6.3 ARCHITECTURAL COMPONENTS

6.3.5 PARAPETS AND APPENDAGES

6.3.5.1 UNREINFORCED MASONRY PARAPETS

Unreinforced masonry (URM) parapets, cornices and appendages pose a significant falling hazard and have caused numerous injuries and required costly repairs in past earthquakes. While the function of parapets is "nonstructural," i.e., to prevent fire spread, create a safety railing or conceal roof-mounted equipment, they are a structural concern that requires engineering expertise to address.

TYPICAL CAUSES OF DAMAGE

- Heavy unbraced parapets typically fail out-of-plane at the roofline and may take part of the building wall with it as they fall. Even small pieces of masonry falling several stories may cause serious bodily injury.
- Appendages may crack or spall; connections may be damaged. Pounding between adjacent buildings often results in damage to brittle masonry parapets, cornices, and appendages.
- Failed parapets may fall either inwards or outward. When parapets collapse inward they can damage the roof and have the potential to fall through light roof construction posing a safety hazard to occupants below. If they collapse outward they can fall to the street or onto the roof of an adjacent property.

Damage Examples

Figure 6.3.5.1-1 URM parapet fell and smashed two cars in the 1992 magnitude-7.2 Petrolia Earthquake. A parapet at same location in Ferndale, California failed in 1906 and killed two cows (NGDC, 2009).

Figure 6.3.5.1-2 Unreinforced masonry parapet failures along Beach Street, Watsonville in the 1989 magnitude-6.9 Loma Prieta Earthquake (NGDC, 2009).

Figure 6.3.5.1-3 Damage to roof framing caused by failure of overhanging brick masonry during the 1962 magnitude-5.8 Cache Valley, Utah earthquake (Photo courtesy of PEER Steinbrugge Collection, No. S828).

SEISMIC MITIGATION CONSIDERATIONS

- Some jurisdictions have parapet ordinances requiring seismic bracing for URM parapets along a public right of way; check the local jurisdiction for requirements.
- Parapet and roof conditions may vary widely. An engineered design accounting for specific as-built construction details is needed to provide reliable earthquake performance. Flashing and weatherproofing must be provided for any roof-mounted connections.
- Connection details for terra cotta cornices and appendages are similar to those for anchored veneer. See Section 6.3.1.2 and check the internet for various types of masonry, stone and veneer anchors.

Mitigation Examples

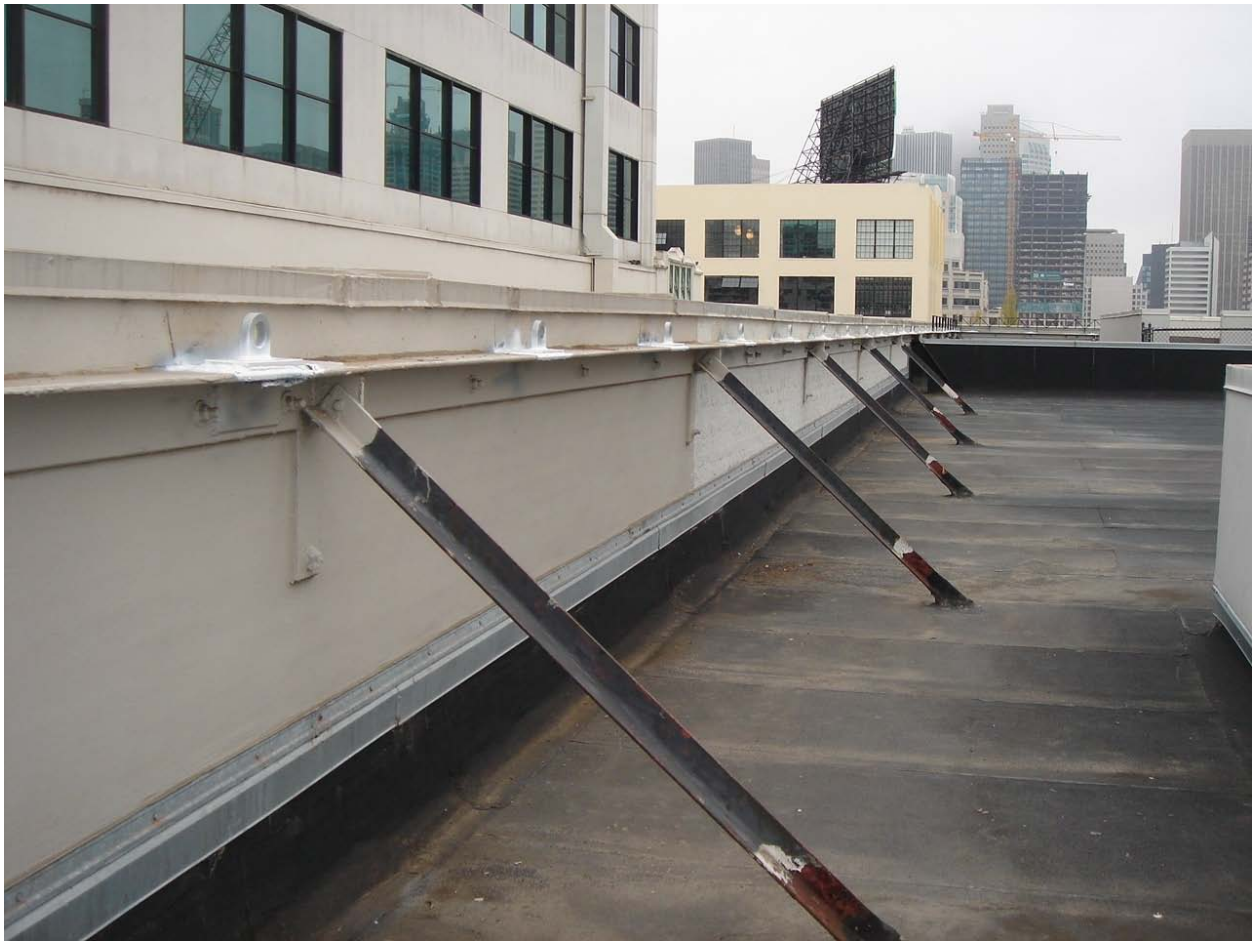
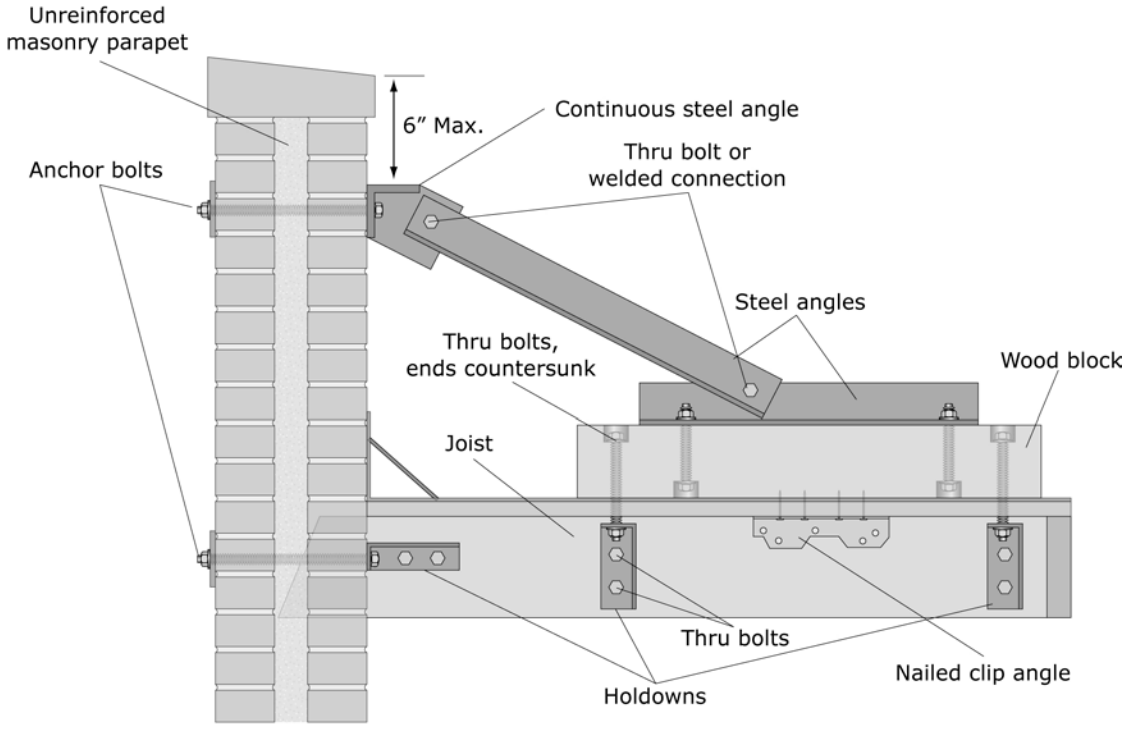


Figure 6.3.5.1-4 Bracing of URM parapet (Photo courtesy of Maryann Phipps, Estructure).

Figure 6.3.5.1-5 Bracing of unreinforced masonry parapet (Photo courtesy of Degenkolb Engineers).

Figure 6.3.5.1-6 Close-up of parapet bracing (Photo courtesy of Degenkolb Engineers).

Mitigation Details



Note: Typical brace configuration shown; parapet and roof conditions may vary widely. Provide appropriate weatherproofing and flashing details.

Figure 6.3.5.1-7 Unreinforced masonry parapet (ER).