Seattle URM Retrofit Recognition: Technical Briefing

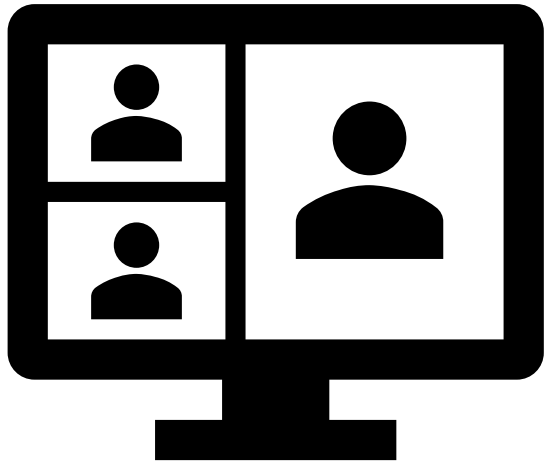
Photo by John Skelton

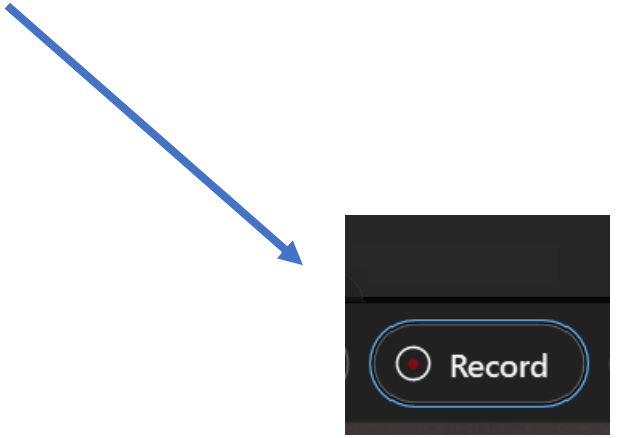
- Derek Ohlgren, P.E., URM Program Lead Engineer
- Amanda Hertzfeld, URM Program Manager

October 17, 2024

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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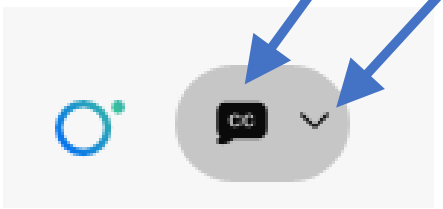
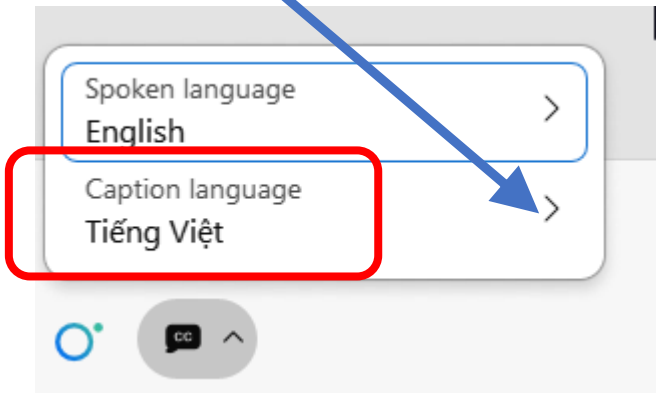




Introductions

Seattle Department of Construction & Inspections:

- Derek Ohlgren, P.E., URM Program Lead Engineer
- Amanda Hertzfeld, URM Program Manager

Agenda

Meeting Goal:

- Review 2021 Seattle Existing Building Code adoption recognizing URM retrofit minimum standards and provide opportunity for questions.

Topics for Discussion:

- Changes to 2021 Seattle Existing Building Code (SEBC)
  - URM retrofit definitions, minimum standard and methodology
  - Modification to Substantial Alteration Triggers
- Updates to the City of Seattle URM Database
- Procedure to demonstrate retrofit status of URM buildings
- Procedure to appeal URM determination of non-URM buildings

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
- Dennis Pradere, SE
- Susan Chang, PhD, PE, Geotechnical Engr Group Supervisor
- Pao Huang, PhD, PE, Geotechnical Engineer

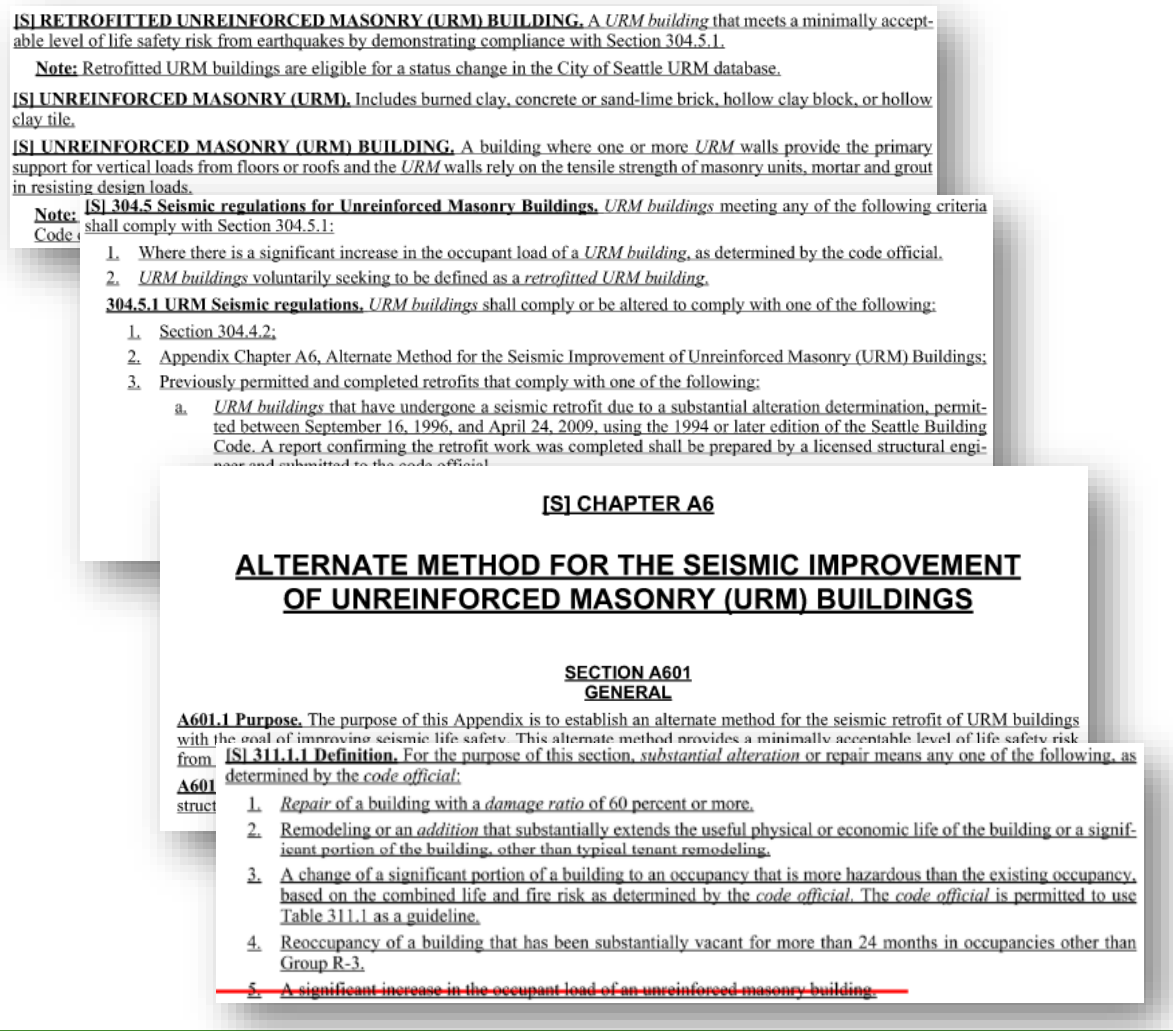
SEAW Existing Building Committee Volunteers

- 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)

Why Retrofit?

2021 SEBC Adoption of URM Retrofit Recognition

- Defines minimum voluntary seismic safety requirements to be recognized as "retrofitted". (Section 202)
- Establishes pathways for previous retrofits to be eligible for "retrofitted" status. (Section 304.5)
- Establishes the **Alternate Method** for URM retrofits, minimizing cost and collapse hazard. (Appendix A6)
- Sub-Alt trigger #5 moved and changed (Section 311.1)



[S] RETROFITTED UNREINFORCED MASONRY (URM) BUILDING. A *URM building* that meets a minimally acceptable level of life safety risk from earthquakes by demonstrating compliance with Section 304.5.1.

Note: Retrofitted URM buildings are eligible for a status change in the City of Seattle URM database.

[S] UNREINFORCED MASONRY (URM). Includes burned clay, concrete or sand-lime brick, hollow clay block, or hollow clay tile.

[S] UNREINFORCED MASONRY (URM) BUILDING. A building where one or more *URM* walls provide the primary support for vertical loads from floors or roofs and the *URM* walls rely on the tensile strength of masonry units, mortar and grout in resisting design loads.

Note: Code

[S] 304.5 Seismic regulations for Unreinforced Masonry Buildings. *URM buildings* meeting any of the following criteria shall comply with Section 304.5.1:

1. Where there is a significant increase in the occupant load of a *URM building*, as determined by the code official.
2. *URM buildings* voluntarily seeking to be defined as a *retrofitted URM building*.

304.5.1 URM Seismic regulations. *URM buildings* shall comply or be altered to comply with one of the following:

1. Section 304.4.2;
2. Appendix Chapter A6, Alternate Method for the Seismic Improvement of Unreinforced Masonry (URM) Buildings;
3. Previously permitted and completed retrofits that comply with one of the following:
   a. *URM buildings* that have undergone a seismic retrofit due to a substantial alteration determination, permitted between September 16, 1996, and April 24, 2009, using the 1994 or later edition of the Seattle Building Code. A report confirming the retrofit work was completed shall be prepared by a licensed structural engi-

[S] CHAPTER A6

ALTERNATE METHOD FOR THE SEISMIC IMPROVEMENT OF UNREINFORCED MASONRY (URM) BUILDINGS

SECTION A601
GENERAL

A601.1 Purpose. The purpose of this Appendix is to establish an alternate method for the seismic retrofit of URM buildings with the goal of improving seismic life safety. This alternate method provides a minimally acceptable level of life safety risk from

A601
struct

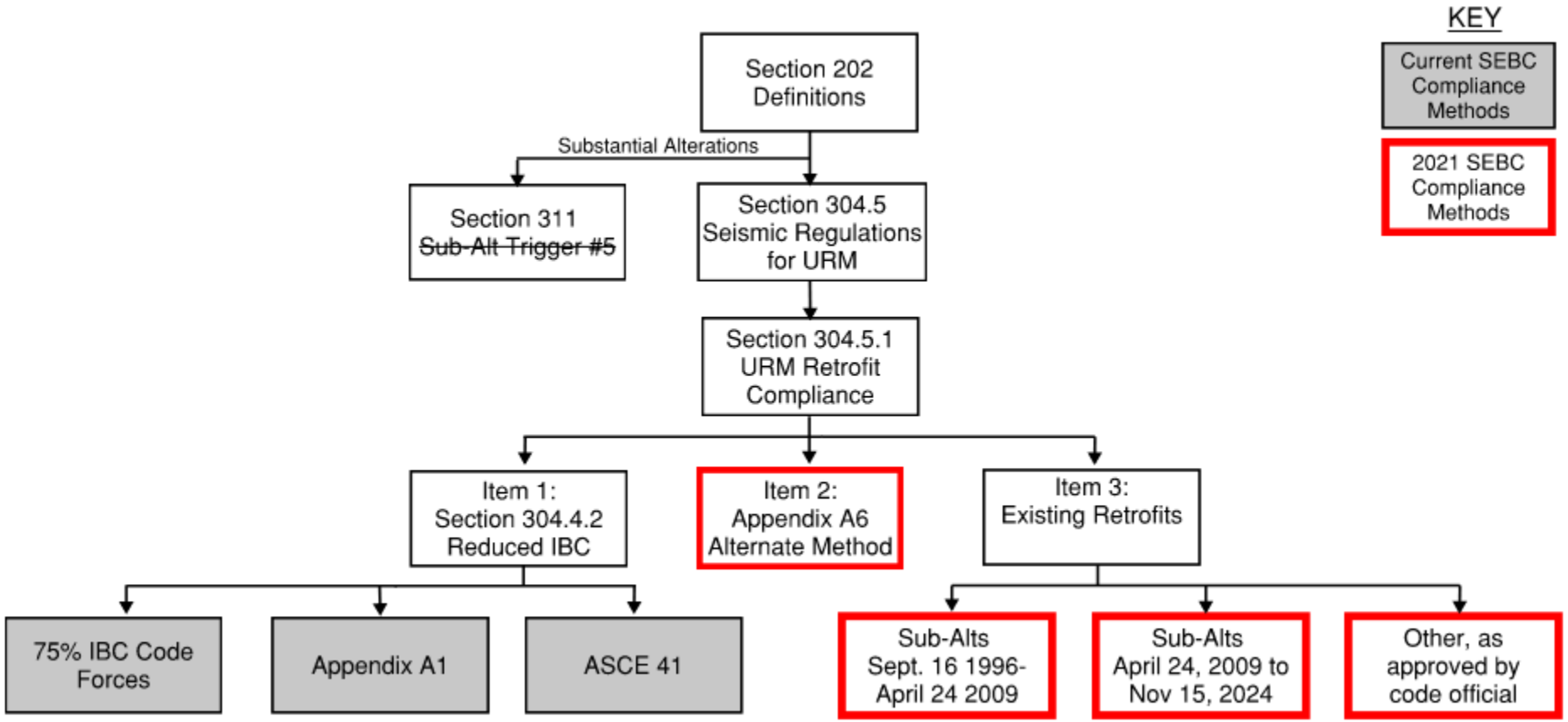
[S] 311.1.1 Definition. For the purpose of this section, *substantial alteration* or repair means any one of the following, as determined by the *code official*:

1. *Repair* of a building with a *damage ratio* of 60 percent or more.
2. Remodeling or an *addition* that substantially extends the useful physical or economic life of the building or a significant portion of the building, other than typical tenant remodeling.
3. A change of a significant portion of a building to an occupancy that is more hazardous than the existing occupancy, based on the combined life and fire risk as determined by the *code official*. The *code official* is permitted to use Table 311.1 as a guideline.
4. Reoccupancy of a building that has been substantially vacant for more than 24 months in occupancies other than Group R-3.
5. ~~A significant increase in the occupant load of an unreinforced masonry building.~~

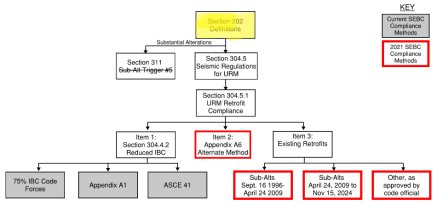
2021 SEBC Adoption of URM Retrofit Recognition

- Encourages voluntary URM retrofits.
- A voluntary retrofit on its own does not trigger a Substantial Alteration
- Additional scope of work performed along side a voluntary seismic retrofit may trigger a Substantial Alteration
- The Alternate Method does NOT relieve the owner of Substantial Alteration requirements when triggered by other rehabilitation work in the future.

2021 SEBC Summary of Changes



Section 202: General Definitions



UNREINFORCED MASONRY (URM). Includes burned clay, concrete or sand-lime brick, hollow clay block, or hollow clay tile.

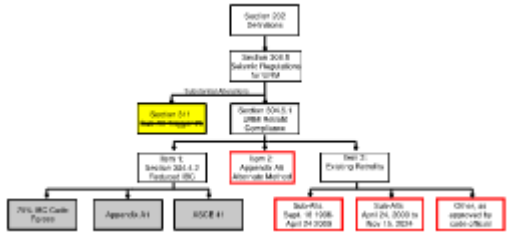
UNREINFORCED MASONRY (URM) BUILDING. A building where one or more *URM* walls provide the primary support for vertical loads from floors or roofs and the *URM* walls rely on the tensile strength of masonry units, mortar and grout in resisting design loads.

NOTE: URM buildings were generally constructed prior to 1945 and unlawful after adoption of the 1973 Uniform Building Code on May 7, 1977.

RETROFITTED UNREINFORCED MASONRY (URM) BUILDING. A *URM building* that meets a minimally acceptable level of life safety risk from earthquakes by demonstrating compliance with Section 304.5.1.

NOTE: Retrofitted URM buildings are eligible for a status change in the City of Seattle URM database.

Substantial Alteration Triggers for URM



- **Strike sub-alt definition #5**: *A significant increase in occupant load of a URM building*.
- If scope of work meets Def's #1 through 4, a sub-alt is still triggered. No change.
- The only trigger for URM is to a minimum retrofit level in 304.5.1

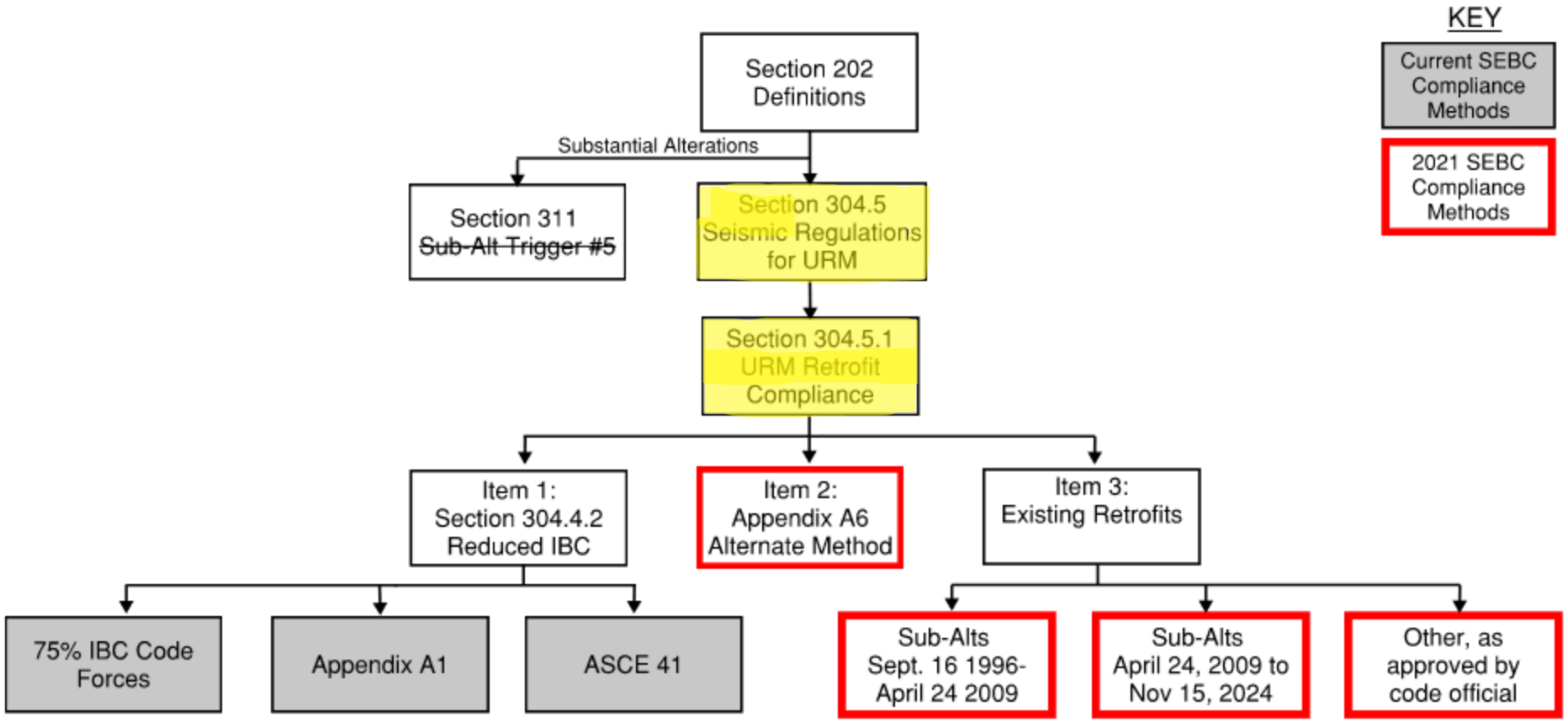
NOTE: Retrofitting to the minimum standard does NOT relieve the owner of Substantial Alteration requirements when triggered by other rehabilitation work.

311.1.1 Definition: *substantial alteration* or repair means any one of the following:

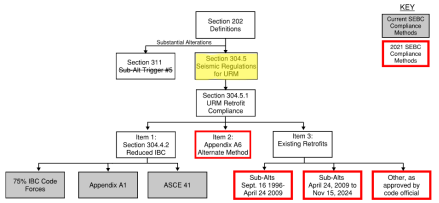
1. Repair of a building with a damage ratio of 60 percent or more.
2. Remodeling or an addition that substantially extends the useful physical or economic life of the building or a significant portion of the building, other than a typical tenant remodeling.
3. **A change of a significant portion of a building to an occupancy that is more hazardous than the existing occupancy, based on the combined life and fire risk.**
4. Reoccupancy of a building that has been substantially vacant for more than 24 months in occupancies other than Group R-3.

~~5. A significant increase in the occupant load of an unreinforced masonry building.~~

Section 304.5: Seismic Regulations for URM



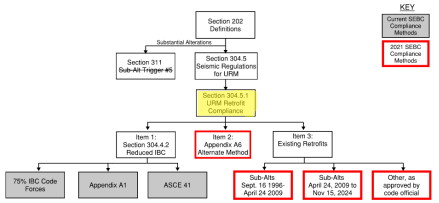
Requirements For All Compliance Methods



304.5 Seismic regulations for Unreinforced Masonry Buildings. *URM buildings* meeting any of the following criteria shall comply with 304.5.1:

1. Where there is a significant increase in the occupant load of a *URM building*, as determined by the code official. (Formerly Sub Alt trigger #5)
2. *URM Buildings* voluntarily seeking to be defined as a *Retrofitted URM Building*.

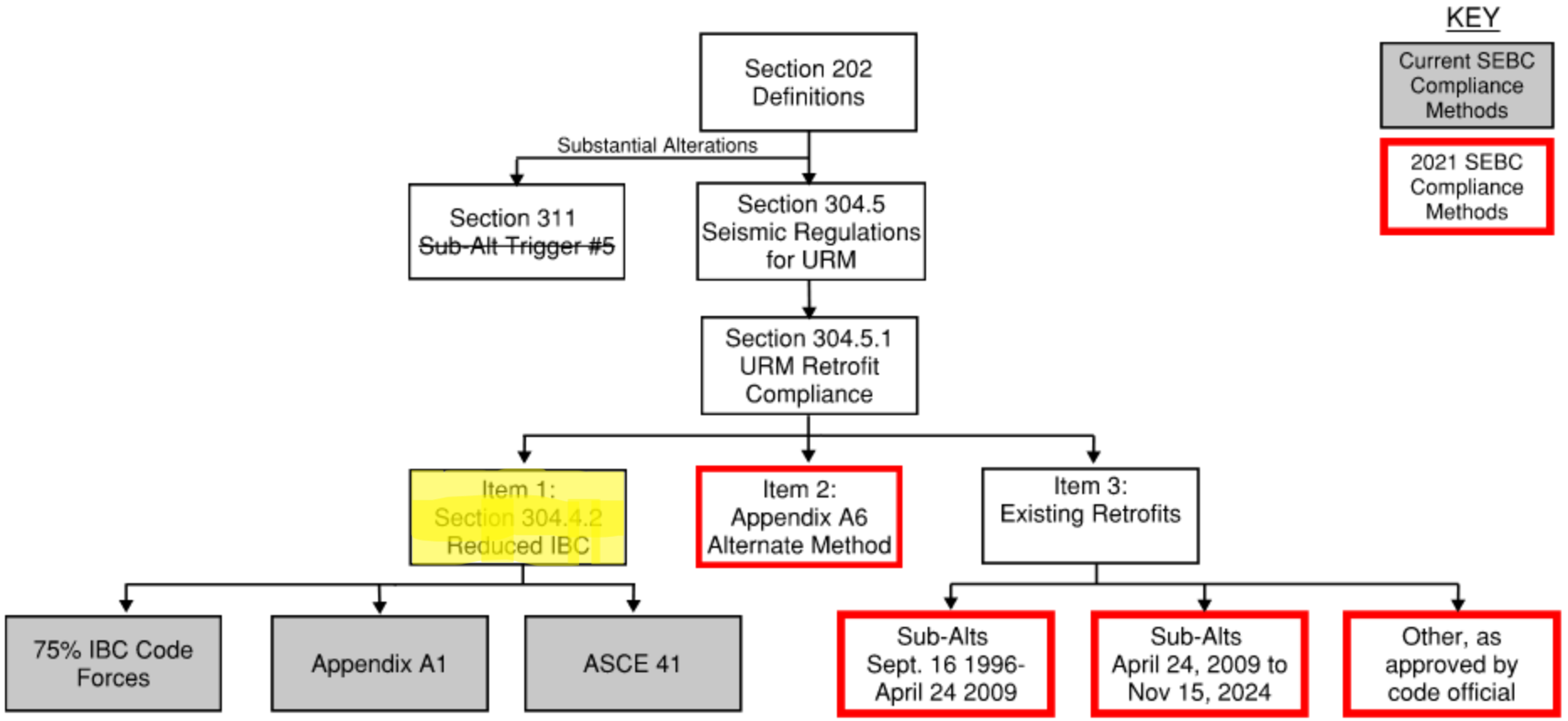
Requirements For All Compliance Methods



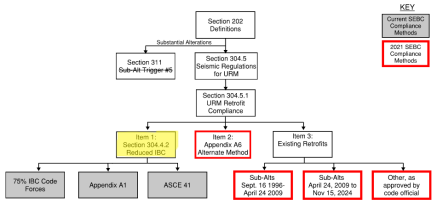
304.5.1 URM Seismic regulations. *URM buildings* shall comply or be altered to comply with one of the following:

1. Section 304.4.2; (current reduced forces method for Sub Alt)
2. Appendix Chapter A6 Alternate Method for the Seismic Improvement of *Unreinforced Masonry (URM) Buildings*;
3. Previously permitted and completed retrofits that comply with one of the following:
   a. *URM Buildings* that have undergone a seismic retrofit due to a substantial alteration determination, permitted between September 16, 1996 and April 24, 2009 using the 1994 or later edition of the Seattle Building Code. A report confirming the retrofit work was completed shall be prepared by a licensed structural engineer and submitted to the code official.
   b. *URM Buildings* that have undergone a seismic retrofit due to a substantial alteration determination, permitted after April 24, 2009 using the 2006 or later edition of the Seattle Building Code.
   c. Other seismic retrofits approved by the code official.

Code Based Retrofit



Code Based Retrofit

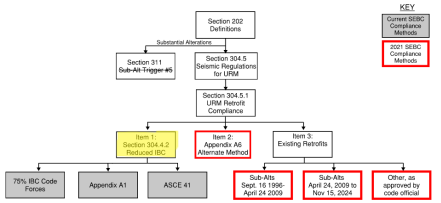


- Section 304.4.2 - Retrofits using reduced IBC forces
  - 75% IBC forces (not typically applied to URM)
  - Appendix Chapter A1 – Seismic Strengthening Provisions for URM Buildings
    - Only for Risk Category I and II buildings per SEBC 304.4.2, Item 1
  - ASCE 41
    - Tier 1&2 retrofit
    - BSE-2E only for Risk Category I-III

[BS] TABLE ((~~304.3.2~~)) 304.4.2
PERFORMANCE OBJECTIVES FOR USE IN ASCE 41 FOR COMPLIANCE WITH REDUCED SEISMIC FORCES

RISK CATEGORY (Based on IBC Table 1604.5)	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1E EARTHQUAKE HAZARD LEVEL	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2E EARTHQUAKE HAZARD LEVEL
I	Life Safety (S-3). See Note a	Collapse Prevention (S-5)
II	Life Safety (S-3). See Note a	Collapse Prevention (S-5)
III	Damage Control (S-2). See Note a	Limited Safety (S-4). See Note b
IV	Immediate Occupancy (S-1)	Life Safety (S-3). See Note c

Code-Based Retrofit



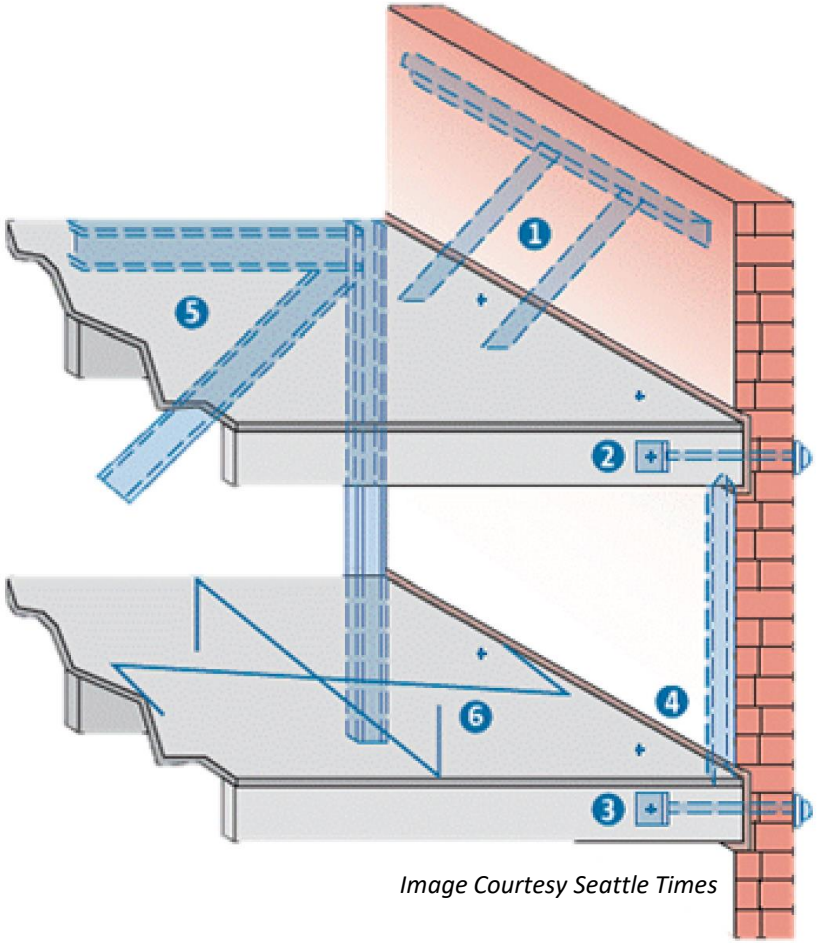
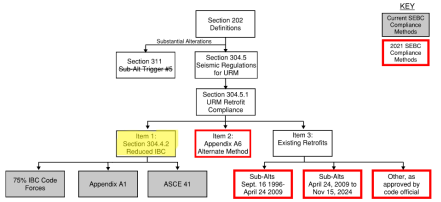


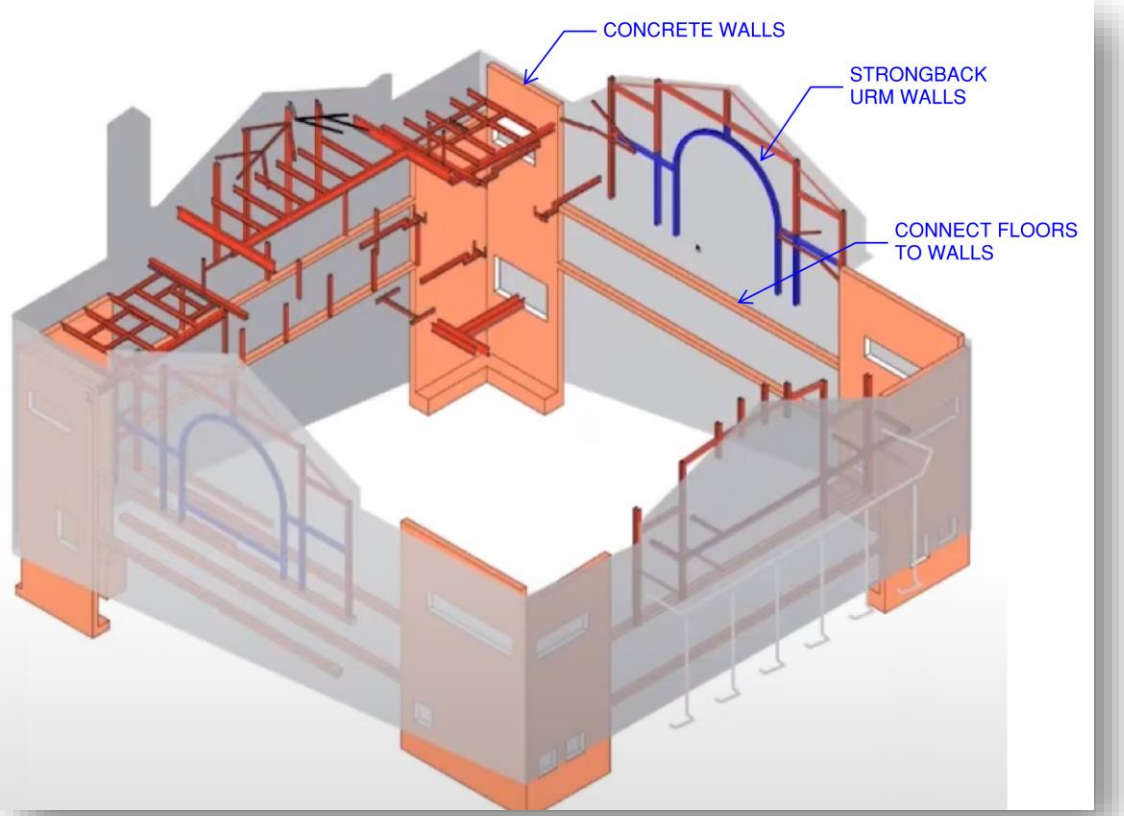
Image Courtesy Seattle Times

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





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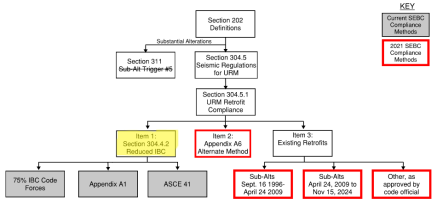
Code-Based Retrofit



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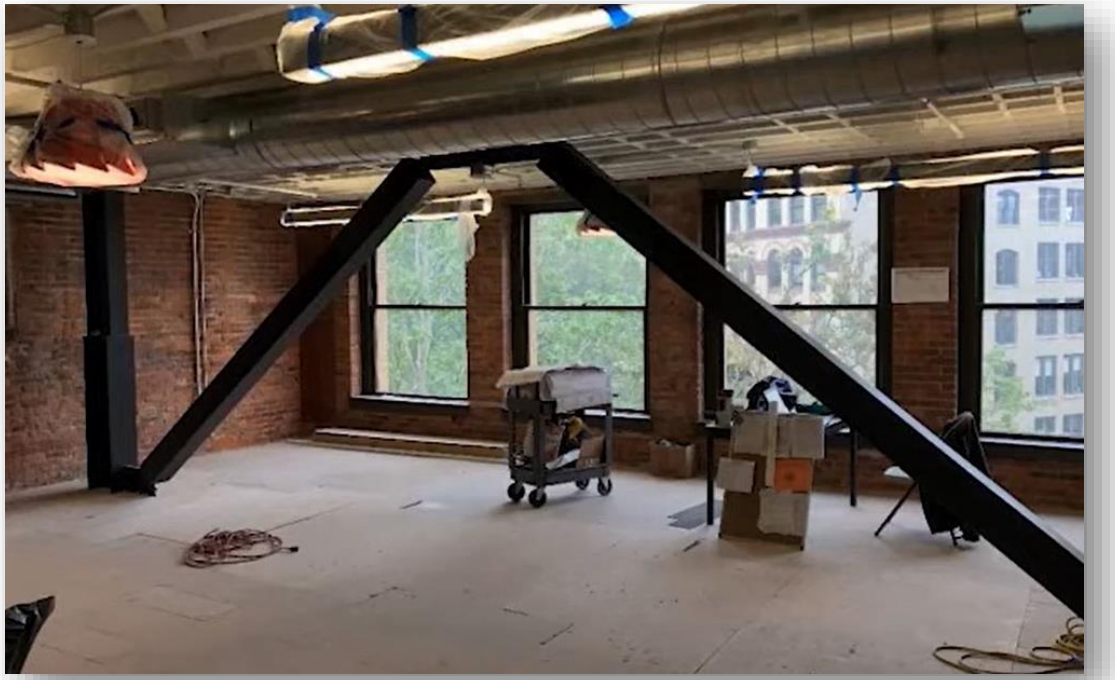

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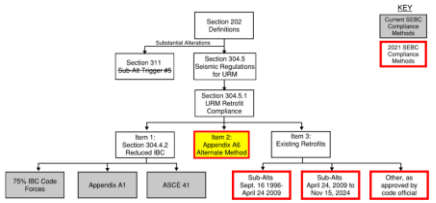
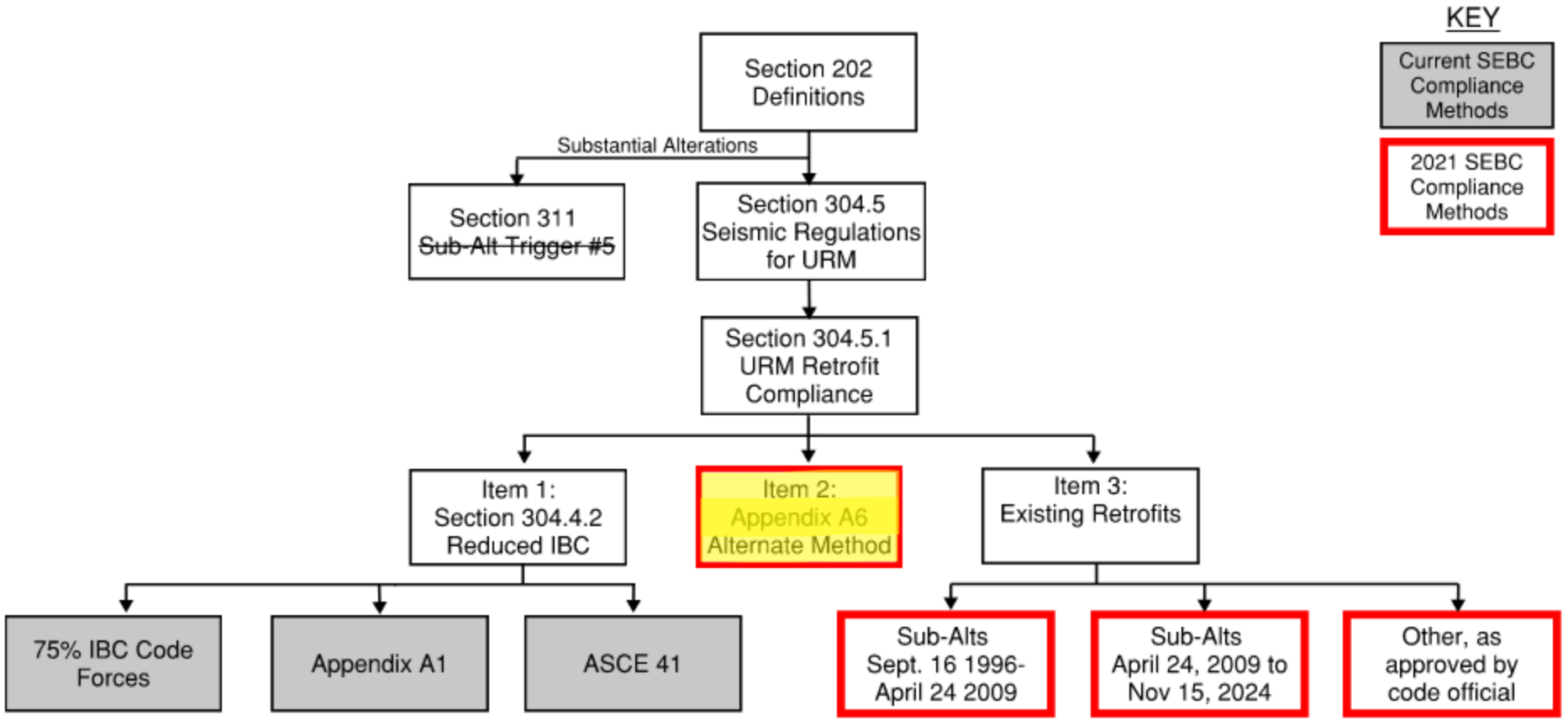
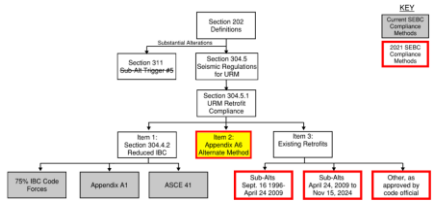
Alternate Method



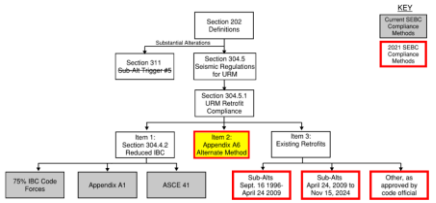


Alternate Method: Qualification



- Same as Director's Rule 6-2023
- 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

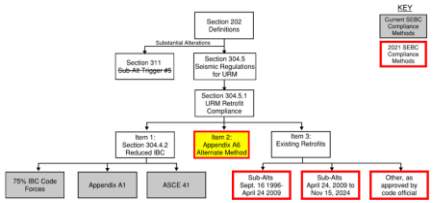
Alternate Method: Qualification



- 6 stories or less; risk category IV not permitted
- Two lines of resistance in each direction, open store front buildings may add a brace to qualify

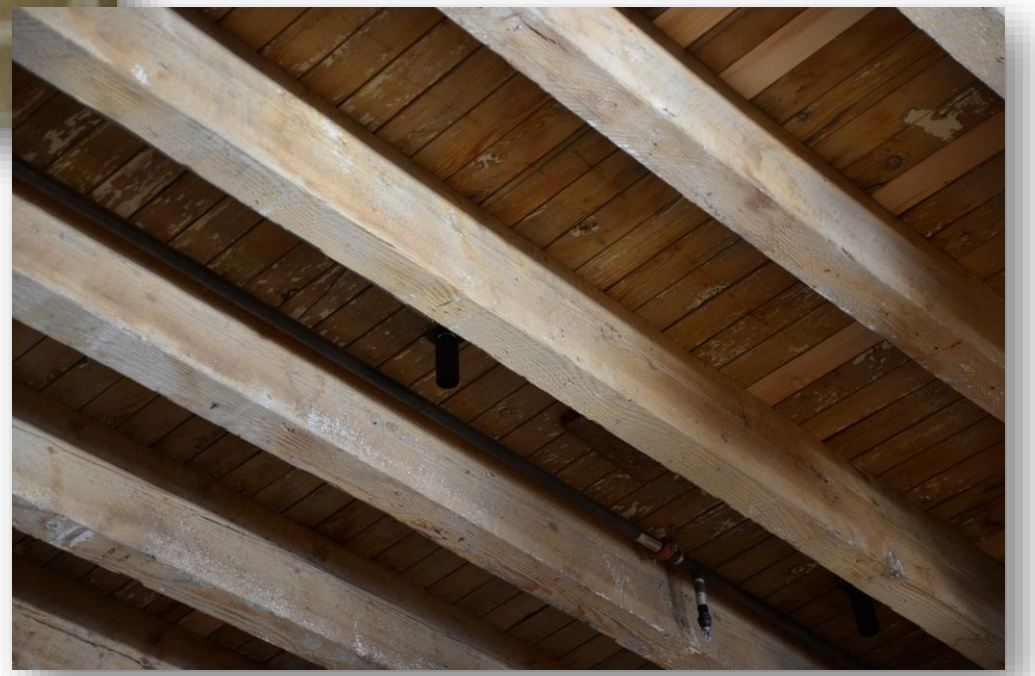
Google Streetview

Alternate Method: Qualification

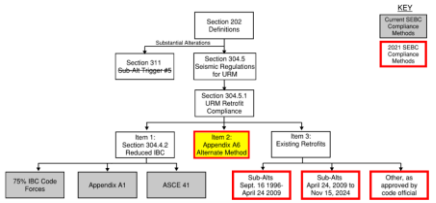


- Mortar shear strength > 30psi (testing required)

- Wood diaphragms all levels above grade, no straight-sheathed diaphragms
- Some exceptions:
  - Crosswalls at 40’ o.c.
  - L<24’ , 2:1 max aspect ratio
- Can be modified to comply



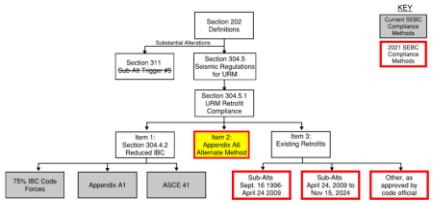
Alternate Method: Qualification



- Wall piers h:w < 2:1 and at least **40 percent** of the total wall length

Google Streetview

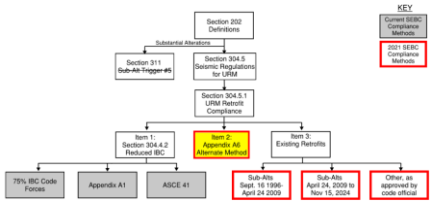
Alternate Method: Qualification



- Wall piers h:w < 2:1 and at least **40 percent** of the total wall length

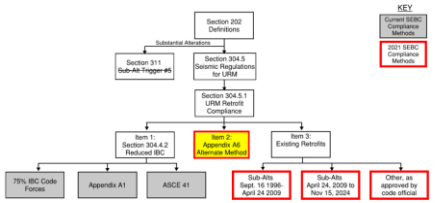
SSF Engineers

Alternate Method



- If you qualify for the Alternate Method, the building has a basic lateral system
- Intended to minimize cost of design and construction while reducing risk of collapse / loss of life.
- Standalone method fully encapsulated within the SEBC
- 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: Wall Anchorage



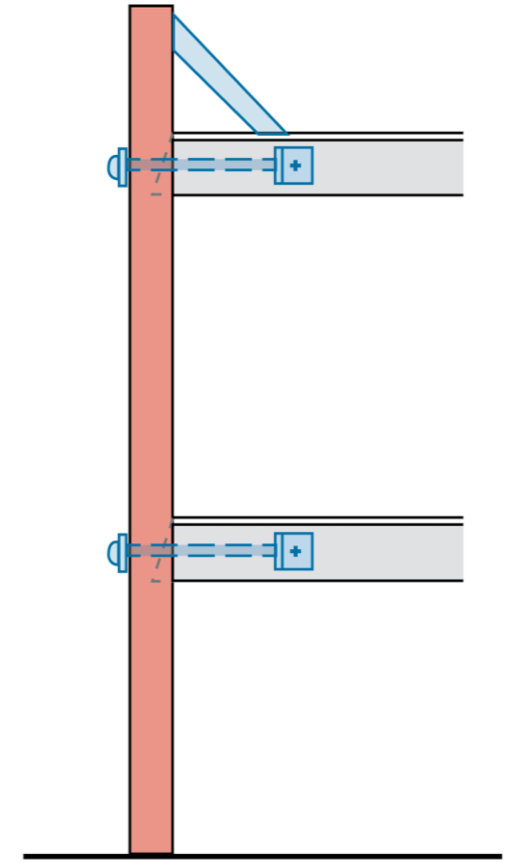


Image Courtesy Seattle Times

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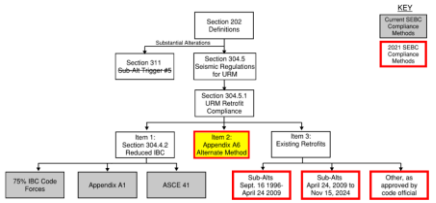
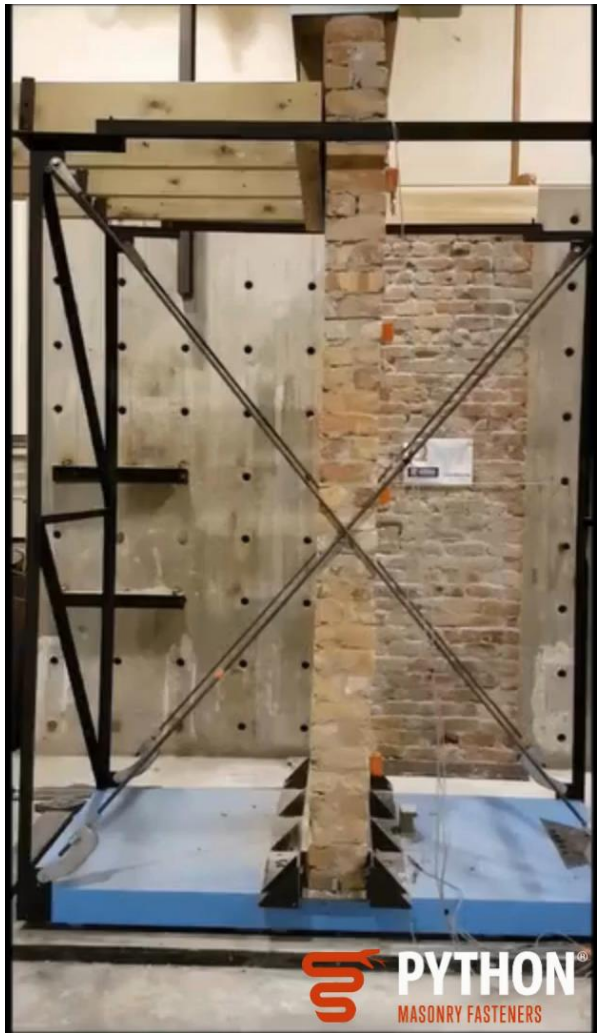
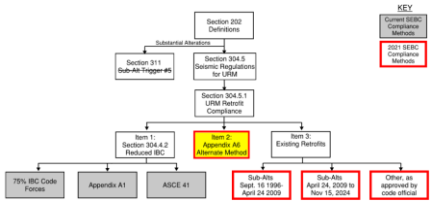
Alternate Method: Wall Aspect Ratio





Alternate Method: Out-of-Plane



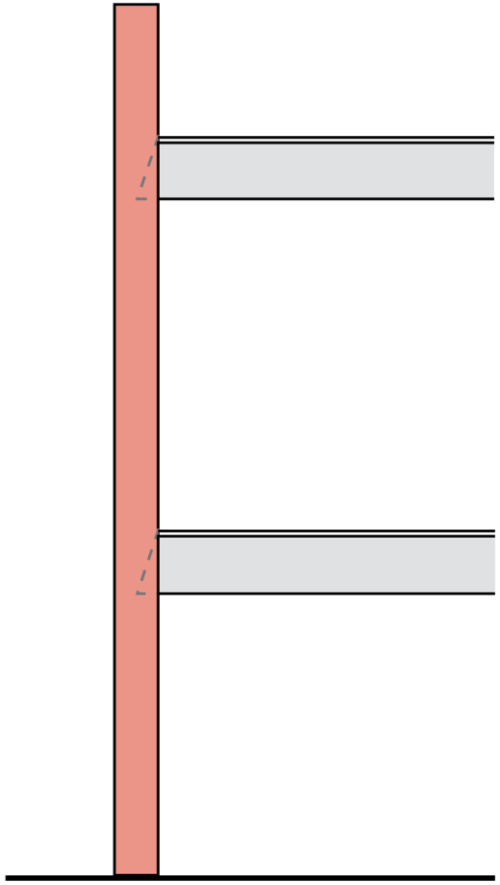


Image Courtesy Seattle Times

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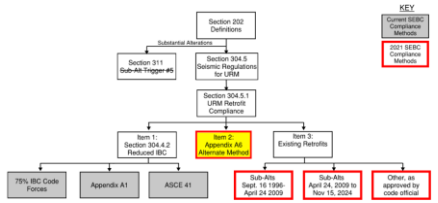
Alternate Method: Parapets



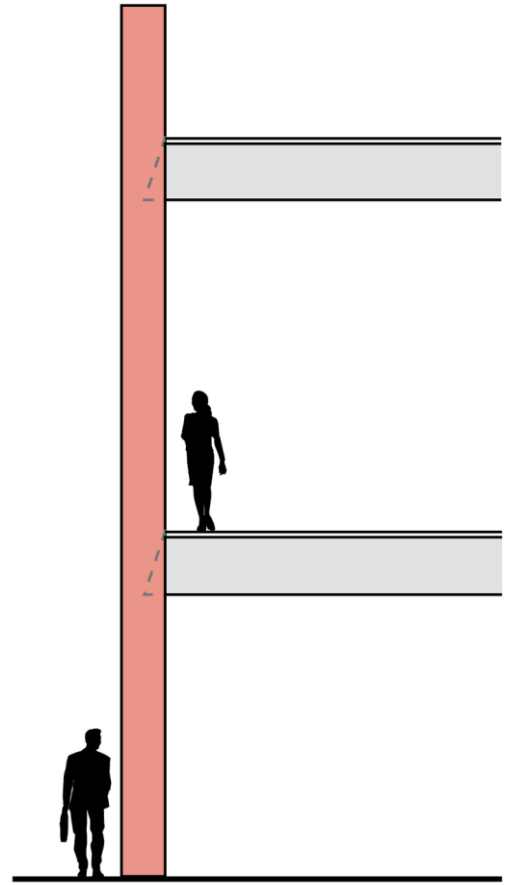
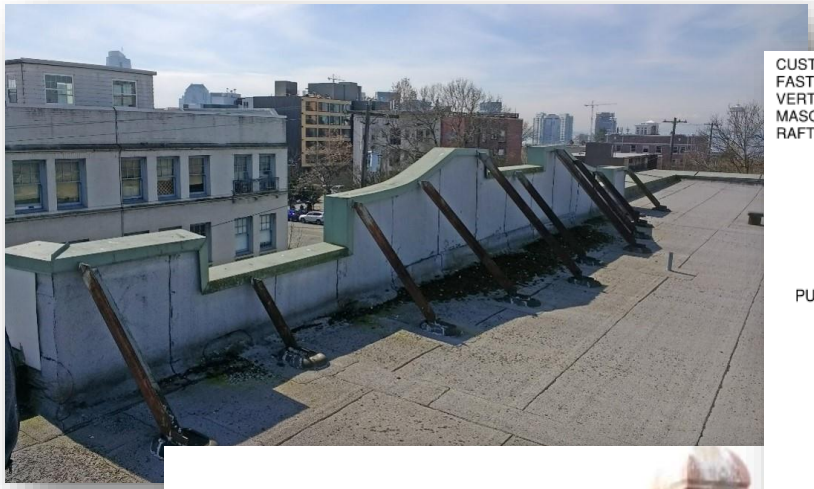
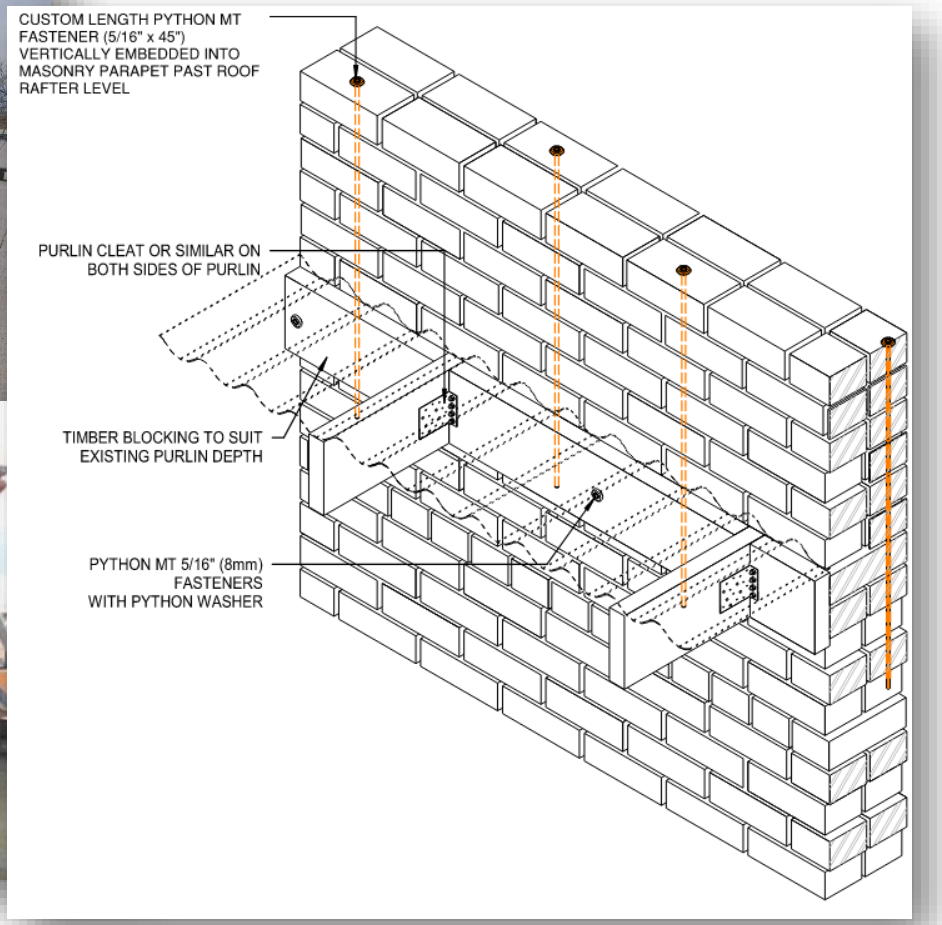


Image Courtesy Seattle Times



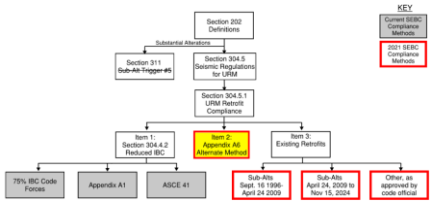
SSF Engineers

SSF Engineers



Python Fasteners

Alternate Method



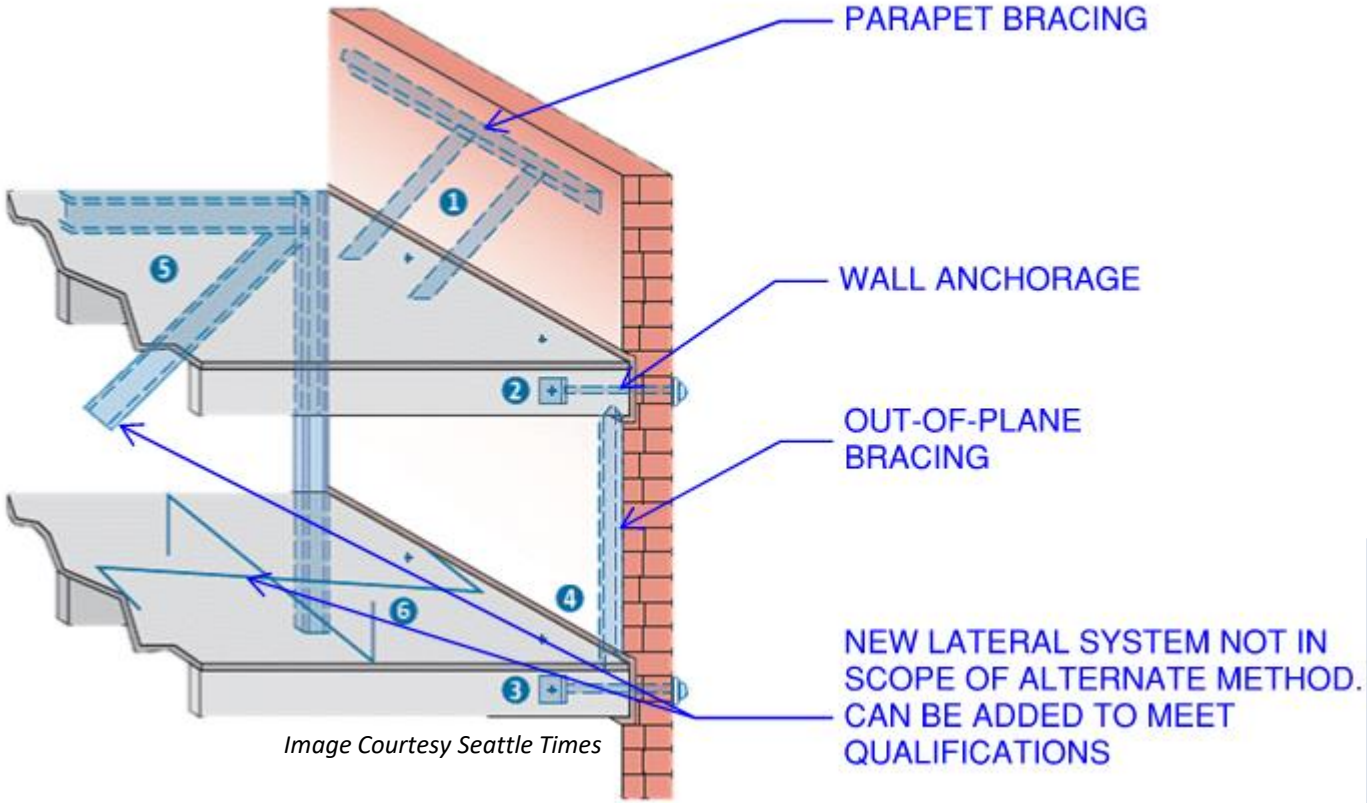
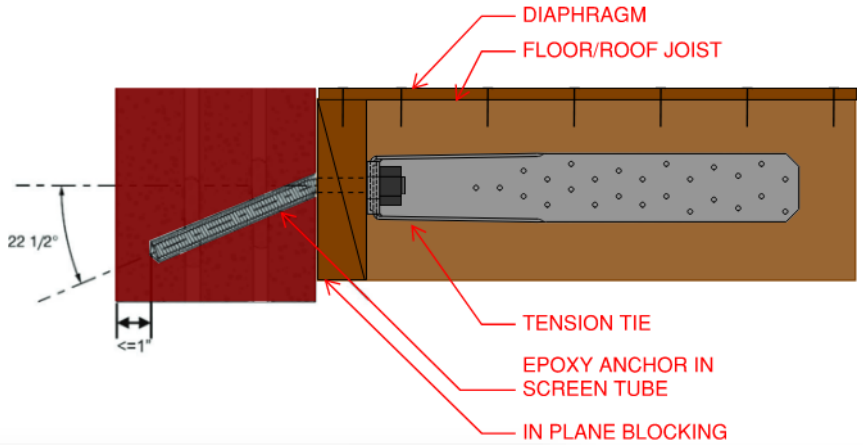


Image Courtesy Seattle Times

Minimizing the Visual Appearance of Retrofits

Example: Use of mechanical or adhesive anchors* from the interior to anchor roofs and floors to

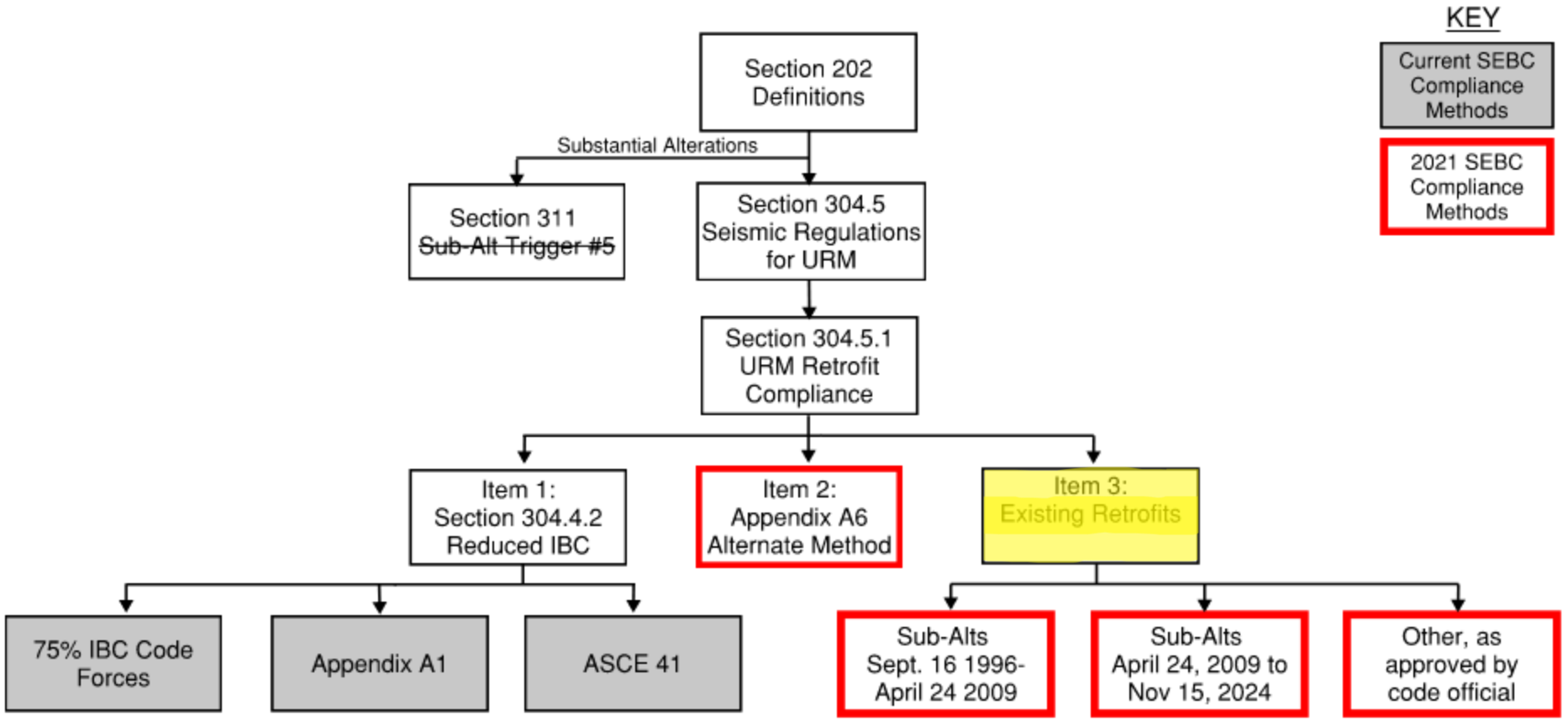


PYTHON

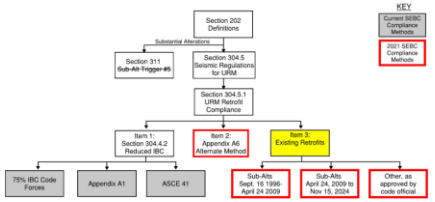
HILTI

**Adhesive anchors have use limitations that may make them more restrictive than mechanical anchors or thru bolts.*

Demonstrating Compliance of Previous Retrofits

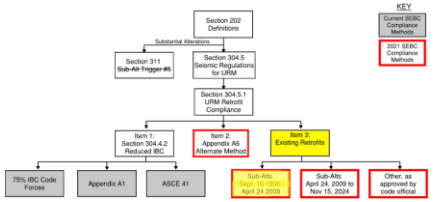


Demonstrating compliance



- Compliance of a previously designed and completed retrofit can be demonstrated by submitting a report to SDCI
- Reports are submitted to SDCI and reviewed by structural plans examiners.
- Buildings must have their Building Final Inspection recorded as PASSED to be reviewed for compliance.
- Buildings with compliant retrofits will have their status in the database changed to “Retrofitted”

Existing Substantial Alteration



- Substantial Alterations permitted between September 16, 1996 and April 24, 2009
- Director's Rule 32-96
- Structural engineer must review drawings and sign/seal report
- Field verification of retrofit, no significant deterioration
- Written summary of force level, evaluation procedure and scope of work
    - Wall anchorage
    - Diaphragm shear transfer
    - Out-of-plane wall bracing
    - Parapet and appendage bracing
    - Supplemental lateral systems (if required)

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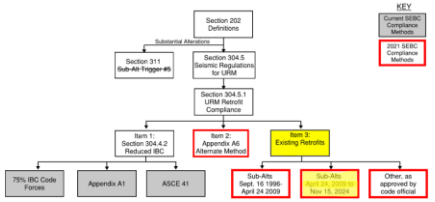
Existing Substantial Alteration



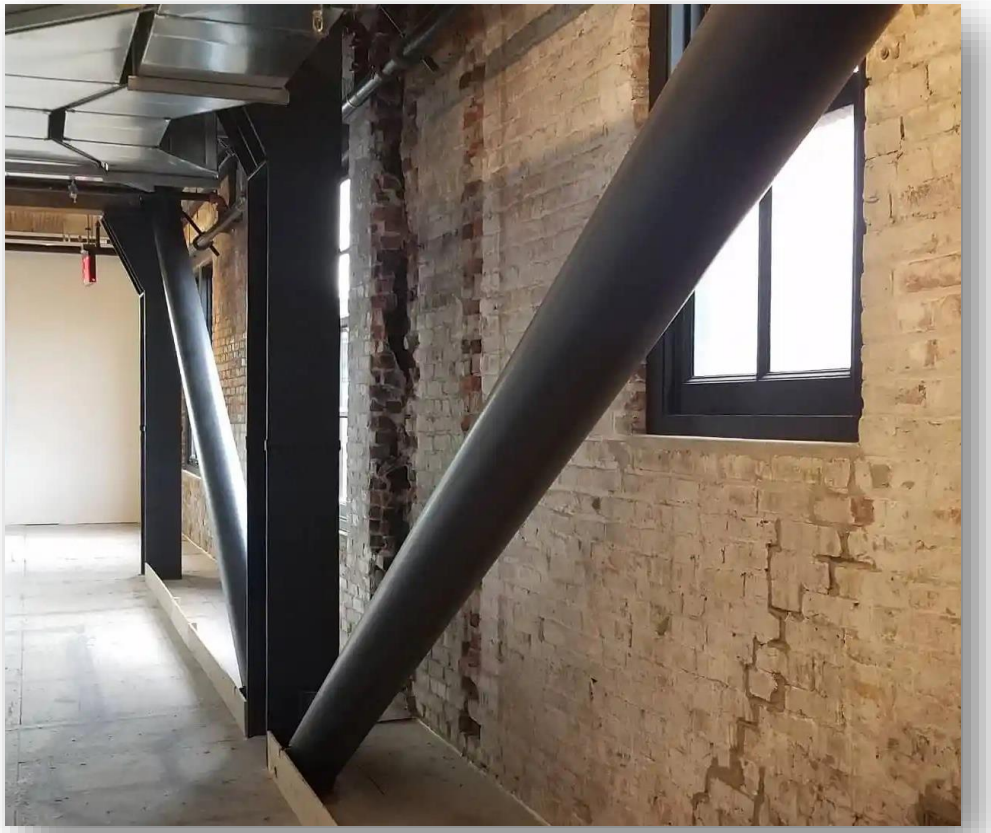
- Substantial Alterations 2006 SBC or newer permitted after April 24th, 2009
- Director's Rule 7-2009
- Limited documentation required via a standard form
- Form can be completed and submitted by the building owner or their representative

Building Final

114 PIKE ST

Print

Status	Details
Passed 1/22/2010 12:00 AM Desired Date: TBD	Record 6193508-CN Construction Permit



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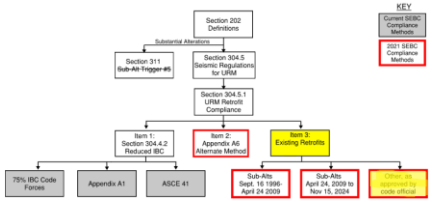
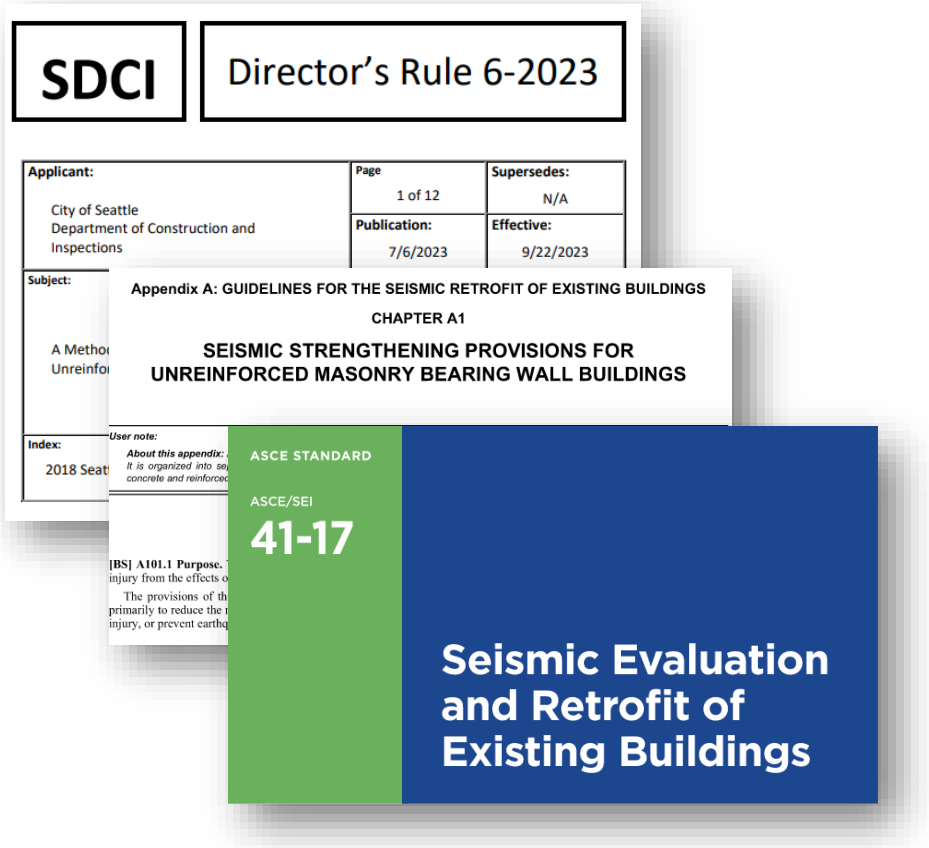
Previously Completed: Other



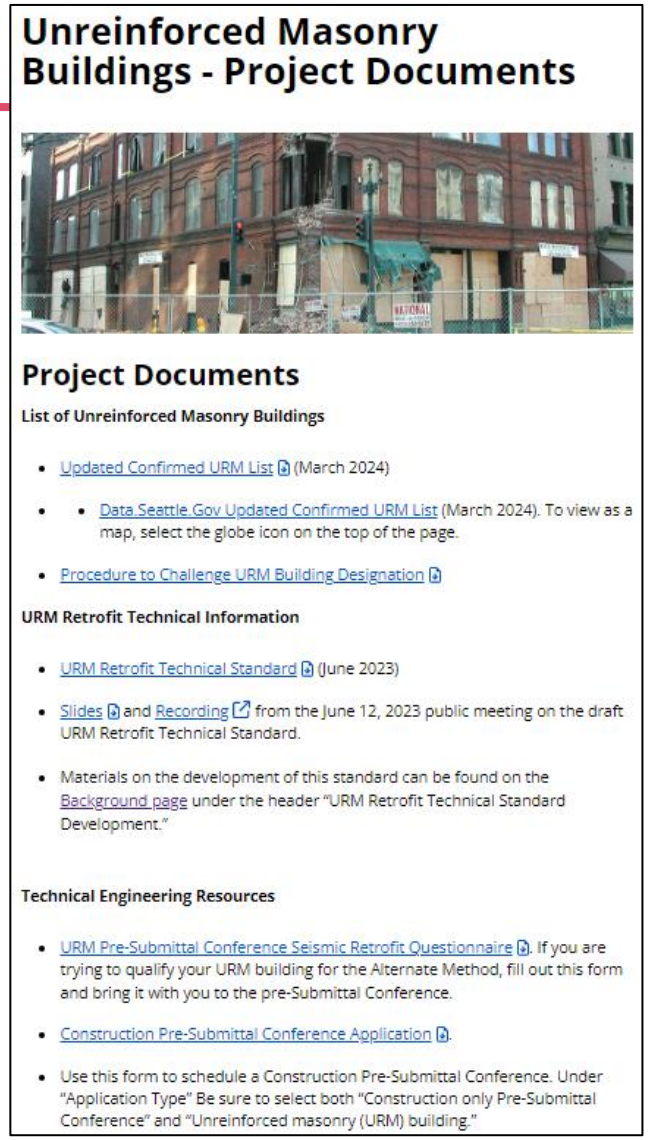
- Previously completed retrofits in compliance with the intent of 304.5.1. Compliant retrofits <u>may</u> include:
  - Voluntary retrofits using reduced seismic forces
    - Appendix Chapter A1
    - ASCE 41 Tier 1 or 2
  - Draft URM Retrofit Technical Standard (2012)
    - Bolts Plus
  - Director's Rule 6-2023



Why Retrofit?

Key Updates

- 2021 Seattle Existing Building Code (SEBC)
  - Codifies URM retrofit recognition pathways and minimum standards
  - Anticipated effective date: November 15th, 2024
- Website Updates:
  - Organized Project Documents, Background Page
  - NEW: FAQ Page
  - NEW: Construction Pre-Submittal Conference Check list (*Project Documents Page*)
  - UPDATED: Procedure to appeal URM determination of non-URM building
    - Now reflects code definitions
  - COMING SOON: Procedure to demonstrate retrofit status of URM building
    - Anticipated November 15, 2024
    - Will clarify reporting requirements and submittal process
  - COMING SOON: Updates to the City of Seattle URM Database
    - Anticipated January, 2025



Unreinforced Masonry Buildings - Project Documents

Project Documents

List of Unreinforced Masonry Buildings

- Updated Confirmed URM List (March 2024)
- Data.Seattle.Gov Updated Confirmed URM List (March 2024). To view as a map, select the globe icon on the top of the page.
- Procedure to Challenge URM Building Designation

URM Retrofit Technical Information

- URM Retrofit Technical Standard (June 2023)
- Slides and Recording from the June 12, 2023 public meeting on the draft URM Retrofit Technical Standard.
- Materials on the development of this standard can be found on the Background page under the header "URM Retrofit Technical Standard Development."

Technical Engineering Resources

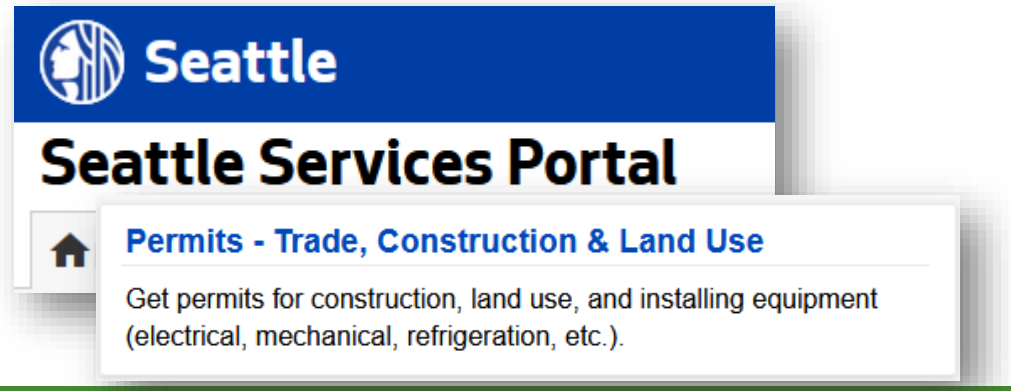
- URM Pre-Submittal Conference Seismic Retrofit Questionnaire. If you are trying to qualify your URM building for the Alternate Method, fill out this form and bring it with you to the pre-Submittal Conference.
- Construction Pre-Submittal Conference Application.
- Use this form to schedule a Construction Pre-Submittal Conference. Under "Application Type" Be sure to select both "Construction only Pre-Submittal Conference" and "Unreinforced masonry (URM) building."

SDCI URM Database Updates

Address	Year Built	No. Story	Neighborhood	Report Occupancy	Occupant Load	Liquefaction Hazard	Landslide Hazard	Steep Slope	Vulnerability Classification	Confirmed Compliant Retrofit	Retrofit Method: SEBC 304.5.1 Item ___
1234 URM Street	1910	3		Residential Commercial Public Assembly	1-100	Y/N	Y/N	Y/N	Critical High Medium	Y/N	1, 2, 3a, 3b, 3c

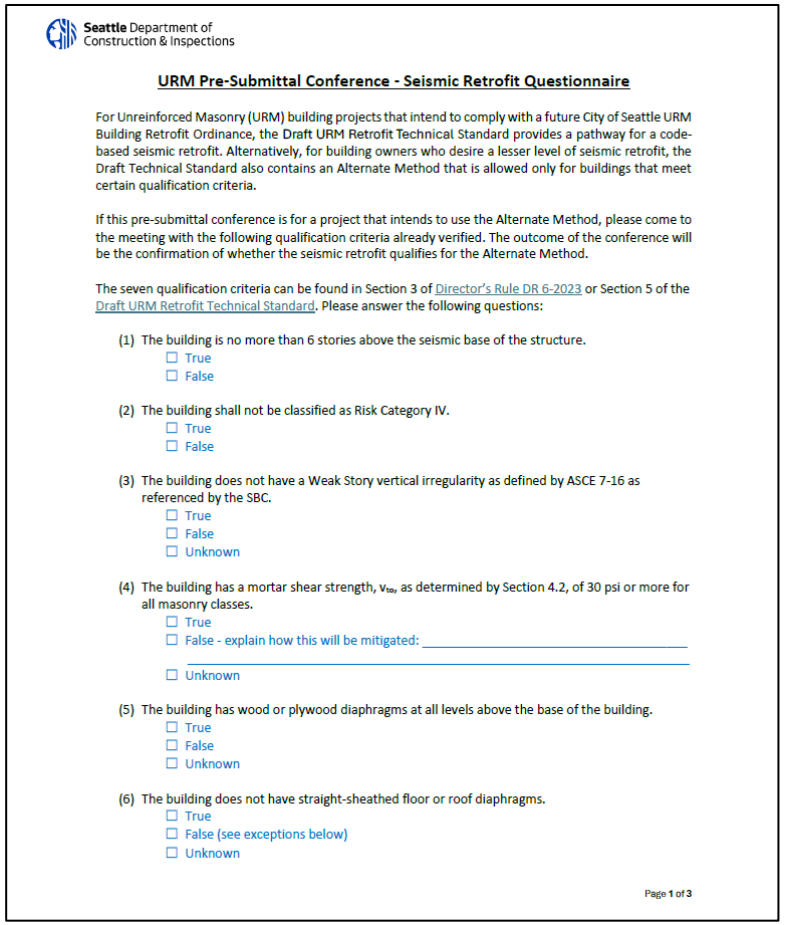
Database appeal

- URM buildings that have been erroneously included in the SDCI URM Database can be removed with proper documentation
  - Report prepared, signed and sealed by a structural engineer
  - Proof of non-URM bearing walls
    - Microfilm, historic plans, visual survey, destructive investigation
  - Reports are submitted to SDCI via Land Use Analysis Request
  - SDCI review fee will be refunded if appeal is granted
  - Burden of proof is on the owner/engineer
  - Applies to URMs that have been demolished



We're here to help

- Free 15- Minute Coaching Sessions are available by request.
  - To schedule, send an email to: SCI_URM@seattle.gov.
- Qualifying for the Alternate Method?
  - Complete the URM Pre-Submittal Conference Seismic Retrofit Questionnaire (*Project Documents Page, Supportive Resources*).
  - Schedule a Construction Pre-Submittal Conference
    - Application Type: Select both:
      - Unreinforced Masonry (URM) building
      - Construction only Pre-Submittal Conference
- Permit coaching and expedited services for small businesses
  - Send email to: Maria.Peterson@seattle.gov with the Office of Economic Development (OED)



Seattle Department of Construction & Inspections

URM Pre-Submittal Conference - Seismic Retrofit Questionnaire

For Unreinforced Masonry (URM) building projects that intend to comply with a future City of Seattle URM Building Retrofit Ordinance, the Draft URM Retrofit Technical Standard provides a pathway for a code-based seismic retrofit. Alternatively, for building owners who desire a lesser level of seismic retrofit, the Draft Technical Standard also contains an Alternate Method that is allowed only for buildings that meet certain qualification criteria.

If this pre-submittal conference is for a project that intends to use the Alternate Method, please come to the meeting with the following qualification criteria already verified. The outcome of the conference will be the confirmation of whether the seismic retrofit qualifies for the Alternate Method.

The seven qualification criteria can be found in Section 3 of Director's Rule DR 6-2023 or Section 5 of the Draft URM Retrofit Technical Standard. Please answer the following questions:

(1) The building is no more than 6 stories above the seismic base of the structure.
- ☐ True
- ☐ False

(2) The building shall not be classified as Risk Category IV.
- ☐ True
- ☐ False

(3) The building does not have a Weak Story vertical irregularity as defined by ASCE 7-16 as referenced by the SBC.
- ☐ True
- ☐ False
- ☐ Unknown

(4) The building has a mortar shear strength, v_{to}, as determined by Section 4.2, of 30 psi or more for all masonry classes.
- ☐ True
- ☐ False - explain how this will be mitigated: _____
- ☐ Unknown

(5) The building has wood or plywood diaphragms at all levels above the base of the building.
- ☐ True
- ☐ False
- ☐ Unknown

(6) The building does not have straight-sheathed floor or roof diaphragms.
- ☐ True
- ☐ False (see exceptions below)
- ☐ Unknown

Page 1 of 3

Comments/ Questions/Input?

Comments to Technical Standard:

Derek Ohlgren, P.E.

URM Program Lead Engineer

Derek.Ohlgren@Seattle.gov

URM Program Questions:

Amanda Hertzfeld

URM Program Manager

Amanda.Hertzfeld@seattle.gov

Not sure who?

SCI_URM@Seattle.gov

- What aspects of today's presentation need more detailed trainings?
- What is your preferred method for receiving education and trainings on these topics?
- Where are you currently experiencing issues with permitting of URM retrofits?