PRIOR URM CITY OF PORTLAND STUDIES: COMBINED EXECUTIVE SUMMARIES

Here are the Executive Summaries of the four key documents that preceded this Workgroup. They are presented in reverse chronological order.

Policy Committee: 2017

Link to the online report https://www.portlandoregon.gov/pbem/article/661773

An unreinforced masonry (URM) building is a structure with at least one wall made of brick or blocks joined by mortar with no steel reinforcing bars.

URM buildings 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, dance halls, and other landmarks that Portlanders know and love. URM buildings define the character of many Portland neighborhoods and business districts.

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

Requirements to strengthen URM buildings were put in place in Portland in 1995. They apply only when a URM building owner seeks permission from the City to increase occupancy, change the use, or make a significant renovation to their building. Since 1995, about 8% of Portland URM buildings 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 URM buildings have had no retrofits at all.

The average Portland URM building is 88 years old. Portland's stock of URM buildings includes about 44 schools, 38 churches, and 248 multifamily structures with over 7,000 residential units. More than 500 URM buildings are on the National Register of Historic Places or are contributing

structures in a designated National Historic District or Conservation District. A complete URM building inventory is available at www.portlandoregon.gov/bds/urms.

In 2014, Portland City Council directed the Portland Bureau of Emergency Management, the Portland Development Commission (now known as Prosper Portland), and the Bureau of Development Services to work together with community stakeholders and subject matter experts to develop recommendations to reduce Portland's risk from URM buildings. Two technical committees composed of outside experts were created to advise on engineering and finance. They met from January to November 2015. From December 2015 to November 2017, a Policy Committee composed of members of both technical committees, along with advocates for historic preservation, affordable housing, schools, churches, and other owners-stakeholders, met to synthesize the technical recommendations and data into a complete policy recommendation. This report represents the culmination of their work.

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 an in-dependent cost-benefit analysis, it is recommended that the city of Portland adopt a limited, mandatory seismic strengthening program.

The Policy Committee proposes a tiered approach, requiring URM building upgrades to critical buildings sooner and to a standard that will enable their use after an earthquake, and lower-risk buildings later, to a cost-effective standard that will still 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 18 of this report.

The Committee recognizes the potentially significant impacts that mandatory URM building retrofits will have on building owners, including small businesses and individuals who rely on building rents as their primary income. The Committee proposes that the City develop a program of property tax exemptions to help offset the costs of retrofitting, as authorized under recent state legislation. The Committee also supports increased state funding for school retrofits, and an extended timeline, if necessary, for affordable housing retrofits. For tax-exempt public assembly spaces, such as churches and synagogues, which are ineligible for public subsidy and do not benefit from tax exemptions, the Committee recommends a program of minimal upgrades plus warning placards.

The Committee further recommends that the City support a public education campaign for building owners and tenants, a voluntary building placarding program to mark retrofitted URM buildings, and an earthquake navigator to assist building owners in navigating the permitting, financing, and design of seismic retrofits.

Benefit-Cost Analysis of Proposed Seismic Retrofit: 2016

Link to the online report https://www.portlandoregon.gov/pbem/article/596311

The purpose of this benefit-cost analysis is to compare the costs and the benefits of the proposed levels of seismic retrofits for unreinforced masonry (URM) buildings in Portland as objectively and quantitatively as possible, within the constraints of available data, to support the City's in-process decision-making about the prospective seismic retrofit ordinance. Benefit-cost results contribute to rational decision-making but should not be the sole basis of decision-making about seismic safety issues in Portland.

Life safety is the predominant motivation for Portland's consideration of mandatory retrofits of unreinforced masonry buildings. Public safety is a paramount priority for the City of Portland and this applies to seismic safety in the same sense that providing effective fire, police and emergency medical services are extremely high priorities for the City and its residents. Historic preservation and economic vitality are also motivating factors, but are secondary to life safety.

The perspective of this benefit-cost analysis of seismic retrofits is holistic – that is, the primary focus is on the overall costs and overall benefits for the City and its residents. However, it is very important to recognize that neither the costs nor the benefits of seismic retrofits are distributed homogeneously to all stakeholders in Portland:

The costs of seismic retrofits are likely to be borne primarily by building owners, but may also be partially borne by the City and/or State and their taxpayers – depending on possible to-be-determined financial credits or incentives that may be offered to owners – and partially borne by tenants via higher post-retrofit rents.

However, the life safety risks are borne predominantly by tenants.

This dichotomy between who pays and who benefits is central to the public policy discussion of the risks from Portland's URM buildings.

Benefit-cost analysis of seismic retrofits is inherently probabilistic. The probability of future earthquakes affecting Portland is relatively well understood. However, it is not possible to predict when any specific earthquake will occur. For example, a M9.0 earthquake on the Cascadia Subduction Zone might happen tomorrow, or next year, or a few decades from now or not for 100 or more years. The latest estimate is that this earthquake has a 12% to 18% chance of occurring in the next 50 years. There are also many other possible earthquakes than can significantly affect Portland.

Benefit-cost analysis of seismic retrofits considers the probabilities of earthquake ground motions over the full range of ground motions large enough to cause building damage. The average annual damages and economic losses are estimated for two states of a URM building: the existing building and the building after completion of a seismic retrofit to a defined seismic performance level. The long-term expected average annual benefits are the difference between the average annual damages and economic losses between the existing building and the retrofitted building.

The net present values of the average annual benefits are calculated from the discount rate, which accounts for the time value of money, and the useful lifetime of buildings. The benefit-cost ratio is calculated by dividing the net present value of benefits by the retrofit costs.

Portland's database of URM buildings includes 1,661 URM buildings, excluding one- and two-family homes. The costs and benefits of seismic retrofits may differ for each one of these URM buildings. However, existing building data are inadequate to complete benefit-cost analyses on a building-by-building basis. Therefore, the benefit-cost analyses are done for Portland's defined URM Classes for a "typical" building with input parameters approximately representative of the average Portland URM building.

A "typical" Portland URM building for benefit-cost analysis is defined as: 10,000 square feet, low-rise (1 or 2 stories) located at the approximate centroid of Portland URM buildings, on firm soil (Site Class D), with an average occupancy of one person per 1,000 SF and additional parameters as defined in the body of this report.

Uncertainty in the benefit-cost results arises from the combined uncertainty and variability of the input parameters. Uncertainty is addressed by evaluating the effects on benefit-cost results – the benefit-cost ratios – for ranges of values for each of the most important input variables.

The benefit-cost results summarized on the following page represent the results for each of Portland's defined URM Classes for the defined "typical" building.

Portland URM Class	Estimated Retrofit Costs Per Square Foot	Typical Building Benefit-Cost Ratio
Class 1	$111.45	N/A
Class 2	$82.62	1.474
Class 3	$68.77	1.661
Class 4-A	$68.77	1.661
Class 4-B	$51.00	1.967
Class 5	$20.00	1.940

The numerical benefit-cost ratios shown on the above apply to the defined "typical" URM building, with the specific defined input parameters, except for Class 5. Benefit-cost ratios for seismic retrofits of individual buildings will vary because benefit-cost ratios vary with all of the input parameters.

The parameters that have the greatest impact on benefit-cost ratios include:

- Estimated seismic retrofit costs,
- Site Class,
- Average 24/7/365 occupancy,
- Estimated casualty rates for each of the defined building damage states, and
- The combination of discount rate and postulated building useful lifetime.

For the defined "typical" URM, life safety benefits – the reduction in injuries and deaths – account for about 55% of total benefits. Thus, the benefits and benefit-cost ratios will be significantly higher or lower for buildings with higher or lower occupancies per 1,000 square feet than the defined "typical" building.

To the extent that the defined "typical" building represents the average Portland URM building and that the input parameters for the benefit-cost analyses are reasonable, the results represent the average benefit-cost ratio for seismic retrofits in Portland for each URM Class.

The benefit-cost analyses presented in this report are necessarily incomplete: detailed data is not available on a building-by-building basis and there are parameters for which meaningful data simply don't exist or could not be estimated quantitatively within the scope of this effort. The non-quantified benefits and the non- quantified costs are addressed qualitatively at the end of this report. On balance, the non-quantified benefits are likely to exceed the non-quantified costs. Thus, a more comprehensive analysis, with all other factors held constant, would likely yield higher benefit-cost ratios.

Conclusions and Further Considerations

Unreinforced masonry buildings in Portland unequivocally pose substantial life safety risks not only to their occupants but also to people on adjacent sidewalks and streets. The "do-nothing" option – to simply hope that a major earthquake doesn't occur – does not appear to be the best policy. The question is not whether something should be done to reduce the risks from URM buildings, but rather what should be done to reduce risks.

The benefit-cost results indicate that the benefits of the URM building seismic retrofits current under consideration exceed the retrofit costs for the defined "typical building" for each URM Class of buildings. However, both the benefits and costs will vary significantly from building to building.

The trend in benefit-cost ratios vs. URM Class indicates that lower cost retrofits to lower performance levels generally have higher benefit-cost ratios than higher cost retrofits with higher performance levels. That is, the lower seismic performance with less reduction in future damages, losses and casualties is offset by the lower cost.

The lower-cost less-comprehensive seismic retrofits will perform relatively well at low to moderate levels of earthquake ground shaking. However, buildings retrofitted to lower seismic performance

levels will perform substantially poorer than buildings retrofitted to higher performance standards in major earthquakes with high levels of ground shaking and/or long duration ground shaking including large magnitude M8 or M9 Cascadia Subduction Zone earthquakes as well as M6+ or M7 local earthquakes on the Portland Hills Fault or other crustal faults within or near Portland. Thus, the lower-cost seismic retrofits reduce earthquake risk – future casualties, damages and other economic impacts – to a lesser extent than do the higher-cost seismic retrofits.

The benefit-cost results – benefit-cost ratios above 1.0 – indicate that the benefits of the proposed seismic retrofits for URM buildings exceed the costs for the City of Portland and its residents. Thus, these results support and help to justify the proposed seismic retrofit ordinance.

The above conclusion notwithstanding, there are other aspects of the City's decision making about the details of the ordinance that are not addressed by the present benefit-cost results, including:

- Are the proposed seismic performance levels for each URM Class appropriate and achievable or are there alternatives that provide an adequate level of life safety at a lower cost?
- Are financial incentives necessary to make retrofits more affordable to building owners?
- Will the proposed ordinance have undesired effects, such as the demolition of many URM buildings, including those with historical significance, and/or severe financial hardship for building owners?

Support Committee: 2015

Link to the online report https://www.portlandoregon.gov/pbem/article/556652

The Cascadia subduction zone (CSZ) poses a great natural hazard in the region. The last decade has provided unexpected lessons in the enormous risks from giant subduction earthquakes. Sumatra 2004, Chile 2010, and Japan 2011 each caused devastation, billions of dollars in damage and took thousands of human lives. In addition, other local crustal faults (e.g. the Portland Hills fault) present additional, if not higher, risks because of their closer proximity to Portland. The 2011, 6.3 magnitude quake in Christ Church, New Zealand, is an example of the damage a crustal earthquake can cause.

Acknowledging these inescapable hazards, the City of Portland has embarked upon a process to improve the safety and the overall resiliency of the City including a review of the City's Unreinforced Masonry Retrofit (URM) codes (CC 24.85).

URMs are one of the City's most earthquake vulnerable type of structures and pose considerable risk to the life and safety of the public in a seismic event. According to the Bureau of Development Services (BDS) there are approximately 1,800 URM buildings in the City of Portland. These buildings have at least one bearing wall that is constructed of masonry with little or no reinforcement; and, often there are no structural attachments between the exterior wall, and the roof and floors of the building. Because they lack reinforcing and attachments, these buildings are prone to significant damage or collapse in an earthquake. While some URM buildings have been structurally improved, most are susceptible to serious damage in moderate and large earthquakes.

City Council directed staff to conduct research about URM retrofit best practices in other cities and to return to Council with policy recommendations including proposed code changes and assistance program(s) to support implementation. To assist in this effort, three advisory committees were assembled to provide expert input and guidance in the development of the staff recommendations:

- Retrofit Standards Committee (RSC),
- Seismic Retrofit Support Committee (SRSC), and
- Policy Committee

This report summarizes the activities of the SRSC which was charged with evaluating and recommending various options to help private building owners overcome barriers to complying with proposed code changes.

Some have questioned why the City should be involved in providing support or assistance to private building owners to improve their buildings. Private-owner earthquake losses are more than a simple collection of losses experienced by private owners. The risk of collapse poses a significant public hazard and the damage caused by an earthquake will impair the City's ability to function.

The consequences of cumulative damage to Portland's building infrastructure make private building damage a public concern.

Although the public interest in the retrofit of privately-owned buildings appears obvious to some, just how to provide support is not. The decision to improve building performance is very complex, and the cost and complexity of a seismic retrofit are often impediments to performance. No one incentive or action can adequately address the problem for all owners. Some owners lack access to capital; others have access, but a URM retrofit may not fit their lender's risk profile. Still other, especially smaller projects will not pencil financially without grant funding. In the absence of workable options, building owners may simply have to sell or demolish the URM building.

The SRSC concluded that what is needed is a suite of options that can be tailored to the unique needs of each building and each owner. In addition, that government resources should be invested where they leverage the most life/safety impact for the greatest number of buildings at the least cost to the public.

The SRSC membership included representatives from a variety of stakeholders including financial, structural engineering, building owners, historic preservationists, developers and governmental agencies. In preparation for the committee's discussion, staff conducted extensive research about seismic retrofit assistance tools used in other cities. That research was summarized in a matrix organized into four broad categories which was used to facilitate SRSC discussions:

- Financial Assistance
- Policy
- Technical Assistance
- Information Support

FINANCIAL ASSISTANCE

Financial assistance tools that provide adequate access to capital or reduce the cost of a retrofit project were fully supported by the SRSC. Any eligible tool that increased access to capital (loan program, credit enhancement), reduced the direct costs of a retrofit project (grants, fee waivers, rebates, state/federal tax credits) or reduced the on-going financing and operating costs of the building (low interest loans, interest rate buy-downs, property tax abatement) should be pursued. By doing so, owners would have a suite of tools that could be assembled to meet their unique financial needs and thus increase the likelihood of owners' compliance with updated codes.

POLICY

There are a number of non-financial support tools that could facilitate seismic retrofits. The City's existing codes exempt seismic retrofit projects from triggering other building updates (fire, set-backs, landscape.) The SRSC strongly recommended that water and storm water upgrades be added to the list of exempted upgrades.

The committee also had a robust discussion about and recommended the development of a floor-area-ratio (FAR) URM Retrofit density bonus that owners could sell to help finance URM retrofits. Many felt this was a mechanism that had little direct cost to the City but could provide a source of new capital to finance a portion of retrofit projects costs. The need to create a FAR market place where sellers and buyers can easily find each other was also discussed.

The committee also recommended the creation of an expedited permit review process; the assignment of one staffer within each bureau as project lead with authority to resolve project design conflicts; and the creation of a Seismic Retrofit Ombudsman position to help shepherd projects throughout the approval process with multiple bureaus and provide guidance about different financial assistance tools and how to access them.

TECHNICAL ASSISTANCE

The committee discussed a number of methods to provide technical assistance to support owners' performance. In addition to the Ombudsman position, the committee supported the idea of standardized retrofit design options that were preapproved with City bureaus (although some questioned whether standardization was possible.) The majority of the committee did not support the idea of a seismic retrofit contractor certification or of the City assembling a pool of technical advisors. Most of the committee felt that the private sector could take care of itself without government assistance in these areas and that limited government resources were better spent on other strategies.

INFORMATION SUPPORT

The SRSC discusses five key topics in the Information Support category: Placarding; Public Awareness Campaign; a Building Rating System; Tenant Notification; and Real Estate Transfer Disclosure. They supported the idea of requiring placarding of buildings but only in the case of non-compliance with required rehabilitation standards and with adequate notification by the City before posting; supported the creation of a robust, multi-focused public awareness campaign; decided to defer evaluation of a building rating system until the US Resiliency Council publishes is rating system (see "End Note" at end of report); most of the Committee rejected the idea of tenant notification and felt this was better handled through the awareness campaign; and most felt that the real estate transfer disclosure was redundant to existing laws and practices.

The report that follows provides more detail about the process the committee engaged in to develop these recommendations and more nuances of their discussions.

Standards Committee: 2015

Link to the online report https://www.portlandoregon.gov/pbem/article/528316

There are approximately 1800 unreinforced masonry buildings (URM) in Portland. These structures experience a higher rate of collapse and sustain higher levels of damage than other building types in a seismic event. In their 2011 report, The Oregon Resilience Plan, the Oregon Seismic Safety Policy Advisory Commission (OSSPAC) recommended that URM buildings "should not be allowed to remain in service indefinitely unless they are fully upgraded."

Currently, the City of Portland requires seismic upgrades to buildings based on Title 24.85. These provisions require seismic upgrades when there is a change of use to a more hazardous classification, an increase in occupancy, or an alteration to the building that exceeds specific cost thresholds. Because Title 24.85 provisions only require seismic retrofits when an owner voluntarily undertakes an alteration or upgrade to their property, they are called "passive triggers." The Bureau of Development Services estimates that less than 20% of Portland's URM inventory has been upgraded since Title 24.85 went into effect in 1995. This rate would need to quadruple to meet the Oregon Resilience Plan goal of retrofitting these most vulnerable buildings within 50 years.

The Portland City Council has directed the Portland Bureau of Emergency Management (PBEM), Portland Development Commission (PDC), and Portland Bureau of Development Services (BDS) to investigate best practices regarding how other jurisdictions have addressed this problem and submit a policy recommendation report by summer 2016. The URM Seismic Retrofit Project recommendations will be developed by three committees. This report represents the Retrofit Standards Committee recommendations, which were developed by experts in the fields of structural engineering, architecture, and geology working with BDS staff to review relevant research and best practices from other west coast jurisdictions. Members of the public attended the meetings and had opportunity to comment throughout the policy recommendation development process.

The key recommendation of the Retrofit Standards Committee is that Portland adopt a mandatory seismic strengthening program that would require some level of upgrade for all URM structures with the exception of one and two-family dwellings.

The committee's goal in developing recommendations for a mandatory seismic retrofit program was to assign an appropriate upgrade standard to URM buildings based the building use and the risk to human safety posed by the structure. To accomplish this, the Committee divided the City's URM inventory into 5 "URM Classifications." Class 1 buildings represent essential facilities such as hospitals and fire stations. These buildings must undertake comprehensive seismic upgrades so that they may be occupied and are operational immediately after an earthquake. Class 2 buildings include schools and other high occupancy structures. These structures must be upgraded to provide a performance standard between Life Safety and Immediate Occupancy. The remaining URM classifications range from Class 3 buildings that exceed 4 stories or have 300 or more

occupants, to one or two-story Class 5 buildings with ten or less occupants. The required performance levels for these classifications range from Life Safety Performance in a Design Level Earthquake for Class 3 buildings, to roof parapet bracing and exterior wall to floor attachments to mitigate falling and collapse hazards for Class 5 buildings. The URM classification and performance standards are specified in Table 1 on pages 13-14 and described on pages 10-12.

When considering required timelines for mandatory upgrades, the Retrofit Standards Committee sought to balance the need for seismic safety improvements in the near term, with the need expressed by building owners to plan for the cost and disruption associated with retrofit projects. This balance was achieved by allowing longer time frames for the entire retrofit, while establishing intermediate benchmarks so that significant life/safety benefits are realized in a shorter time horizon. For example, Class 3 buildings must complete all retrofits within 25 years, but parapet and wall to roof attachments must be completed in 10 years, and all exterior/bearing wall to floor attachments must be complete within 20 years. All buildings must have a seismic evaluation within 3 years of notification by the City so that owners are able to plan for the required upgrades. Complete timeline recommendations are specified in Table 2 on page 16 and described on pages 16-18.

In addition to mandatory seismic upgrades, the Retrofit Standards Committee also recommended several amendments to Title 24.85 and made additional recommendations to support the proposed mandatory seismic upgrade program. The proposed Title 24.85 amendments focus on making the passive triggers in 24.85 more effective by tightening requirements for parapet bracing, as well as modifying the cost, use, and occupancy thresholds that trigger seismic upgrades when an owner applies for an alteration or addition permit for the building. The committee also recommended that an enforcement policy be coupled with the mandatory upgrade provisions to ensure compliance and advocated several strategies to inform the public and building occupants about a building's seismic resilience. These include tenant notification, building placards, and real estate transaction disclosures. The committee also noted that consideration should be given to an upgrade policy for other dangerous building types such as non-ductile concrete structures, and the importance of further policy development to strengthen historic URM buildings against seismic events. All the Committee's proposed recommendations are summarized in Section V found on pages 20-23.

The Oregon Resilience Plan found that the State currently has a low seismic resilience, leaving Oregon residents vulnerable to significant loss of infrastructure, basic services, and slow economic recovery following a major Cascadia subduction zone earthquake. URM buildings are some of the most vulnerable structures in a seismic event, and even minor earthquakes can pose public hazards when parapet walls and other loosely attached structures fall. The Seismic Retrofit Standards Committee urges the adoption of the mandatory upgrade program and associated recommendations as an important step in improving the safety of Portland's residents and its infrastructure during and after an earthquake.