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LINEAR & NONLINEAR EVALUATION OF IMPROVING PERFORMANCE LEVEL OF CBF STEEL STRUCTURES USING IMPORTANCE FACTOR

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In this paper, the performance of two types (eight story) of steel structures with converging bracing system in both direction x and y have been evaluated by the fourth edition of the Iranian Seismic Design Code (Standard 2800, 1393) and the instruction for Seismic Rehabilitation of Existing Buildings (code 360, 1392). Also, the seismic performance of the structure in the field of linear and nonlinear behavior is investigated. For this purpose, the buildings were firstly designed according to the Iranian seismic code with intermediate and very high important factor (I), in the highest seismic zone and type 3 soil with combining load in the sixth chapter of the national regulations based on the strength method. Then, using the linear and nonlinear methods, based on Instruction for Seismic Rehabilitation of Existing Buildings, the building is evaluated. Table 1 shows the basic parameters for analysis and design of the structures, Figure 1 shows demand capacity ratio in direction x**.** The specifications of the buildings are as follows: Height of story 3.5 m, Design base acceleration (A=0.35), Behavior coefficient (R=5.5), Importance factor for buildings is I=1, 1.4, Type of site soil (175 m/s < Vs < 375 m/s).

Eight story building with intermediate importance factor — Eight story building with very high importance factor
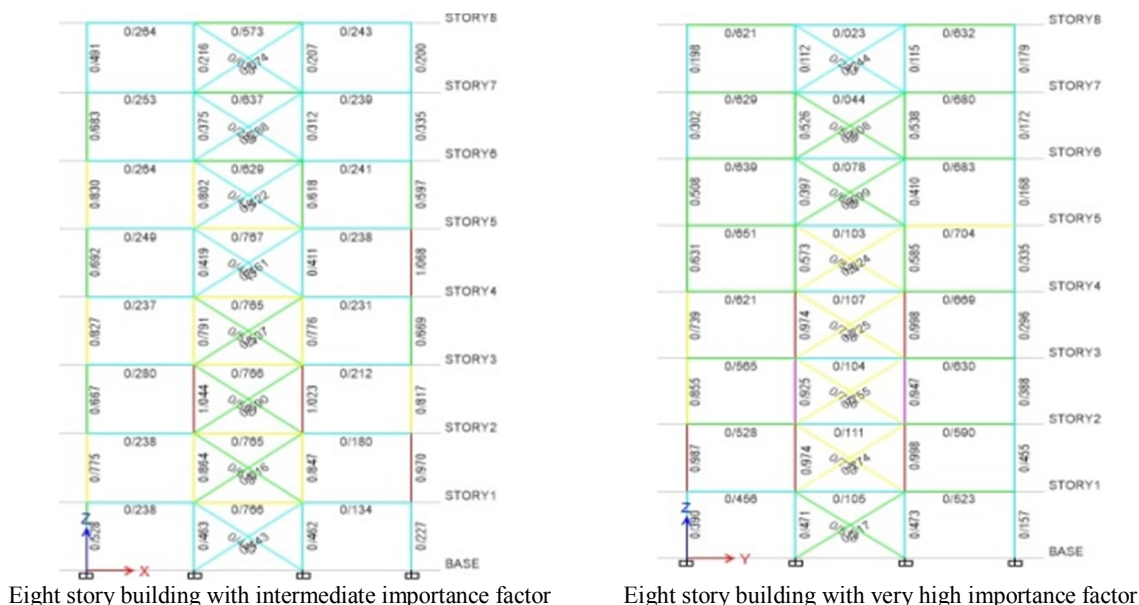
Figure 1. Demand capacity ratio.

LINEAR STATIC ANALYSIS RESULTS

According to Seismic Rehabilitation Instruction in this project (steel structure with converging bracing system) member of displacement-control include braces and member of fore-control include beams and columns. According to Seismic Rehabilitation Instruction value of M in braces for Immediate Occupancy (IO) performance is 1.25 and for life safety performance is 5. The results of the displacement-control's members in the buildings under study are in Table 1.

Table 1. Linear static analysis results.

Eight story building with very high importance factor					Eight story building with intermediate importance factor				
Story	**Design Section**	**Combo**	**Ratio**	**M IO**	**Story**	**Design Section**	**Combo**	**Ratio**	**MLS**
STORY8	2UNP 00	QUD2(C)	0.575	1.25	STORY8	2UNP200	QUD2(C)	0.518	5
STORY8	2UNP200	QUD3(T)	0.451	1.25	STORY8	2UNP200	QUD3(T)	0.41	5
STORY8	2UNP200	QUD3(C)	0.563	1.25	STORY8	2UNP200	QUD1(C)	0.518	5
STORY8	2UNP200	QUD2(T)	0.461	1.25	STORY8	2UNP200	QUD4(T)	0.409	5
STORY7	2UNP200	QUD2(C)	1.13	1.25	STORY7	2UNP200	QUD2(C)	1.083	5
STORY7	2UNP200	QUD3(T)	0.894	1.25	STORY7	2UNP200	QUD3(T)	0.856	5
STORY7	2UNP200	QUD3(C)	1.117	1.25	STORY7	2UNP200	QUD1(C)	1.082	5
STORY7	2UNP200	QUD2(T)	0.906	1.25	STORY7	2UNP200	QUD4(T)	0.855	5
STORY6	2UNP200	QUD2(C)	1.552	1.25	STORY6	2UNP200	QUD2(C)	1.579	5
STORY6	2UNP200	QUD3(T)	1.24	1.25	STORY6	2UNP200	QUD3(T)	1.245	5
STORY6	2UNP200	QUD3(C)	1.542	1.25	STORY6	2UNP200	QUD1(C)	1.577	5
STORY6	2UNP200	QUD2(T)	1.25	1.25	STORY6	2UNP200	QUD4(T)	1.243	5
STORY5	2UNP200	QUD4(C)	1.778	1.25	STORY5	2UNP200	QUD2(C)	1.898	5
STORY5	2UNP200	QUD1(T)	1.437	1.25	STORY5	2UNP200	QUD3(T)	1.527	5
STORY5	2UNP200	QUD1(C)	1.827	1.25	STORY5	2UNP200	QUD1(C)	1.898	5
STORY5	2UNP200	QUD4(T)	1.468	1.25	STORY5	2UNP200	QUD4(T)	1.527	5
STORY4	2UPN220	QUD4(C)	1.628	1.25	STORY4	2UNP200	QUD2(C)	2.228	5
STORY4	2UPN220	QUD1(T)	1.39	1.25	STORY4	2UNP200	QUD3(T)	1.79	5
STORY4	2UPN220	QUD1(C)	1.673	1.25	STORY4	2UNP200	QUD1(C)	2.227	5
STORY4	2UPN220	QUD4(T)	1.399	1.25	STORY4	2UNP200	QUD4(T)	1.789	5
STORY3	2UPN220	QUD4(C)	1.715	1.25	STORY3	2UNP200	QUD2(C)	2.473	5
STORY3	2UPN220	QUD1(T)	1.463	1.25	STORY3	2UNP200	QUD3(T)	1.985	5
STORY3	2UPN220	QUD1(C)	1.714	1.25	STORY3	2UNP200	QUD1(C)	2.472	5
STORY3	2UPN220	QUD4(T)	1.437	1.25	STORY3	2UNP200	QUD4(T)	1.984	5
STORY2	2UPN220	QUD4(C)	1.724	1.25	STORY2	2UNP200	QUD2(C)	2.608	5
STORY2	2UPN220	QUD1(T)	1.466	1.25	STORY2	2UNP200	QUD3(T)	2.089	5
STORY2	2UPN220	QUD1(C)	1.732	1.25	STORY2	2UNP200	QUD1(C)	2.607	5
STORY2	2UPN220	QUD4(T)	1.454	1.25	STORY2	2UNP200	QUD4(T)	2.088	5
STORY1	2UPN220	QUD2(C)	1.092	1.25	STORY1	2UNP200	QUD2(C)	1.803	5
STORY1	2UPN220	QUD1(T)	0.931	1.25	STORY1	2UNP200	QUD3(T)	1.429	5
STORY1	2UPN220	QUD1(C)	1.108	1.25	STORY1	2UNP200	QUD1(C)	1.802	5
STORY1	2UPN220	QUD2(T)	0.917	1.25	STORY1	2UNP200	QUD4(T)	1.427	5

According to the results of this research, the performance of the designed components satisfy life-safety performance with intermediate importance factor but will not be satisfied immediately occupancy (IO) performance. Also, the results of Fani and Homami's research indicate that buildings do not meet the Standard 2800 objectives for immediate occupancy against severe earthquakes (Fani & Homami, 2012).

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