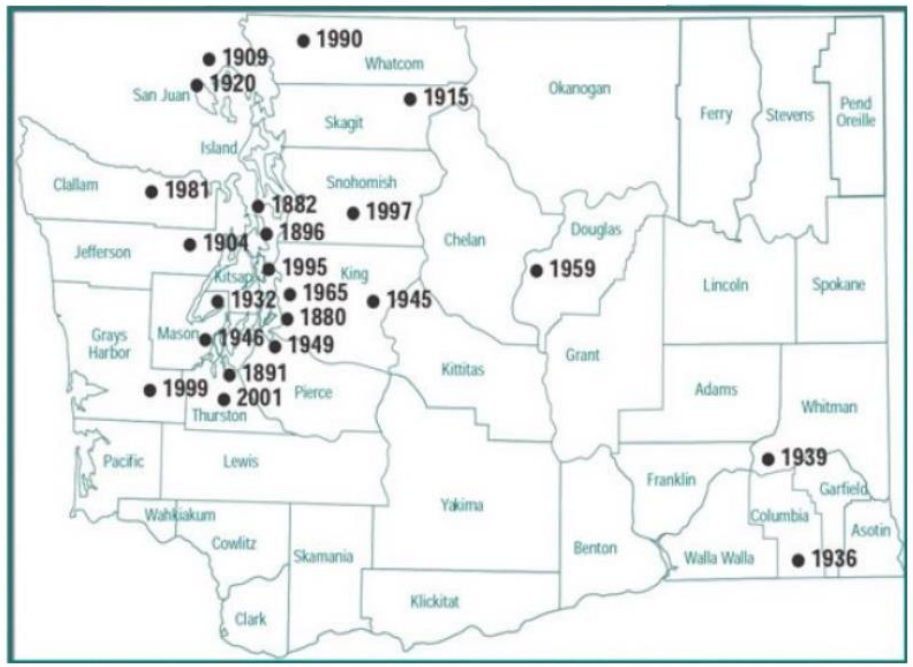
1	Mill Creek	'81	13	Leech River	'08	25	Boylston Ridge	'13
2	Seattle	'92	14	Rattlesnake Mt.	'09	26	Birch Bay	'12
3	Southern Whidbey Island	'96	15	Frigid Creek	'09	27	Sandy Point	'12
4	Olympia	'01	16	Frenchman Hills	'11	28	Boulder Creek	'13
5	Strawberry Point	'01	17	Saddle Mountain	'11	29	Darrington-Devil's Mt.	'14
6	Canyon River	'01	18	Umtanum	'11	30	Reecer Creek	'14
7	Latah	'01	19	Naches-White River	'11	31	Spencer Canyon	'15
8	Tacoma	'04	20	Wenas Valley	'11	32	Burbank	'15
9	Utsalady Point	'04	21	Coyote Spring	'11	33	Manastash Ridge	'16
10	Lake Creek/Boundary Creek	'07	22	Yakima Ridge	'11	34	Walula fault	'16
11	Sequim	'07	23	Artesian	'11			
12	San Juan Fault	'08	24	Spokane fault	'13			

Source: U.S. Geological Survey

Reporting by SANDI DOUGHTON, Map by MARK NOWLIN / THE SEATTLE TIMES

Earthquakes: Not if, but when

Figure 5-3. Major earthquakes in Washington since 1880



In the next 50 years:

Seattle has an 86% chance of experiencing a M6.8 earthquake

and

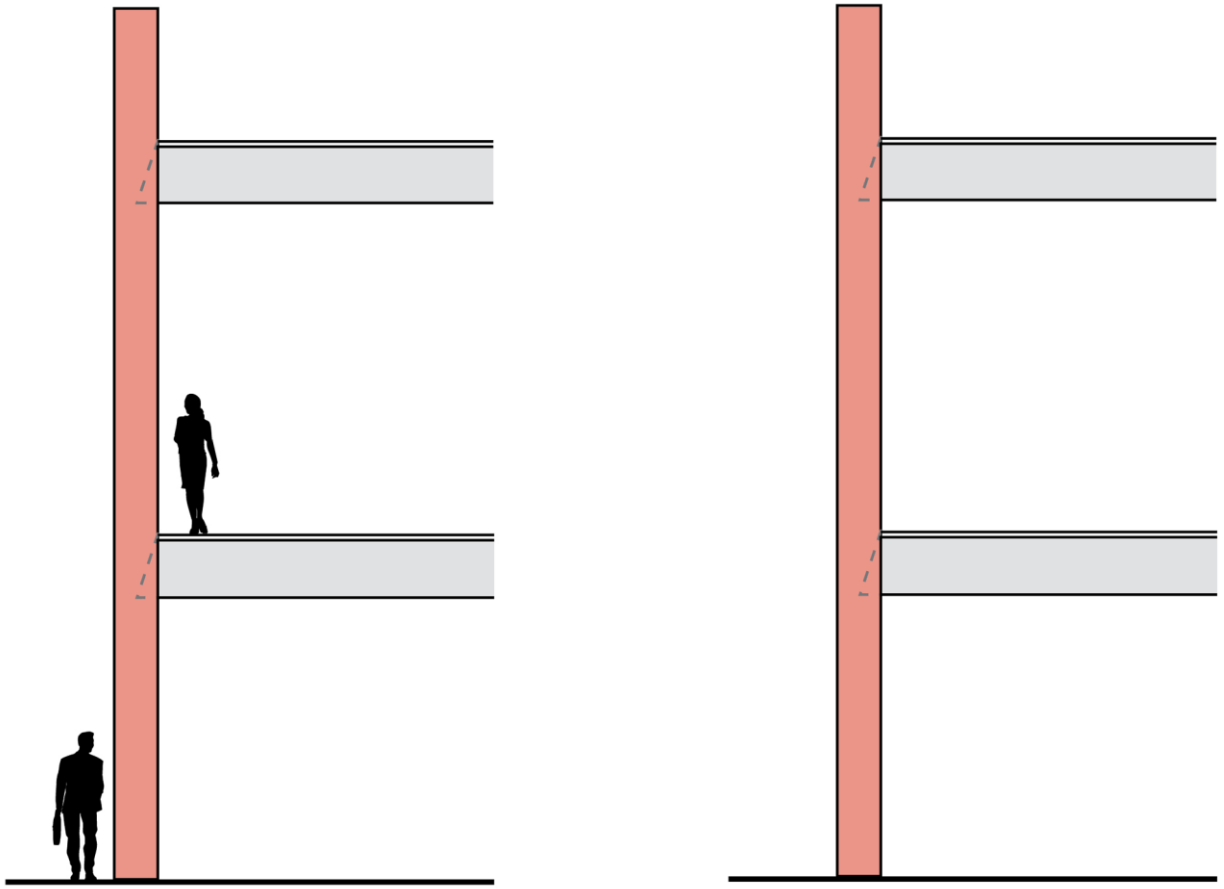
33% of experiencing a M8 Earthquake.

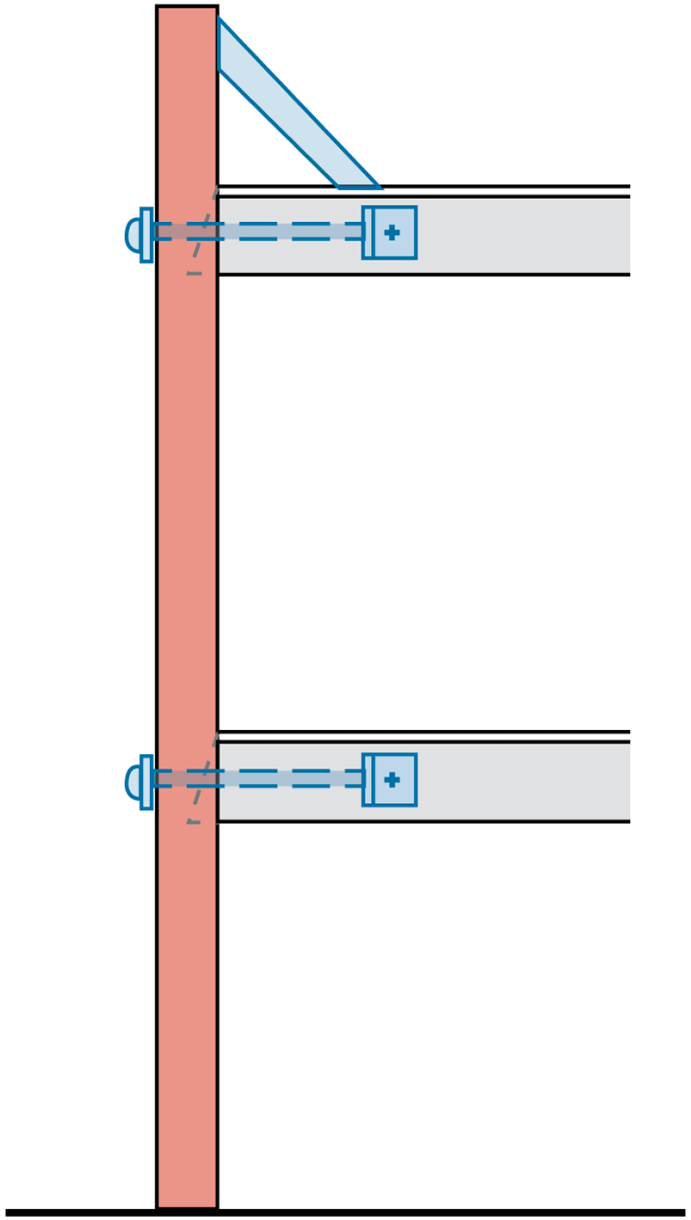
Seattle HMP, SHIVA v7.0 4/10/2019

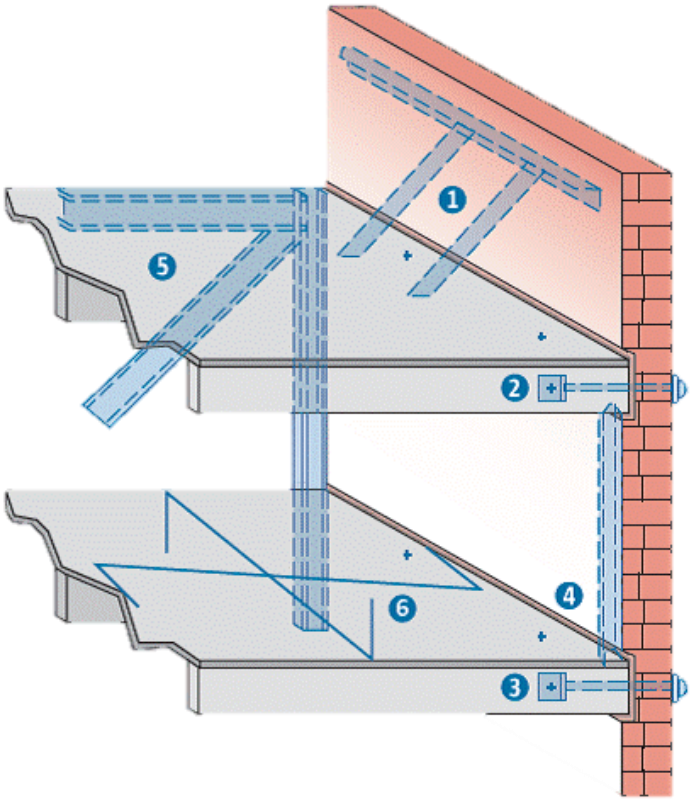
Nisqually 2001 | Sichuan China 2008 | Chile 2010 | Haiti 2010 | Tohoku Japan 2011 | Christchurch NZ 2011 | Napa 2014 | Chiapas Mexico 2017 | Magna Utah 2020 | Turkey/Syria 2023


FENI NDERGROUND
FENIX CAFE
FENIX


WESTERN MOTOR COACH
19303 HWY. 99
LYNNWOOD, WA 98036
SERVICE
RENTAL
SALES
774-1414



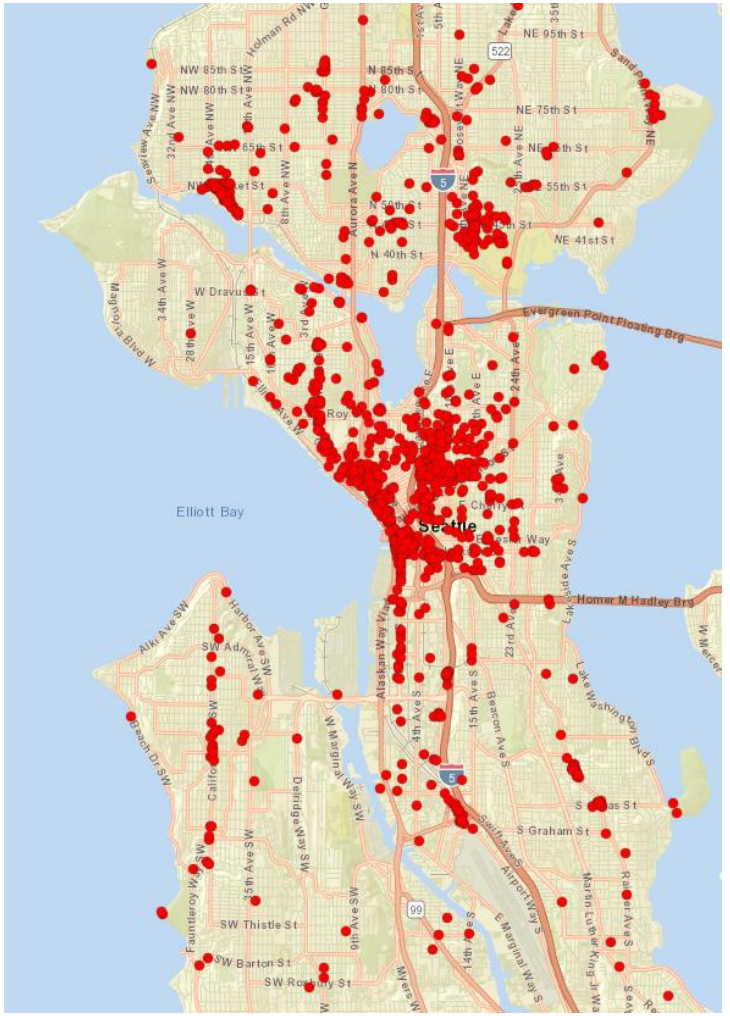



1
5
2
6
4
3

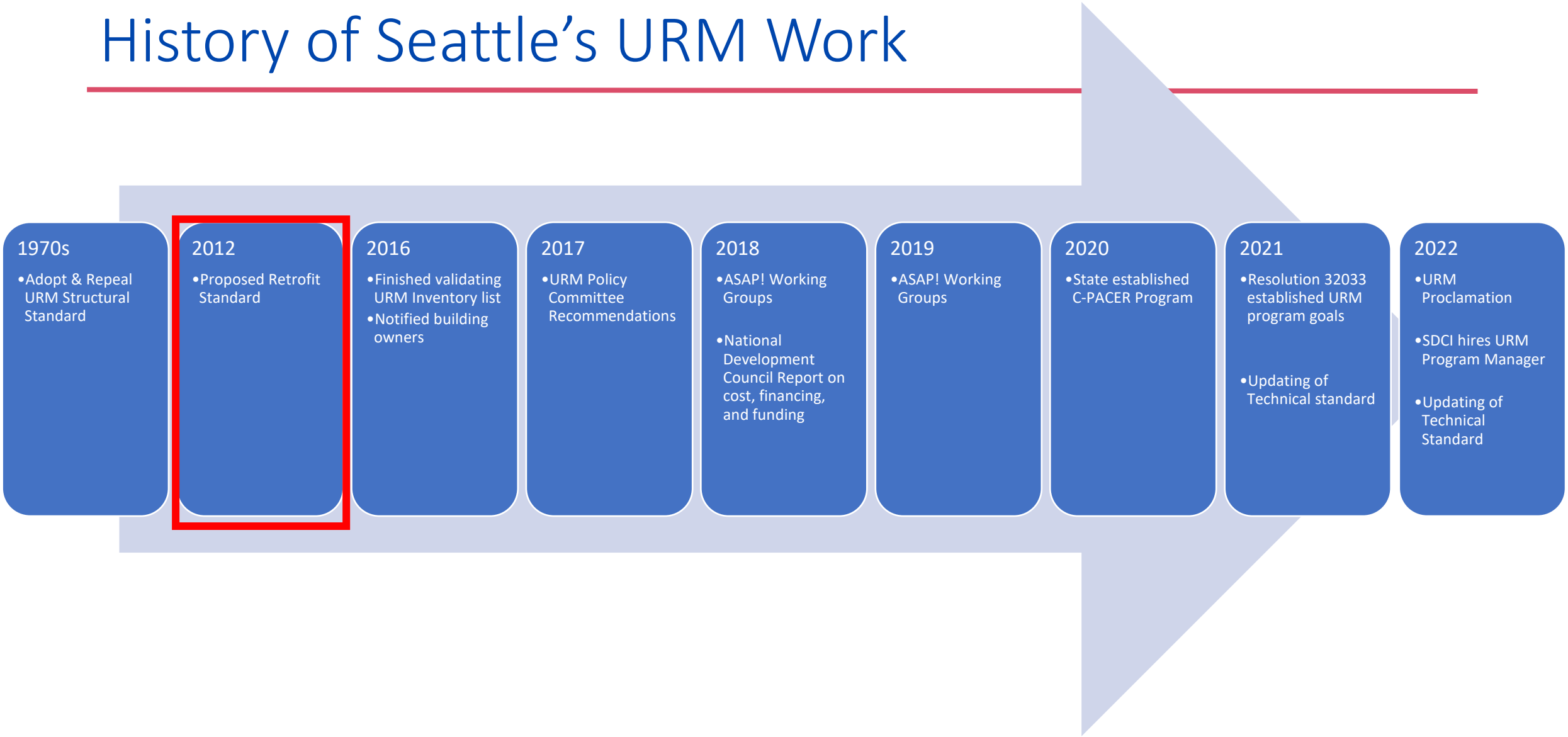
Seattle's URMS

Vulnerability Classification	Number of URMs
Critical vulnerability: emergency service facilities and schools	75
High vulnerability : buildings over three stories in poor soil areas (i.e., liquefaction and slide areas); and buildings containing public assembly spaces with occupancies of more than 100 people	184
Medium vulnerability: all other buildings	883
Total Confirmed URMs	**1,142**

Number of URMs by classification, September 2021



History of Seattle's URM Work



Summary of Resolution 32033

URM Program is anticipated to include:

- Definition of URMs
- Identification of the type of seismic retrofit standard required to bring URMs into compliance, depending on type of building
- Categorization system for building types and/or uses that prioritizes key buildings and services
- Timeline for compliance
- Enforcement strategy
- Variety of potential funding opportunities and financial incentives for building owners to alleviate the financial burden of required seismic retrofits for URMs

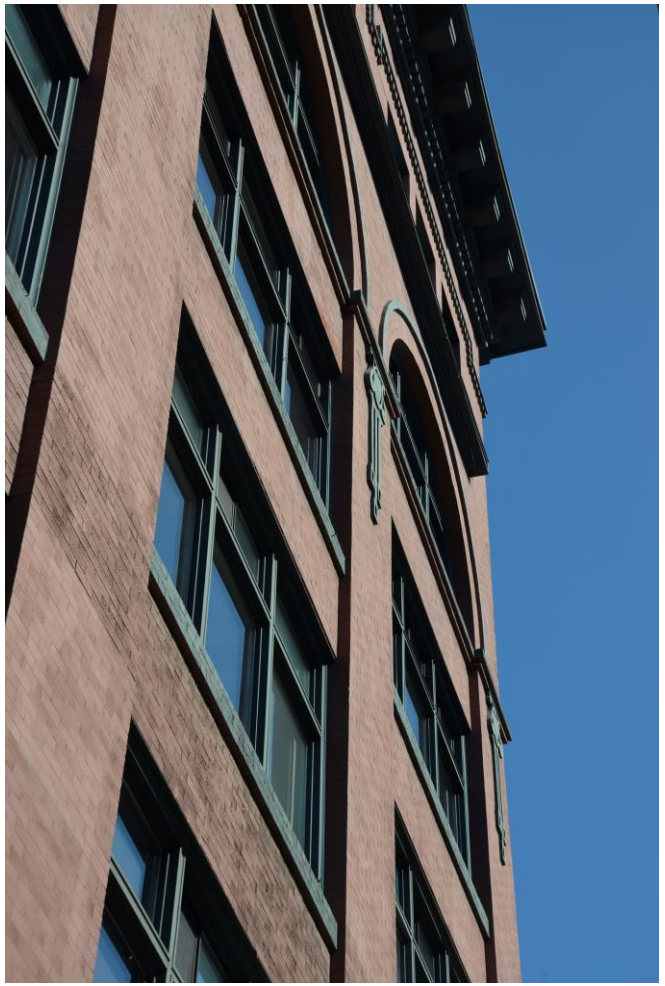
URM Ordinance Goals (Resolution 32033)

Establish Goals of a phased mandatory URM retrofit program

- Primary Goal:
  - Protect life safety by reducing the risk of injury from collapse of URMs in the event of an earthquake
- Additional Goals:
  - Preserve Seattle's historic and culturally significant landmarks and structures that contribute to neighborhood character
  - Improve the City's resiliency to earthquake events
  - Minimize the impact of a URM retrofit program on vulnerable populations to the extent financially feasible

URM Technical Standard Task Group

- Formed July 2022
- Comprised of SDCI staff & practicing engineers from the SEAW Existing Building Committee
- Task group purpose: review and update the 2012 Draft URM Technical Standard based on current codes, seismology, and to improve clarity



URM Technical Standard Task Group

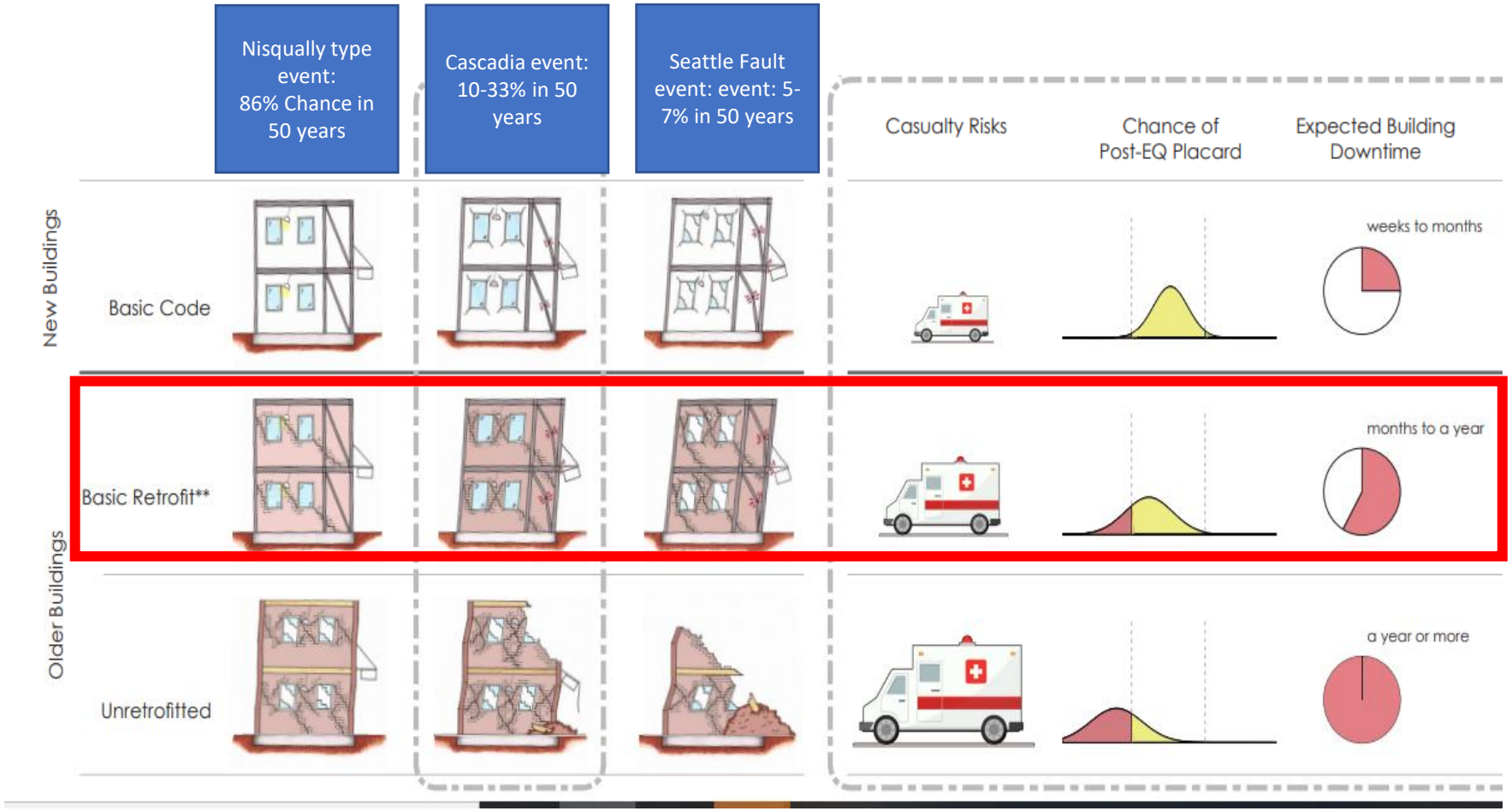
Seattle Department of Construction and Inspections (SDCI)

- Kai Ki Mow, SE, Principal Engineer
- Nathalie Boeholt, SE, Technical Codes Manager
- Kevin Solberg, SE, Structural Plans Engineer - Supervisor
- Susan Chang, PhD, PE, Geotechnical Engr Group Supervisor
- Pao Huang, PhD, PE, Geotechnical Engineer

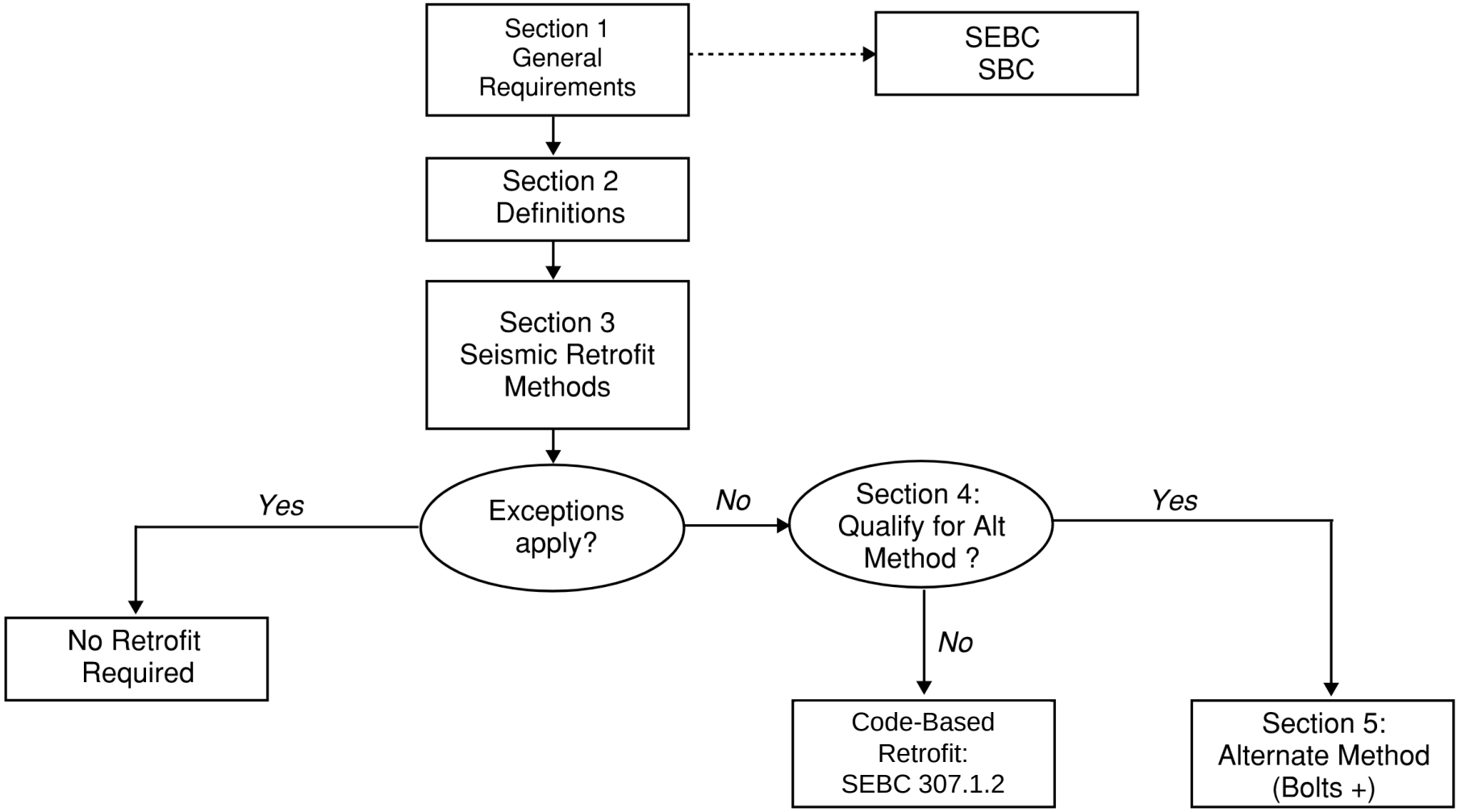
SEAW Existing Building Committee Volunteers

- Beatriz Arostegui (MKA)
- Greg Coons (SSF)
- Wes Neeley (PCS)
- Andy Quinn (BCQ)
- Francesca Renouard (SSF)
- Peter Somers (MKA)
- David Sommer (Degenkolb)
- Abby Van Harpen (MKA)
- Bryan Zagers (CPL)

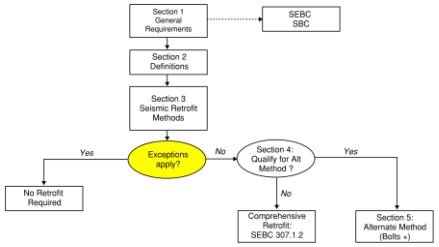
URM Retrofits and Building Performance



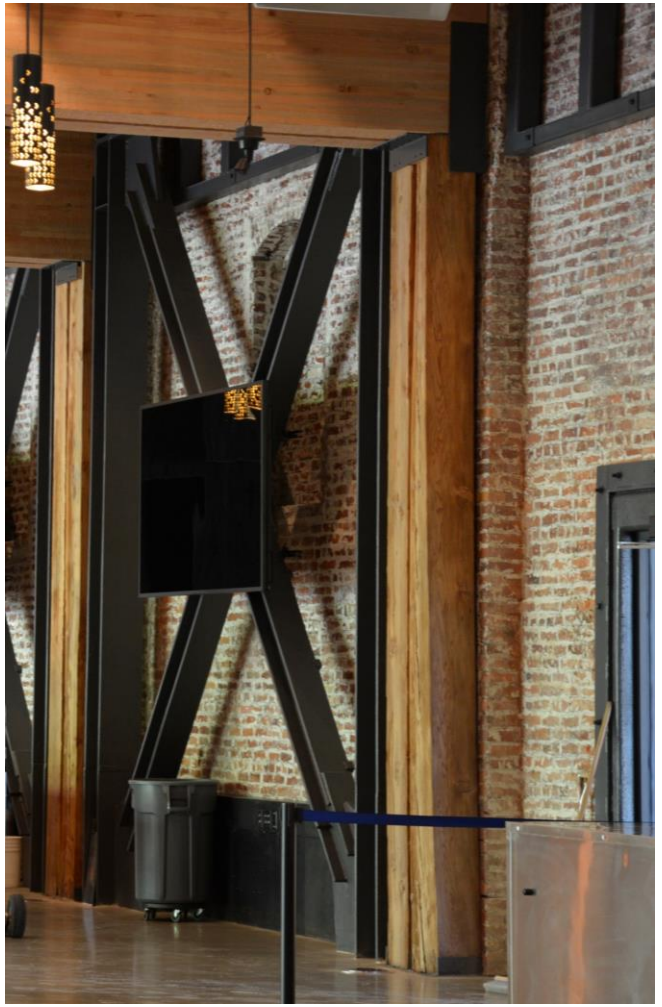
URM Technical Standard Organization



Exceptions

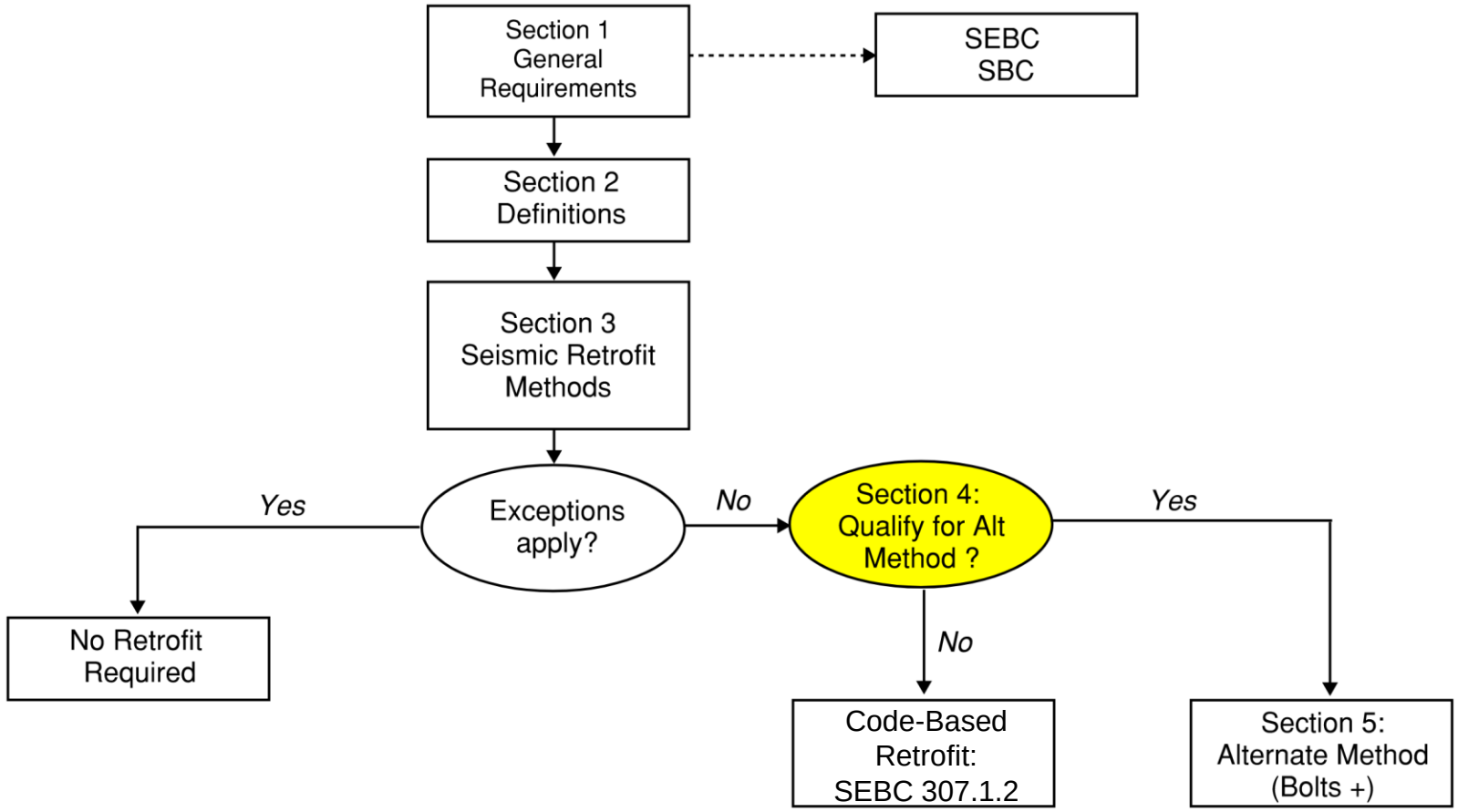


- Substantial Alterations 2006 SBC or newer
  - Limited documentation required
- Substantial Alterations using 1994 SBC – 2003 SBC
  - Structural engineer must review drawings
  - Field verification of retrofit, no significant deterioration
  - Key retrofit components must be present
- Other retrofits that can be shown to meet seismic performance intent

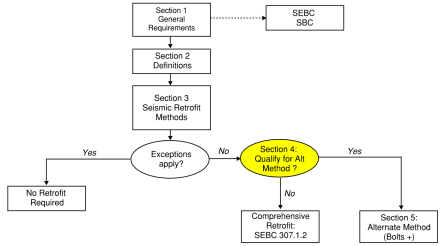


Lund Opsahl

Exceptions

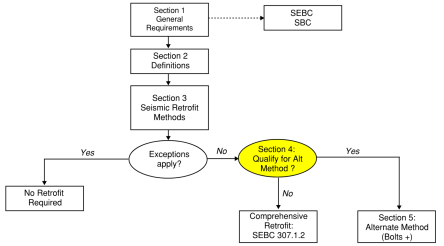

Section 1
General
Requirements
SEBC
SBC
Section 2
Definitions
Section 3
Seismic Retrofit
Methods
Exceptions
apply?
Yes
No
No Retrofit
Required
Section 4:
Qualify for Alt
Method ?
Yes
No
Code-Based
Retrofit:
SEBC 307.1.2
Section 5:
Alternate Method
(Bolts +)

Alternate Method: Qualification



- 6 stories or less; risk category IV not permitted
- No weak story irregularity
- Mortar shear strength > 30psi (testing required)
- Wood diaphragms all levels above grade, no straight-sheathed diaphragms
- Two lines of resistance in each direction, open store front buildings may add a brace to qualify
- Wall piers h:w < 2:1 and at least **40 percent** of the total wall length
  - …or demonstrate the wall pier **DCR < 2.5** for in-plane forces

Alternate Method: Qualification



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Google Streetview

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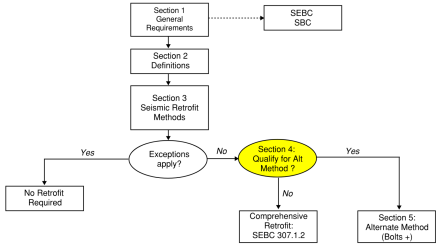

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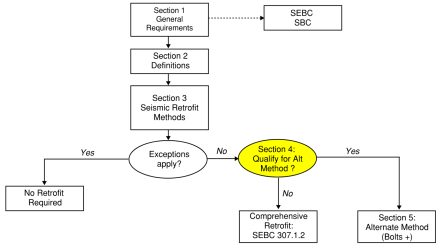
SSF Engineers

Alternate Method: Qualification



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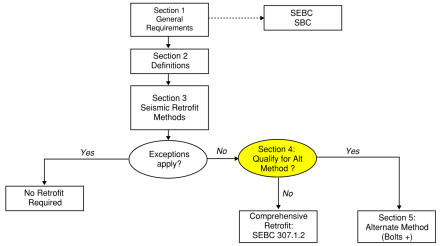
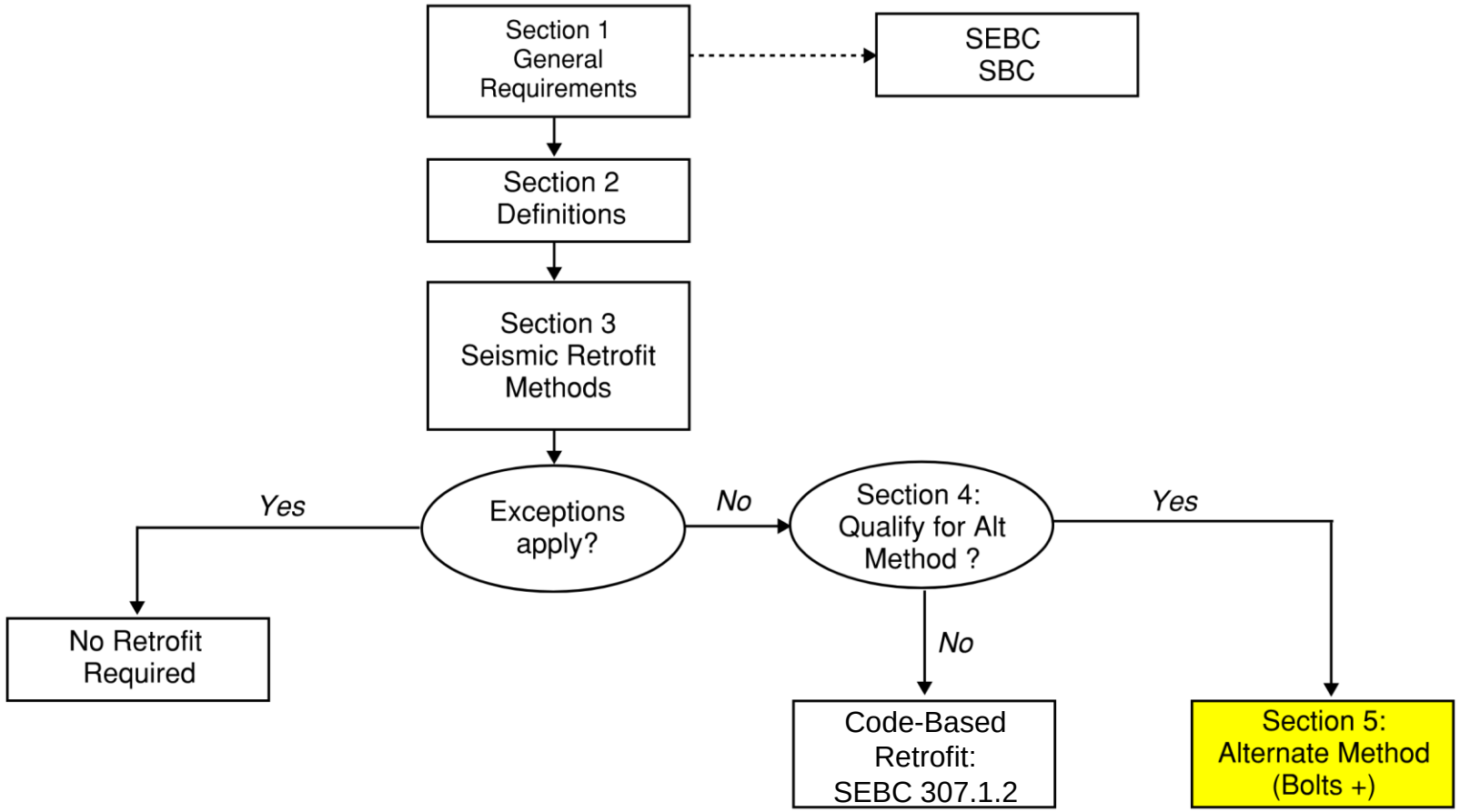


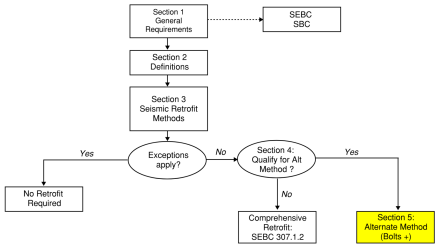
- Mortar shear strength > 30psi (testing required)

- Wood diaphragms all levels above grade, no straight-sheathed diaphragms
  - some exceptions

Alternate Method



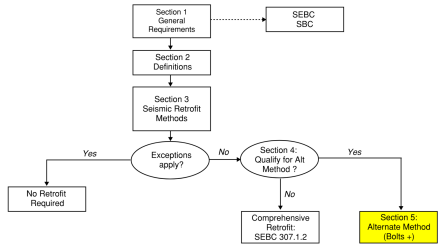
Alternate Method



Basic assumption:

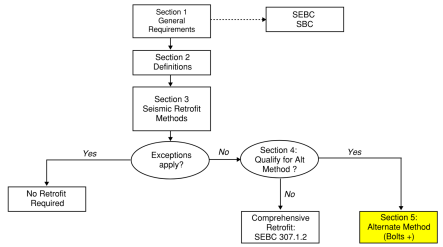
- If you qualify for the Alternate Method the building has a basic lateral system

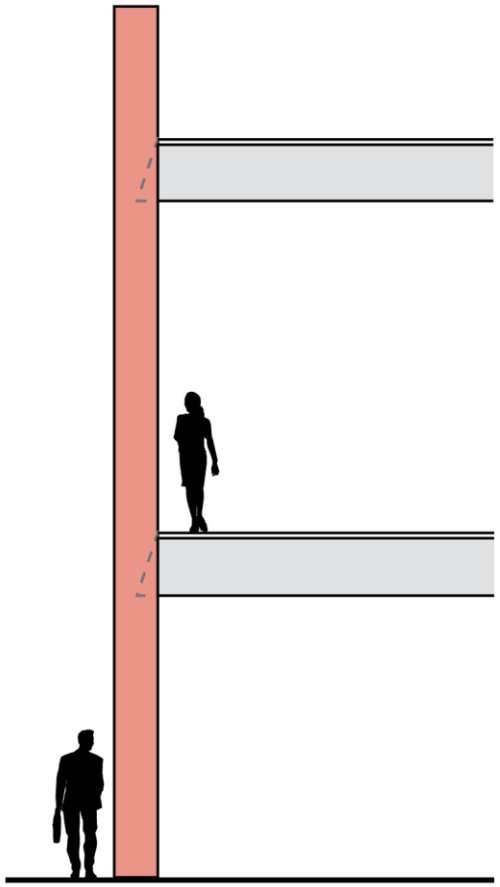
Alternate Method

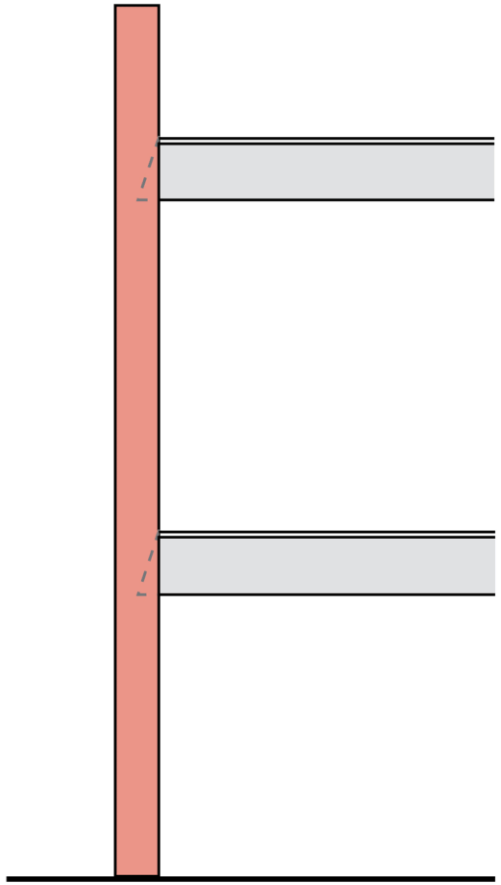


- Intended to minimize cost of design and construction while reducing risk of collapse / loss of life.
- Standalone method fully encapsulated within the standard
- Modeled after 2018 SEBC Appendix A1 and “Bolts+” programs, addressing (4) critical components:
  - wall anchorage (tension anchors)
  - diaphragm shear transfer (shear anchors)
  - out-of-plane wall bracing
  - parapet/appendage bracing

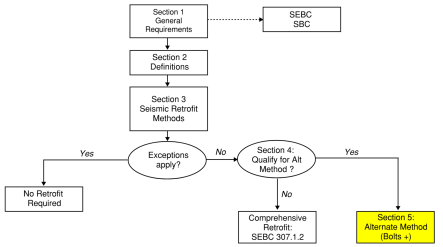
Alternate Method

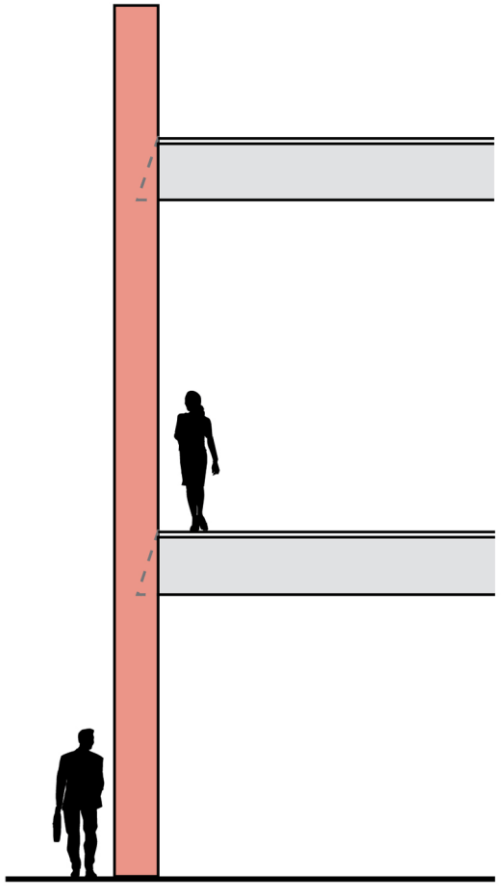


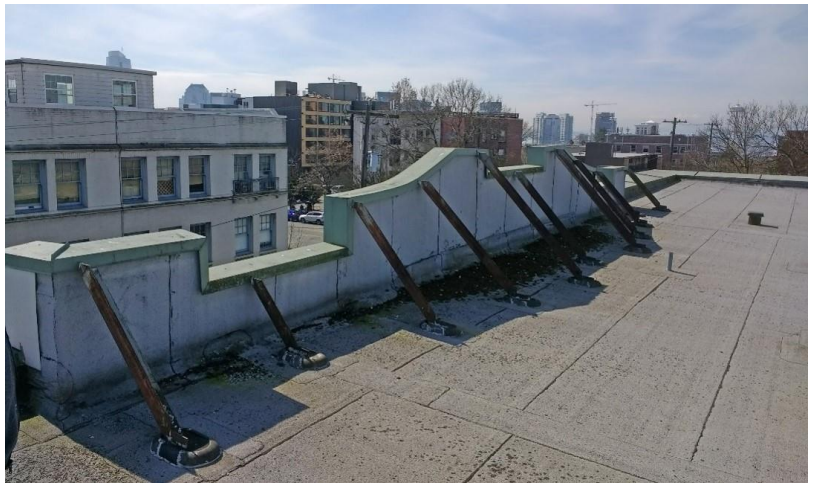




Alternate Method: Parapets







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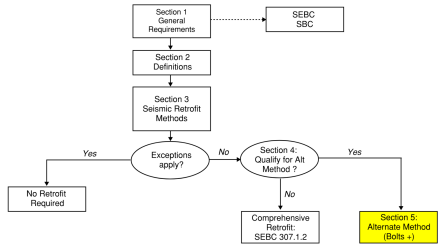
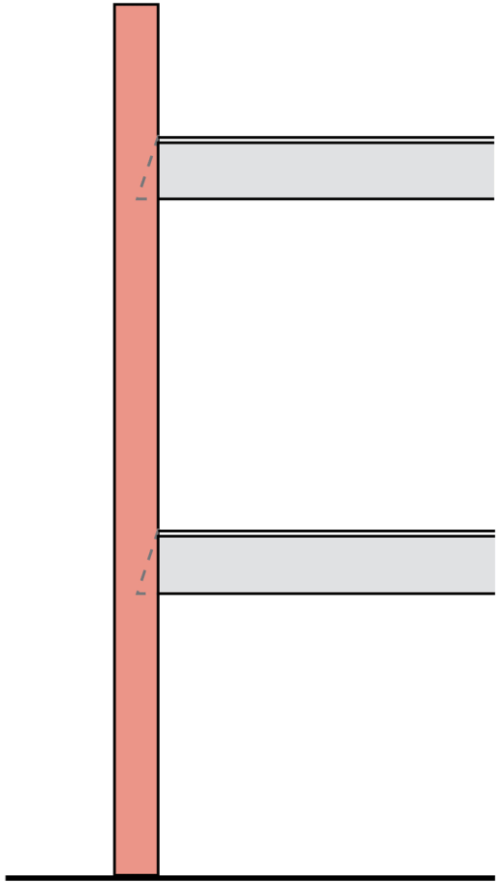
SSF Engineers

Alternate Method: Out-of-Plane





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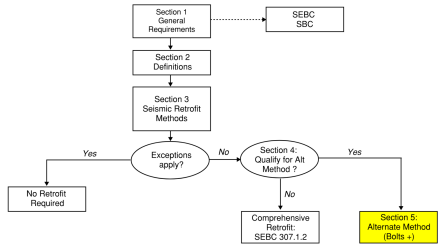
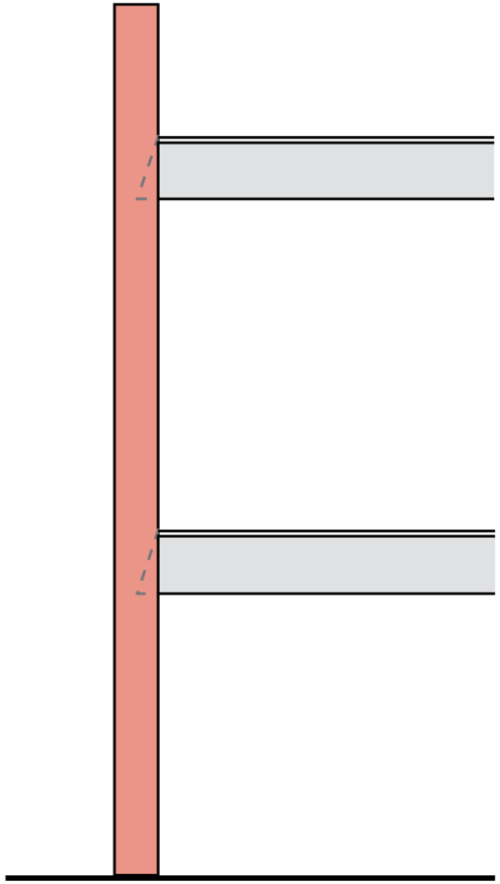
MKA

Alternate Method: Wall Anchorage





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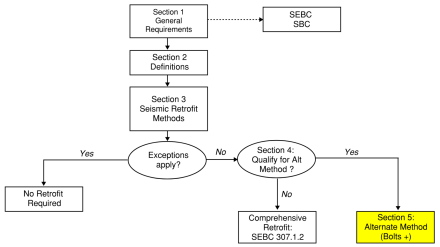
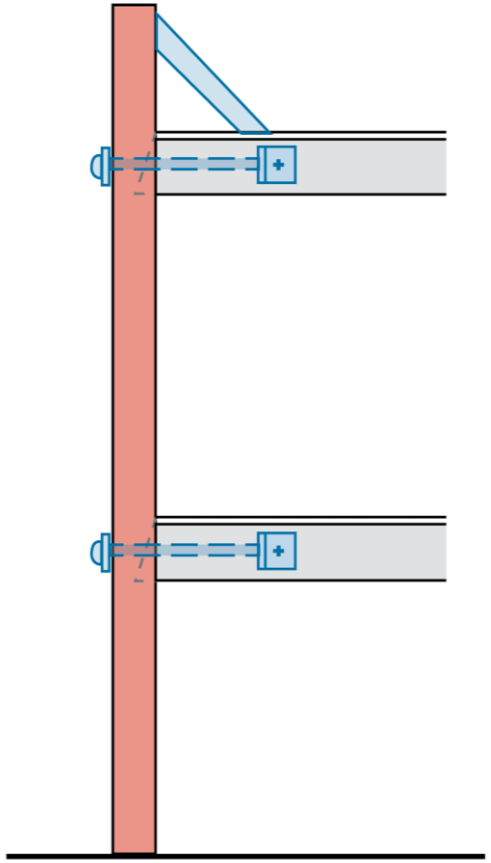
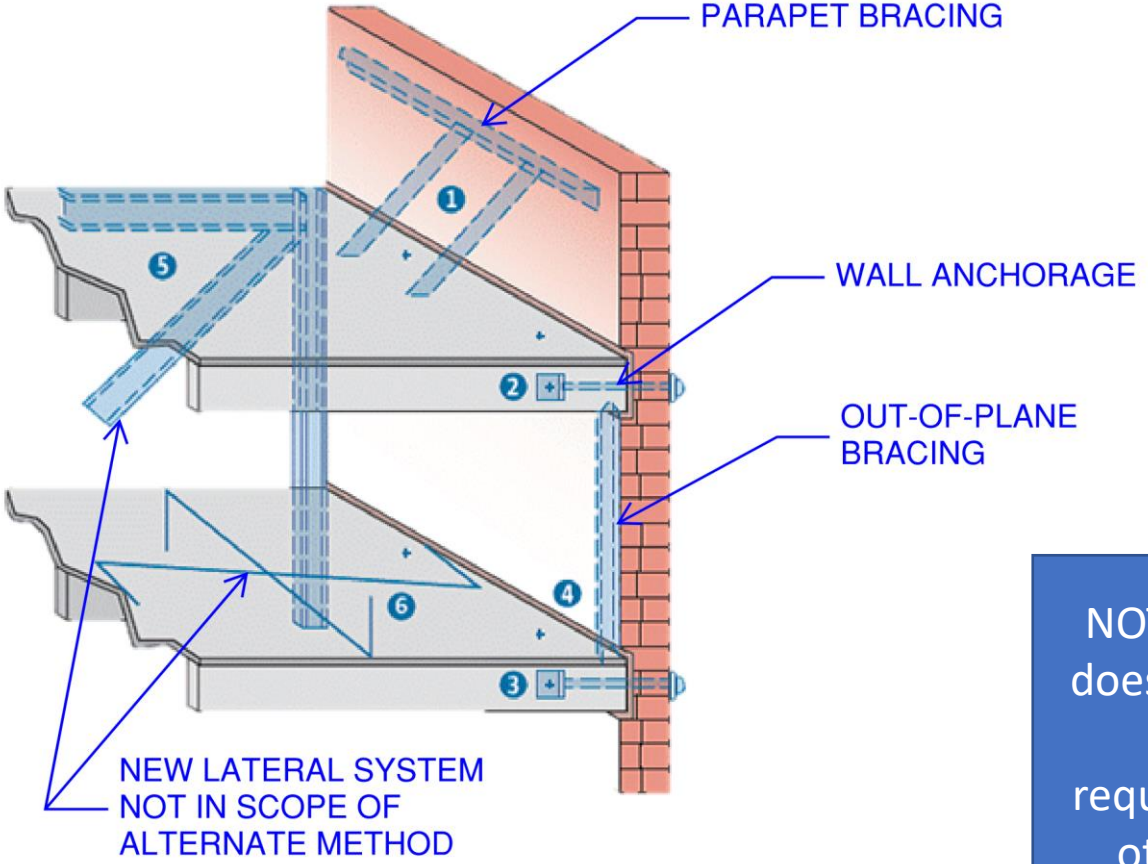
Alternate Method

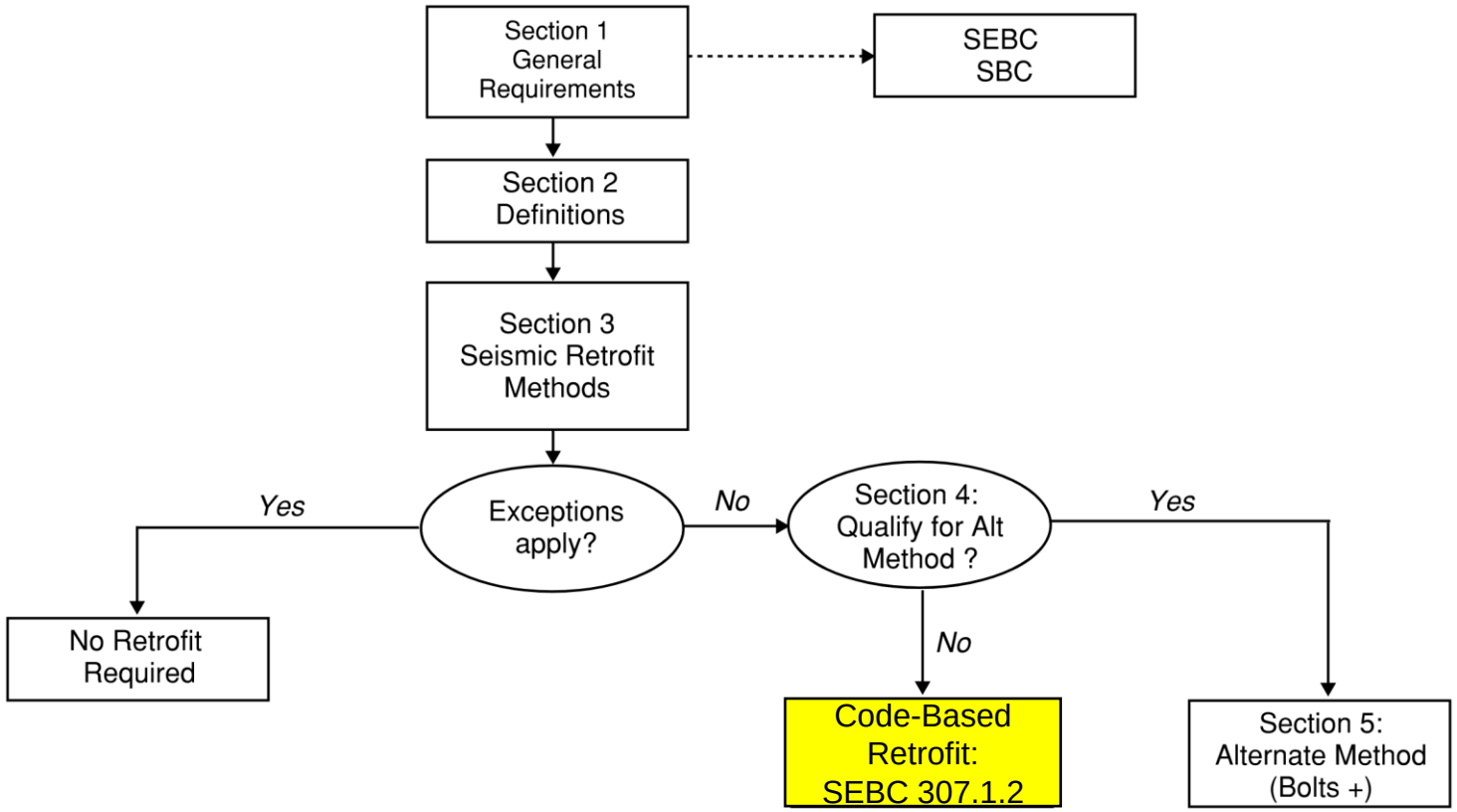






NOTE: The Alternate Method does NOT relieve the owner of Substantial Alteration requirements when trigged by other rehabilitation work.

Code-Based Retrofit



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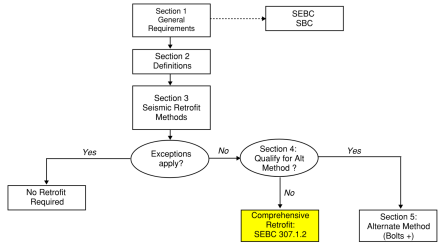
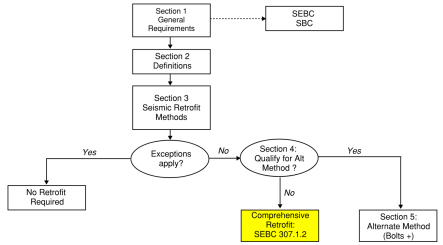


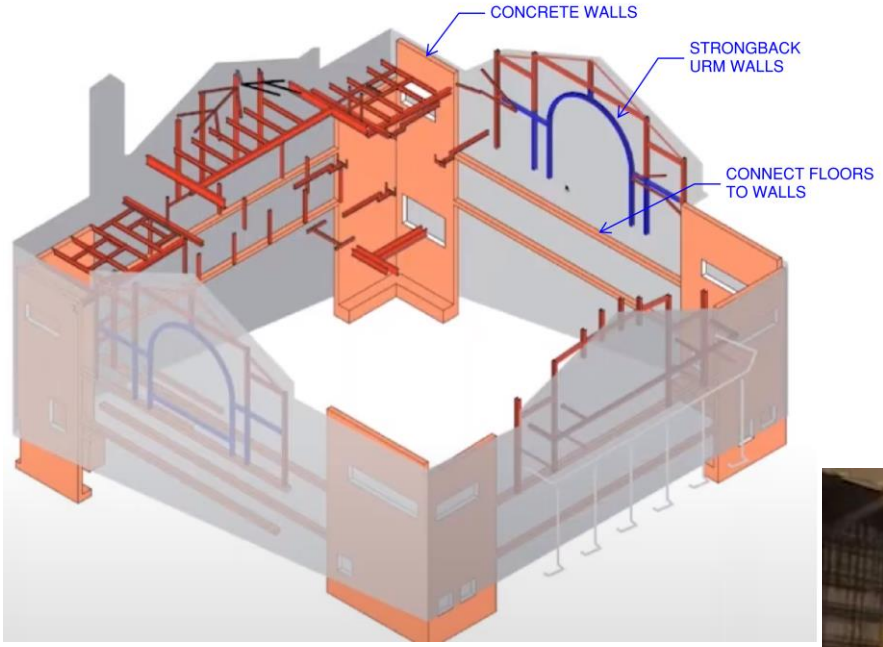
- Same retrofit standard as buildings undergoing Substantial Alteration
- Must address comprehensive list of common deficiencies
- Uses seismic forces around 75% of new buildings
- Typically uses a series of checklists to determine where to target retrofit efforts
  - New/strengthen lateral system
  - Wall bracing
  - Wall anchors
  - Floor diaphragm strengthening

Table 17-36. Collapse Prevention Structural Checklist for Building Types URM and URMa

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Low and Moderate Seismicity			
Seismic-Force-Resisting System			
C NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
C **NC** N/A U	SHEAR STRESS CHECK: The shear stress in the unreinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 30 lb/in.^{2} (0.21 MPa) for clay units and 70 lb/in.^{2} (0.48 MPa) for concrete units.	5.5.3.1.1	A.3.2.5.1
Connections			
C **NC** N/A U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
C NC N/A U	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers	5.7.1.3	A.5.1.2

Code-Based Retrofit



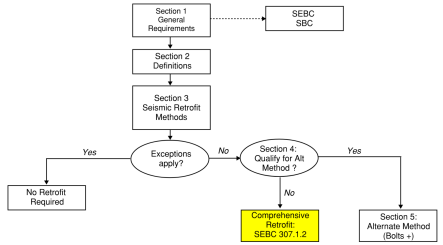


BuildingWork

BuildingWork

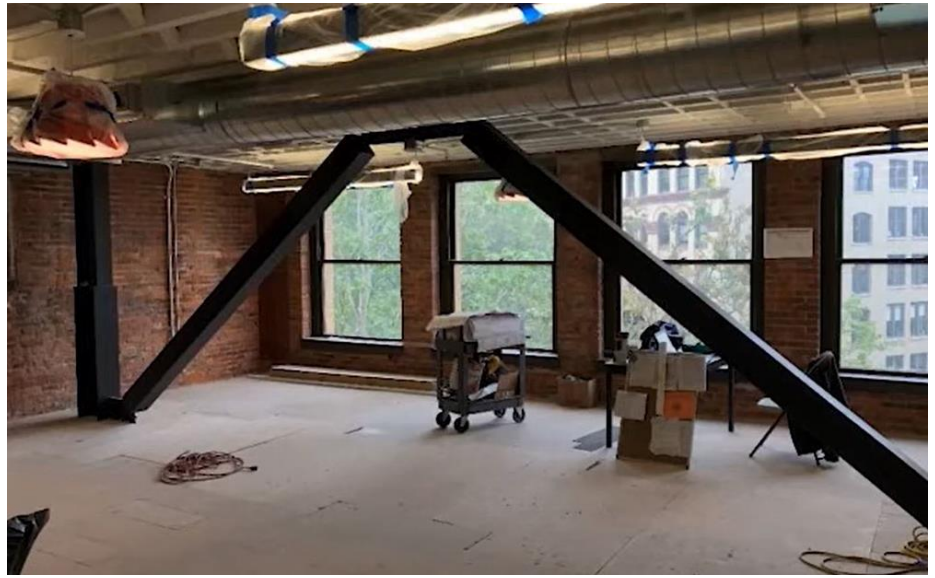
MKA

Code-Based Retrofit



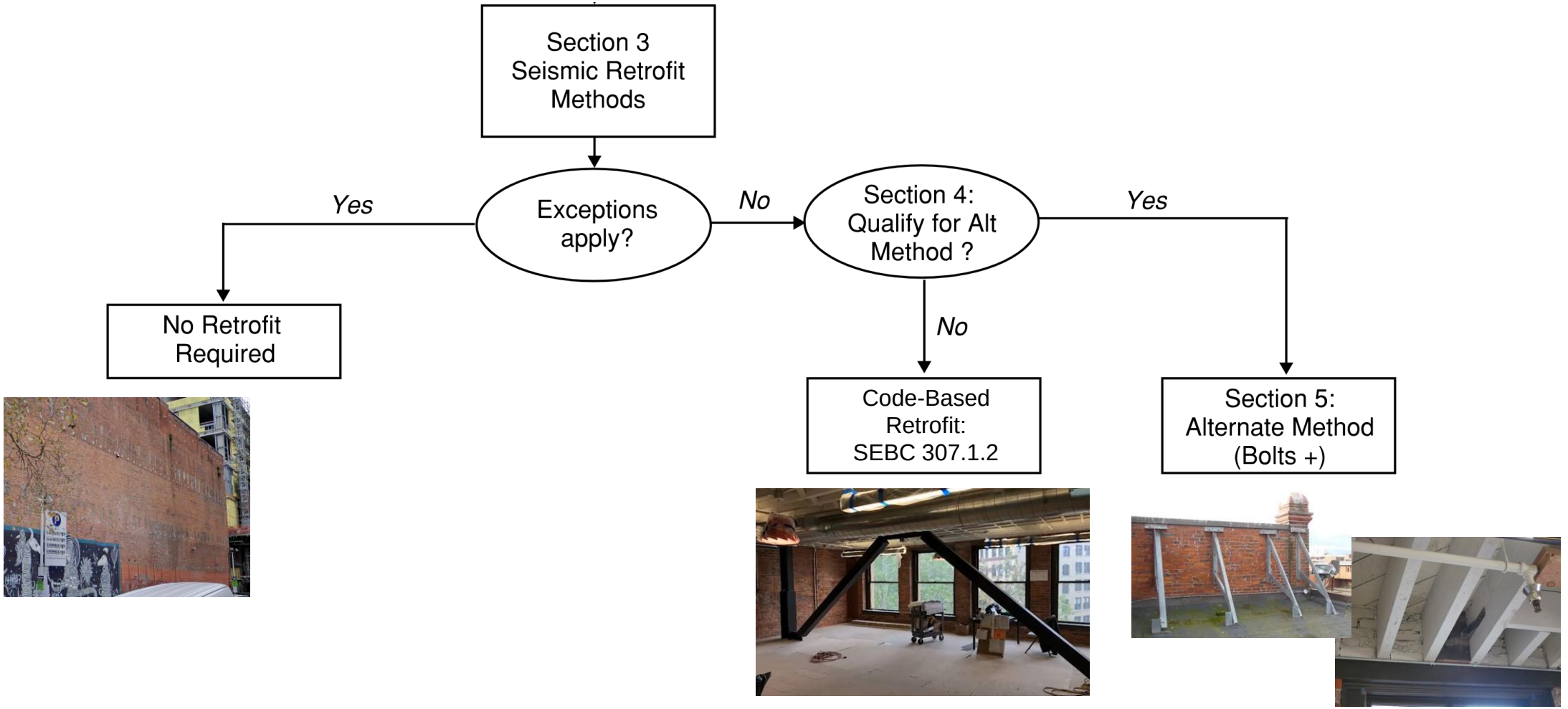
SSF Engineers

Lund Opsahl



SSF Engineers

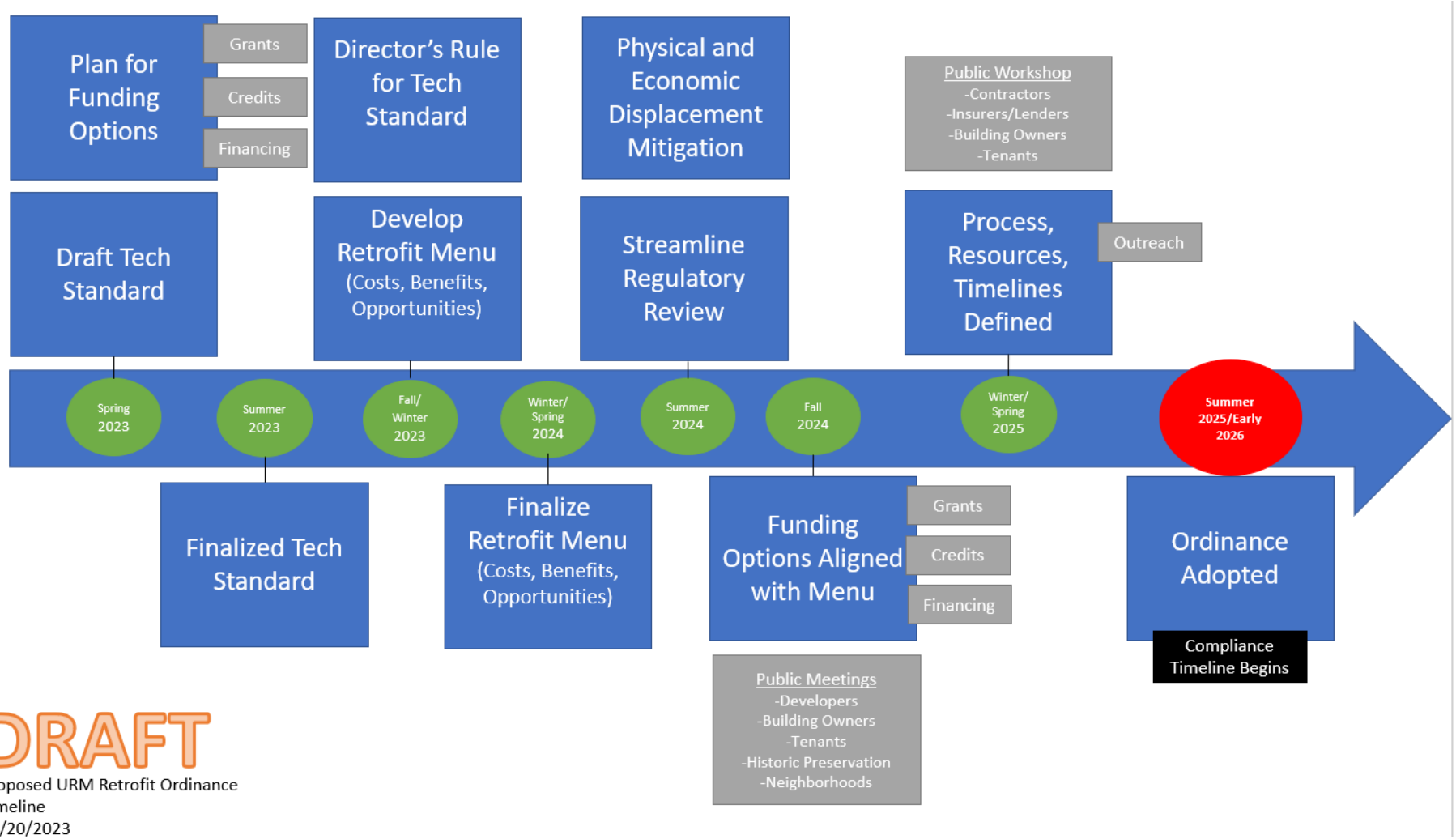
URM Technical Standard



Additional Notes

- Seismic retrofit work will not be a contributing factor for other Substantial Alteration triggers.
- Draft Technical Standard will be published to SDCI website by the end of the month.
  - SDCI will develop a Director's Rule to encourage voluntary retrofits informed by the technical standard;
  - Goal: By the end of the year
- SDCI will be hiring a Senior Structural Engineer to provide dedicated technical assistance to the URM Program Manager, the public, and the engineers in charge of the retrofit.

Pathway to Mandatory Ordinance



DRAFT

Proposed URM Retrofit Ordinance Timeline
04/20/2023

Comments/ Questions?

Comments to Technical Standard:

Kevin Solberg

Engineer Supervisor

Kevin.Solberg@Seattle.gov

Nathalie Boeholt

Technical Codes Manager

Nathalie.Boeholt@seattle.gov

URM Program Questions:

Amanda Hertzfeld

URM Program Manager

Amanda.Hertzfeld@seattle.gov