WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 08-4

Identification and Mitigation of Unreinforced Masonry Structures

Policy Recommendation 08-4

Unreinforced masonry bearing wall structures represent one of the greatest life safety hazards and economic burdens to the public during a seismic event. WSSPC recommends 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 which will effectively address the reduction of this hazard.

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 blocks, or adobe materials that are not strengthened by the addition of steel rods or other bracings. 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 pedestrians or other 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 tend to be inadequate, allowing floors and roofs to separate from the walls and collapse. Historically, this has been a major contributing factor to loss of life in earthquakes throughout the world.

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

WSSPC recognized that there is a societal cost to the inventory and remediation of unreinforced masonry buildings, but in those areas of high seismicity, failure to address this issue will have chilling effects. 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 retrofitting those buildings deemed to be a hazard is recommended.

It is realized that resistance is to be expected when dealing with retroactive ordinances. However, as can be seen by those areas which have adopted fire sprinklers retroactively, versus those which have not, even minimal remediation can yield discernable life saving results. Standardized retrofit concepts for unreinforced masonry structures are available through FEMA publications; however, this in no way negates the need for local engineering analysis and design.

Facilitation and Communication

Implementation

WSSPC recommends that States adopt a program to identify the extent of risk that unreinforced masonry structures represent in a community.

The first phase 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 structures built under the Uniform Building Code of 1961 or later should have been reinforced, although this should be verified by field inspections.

Private owners of structures erected prior to the effective date of the 1961 Uniform Building Code should be notified that their buildings may be a potential threat to human health and safety and require professional structural inspection with submittal of the inspection findings to an appropriate agency. This inventory process may take several years, but upon completion a more accurate assessment of a community's risk will be evident.

As a second step, the development of a plan to mitigate this hazard 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 workable option. Neither litigation nor forced abandonment of these structures is desirable. The reduction in occupancy or limitations on use may be an acceptable risk option. Permits issued for the sole purpose of seismic retrofitting should not affect or trigger additional jurisdictional requirements or property tax increases.

Alternate Implementation Plan

WSSPC recommends that each State, province or territory implement the three-phase approach to reducing the risk presented by unreinforced masonry buildings by doing 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 URM structures program through:
    a. Completing mitigation design and retrofit,
    b. Abandoning use of the structure, or
    c. Controlling use and occupancy to minimize the potential risk.

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 collecting and identifying these individual efforts, WSSPC will provide a clearinghouse of information which can be used to help promote the policy and advocate its use.

The inventory should be administered annually and contain sufficient detail to help identify the types of programs instituted and their effect in the affected regions.

History

WSSPC Policy Recommendation 08-4 was adopted by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 22, 2008.