DRAFT
Unreinforced Masonry (URM) Policy Committee Report
July 2016

Commissioner Steve Novick, *Commissioner-in-Charge, Bureau of Emergency Management*

Commissioner Dan Saltzman, *Commissioner-in-Charge, Bureau of Development Services*

Mayor Charlie Hales, *Commissioner-in-Charge, Portland Development Commission*

Acknowledgements

Retrofit Standards Committee

David Bugni, P.E., S.E.
Brian Emerick, AIA
Mike Hagerty, P.E., S.E.
Ian Madin, MS, RG
Mark Tobin, P.E., S.E.
Reid Zimmerman, P.E.

Seismic Retrofit Support Committee

Avi Ben-Zaken
Kristen Conner
Jessica Engeman
Mike Hagerty
Walter McMonies
Steve Rose
Colin Rowan
Tom Sjostrom
John Tess

Policy Committee

Margaret Mahoney, Chair
Dennis Andersen
Hermann Colas
Tom Corollo
Matthew Eleazer
Brian Emerick
Heather Hoell
Sean Hubert
Matthew Illias
Jonathan Malsin
Walter McMonies
Javier Mena
Peggy Moretti
Ken Rust
Tom Sjostrom
Jen Sohm
Reid Zimmerman

Portland Bureau of Emergency Management

Carmen Merlo, Director
Dan Douthit
Felicia Heaton
Jonna Papaefthimiou

Bureau of Development Services

Amit Kumar, P.E., S.E.
Jake Brown
Ross Caron
Shelly Duquette
Andrew Peterson
Eric Thomas

Portland Development Commission

Peter Englander
Shelly Haack

Office of Management and Finance

Jennifer Cooperman
Debora Leopold-Hutchins

Bureau of Planning and Sustainability

Rachael Hoy
Nicholas Starin

Executive Summary

An unreinforced masonry building, often referred to as a URM, is a structure whose walls are made of brick or blocks joined by mortar, with no steel reinforcing bars.

URMs were constructed in Portland between about 1870 and 1960. Many have aged handsomely. They include historic churches schools, and theaters, as well as restaurants breweries, apartments, dance halls, and other landmarks that Portlanders know and love. URMs define the character of many Portland neighborhoods and businesses districts.

Unfortunately, Portland has a significant earthquake risk, both from a subduction zone off the Oregon coast and crustal faults that snake beneath the city. URMs are highly vulnerable to seismic damage. When the ground shakes, URMs pose a great risk for death or injury, property damage, and loss of economic use.

Requirements to strengthen URMs were put in place in Portland in 1995. Since that time, about 8% of Portland URMs have been demolished, for a variety of reasons. Of those that remain, about 5% have been fully retrofitted, and about 9% have been at least partially upgraded. An estimated 85% of existing URMs have had no retrofits at all. The average Portland URM is 88 years old. Portland's stock of URMs include 46 schools, 36 churches, 272 multifamily structures with at least 6,000 residential units.

Based on the risks Portland faces, the need to ensure public safety, the lack of progress under current codes, , the effectiveness of mandatory seismic retrofit policies in other locations, and the results of a 1994 cost-benefit analysis, it is recommended that all URMs within the city of Portland be required to comply with a new, mandatory seismic strengthening program.

The URM Policy Committee proposes a tiered approach, requiring URM upgrades to critical buildings sooner and to a standard that will enable their use after an earthquake, and low-risk buildings later and to a more cost effective standard that will still greatly reduce the danger they pose to the public. The details of the proposed building classification system, upgrade standards, and proposed timelines are summarized on page 17 of this report.

The URM Policy Committee recognizes the impacts that mandatory URM retrofits may have on building owners. Direct financial subsidies to private entities are challenging. The committee proposes that the City support a program of tax credits for URM building owners, state funding for school retrofits, and an extended timeline for affordable housing retrofits. It further recommends that the City support a public education campaign, a voluntary building placarding program, and a seismic ombudsman to assist building owners in navigating the permitting, financing, and design of seismic retrofits.

Table of Contents

Introduction

An unreinforced masonry building, often referred to as a URM, is a structure whose walls are made of brick or blocks joined by mortar, with no steel reinforcing bars.

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URM Risks

URMs pose a life safety risk to building occupants and passersby. According to the Federal Emergency Management Agency, "More than any other kind of construction, they can be singled out as being seismically vulnerable."[1]

Masonry walls are heavy and brittle, while wooden ceilings and floors are light and flexible. When the ground shakes, the roof and floors pull away from URM walls, which crack and crumble. Typical earthquake damage to URMs includes the collapse of the walls, roofs, and upper floors. Mortar weakens with age, so the risks increase in older buildings. With even light shaking, chimneys, parapets, and architectural ornaments may break off and fall. It is for these reasons that URMs pose a great risk for human injury, property damage, and loss of economic use after an earthquake.

Examples from across the world, including earthquakes in California, New Zealand, and Chile, illustrate potentially tragic outcomes for URM occupants and others nearby during an earthquake.

Fortunately, URMs can be retrofitted using a variety of strategies: walls can be braced; roofs, floors, chimneys and parapets can be more strongly anchored to the walls; and building diaphragms (floors) can be stiffened. Evidence from earthquakes in other states and countries show that URM retrofits work. Seismically strengthened URMs have survived in earthquakes while adjacent un-retrofitted structures were lost.

Existing City Code

Earthquake risk in the Pacific Northwest was not well-understood by scientists until the 1990s. In 1995, the City of Portland updated City Code (Title 24.85) to address the specific seismic risks of URMs. This code was updated again in 2004.

Current code requires building owners to seismically retrofit their buildings when at least 1/3 of the building is changed to a more intensive use, the occupancy increases by 150

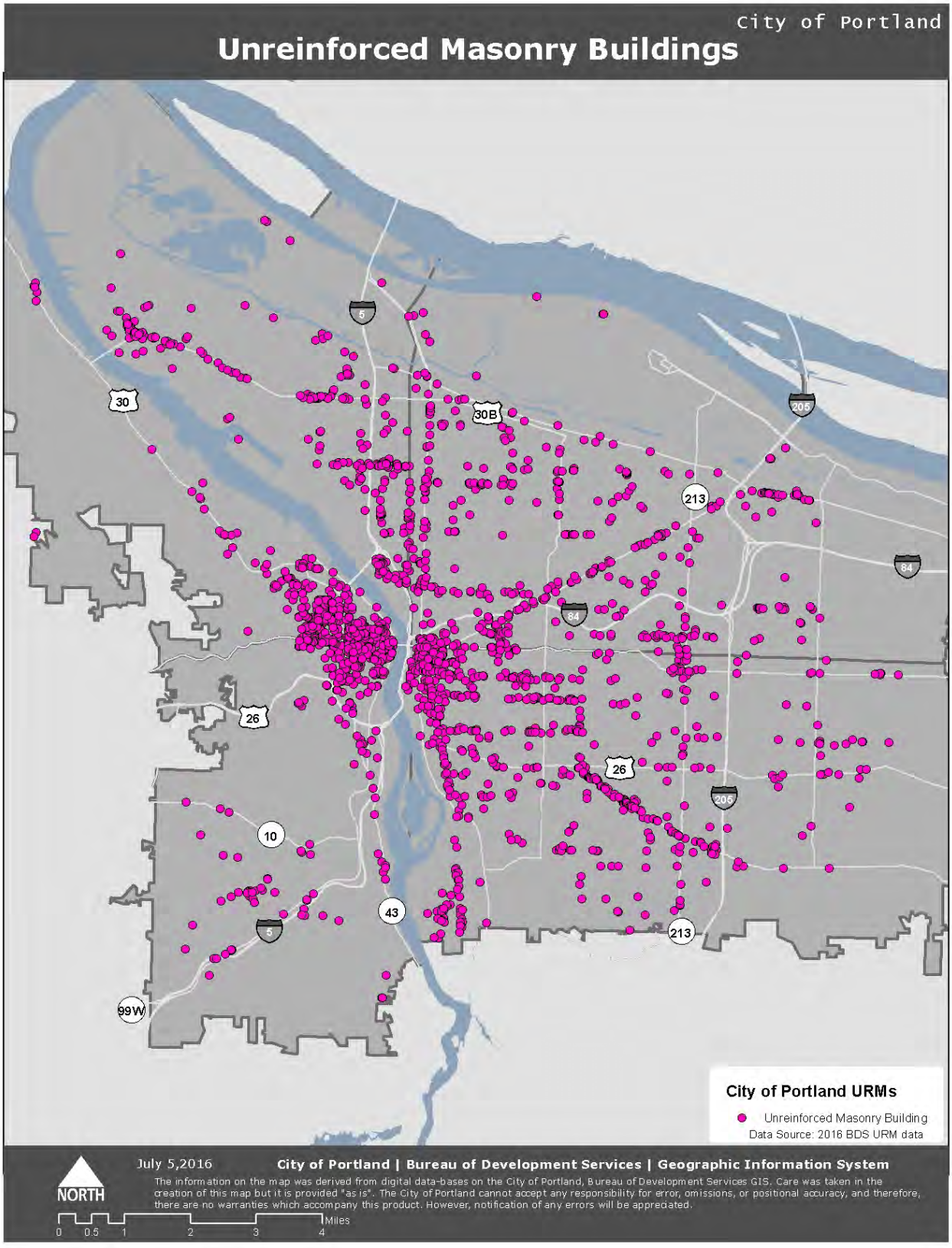
[1] Federal Emergency Management Agency Publication #774: *Unreinforced Masonry Buildings and Earthquakes.* October, 2009.

or more people, or the owner spends more than about $43 (FY2016) per square foot on other improvements. A partial upgrade, to brace the parapets and tie the walls to the roof, is required when more than half of the building is re-roofed. In all cases, seismic improvements are required only when the building owner approaches the City to make other changes; structures that continue in the same use without major upgrades will never be required to retrofit under the current code.

Code Effectiveness Concerns

Since the City's requirement to retrofit URMs was put in place in 1995, about 8% of Portland URMs have been demolished. Of those that remain, about 5% have been fully retrofitted, and about 9% have been at least partially upgraded. An estimated 85% of existing URMs have had no retrofits at all. The current regulations have not proven to be as effective in reducing the risk posed by URM building as had been hoped

In June 2014, the Portland City Council held a work session on Portland's URM risk. Based on information presented at the session, Council directed the Bureau of Development Services (BDS), the Portland Bureau of Emergency Management (PBEM) and the Portland Development Commission (PDC) to work together to propose a strategy to reduce Portland's URM risk. This report represents the work of these bureaus and the advisory body of engineering experts, building owners, and community stakeholders they assembled to support the effort.


City of Portland
Unreinforced Masonry Buildings
5
30
30B
205
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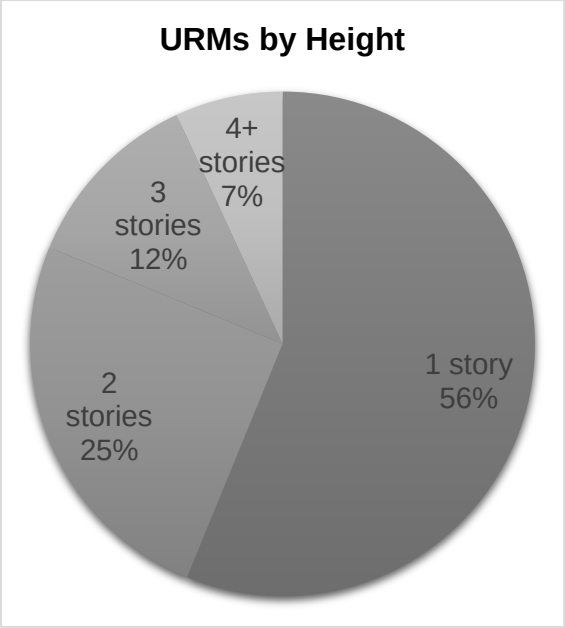
43
5
213
99W
City of Portland URMs
Unreinforced Masonry Building
Data Source: 2016 BDS URM data
July 5,2016
City of Portland | Bureau of Development Services | Geographic Information System
The information on the map was derived from digital data-bases on the City of Portland, Bureau of Development Services GIS. Care was taken in the creation of this map but it is provided "as is". The City of Portland cannot accept any responsibility for error, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. However, notification of any errors will be appreciated.
NORTH
Miles
0 0.5 1 2 3 4

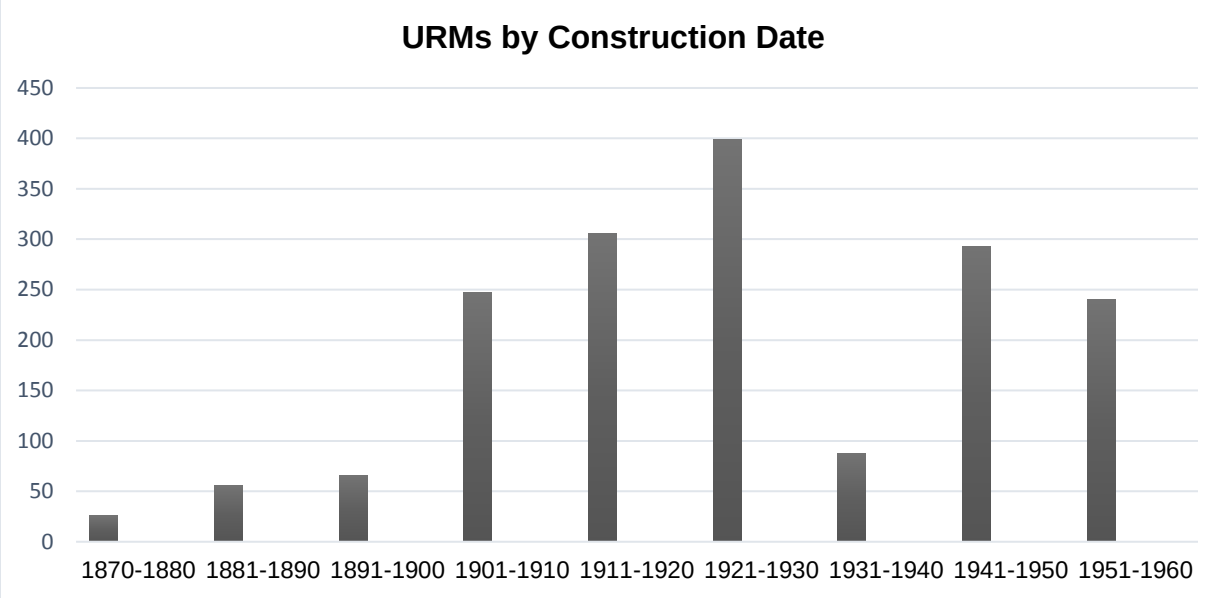
URMs by the Numbers

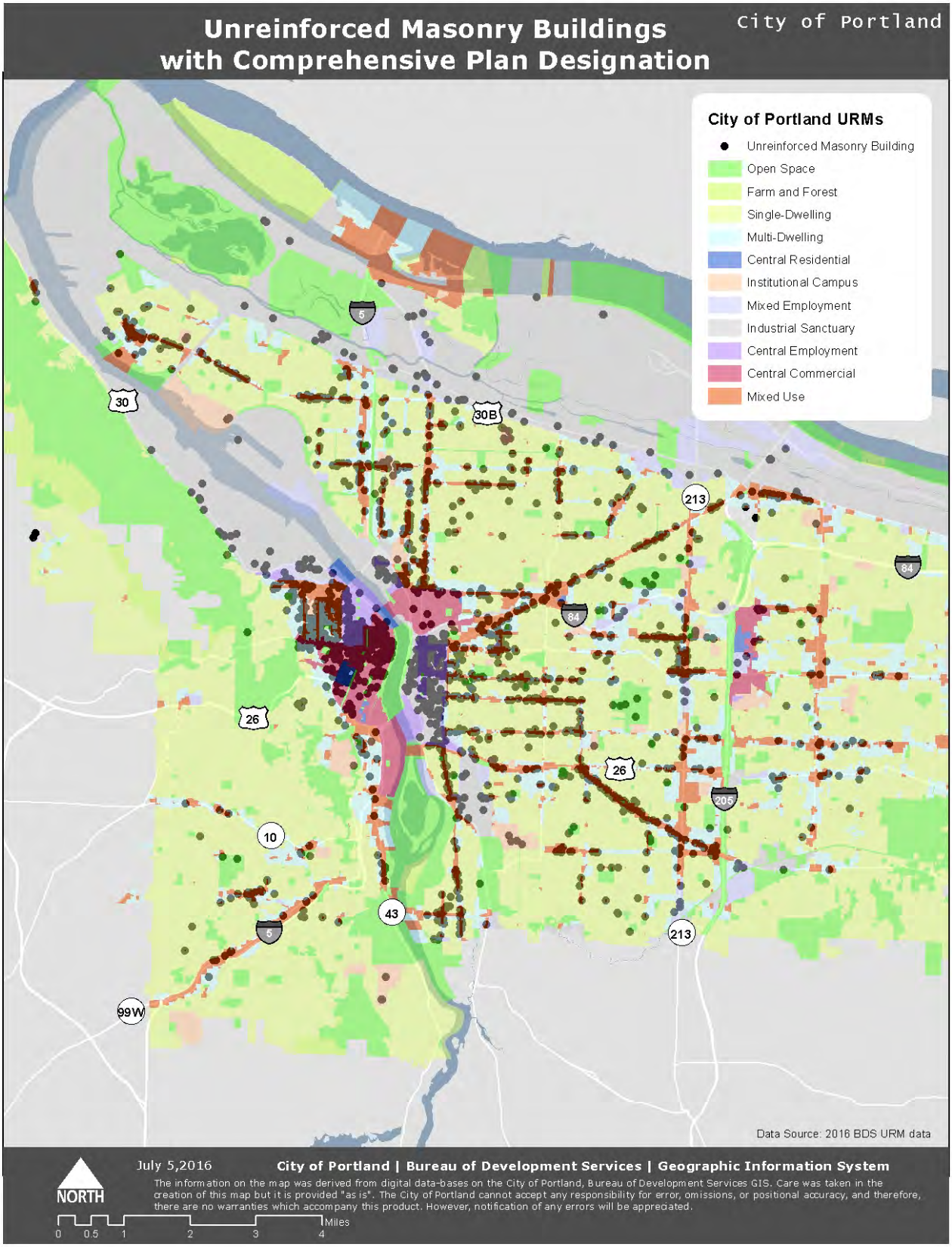
Portland conducted a URM inventory in 1994-1996, when the first retrofit requirements for URMs were adopted, and updated the inventory in 2015-2016 as part of this current effort. Altogether, this work identified 1,884 URMs. Of those, 153 were demolished and 87 were fully upgraded after the first inventory was completed. The average remaining URM is 88 years old.

Portland's URMs include 47 schools, 36 churches, and 272 multifamily structures, including at least 6,000 residential units. About 405 of them are now registered as historic; all are more than 50 years old, and thus eligible for consideration as historic structures. The complete URM inventory is available on the BDS website.



Add additional infographics. Add #s for affordable housing and liquefaction risk (all forthcoming from BDS).




Unreinforced Masonry Buildings
with Comprehensive Plan Designation
City of Portland
City of Portland URMs
Unreinforced Masonry Building
Open Space
Farm and Forest
Single-Dwelling
Multi-Dwelling
Central Residential
Institutional Campus
Mixed Employment
Industrial Sanctuary
Central Employment
Central Commercial
Mixed Use
5
30
30B
213
84
84
26
26
205
10
43
5
213
99W
Data Source: 2016 BDS URM data
July 5,2016
City of Portland | Bureau of Development Services | Geographic Information System
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NORTH
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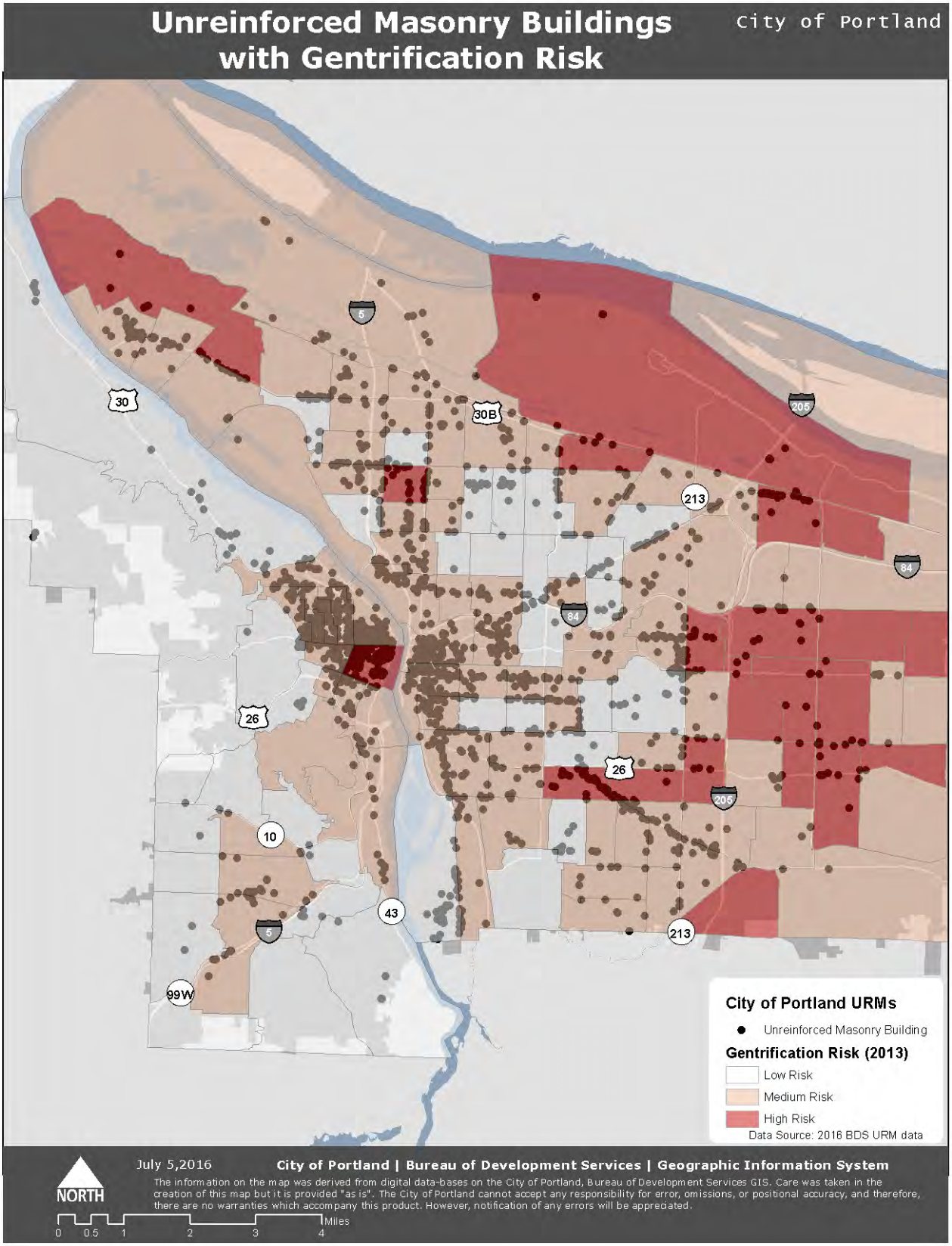


Gentrification vulnerability is based on a 2012 *Gentrification and Displacement Study* completed for the Bureau of Planning and Sustainability. Gentrification is defined as involuntary residential displacement. Risk factors include high numbers of renters, people of color, households below 80% median family income, and population age 25+ without a bachelor's degree. More information: BPS website.

Cost - Benefit Analysis

The Portland Bureau of Emergency Management and Bureau of Development Services commissioned a cost-benefit analysis in spring 2016 to look at the potential costs and benefits of mandatory seismic retrofits of URMs in Portland.

Summarize results and reference/link to complete document when available. Include costs of inaction and benefits of mandatory retrofits. Relate to gentrification map (previous page.)

Policy Development Process

The Portland City Council directed BDS, PDC, and PBEM to work together on the URM project. Each bureau brought unique expertise to the process: PBEM is responsible for convening citywide efforts to reduce natural hazard risks; BDS administers Portland's building code and developed the original URM inventory; and PDC has a close relationship with Portland's business community and knowledge of redevelopment financing mechanisms. Together, these three bureaus devised a three-step process that was intended from the beginning to incorporate scientific, financial, and social considerations.

Retrofit Standards Committee

The first step in the policy development process was to assemble the Retrofit Standards Committee, a group of engineers, architects and geologists with knowledge of the current building code and best practices for seismic design. Their charge was to suggest the scientific and technical basis for a sound URM policy. This group met from January to April 2015, reviewed current and emerging policies and research, and developed a report that summarized current practices and recommended mandatory seismic upgrades for all Portland URMs. They developed a classification system, upgrade standards, and timelines for each class. These standards were supported by subsequent committees and are summarized in this report's *Recommendations*.

Two recommendations of the Retrofit Standards Committee were not supported by subsequent committees. First, this committee supported standards that would require owners to disclose a building's URM status to potential buyers, and managers to disclose the status to potential tenants. Second, the Retrofit Standards Committee supported the placarding of un-retrofitted URMs. Both these policies were intended to create market demand for URM retrofits and thus generate greater return on investment for seismic retrofitting. However, other committees did not support URM status disclosure to renters or purchasers, citing the existing availability of information on the Internet. And they did not support non-voluntary placarding, except for buildings that fail to comply with retrofit standards beyond statutory deadlines, because they viewed placarding as punitive.

Seismic Retrofit Support Committee

The Retrofit Standards Committee passed their recommendations to the Seismic Retrofit Support Committee. This group was made up of building owners, developers and bankers. They met from May to December 2015and researched the cost and possible financial support available to URM building owners to carry out seismic retrofits. This committee spent a great deal of effort to develop a realistic range of costs for seismic retrofits; this issue was vexing for a number of reasons, including a relatively small

number of comparable projects, and the difficulty of comparing projects where seismic retrofits were a primary goal with projects where the seismic work was an add-on to another effort.

Project costs may also include many different elements, including not only costs to design and construct the retrofit, but lost rents and costs to finance the work, relocate tenants, store building contents off-site, rent alternate space, etc. The most current and reliable cost information will be provided in the cost-benefit study, which is expected to be completed in fall 2016, after the Retrofit Standards Committee finalized their report.

The Seismic Retrofit Support Committee found examples of many potentially fair and useful mechanisms to distribute subsidies that support seismic retrofits and leverage private investment. However, they identified few sources of public capital to fund direct subsidies. In the end, their best strategies were primarily focused on state tax policy; these proposals are also summarized under *Recommendations*.

URM Policy Committee

The URM Policy Committee was convened in January 2016 and charged with reviewing the work of the previous committees, settling disagreements and unresolved issues, and developing a balanced set of recommendations for BDS, PBEM and PDC staff to translate into a policy proposal for the City Council. The Policy Committee includes some members of both the Retrofit Standards and Seismic Retrofit Support Committees, as well as stakeholders representing school, church, historic preservation, local business, and affordable housing interests. The Portland Housing Bureau, Bureau of Planning and Sustainability, and City Risk contributed to our discussions as well. This report is the culmination of the Policy Committee's work.

Public Engagement

All meetings of the three URM committees were open to the public, and invited public comment during each session. Interested parties did attend meetings, and minutes and supporting documents were posted on the project website and emailed to everyone who indicated interest.

To increase public awareness about the issue, the Policy Committee sought broader public engagement on their draft recommendations; BDS and PBEM actively sought media interest in the URM inventory and the release of their draft policy recommendations; PBEM developed a video tour of Portland URMs; the Policy Committee hosted two evening public forums in different transit-accessible locations and solicited written comments on the draft policy on their website and in printed materials available at the meetings and at the BDS Permit Center.

[Summarize public participation in the meetings, the range of comments, and any changes to the recommendations that were made as a result.]

City staff also sought opportunities to address other public bodies throughout the policy development process; they presented interim work products to the Development Review Advisory Committee (DRAC), Downtown Neighborhood Association, Portland Business Alliance (PBA), Building Owners and Managers Association (BOMA), Portland Public Schools, Structural Engineers Association of Oregon (SEAO) and others. A complete list of these presentations is given at the end of this report.

Policy Recommendation: Mandatory URM Retrofits

Based on the seismic risks Portland faces, the need to ensure public safety, the lack of progress under current codes, the effectiveness of mandatory seismic retrofit policies in other locations, and the results of the 1994Cost-Benefit Analysis, the Policy Committee recommends that all URMs within the city of Portland be required to comply with a new, mandatory seismic strengthening program. In this finding, the Policy Committee supports the research and recommendations of earlier committees.

The committee does support the following limited exceptions to mandatory upgrades:

1) One- and two-family homes
2) Buildings that have already undergone seismic strengthening, and meet the standards below:
   a) Buildings that have been fully upgraded to Seismic Zone 3 requirements under the Oregon Structural Specialty Code (OSSC) 1993 or later editions
   b) Buildings with currently approved Phased Seismic Strengthening Agreements with the City for a full seismic upgrade, as long as the building remains in the same or lower URM classification
   c) Class 3, 4, or 5 URMs (classes described below) that have already undergone a full seismic upgrade to ASCE 31/41 standards.

URM Classification: Terms

The American Society of Civil Engineers (ASCE) publishes generally-accepted standards for the design of buildings. ASCE Standard 41 (ASCE 41) is the standard for the Seismic Evaluation and Retrofit of Existing Buildings. ASCE standards are technical documents intended to be referenced primarily by other civil engineers. ASCE 41 employs many terms of art, a few of which are useful for everyone when discussing the classification of URMs, and others of which are necessary for a precise technical definition of the proposed standards:

ASCE 41 EVALUATION: the process of evaluating an existing building for potential earthquake-related risk to life posed by the building, performed and documented according to the ASCE 41 standard.

ASCE 41-BPOE IMPROVEMENT STANDARD: the Tier 1 and Tier 2 deficiency-based retrofit using the basic performance objective for existing buildings (BPOE) as defined in ASCE 41, unless a tier 3 evaluation is required by ASCE 41.

ASCE 41-BPON IMPROVEMENT STANDARD: Tier 3 retrofit using the basic performance objective equivalent to new buildings (BPON) as defined in ASCE 41

BPOE- Basic Performance Objective for Existing Buildings: a series of defined performance objectives based on a building's risk category meant for evaluation and retrofit of existing buildings; shown in table 2-1 of ASCE 41 standards.

BSE-1E: Basic Safety Earthquake-1 for use with the BPOE, taken as a seismic hazard with a 20% probability of exceedance in 50 years, except that the design spectral response acceleration parameters sxs and sx1 for bse-1e seismic hazard level shall not be taken as less than 75 percent of the respective design spectra response acceleration parameters obtained from BSE-1N seismic hazard level and need not be greater than BSE-2N at a site.

BSE-1N: Basic Safety Earthquake-1 for use with the basic performance objective equivalent to new buildings standards, taken as two-thirds of the BSE-2N.

BSE-2E: Basic Safety Earthquake -2 for use with the basic performance objective for existing buildings, taken as a seismic hazard with a 5% probability of exceedance in 50 years, except that the design spectral response acceleration parameters of sx_s and sx_1 for BSE-2E seismic hazard level shall not be taken as less than 75 percent of the respective design spectra response acceleration parameters obtained from BSE-2N seismic hazard level and may not be greater than BSE-2N at a site.

BSE-2N: Basic Safety Earthquake-2 for use with the basic performance objective equivalent to new buildings standards, taken as the ground shaking based on risk-targeted maximum considered earthquake (MCE_r) per ASCE 7 at a site.

COLLAPSE PREVENTION: the post-earthquake damage state in which a structure has damaged components and continues to support gravity loads but retains no margin against collapse. *A structure retrofitted to "collapse prevention" is not expected to collapse during the initial earthquake but may be left in a very vulnerable state. The structure might not be practical to repair and is not safe to reoccupy. Significant risk of injury caused by falling hazards from structural debris might exist.*

DAMAGE CONTROL: a post-earthquake damage state between the Life Safety Structural Performance level and the Immediate Occupancy Structural Performance level. It is intended to provide a structure with a greater reliability of resisting collapse and being less damaged than a typical structure, but not to the extent required of a structure designed to meet the Immediate Occupancy Performance level. *A structure retrofitted to "Damage Control" is*

not expected to be usable immediately after an earthquake. The damage is controlled to permit return to function more quickly than "Life Safety," but not as quickly as "Immediate Occupancy."

DESIGN EARTHQUAKE: the earthquake referenced in the evaluation or retrofit of a building.

IMMEDIATE OCCUPANCY: the post-earthquake damage state in which a structure remains safe to occupy and essentially retains its pre-earthquake strength and stiffness. *A structure retrofitted to "Immediate Occupancy" is expected to suffer very limited structural damage. The risk of life threatening injury as a result of structural damage is very low. Although some minor structural repairs might be appropriate, they would not be required before re-occupancy.*

LIFE SAFETY: an expected post-earthquake damage state in which a structure has damaged components but retains a margin against the onset of partial or total collapse. *A structure retrofitted to "Life Safety" will permit occupants to exit safely after an earthquake, but it may or may not be reparable. Injuries might occur during the earthquake but the overall risk of life-threatening injury as a result of structural damage is expected to be low.*

LIMITED SAFETY: a post-earthquake damage state between "Life Safety" and "Collapse Prevention." *Limited Safety is intended to provide a structure with a greater reliability of resisting collapse than collapse prevention, but not to the full level that "Life Safety" may imply.*

LIQUEFACTION: a phenomenon in which soil loses strength and stiffness in response to applied stress (usually earthquake shaking) and behaves like a liquid.

MAXIMUM CONSIDERED EARTHQUAKE: an extreme seismic hazard used for the evaluation or retrofit of a building.

TYPE E SOILS: The National Earthquake Hazards Reduction Program identifies five categories of soil types (A through E) and assigns amplification factors to each. Type E soils in general have the greatest potential to amplify ground shaking.

URM Classifications, Standards, and Timelines

It would not be practical to upgrade all URMs to the same standard, or on the same timeline; some buildings have many occupants or serve a critical function and require significant investment to reduce the risk they pose to the public. Non-critical buildings with low occupancy can be improved over a longer timeline, utilizing less expensive methods that are adequate given their risks. For this reason, the Policy Committee recommends that URM buildings be grouped in a classification system and retrofitted to meet standards and a timeline appropriate to the risk posed by the building. The proposed

groupings and standards are described in general terms below and in more precise technical terms in the table that follows.

Class 1: Critical buildings and essential facilities. This category is for critical structures such as hospitals, police and fire stations, power generating stations, and water treatment plants. Class one includes all the buildings in Oregon State Structural Code (OSSC) Risk Category IV, plus essential utilities.

Class 1 URMs are structures essential to emergency response. Therefore, they must meet the highest proposed performance objective; they would be expected to remain operational after a Design Earthquake and provide for Life Safety in a Maximum Considered Earthquake.

These buildings are also expected to meet the shortest retrofit timelines, assessing all structures to ASCE 41 standards within three years and achieving all retrofits within ten years. The URM database has identified ten Class 1 URMs.

Class 2: Schools and high-occupancy structures. This category addresses schools and other structures with many occupants, such as churches and theaters. Many of these structures are Risk Category III buildings in the OSSC.

Due to the substantial life-safety risk posed by buildings in this class, it is expected that they would be retrofitted to provide greater resistance to collapse or major structural damage than a typical URM. However, they would not be expected to meet the Immediate Occupancy Performance Level of URM Class 1 buildings.

The performance level for this category is set between Life Safety and Immediate Occupancy for a Design Earthquake, and between a Life Safety Performance and Collapse Prevention for a Maximum Considered Earthquake.

These buildings are expected to have an ASCE 41 assessment within three years, perform parapet, cornice, and chimney bracing and wall to roof attachments within ten years, and be completely retrofitted to the proposed standard within 20 years. There are an estimated 88 Class 2 URMs in Portland: 46 schools, 36 churches and six other public assembly uses (theaters, community centers).

Class 3: Larger URMs. Buildings in this category have more than 300 occupants or 100 residential units, or are at least four stories tall. Because they have more occupants, they represent a relatively high risk to human life when they fail.

The retrofit standard proposed for this category is Life Safety under a Design Level Earthquake and Collapse Prevention in the event of a Maximum Considered Earthquake.

The Committee recommends that buildings in this category have an ASCE 41 assessment within three years, perform parapet, cornice, and chimney bracing and wall to roof attachments within ten years, and be fully retrofitted within a 25-year time frame with

up to an additional five years for the full retrofit if the owner demonstrates hardship. There are approximately 221 buildings in Class 3, 160 of which are more than four stories tall.

Class 4: Everything else. This category includes non-critical one-, two-, and three-story buildings with 10-299 occupants. This represents a large group of URMs that pose less relative risk because they have fewer occupants and no critical uses. However, they still pose a potentially significant threat to the people inside, and to people outside near the building during an earthquake.

The retrofit standard and time frame for completion proposed for Class 4 buildings is generally the same as for Class 3. However, Class 4 URMs that meet certain criteria would be allowed to utilize a retrofit standard called "Modified Bolts Plus." Under Modified Bolts Plus, structures with characteristics generally shown to have improved performance and safety against collapse are required to anchor the walls to ASCE 41 standards, but address other structural deficiencies less comprehensively. Buildings with vertical irregularities or substandard mortar strength, or lacking adequate lateral force resisting elements, could not use Modified Bolts Plus unless those deficiencies were improved first.

Portland has an estimated 1,136 Class 4 URMs, making this the largest class, with nearly two-thirds of all existing Portland URMs. Considering the large number of Class 4 URMs, and the finite capacity of Portland's professional community to actually perform assessments, the Committee recommends that Class 4 URMS have five years to complete the initial ASCE 41 assessment. After the assessment, they should follow the same timeline as Class 3 for the retrofits, completing parapet, cornice, and chimney bracing and wall to roof attachments within ten years, and full retrofits within 25 years, with up to five additional years available for hardship.

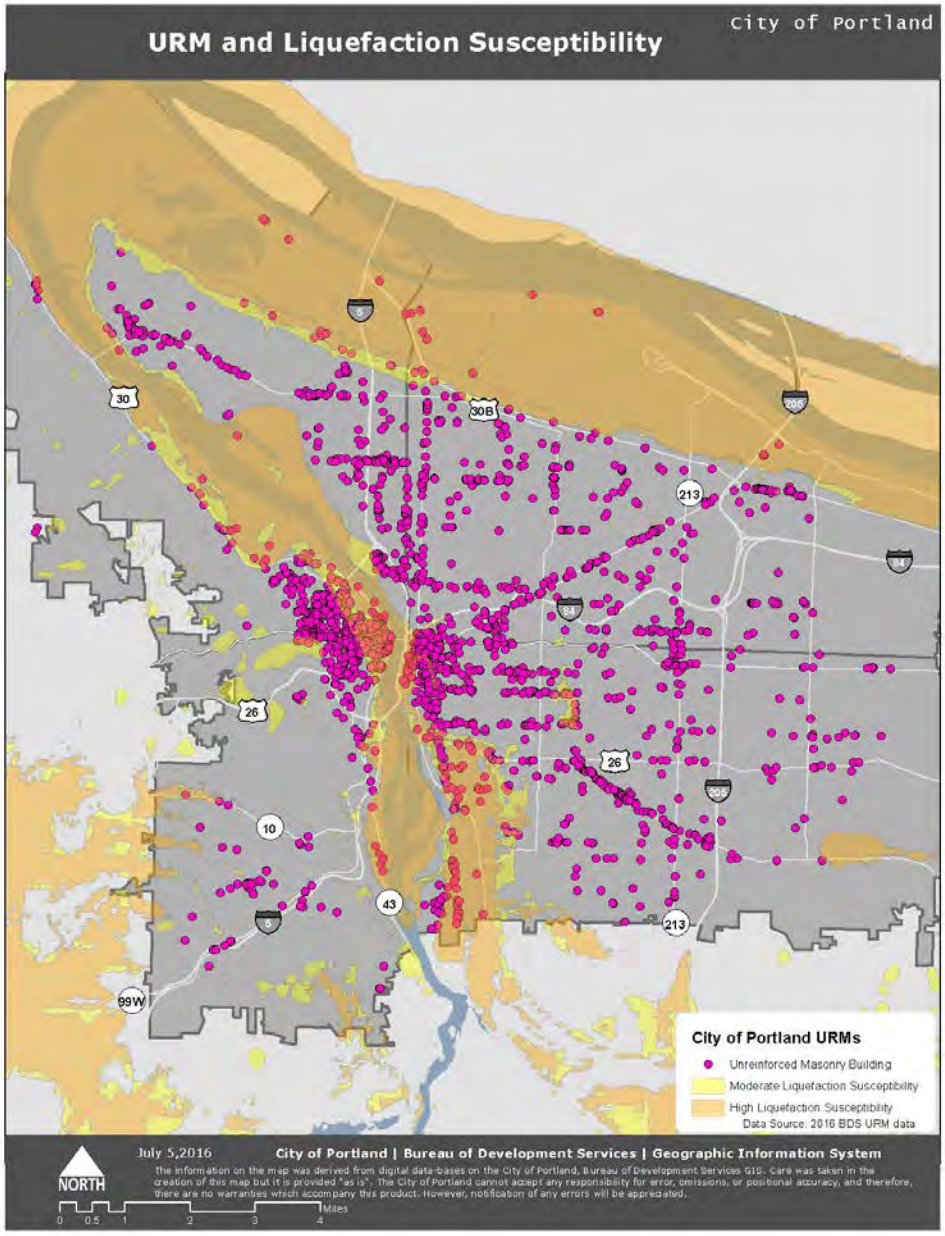
Class 5: Low occupancy structures. This category includes one and two-story buildings with zero to ten occupants. These are relatively low-risk, low-occupancy structures.

They are proposed to meet an upgrade standard that primarily protects adjacent structures and people outside near the building: to mitigate falling hazards by bracing parapets and attaching exterior and bearing walls to floors and roofs. Exterior walls would need to be braced only if they presented a collapse hazard in a Design Earthquake.

Because the standards proposed for class five buildings are relatively easier to meet, the Policy Committee supports five years for assessment and a ten-year timeline for completing these retrofits.

Soils, Liquefaction, and Earthquake Risk

Liquefiable and Type E soils can magnify the stress on a building during an earthquake and significantly increase damage to the structure. Ground improvement measures or deep foundations can mitigate this risk. But these steps are often impractical for existing buildings. Therefore, the committee proposes that a geotechnical report be required as part of the building assessment for URM buildings in high liquefaction zones or on Type E soils. The report would verify if poor soils are a concern on the site, and inform the owners of the risk to their URM building as a result. This evaluation will enable owners to make an informed economic decision as to whether the building should be upgraded or demolished.



The table on the following page summarizes the committee's recommendations with respect to URM classification, assessment, timelines, and standards.

URM Retrofit Standard Summary

Seismic Risk	Classification	Description	Upgrade Level[2,3]	Approximate # of Buildings[4]
Highest ↓	**URM Class 1**	Critical Buildings (Risk category[1] IV buildings, power generating stations serving critical facilities, water facilities, and other public utilities)	**Evaluation and Retrofit Level:** Tier 3 in accordance with ASCE 41 **Performance Objective:** BPON for Risk Category IV **Structural Performance Objective**: Immediate Occupancy for BSE-1N and Life Safety for BSE-2N **Non-Structural Performance Objective**: Operational for BSE-1N for all non-structural components assigned a component importance factor, Ip=1.5 as defined in ASCE 7-10 Chapter 13, as well as URM parapets, cornices, partitions and chimneys and hollow clay tile partitions.	10
	URM Class 2	A. All school buildings B. Risk category[1] III buildings	**Evaluation and Retrofit Level:** Tier 3 in accordance with ASCE 41 **Performance Objective:** BPOE for Risk Category III **Structural Performance Objective**: Damage Control for BSE-1E and Limited Safety for BSE-2E. **Non-Structural Performance Objective:** Position Retention for BSE-1E for URM parapets, cornices and chimneys as well as unreinforced masonry or clay tile partitions along major routes of egress.	88, including 46 schools 36 churches 6 other buildings
	URM Class 3	A. Buildings ≥ 4 stories or B. Buildings with ≥ 300 occupants or C. Residential buildings with ≥ 100 units	**Evaluation and Retrofit Level:** Tier 2 deficiency only in accordance with ASCE 41 (unless Tier 3 required by ASCE 41) **Performance Objective :** BPOE for Risk Category II **Structural Performance Objective:** Life Safety for BSE-1E. When Tier 3 is required by ASCE 41, structural performance objective also includes Collapse Prevention for BSE-2E. **Non-Structural Performance Objective**: Life Safety for BSE-1E for URM parapets, cornices and chimneys.	221, including 160 buildings of four or more stories

Footnotes:

1. Risk category as defined in Oregon Structural Specialty Code, 2014 Table 1604.5. (See Appendix B)
2. ASCE 41 refers to latest edition of American Society of Civil Engineers standard ASCE 41. At the time of writing of this report the reference standard is ASCE 41-13.
3. Refer to the glossary for definition of BPOE, BPON, BSE-1, and BSE-2 etc. Note that BSE-1E and BSE-2E are defined differently in this report than in ASCE 41.
4. The number of URM buildings was obtained from inventory referenced in this report.

Risk	Classification	Description	Upgrade Level[2,3]	Approximate # [4]
 **Lowest**	**URM Class 4**	All other URMs not categorized as URM Class 1, 2, 3, or 5.	**Evaluation and Retrofit Level:** Tier 2 deficiency only in accordance with ASCE 41 (unless Tier 3 is required by ASCE 41) **Performance Objective :** BPOE for Risk Category II **Structural Performance Objective:** Life Safety for BSE-1E. When Tier 3 is required by ASCE 41, structural performance objective also includes Collapse Prevention for BSE-2E. **Non-Structural Performance Objective**: Life Safety for BSE-1E for URM parapets, cornices and chimneys. **Exception: If a building conforms to or is brought up to the minimum requirements described in **footnote 5** below, then only the following elements are required to be upgraded per ASCE 41 for Life Safety performance under the BSE-1E and Collapse Prevention under the BSE-2E: (a) brace URM parapets, cornices and chimneys; (b) anchor URM walls to floors and roofs for out of plane loading; (c) attach diaphragm to vertical elements to transfer in plane shear; and (d) out-of-plane URM wall bracing if h/t ratio exceeds that reqd. by ASCE 41-13 Table 11-5.	1,136
	URM Class 5	1 and 2-story buildings with 0-10 occupants.	**Performance Objective:** Limited Performance Objective Only the following elements are required to be upgraded per ASCE 41 for Life Safety performance under the BSE-1E and Collapse Prevention under the BSE-2E : (a) brace URM parapets, cornices and chimneys; (b) anchor URM walls to floors and roofs for out of plane loading; (c) attach diaphragm to vertical elements to transfer in plane shear; and (d) out-of-plane URM wall bracing for URM walls with h/t ratio greater than 16 for one-story buildings or h/t ratio greater than 18 for the first story of a multi-story building, or h/t ratio greater than 14 for walls in top story of a multi-story building.	276

Footnotes (Continued):

5. Minimum Requirements / Building Configurations when limited upgrade is applicable for URM Class 4 buildings:

a) The building does not have vertical irregularity type 5a or 5b (a "weak story") as defined is ASCE 7-10, Table 12.3-2.

b) The building has a mortar strength (v_t) of 30 psi or more for all masonry at an axial stress of 0 psi.

c) The building has diagonally sheathed or plywood diaphragms at all levels above the base of the building.

d) The building has or will be provided with a minimum of two lines of vertical elements of the lateral force resisting system parallel to each axis. Masonry walls shall have piers with a height to width ratio that does not exceed 2:1. Wall piers shall occupy not less than 40 percent of the wall's length for the wall to be considered as providing a line of resistance. Exception: If a design professional registered in Oregon can demonstrate that the flexural, shear and compressive strength Demand/Capacity ratio are equal to 2.0 or less for all walls when evaluated using ASCE 41.

Special Consideration for Affordable Housing

The Policy Committee discussed the special challenges facing affordable housing, defined as residential units legally bound to provide housing units at below-market rents to qualified residents.

Affordable housing providers have no or limited ability to increase rents to cover the costs of retrofitting. The tenants that must be relocated while seismic work is done are often vulnerable. A handful of providers also own the bulk of the affordable URM buildings; some indicated that they would struggle to update all structures on the same timeline given the low number of units available for relocating tenants, and their own limited capacity to manage major construction projects.

In consideration of these issues, and of the city's current housing crisis, the Policy Committee recommends that affordable housing be exempt from the timelines for seismic upgrades beyond roof and parapet bracing, if owners enter into a Preservation and Resiliency Agreement with the Portland Housing Bureau. Such an agreement would require owners to make and keep units affordable long term, and would include milestones and timelines for achieving seismic upgrades. Affordable housing would still be required to provide structural assessment and parapet and roof upgrades on the same timeline as other structures. And affordable housing would still be required to meet the same standards as other structures, simply on a modified timeline. This strategy may have the added benefit of encouraging building owners to consider making low-market-rate units permanently affordable.

The Portland Housing Bureau has agreed to present to City Council an Affordable Housing Preservation and Resiliency Strategy, including targeted milestones and preservation timeframes no later than December 30, 2017. Buildings not participating in a Preservation and Resiliency Agreement will be subject to the timelines set forth in the URM policy recommendations.

Special Consideration for Other Uses

The Policy Committee also discussed the difficulties facing schools, religious buildings, and historic structures. Each type has special challenges.

Schools are perpetually underfunded, and they struggle to complete work without displacing students during the school year. Projects of more than three months pose additional problems; in a sense, schools also serve vulnerable tenants, difficult to relocate.

Both religious and secular non-profit community buildings provide social benefits such as homeless services, resources for low-income people, affordable daycare, and community meeting space. They also often struggle with little access to capital and a limited ability to manage complex legal or financial transactions.

Historic structures, which may also be churches, schools, or community centers, must also meet design standards for historic buildings that are set by the National Parks Service; these standards are usually inflexible. These can make the design and review of seismic improvements even more complex and costly than they would otherwise be.

The Policy Committee recognized the challenges facing these special uses, which are vital to our civic life. However, there was no indication that a longer timeline would improve the situation for these structures and, as for affordable housing, no thought that seismic retrofit standards ought to be diminished. Occupants' safety remains the primary concern. Therefore, the committee agreed that wherever possible, these buildings should be prioritized for public support to achieve retrofits. Mechanisms to provide such support are described later in this report.

Notice to Owners

If new rules are adopted for URMs, the owners of all known or suspected URMs should be notified in writing of their building's status. The letter should explain the new rules that apply to URMs, how to access the information that led to the building's classification as a URM, and how to appeal this classification if they believe it is incorrect.

Appeals

Upon notification of their building's status as a URM, some owners may consider their building incorrectly classified. An appeal process will be necessary. This process should provide an opportunity for the building owner to demonstrate why their building should not be subject to mandatory URM upgrades. Acceptable basis for exemption should include documentation that the URM building:

1. Was demolished
2. Is currently permitted as a one or two family dwelling
3. Is a Class 3, 4, or 5 building already fully upgraded to ASCE 41 or equivalent standard, or to Seismic Zone 3 requirements under the Oregon Structural Specialty Code (OSSC) 1993 or later editions
4. Is in compliance with an existing phased seismic agreement with the City of Portland
5. Had a voluntary upgrade or an upgrade that followed a different guideline, but also met ASCE 41 standards (such documentation would need to include an ASCE 41 evaluation)
6. Is not a URM.

Documentation of conditions 5 or 6 should come from a qualified design professional, such as a registered engineer.

Enforcement

The majority of URM owners will likely upgrade their buildings within established timelines. However, it will be necessary for the City to provide for enforcement. The Policy Committee proposes the following penalties for non-conformance, which are generally in accord with penalties imposed by BDS for comparable building code violations:

1) Failure to complete the evaluation report within the established timeline: $500 per month to a maximum of $6,000. If evaluation is not complete a year after the deadline, no additional permits will be issued for the property.
2) Failure to brace parapets, cornices, chimneys, and wall-to-roof attachments and / or failure to complete wall-to-floor attachments and wall strengthening within the established timeline: All permits will be withheld and a fine of $2,000 per month to a maximum of $12,000 (six months) will accrue until required work is permitted and completed. At the building owner's expense, a sign will be posted at the building entry identifying the building as a URM building that is potentially hazardous in the event of an earthquake. The building owner will be required to notify building tenants that the building is potentially unsafe in the event of an earthquake, and record against the building title that the property is not in compliance with City ordinance and that the City may withdraw its certificate of occupancy.
3) Failure to complete all required seismic upgrades within the established time frame: A penalty of $5,000/month with a maximum of $60,000 (12 months) will be assessed. The building owner will be required to notify building tenants that the building is potentially unsafe in the event of an earthquake, and post a sign at the building entry identifying the building as potentially hazardous in the event of an earthquake. If the required work is not completed within two years of the established time frame, then the certificate of occupancy may be revoked.

Policy Recommendation: Support for URM Retrofits

If funds could be identified, direct financial support for URM retrofits would be valuable to building owners. The Seismic Retrofit Support Committee identified a number of subsidy programs for URM building owners that could be of merit. However, all of these programs require an eligible source of capital funds to finance.

The Seismic Retrofit Support Committee reviewed financing mechanisms in other states. A few California cities with mandatory seismic retrofitting laws did pass bonds to finance the retrofit of private buildings; however, the Committee did not believe that the City or its residents presently

have the appetite for a general obligation bond to finance seismic retrofits of privately-owned buildings.

The Committee identified only one source of available capital funds. PDC committed to making $5 million available for URMs in the Old Town – Chinatown Urban Renewal Area (URA). PDC is seeking opportunities that could provide a financial model that would apply outside of URAs. However, PDC's funding can only be spent within the geographic boundaries of the URA; much of the funding in these districts has been expended, as the districts are expiring. Therefore, URA funds are not a viable mechanism to finance additional URM retrofitting.

The Committee was unable to identify other eligible sources of capital to subsidize seismic retrofits. The City is also prohibited by the Oregon Constitution from extending loans to private entities. However, if eligible funding were identified, the Committee agreed that the following programs potentially have merit:

First Priority:

- Seismic retrofit loan program.
- Direct grants to owners to defray some costs of a seismic retrofit.
- Rebates for seismic assessment costs for projects that complete seismic retrofits.

Second priority:

- Credit enhancement for privately financed retrofits.
- Interest rate buy-down of the retrofit loan (for 3-5 years).

In the absence of available capital funds, the Committee recommends that the City focus on state legislative efforts, technical assistance, a public information campaign including voluntary placarding, and other policy supports such as transfer of development rights. While there will be a cost to the City to administer these programs, they could provide benefits to many URM owners for less money than direct grants to a much smaller number of building owners.

Legislative Agenda for URMs

The Policy Committee recommends as a high priority that the City allocate staff time to develop and advocate for state legislative policies that would financially support seismic retrofitting.

A state historic tax credit is the best-developed legislative strategy at this time. There are many existing models, because many other states already have credits that complement the Federal Historic Tax credit. In Oregon, Senate Bill 565 was introduced in the 2015 session to create a new State Historic Tax Credit program. It would have authorized the Department of Revenue to conduct an auction for tax credits to generate up to $12 million annually to provide rebates to property owners for eligible rehabilitation

expenses. The legislation did not pass. The Committee recommends reintroducing this legislation in 2017 and advocating for its passage.

A complement to this effort would be a seismic retrofit tax exemption for URMs that prevents seismic retrofits from triggering property tax re-assessments. This legislation needs to be drafted.

An existing program funded by the state legislature for fiscal year 2016-2017 is the Seismic Rehabilitation Grant Program. This competitive grant program provides funds to schools and emergency service facilities for structural seismic improvements. In FY 2016-17, $125 million is available for school and $30 million for emergency services buildings. The City should advocate for continued and increased funding for this program in future fiscal years.

Another legislative strategy which requires more development but also shows promise is a special property tax exemption for URMs, similar to the rules in place for brownfields. For brownfields, the law currently allows local governments to adopt a special property tax assessment on brownfields land or a property tax exemption on improvements and personal property located on the brownfield. This is a direct financial incentive to parties willing to redevelop them. It does require the agreement of at least 75% of the taxing districts within a municipality to agree before it can become effective.

The Seismic Commercial Property Assessed Clean Energy (C-PACE) program, which is authorized under Senate Bill 85, provides another potential source of funding. An advantage of this type of financing is that it transfers with building ownership. However, this program requires the investment in the retrofit to generate savings or revenue to support the payoff of the loan over time. It is unclear how to capitalize on the potential avoided catastrophic costs that a retrofit provides in order to pay off the retrofit loan. If retrofitted structures predictably commanded higher rents than non-retrofitted ones, this structure could work. This is probably a longer-term strategy, but still potentially helpful within the time frame of the required retrofits.

Technical Assistance: Earthquake Ombudsman

The Committee recommends that the City create a staff position to serve as an ombudsman or "concierge" to help URM owners navigate the URM retrofit process, including design, permitting, and financing. This need was highlighted by both the Support and Retrofit Standards committees, and by the Historic Preservation Subcommittee of the Policy Committee.

Mandatory URM retrofits have the potential to disproportionately impact neighborhoods and community groups with fewer resources available to perform retrofits. The ombudsman position is expected to be of particular benefit to non-profits and small business owners, who are more likely to struggle in navigating the permitting and financing processes. The work of the

ombudsman should prioritize historically underserved neighborhoods. This strategy is important from an equity standpoint.

Public Education Campaign

The Committee recommends that the City conduct a comprehensive public awareness campaign about earthquake risk in general and the specific risks of URMs. This recommendation was also made strongly by both technical committees. They emphasized the importance of reaching out to the general public and to URM owners in particular. A public information campaign will help encourage market demand for URM retrofits and over time make private financing of the retrofits more feasible.

Placarding

The Committee recommends that the Bureau of Development Services develop a placard that states a URM building has been retrofitted to meet the City standard, and distribute these placards to buildings that meet the URM requirements. The placards should be tied to the broader public education program. Voluntary placarding of upgraded buildings will support building owners who have made seismic improvements and want to stimulate market demand for retrofitted buildings, without directly penalizing building owners who have not yet made upgrades.

The US Resiliency Council has a building rating system that applies to all construction types (not just URMs) and that assigns 1-5 stars based on the building's safety, repair cost and time to regain basic function after an earthquake or other hazard. The Committee noted this program as an opportunity to lead by example, and encouraged the City to consider obtaining a US Resiliency Council rating for all City buildings. Any private building owner can participate in the rating system if they are interested

Other Policy Supports

The Policy Committee did not have the responsibility or the technical expertise to fully develop recommendations around density and the transfer of development rights. However, the group heard from the Bureau of Planning and Sustainability about concurrent efforts to revise the City's system for density bonuses and the transfer of development rights. In concept, they were supportive of efforts that would permit URM building owners to benefit from selling excess floor area ratio (FAR) to finance seismic retrofits. They recommend that the City move forward in these efforts, and that BDS and PBEM remain involved as this work is completed. The earthquake ombudsman might eventually be important in ensuring all eligible property owners have the opportunity to benefit from this program.

The Committee also recommended that the City permit seismic upgrades to buildings without requiring owners to address water and storm water nonconformities, similar to the way ADA upgrades are presently treated.

Code language needs to be developed in this area.

The Committee also acknowledged that while URMs are dangerous in earthquakes, they are not the only buildings to pose a significant risk. Soft-story buildings that lack a shear wall on the first floor are vulnerable to collapse for that reason. Non-ductile concrete buildings are made of brittle unreinforced concrete and have many of the same risks as URMs. As a next step, the Committee recommends that the City conduct an inventory of both soft-story and non-ductile concrete buildings, and consider enacting similar retrofit requirements for these buildings.

Next Steps

The Policy Committee has laid out a suite of recommendations for implementing a mandatory URM retrofit policy in the City of Portland. The recommendations touch on multiple bureaus, and some depend on the state legislature. It will take time to implement them. But the timelines proposed for retrofits are also long and allow the possibility of adjustments along the way. Making a commitment to eventually upgrade all URMs, notifying property owners of their building's status, and taking the first step towards retrofit—completing building assessments—are important commitments.

The Policy Committee proposes the following next steps in the implementation of a mandatory URM policy:

- Direct BDS to codify proposed building regulations and return to Council for adoption by May 2017.
- Direct BDS to continue to update the URM inventory, and to prepare to send a notice to URM owners of their status and start the clock on mandatory upgrades following the adoption of new building code regulations.
- Direct BPS to work with BDS and PBEM to codify transfer of development rights for retrofitted URMs and return to Council for adoption, with other elements of the Comprehensive Plan expected to be brought forward in 2016.
- Direct PBEM to work with the Office of Government Relations, PDC, and community partners to develop and advance a legislative agenda for the 2017 legislative session, including a state historic tax credit and increased funding for the state's Seismic Rehabilitation Grant Program. Explore the feasibility of other state tax mechanisms for future legislative sessions.
- Direct PDC, PBEM, and BDS to continue working together to develop a budget for an earthquake ombudsman and a public education campaign, and bring those proposals forward for fiscal year 2017-18.
- Direct PBEM, BDS, and OMF to work together to develop a cost estimate for US Resiliency Council rating of City buildings, and return to

Council in a study session to review it before the end of fiscal year 2017-18.

- Direct PBEM and BDS to work together to develop an inventory of soft-story buildings and non-ductile concrete buildings, and return to Council in a study session to review it before the end of 2017.

Parting Thought

Mandatory URM retrofitting will be difficult for building owners, including some worthy Portland institutions. It will require the commitment of funds and the sustained attention of City government for years to come. Change will come slowly. Upgrades are inconvenient during installation, and invisible after completion; some buildings will be torn down instead. The Policy Committee recognizes all these difficulties. As these complexities become clear to others, it may be tempting to turn away from the issue of URMs.

However, Portland has a high concentration of URMs – more than any other City in the Pacific Northwest. We also have high seismic hazard. A recurring lesson from around the globe is that the costs to retrofit before an earthquake are still are much less than the losses otherwise experienced afterwards. Seismic retrofits are best practice. And other cities have already led the way on this issue. In San Francisco, Los Angeles and elsewhere, un-retrofitted URMs have been virtually eliminated. There is evidence these changes have saved lives and prevented many millions in property damage and business closures. It is the position of the Committee that the City of Portland owes its residents nothing less.