8th International Conference on Seismology & Earthquake Engineering
11-13 Nov. 2019, Tehran, Iran

SEISMIC RESILIENCE OF A STEEL MOMENT RESISTING FRAME USING FEMA P-58

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Keywords: Seismic resilience, Steel moment resisting frame, FEMA P-58, Incremental dynamic Analysis, Repair cost

This study presents a methodology for the seismic resilience assessment of steel moment resisting frame. Seismic resilience is defined as the ability of a system to maintain a level of performance after an earthquake event. The resilience is defined using a mathematical function describing the serviceability of the system, which is described as functionality. Graphically, the resilience is defined as the normalized shaded area underneath the functionality Q(t) of a system (Figure 1).

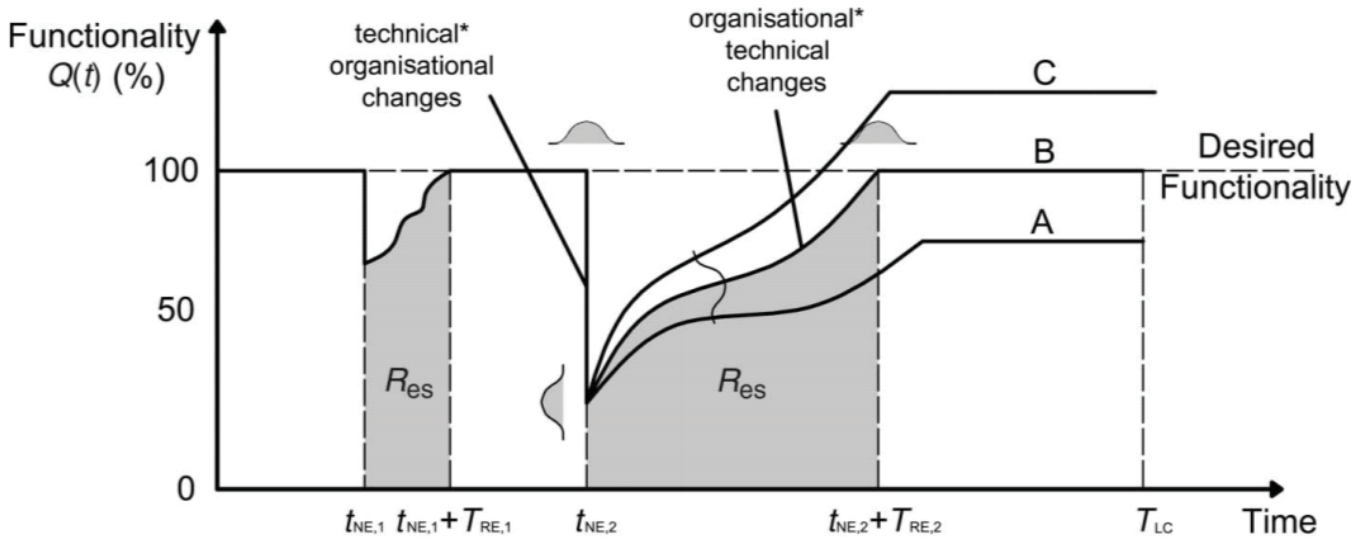
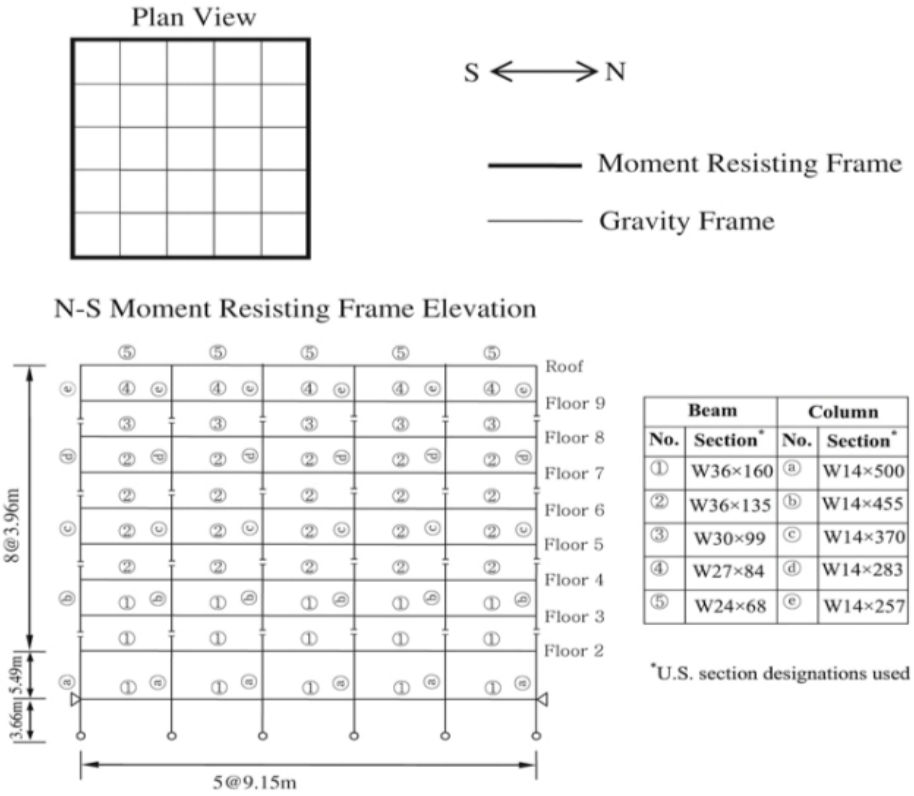


Figure 1. Schematic representation of seismic resilience (Cimellaro et al., 2010).

A benchmarked nine-story prototype steel moment resisting building frame structure is used in this investigation. This building was designed by Brandow & Johnston Associates, Los Angeles, California as part of the SAC Phase II Steel Project (Figure 2). Fragility curves were derived from incremental dynamic analysis (IDA) curves obtained from time–history analyses using OpenSEES.



Beam		Column	
No.	Section*	No.	Section*
①	W36×160	ⓐ	W14×500
②	W36×135	ⓑ	W14×455
③	W30×99	ⓒ	W14×370
④	W27×84	ⓓ	W14×283
⑤	W24×68	ⓔ	W14×257

*U.S. section designations used

Figure 2. SAC model frame structure (Kim and Kurama, 2008).

The FEMA P-58 procedure is used to estimate repair costs. Estimates of the total building value are needed to give context to the repair costs calculated using FEMA P-58. The RSMeans square foot cost estimator was used to determine building values (www.rsmeansonline.com).

The results show that the use of FEMA P-58 method makes it easier to calculate seismic resilience, and seismic design can improve resilience.

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