

## NFPA 13 Seismic Analogy

*Incorporates conservative simplifying assumptions*

©2014 Kraig Kirschner  
AFCON

NFPA 13 Chapter 9 sway brace criteria is used to analyze seismic stress and define strategies to minimize resultant movement and deflection of the fire sprinkler system which includes its piping, hangers, and appurtenances. This analogy insures that seismic force is substantially resisted by sway bracing properly applied between the building structure and the fire sprinkler system. Accordingly, implementation of Chapter 9 sway brace criteria shall enhance the durability and integrity of the NFPA 13 fire sprinkler system during a seismic event.

The analogous approach of NFPA 13 incorporates conservative simplifying assumptions that include state of the art seismic science to maximize performance of the sway brace installation. The mechanics of sway brace installation are dynamic and interdependent. Accordingly, NFPA 13 sway brace mechanics uses a systems approach to enhance reliability. Seismic influences for sway brace installation are divided between the geometry of both structure and the fire sprinkler system. The building structure dictates seismic force corresponding to project location, point load limits, brace position, brace length, brace angle and fastener type. The fire sprinkler system dictates the sway brace zone of influence based on system geometry including system pipe type, pipe size and weight.

Per NFPA 13 Chapter 9 quantify seismic force ( $F_{pw}$ ) specific to project location, construction type and system geometry. Subsequently determine and confirm that this  $F_{pw}$  does not exceed the ability of the following:

1. Verify that the building structure is sufficient to withstand the additional seismic load at the point of sway brace attachment.
2. Determine adequate strength of the system pipe and limit its deflection at mid span between spacing of sway braces.
3. Evaluate minimum acceptable strength of the components of the sway brace assembly including the brace member, fittings and fastener.
4. Analyze vertical reaction seismic force and arrange sway braces to resist its effects on the system pipe and its hangers.

While, NFPA 13 sway brace criteria seems directly focused on the system piping, fittings and sprinkler heads, Chapter 9 recognizes system hangers as being an integral component of the fire sprinkler system. Knowing that the effects of seismic stress on hangers can drastically degrade their ability, Chapter 9 actually prioritizes protection of the system hangers by proper sway brace installation.