**Western States Seismic Policy Council**

**Policy Recommendation 17-4**

# Identification and Mitigation of Unreinforced Masonry Structures

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Unreinforced masonry bearing-wall structures represent one of the greatest life-safety threats and economic burdens to the public during damaging earthquakes. WSSPC recommends that each state, province or territory adopt a program to identify the extent of risk that unreinforced masonry structures represent in their communities and develop recommendations that will effectively address the reduction of this risk.

**Executive Summary**

Unreinforced masonry is recognized by the Federal Emergency Management Agency as one of the structural building types most prone to failure during an earthquake. A review of the U.S. Geological Survey Hazards Program website listing earthquakes that generated 1,000 or more deaths since 1900 shows that unreinforced walls are a significant contributing factor in losses in both the financial sector and human lives.

WSSPC strongly believes that jurisdictions must be proactive to address this threat to their citizens. Legislatively mandated programs and/or local municipally adopted ordinances have proved effective at addressing this risk.

# Background

During earthquakes, unreinforced masonry (URM) structures are vulnerable to catastrophic collapse and represent a significant life safety threat, as occurred in the 2008 Wells, Nevada earthquake. Unreinforced masonry structures are made from brick, hollow clay tile, stone, concrete block, or adobe materials that are not strengthened by the addition of steel or other reinforcement. Common building examples include older industrial complexes, schools, mercantile establishments, and private residences.

Also of concern are components of these structures such as walls, unsupported parapets, and fireplace chimneys, which can fall on sidewalk pedestrians or people trying to exit a building. The masonry usually is held together with weak mortar and is unable to resist lateral forces. Wall and roof anchorage tends to be inadequate, allowing floors and roofs to separate from the walls and collapse. Historically, this type of building damage has been a major contributing factor to loss of life in earthquakes throughout the world.

WSSPC recognizes that there is a societal cost to the inventory and retrofit or replacement of unreinforced masonry buildings, but in areas of high seismicity, failure to address this issue will have expensive and lethal consequences. In order to minimize the cost and make programs more politically acceptable, the three-stage approach of identifying the population of hazardous buildings, analyzing the risk presented by these buildings, and prioritizing the retrofitting of those buildings deemed to be a hazard is recommended.

It is recognized that resistance by owners and users of URM structures is to be expected when dealing with retroactive building ordinances. However, as can be seen by those jurisdictions that have adopted fire sprinklers retroactively, versus those that have not, even minimal remediation can yield discernible life-saving results. The International Existing Building Code Appendix Chapter 1, the American Society of Civil Engineers National Standard ASCE 41-13 “Seismic Evaluation and Retrofit of Existing Buildings” and retrofit concepts described in FEMA publications for unreinforced masonry structures are available; however, this in no way negates the need for local engineering analysis and design.

**Internal Section:**

**Facilitation and Communication**

WSSPC recommends that each State, province, or territory adopt a voluntary or mandatory program to identify the extent of risk that unreinforced masonry structures represent in their communities.

**Voluntary Implementation Plan**

The first phase of a voluntary plan involves creating an inventory of unreinforced masonry structures and is a relatively low-cost process. State and local entities, including school districts, should be responsible for identifying their own URM structures. A review of the locally adopted codes is necessary. All masonry structures built in high seismic hazard areas under the Uniform Building Code of 1961 or later[[1]](#footnote-1) should have been reinforced. Further, field verification is essential. Also refer to ASCE 41-13 Table 4-6 that defines benchmark editions of other guidelines and building codes that may have been adopted and implemented in the area under consideration.

Private owners of unreinforced masonry structures should be notified that their buildings may be a potential threat to human health and safety and require professional seismic evaluation with submittal of the findings to the authority having jurisdiction. This inventory process may take several years to carry out, but upon completion a more accurate assessment of a community’s risk will be available.

As a second step, the development of a plan to mitigate this risk will need to be addressed. Using a multi-pronged approach, including obtaining grant funding when possible, incentives to reduce taxes, possible adjustment of permit application fees, or the providing of design and construction assistance, may make mitigation a more feasible option. Neither litigation nor forced abandonment of these structures is desirable. Replacement or a reduction in occupancy or limitations on use may be acceptable risk-reduction options. Permits issued for the sole purpose of seismic retrofitting should not affect or trigger additional jurisdictional requirements or property tax increases.

**Alternate Mandatory Implementation Plan**

An alternate mandatory URM implementation plan to reduce the risk presented by unreinforced masonry buildings is a three-phase approach comprised of the following:

1. Adopt a legislative initiative requiring the inventory of unreinforced structures within a jurisdiction;
2. Develop or cause to have developed a mitigation plan that identifies hazardous structures and includes a cost-benefit analysis; and
3. Implement a mandatory URM structures program through:
   1. Completing mitigation design and retrofit,
   2. Abandoning or replacing use of the structure,
   3. Controlling use and occupancy to minimize the potential risk, or
   4. Minimizing the public’s exposure to masonry falling risks around the perimeters of URM buildings.

**Assessment**

The effectiveness of this policy can be determined by maintaining an inventory of states, provinces and territories with active programs to mitigate the dangers of unreinforced masonry bearing wall structures. By compiling these individual efforts, WSSPC will provide a clearinghouse of information on its website that can be used to help promote the policy and advocate its use.

The referenced clearinghouse should be established by WSSPC allowing member states, provinces and territories to enter in relevant data containing sufficient detail to help identify the types of programs instituted and their progress in the affected regions.

**History**

WSSPC Policy Recommendation 17-4 was originally adopted as WSSPC Policy Recommendation 08-4 by unanimous vote of the WSSPC members at the April 22, 2008 WSSPC Annual Business Meeting in Seattle, Washington. It was revised and re-adopted as WSSPC Policy Recommendation 11-4 by unanimous vote of the WSSPC members at the April 4, 2011 WSSPC Annual Business Meeting in Boise, Idaho. It was revised and re-adopted as WSSPC Policy Recommendation 14-4 by unanimous voice vote of the WSSPC members at the July 21, 2014 WSSPC Annual Business Meeting in Anchorage, Alaska. It was readopted as WSSPC Policy Recommendation 17-4 by unanimous voice vote of the WSSPC members at the April 28, 2017 WSSPC Annual Business Meeting in Oklahoma City, Oklahoma.

1. Unreinforced masonry buildings exist in areas that are now or were previously mapped as areas of lower seismic hazard. These may or may not have been built to building codes that were in place at the time. Regardless of prior codes, existing masonry buildings in the areas of lower seismicity should not be presumed to be reinforced based only on historical codes. This is of particular concern if the current seismic hazard mapping is higher than that which was identified in the older code. [↑](#footnote-ref-1)