**DEVELOPMENT OF HIGH-PERFORMANCE EARTHQUAKE RESILIENT SEISMIC FORCE RESISTING SYSTEMS**

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Recent earthquakes in Japan and New Zealand have shown that even the most developed countries with modern building codes still vulnerable to strong earthquake shaking. The issue lies in the fundamental approach in the structural design, where the earthquake energy is absorbed through inelastically deformation of the structural components. This design approach leads to unrecoverable structural damages and hefty social and financial losses. The loss due to earthquake can be minimized using high-performance earthquake resilient structures, where designated structural fuses, analogous to electrical fuses, are used to dissipate the sudden surge of earthquake energy. This design philosophy will achieve higher performance and allowing the structure to recover efficiently and economically after strong earthquake shaking. Innovative earthquake resilient structures has been developed in the past. However, there is a lack of practical design procedure that can be used by engineering design committee. In this presentation, a novel design procedure, named equivalent energy-based design procedure (EEDP) for fused structures in earthquake applications will be presented. EEDP allows engineers to select structure performance objectives when the structure is experiencing different levels of seismic shaking intensities. With the use of the developed methodology, engineers can efficiently select the structural member sizes to achieve the desire structural period, strength and deformation with simple hand calculation without iteration. Hence, it is very practical and useful for the seismic engineering design communities. Two innovative earthquake resilient structures named Linked Column Frame (LCF) and fused truss moment frames (FTMF) are designed using EEDP and presented. Nonlinear dynamic analyses were conducted to examine the performance of these two innovative fused structural systems. The result shows the proposed EEDP methodology is able to achieve the performance defined by the engineer, making this design procedure ideal for practicing engineering community where high-performance structural systems can be developed for seismic applications.