

# Mechanical Bracing

By Jake Watson, P.E.

Thirty years from now, will the construction community look back and ask: “We knew better, why didn’t we do it right?” Many in the industry currently look back thirty or more years and wonder why we constructed unreinforced masonry (URM) buildings. We have known for many decades the risk associated with high seismicity and brittle construction techniques. We know it, and yet we continue the practice even today by installing mechanical systems without adequately considering seismic hazards.

What are the consequences when mechanical bracing is overlooked? In a word, fire. Structural systems are assumed to move during an earthquake. This movement helps dissipate energy and prevent brittle failures. A ten foot tall building is expected to move horizontally about 3” at the roof. Most mechanical systems can’t tolerate that much movement unless the movement is specifically considered during installation. Broken gas lines, live and exposed electrical lines, even broken water or sewer lines, can leave a structure uninhabitable, unrepairable, or even destroyed after an earthquake.

Salt Lake City isn’t built like San Francisco in 1906 so we don’t need to worry about fire, right? The Building and Fire Research Institute<sup>1</sup> specifically addressed fires in modern construction after the Northridge and Kobe earthquakes in 1994 and 1995, respectively. Northridge experienced 158 structure fires and in Kobe it is estimated that more than 6500 structures were completely burned resulting in more than 7.5 million square feet destroyed.

Bracing mechanical systems in buildings is the orphan in many projects. Everyone understands it should be done, but few take responsibility. Current practice generally assigns the responsibility to the contactor through the Mechanical Engineer. Unfortunately, many Mechanical Engineers lack the training to determine seismic hazard and bracing requirements. Frequently an engineer will reference a national standard and hope bracing is done correctly. Without the skills to check the designs and installations, they blindly trust suppliers and contractors to do it correctly. Similarly, Structural Engineers leave mechanical bracing outside their scope of services. Many are never retained to review design criteria for their project, let alone the actual design or installation.

How do we improve future construction? Four steps could help improve construction practices:

1. Require mechanical bracing drawings. Simple 8-1/2x11 drawings can convey all the bracing requirements necessary for almost all construction jobs. Without drawings, how can inspectors or design professionals review construction?
2. Train mechanical inspectors to use *The Seismic Restraint Manual for Mechanical Systems*. As long as inspectors overlook mechanical bracing, there is little incentive for the industry to improve construction practices.
3. Make the professional responsible for the structural system review mechanical bracing design criteria. If another consultant is retained to design mechanical bracing, the responsible professional should review bracing designs and coordinate loading requirements with the structural system.

4. Many mechanical installations may be constructed using prescriptive methods. If there is not a design professional overseeing construction, make sure the contractor owns, understands, and is using *The Seismic Restraint Manual for Mechanical Systems*<sup>2</sup>.

Thirty years from now, will we look back and wonder why we didn't do better? Every preventative step we take will help our society in the long run. When Utah has a seismic event, many questions will be asked of the construction community. Lets make every effort to protect the lives and property of our citizens now so we can answer those questions in the future.

---

<sup>1</sup> U.S./Japan Government Cooperative Program on Natural Resources (UJNR). Fire Research and Safety. 13th Joint Panel Meeting. Volume 2. March 13-20, 1996, Gaithersburg, MD, Beall, K. A., Editor(s), 303-312 pp, 1997.

<sup>2</sup> SMACNA, *The Seismic Restrain Manual for Mechanical Systems* (Sheet Metal and Air Conditioning Contractors National Association)