6.4 MECHANICAL, ELECTRICAL, AND PLUMBING COMPONENTS

6.4.9 LIGHT FIXTURES

6.4.9.3 PENDANT LIGHT FIXTURES

This section covers pendant light fixtures, chandeliers, ceiling fans, and other similar suspended items.

TYPICAL CAUSES OF DAMAGE

- Suspended items can swing and impact building elements or adjacent equipment, resulting in damage to the fixture or damage to the surrounding items. Lenses, bulbs, or decorations may come loose and fall and endanger occupants.
- If the item is not sufficiently well supported, or if the item is connected only to ceiling framing which is damaged in an earthquake, the entire fixture may become dislodged and fall. Where a string of fixtures are attached end to end, the failure of one fixture can overload the supports for the adjacent fixtures leading to progressive collapse.

Damage Examples

Figure 6.4.9.3-1 Failure of a strip of pendant light fixtures at Dawson Elementary School library as a result of the 1983 magnitude-6.4 Coalinga Earthquake. Note that in this case the support stems failed at the ceiling connection and the stem came down with the lights (Gary McGavin, NGDC, 2009).

Figure 6.4.9.3-2 Failure of pendant light fixtures at Northridge Junior High School as a result of the 1994 Northridge Earthquake. In this example, the support stem failed at the fixture connection and the stem is still attached at the ceiling (Photo courtesy of Gary L. McGavin).

Figure 6.4.9.3-3 Failure of pendant light fixture in the 2010 magnitude-7 Haiti Earthquake; stem of fixture broke and conduit pulled loose (Photos courtesy of Eduardo Fierro, BFP Engineers).

SEISMIC MITIGATION CONSIDERATIONS

- All light fixtures should have positive attachments to the structure to prevent falling hazards. Per ASTM E580, *Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions* (ASTM, 2010), pendant fixtures in suspended ceilings must be supported directly from the structure above by no less than #9 gauge wire or an approved alternate support. The ceiling suspension system shall not provide any direct support and rigid conduit is not permitted for the attachment of fixtures.
- For California schools, DSA IR 25-5, *Metal Suspension System for Lay-in Panel Ceilings* (California Department of General Services, 2009c), requires the following: "Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting two (2) times the weight of the fixture. A bracing assembly, (see Section 6.3.4.1), is required where the pendant hanger penetrates the ceiling. Special details are required to attach the pendant hanger to the bracing assembly to transmit horizontal force. If the pendant mounted light fixture is directly and independently braced below the ceiling, i.e. aircraft cables to walls, then brace assembly is not required above the ceiling." See DSA IR 16-9, *Pendant Mounted Light Fixtures* (California Department of General Services, 2009a), for additional requirements for pendant mounted fixtures.
- For older installations, provide a safety chain or cable for the fixture and provide restraints for lenses and bulbs that can readily fall from the fixture.
- If the fixture can impact other items and cause failure of an essential component, or if impact can create a falling hazard, then seismic restraints that limit the range of motion of the fixture should be installed.

Mitigation Details

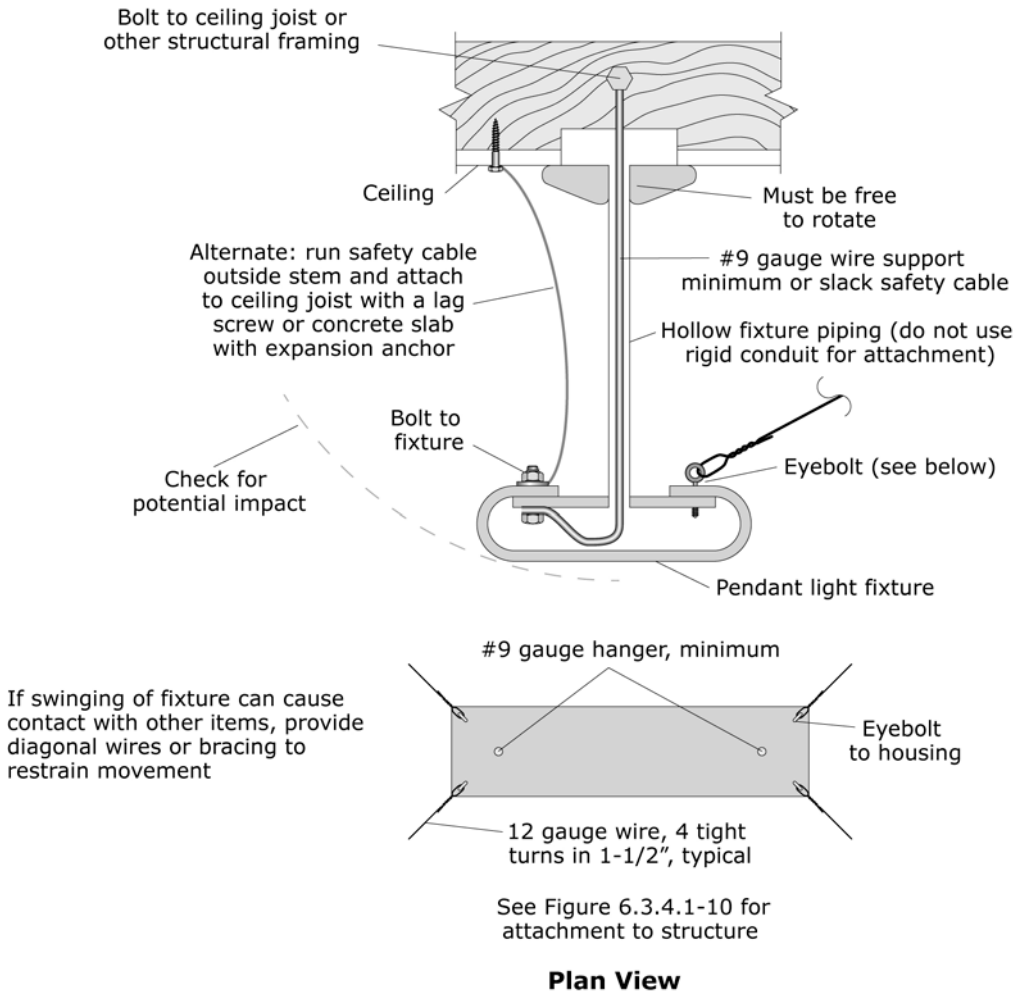

Figure 6.4.9.3-4 Pendant light fixture (NE).