



AISC, Fire & Seismic

The American Institute of Steel Construction, (AISC), is an authoritative source for structural and architectural information related to steel construction. In addition to their excellent free monthly magazine, Modern Steel Construction, the AISC also hosts a website with extensive information on steel construction. Most of this is aimed at structural engineers but I recently came across two publications on the website that will be useful for architects and product reps. The first is on fire protection in buildings and the other is on seismic and earthquake design.

The AISC website can be found at, www.aisc.org. In Facts for Steel Buildings, located in the Free Pubs tab on the home page, you'll find "Fire Facts" and "Earthquakes and Seismic Design" both which can be downloaded for free.

"Fire Facts" starts with a section on basic fire science. Here, the four stages of a typical fire and factors leading to "flashover" are described. Heat transfer and temperatures resulting from different building fire conditions are explained. The difference between standard test fires, (per ASTM E119, UL 263 & NFPA 251), and real fires is explained. (Test fires are hotter and burn longer than a typical building fire.) Active and passive fire protection systems, and their effectiveness, are presented.

The section on spray applied fire resistive materials, (SFRM), explains the differences in the two major types commonly used today. Intumescent coatings are also described. The weight and shape of the member being protected, (the W/D ratio), is the primary determinant of the SFRM thickness. The object of any SFRM is to keep the temperature of the steel below 1,300 F, the upper limit of steel's elastic range. Since steel doesn't begin to melt until it reaches a temperature of 2,700 F, there's little likelihood of steel in a building fire actually melting since temperatures in typical building fires rarely exceed 1,500 F.

The development of fire codes by the NFPA and the IBC codes is described. The publication concludes with a statistical section showing that steel framed buildings perform well in fires. Examples cited include the 1988 First Interstate Bank Tower fire in Los Angeles and the 1991 Meridian Plaza fire in Philadelphia.

"Earthquake and Seismic Design" begins with an interesting history of steel framed buildings and their performance in earthquakes. Steel structures in the 1906 San Francisco earthquake

performed well enough that of the 30 high rise structures in existence then, all survived the earthquake and subsequent fires, and 20 are still in use today. Structural codes evolved significantly in the 1970s with greater attention being paid to the affects of soil factors in design. Seismic design codes were also made more stringent by requiring structures to resist the 2500 year seismic event where previously the 500 year event was the standard. Redundancy in structural frames became an important factor and the critical importance of continuity in the structural load paths received increased attention.

Until the 1990s, steel frames were thought to be inherently ductile. The failure of numerous welded joints in both moment frames and braced frames in the 1994 Northridge earthquake lead to significant improvements in the building code provisions governing joint design.

The section on seismology discusses the causes of earthquakes, where they occur, the use of the Richter Scale for measuring earthquake magnitude, the Modified Mercalli Scale to measure intensity, and why structural engineers use ground acceleration, rather than either scale, in seismic design.

The section on earthquake engineering presents the reasoning behind each variable in the formula for calculating seismic loads and does so without extensive use of mathematical formula. Elastic and inelastic response, special and ordinary braced frames, moment frames, and buckling restrained braced frames are just some of the topics presented. Not enough detail here to actually do structural engineering but you'll be able to better understand what the engineers are talking about.

"Earthquake and Seismic Design" was written for the AISC in 2009 by Ronald O. Hamburger, SE, of Simpson Gumpertz & Heger, Inc. It has 64 pages. "Fire Facts" was written in 2003 by Richard G. Gewain & Nestor R. Iwankiw of Hughes Assoc., Inc., and Fraid Alfawakhiri of AISC. It has 51 pages. Each topic in both documents is presented in a question and answer format which makes them useful as reference materials.

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