Seismic Fuses

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Structural fuses help increase the predictability of a

during the earthquake as members yield.

To survive a large earthquake, a building's structure must dissipate the energy imparted by the ground accelerations. Introducing a fuse into the structural frame can provide this dissipation, as well as create a predictable structural response to an unpredictable set of forces. In fact, documents such as the *Glrcpl_rgml_j@sqjbgle Ambc* mandate such a solution.

qrpsarsbc r f _ar pcqgqrq r f c dmpacq apc_rcb ` wdh f cesiptaf odis_ie s _lb npH_qml Cpgaiqcl gq bgpcarmp/md PGQA%q Qrccj Qmjsrgmlq Aclrcp,*

vides the means to dissipate energy in a ductile manner. In steel buildings the energy dissipation is largely accomplished through cyclic yielding of specific segments of specific steel members. The *Qcgqkga Npmtgqgmlq* contain a series of requirements for members of the SLRS to provide stable system ductility, and have two overall goals: to force deformations to occur in specific locations (fuses); and to ensure that frames can undergo controlled deformation in a ductile, well-distributed manner.

The Fuse Concept

By forcing the ductility demand to the fuses, the behavior of the system becomes more predictable. The fuse is usually one member type of each frame system, and the *Qcgqkga Npmtgqgmlq* intend for these elements to stay ductile through cyclic yielding. These members are generally required to have low width-to-thickness ratios to avoid local buckling, and eventually fractures, well into the elastic range. They must also be adequately braced to avoid member buckling at large deformations.

The remaining frame members are designed to remain essentially elastic while the fuse yields dissipate the energy. These members are often sized based on the expectation that the fuse is the overloaded element in the system.

Controlled Deformation

As the fuse yields, the force distribution in the system changes as the deformations increase. The post-yielding force distribution can be very different from the elastic and the "non-yielding" elements, and connections can experience inelastic behavior. These deformations are cyclic, which further increases the demands. As such, the *Qcgqkga Npmtgqgmlq* contain requirements for members and connections of the SLRS outside of the fuse, such as limiting width-to-thickness ratios to delay or preclude local buckling, and bracing µ l'

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MOMENT FRAMES

Fuse: Flexural yielding of beams near ends. Panel Zones may have yielding in SMF.

Special Moment Frames (SMF)

- ➜ Connections must meet specific strength and rotation criteria, and conformance is demonstrated using either the prequalification process of Appendix P or testing per Appendix S.
- ➜ The beams have flange bracing requirements and width-to-thickness ratio limits more restrictive than the AISC *QncagĞa_rgml dmp Qrpsarsp_j Qrccj @sgjbgleq*.
- ➜ Columns are proportioned to preclude hinging in the column (the so-called “strong-