RELIABILITY EVALUATION OF ENGINEERING DEMAND PARAMETERS BASED ON THE LENGTH OF SEISMIC LINKS IN ECCENTRICALLY BRACED FRAMES

Leila HAJNAJAFI
PhD Candidate, Amirkabir University of Technology, Tehran, Iran
lila_najafi@aut.ac.ir

Mohsen TEHRANIZADEH
Professor, Amirkabir University of Technology, Tehran, Iran
dtehz@yahoo.com

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Reduction in deviation of performance indexes conclude reduction of deviations in decision parameters. Many approaches have been followed for this purpose to encounter as few deviations in structural responses as it is possible. One approach for reducing the deviations in structural responses is adjusting structural design specifications and utilizing appropriate seismic systems. One of prevalently employed seismic systems is eccentrically braced frames (EBF) which are very well-organized structures for resisting earthquakes as they combine the ductility that is characteristic of moment frames and the stiffness associated with braced frames (Chao and Goel, 2006). The mechanism of behavior in EBF systems and their ductility and stiffness could be adjusted by altering the length of link-beam and therefore can be set to get the efficient condition (Ohsaki and Nakajima, 2010). This study evaluates the seismic reliability of engineering demand parameters according to the different length of seismic links based on the first order second moment reliability method (FOSM).

The selected EDPs like most of the performance-based assessments are inter-story drift ratios (IDR) and peak floor acceleration (PFA) and two dimensional generic one-bay frames in 3, 5, 8 and 15 stories and fundamental periods between 0.34 (s) and 2.02 (s) representative of typical structures with different heights and fundamental periods were employed subjected to two groups of near and far field records. Energy-based deterioration model providing four major sources of cyclic deterioration, (basic strength, post-capping strength, unloading stiffness and accelerated reloading stiffness), was served in this study (Ibarra et al., 2005). The amounts of each point for cyclic deterioration model were derived from FEMA273 (FEMA, 1997) or ATC-58 (ATC, 2011).The values of reliability index (β) were calculated subjected to the drift and peak floor acceleration for each story of the models; then, the median of these β values has been picked out as the representative of the results' dispersion around the median value for each of the models and was exhibited in Tables 1 and 2.

It has been discovered that for the models by each number of stories, there is an efficient length of link beam that is located in the range of ratios between 0.25 to 0.33 (ratio of the length of link-beam member to the length of braced span) for models with different number of stories conducting to the most reliable EDPs. In addition, it could be seen that the efficient length of link beams are very close for both drift and acceleration EDPs. It could also be concluded that the dispersion values subjected to far-field records are almost constant by altering the length of link-beams. Associated diagrams could be straightforwardly utilized for risk assessment or design of EBF systems supporting achievement of appropriate length of link beams in countering reliability of EDP parameters.

Table 1. Median values of β for drifts

	Beta Values for Drift Subjected to near-field records					
	e=0.5 m	e=1.0 m	e=1.5 m	e=2.0 m	e=2.5 m	e=3.0 m
3-story	0.38	0.36	0.32	0.36	0.39	0.38
5-story	0.41	0.38	0.34	0.37	0.40	0.42
8-story	0.36	0.35	0.32	0.34	0.35	0.37
15-story	0.44	0.36	0.34	0.40	0.38	0.37
	Beta Values for Drift Subjected to far-field records					
	e=0.5 m	e=1.0 m	e=1.5 m	e=2.0 m	e=2.5 m	e=3.0 m
3-story	0.08	0.07	0.06	0.05	0.05	0.06
5-story	0.21	0.16	0.20	0.19	0.16	0.17
8-story	0.15	0.14	0.16	0.14	0.14	0.15
15-story	0.07	0.06	0.07	0.05	0.08	0.06

Table 2. Median values of β for peak floor accelerations

	Beta Values for Acceleration Subjected to near-field records					
	e=0.5 m	e=1.0 m	e=1.5 m	e=2.0 m	e=2.5 m	e=3.0 m
3-story	0.24	0.20	0.16	0.18	0.20	0.23
5-story	0.23	0.21	0.17	0.18	0.23	0.32
8-story	0.23	0.21	0.20	0.18	0.20	0.24
15-story	0.24	0.23	0.18	0.20	0.22	0.28
	Beta Values for Acceleration Subjected to far-field records					
	e=0.5 m	e=1.0 m	e=1.5 m	e=2.0 m	e=2.5 m	e=3.0 m
3-story	0.06	0.05	0.05	0.03	0.04	0.04
5-story	0.15	0.13	0.14	0.14	0.12	0.12
8-story	0.14	0.16	0.17	0.12	0.15	0.14
15-story	0.15	0.16	0.16	0.13	0.16	0.15

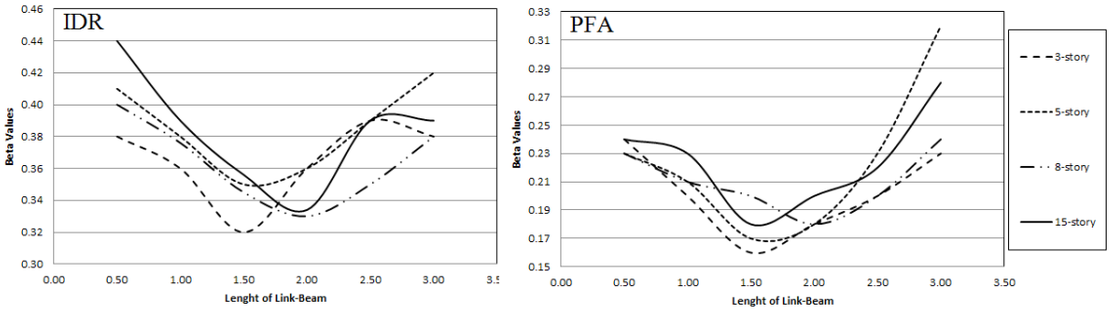

Figure 1. Median values of β for drift and acceleration of the models

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