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EFFECT OF ASYMMETRY ON THE RIGID LINK FOR RANDOM SEISMIC POUNDING MITIGATION

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Connection of adjacent buildings with stiff links is an efficient approach for seismic pounding mitigation. However, use of highly rigid links might alter the torsional response in asymmetric plans and although this was mentioned in the literature, no quantitative study has been done before to investigate the condition numerically. In this paper, the effect of rigid linking on elastic lateral-torsional responses of two adjacent one-story column-type buildings has been studied through comparison to unconnected structures. Three cases are considered, including two similar asymmetric structures, two adjacent asymmetric structures with different dynamic properties and a symmetric system adjacent to an adjacent symmetric one. After an acceptable validation against the actual earthquake as shown in Figure 1, the traditional random vibration method has been utilized for dynamic analysis under ideal white noise input. Results demonstrate that rigid links may increase or decrease the rotational response, depending on eccentricities, torsional-to-lateral stiffness ratios and relative uncoupled lateral stiffness of adjacent buildings. The results are also discussed for the case of using identical cross section for the columns of the system. In contrast to symmetric systems, base shear increase in the stiffer building may be avoided when the buildings lateral stiffness ratio is less than 2. However, the eccentricity increases the rotation of the plans for high rotational stiffness of the buildings as presented in Table 1. In this table, α is the torsional stiffness of the more flexible structure (K_θ) normalized by $b^2 \times K_x$, (b: plan dimension and K_x: lateral stiffness of the more flexible building).

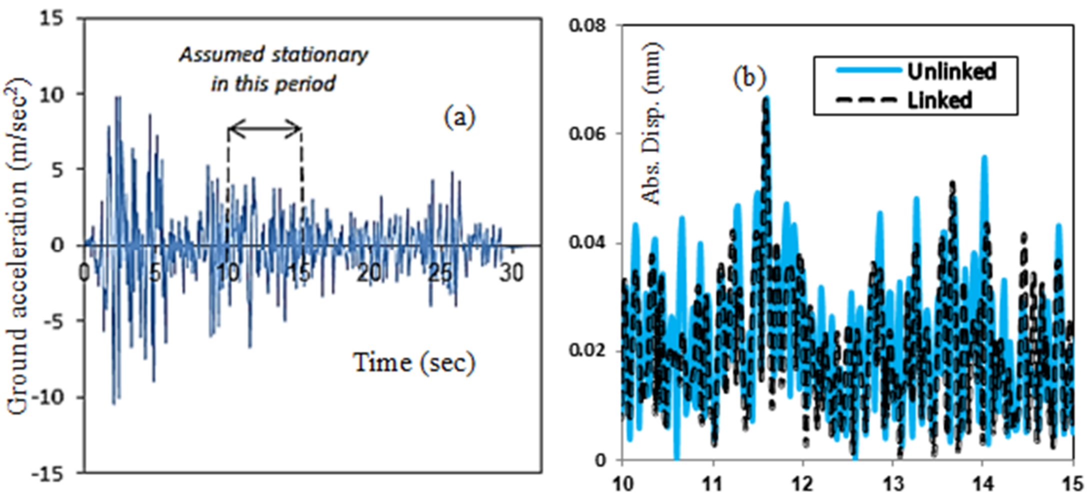

Figure 1. a) Scaled El Centro NS record. b) Absolute displacement-linked and unlinked asymmetric buildings.

Table 1. Linked-to-unlinked response ratio (rotation and displacement at the center of rigidity) for α=0.5.

e'$_1$	e'$_2$	Kx_2/Kx_1 = 0.01 ($K\theta 2/K\theta 1$ = 0.01)		Kx_2/Kx_1 = 0.1 ($K\theta 2/K\theta 1$ = 0.1)		Kx_2/Kx_1 = 0.25 ($K\theta 2/K\theta 1$ = 0.25)		$Kx2/Kx_1$ = 0.5 ($K\theta 2/K\theta 1$ = 0.5)	
		Rot.	**Disp. Cent. Rigid.**	**Rot.**	**Disp. Cent. Rigid.**	**Rot.**	**Disp. Cent. Rigid.**	**Rot.**	**Disp. Cent. Rigid.**
0.05	0.05	4.376	1.606	5.435	1.435	5.917	1.200	4.359	1.079
	0.1	4.411	1.604	5.731	1.415	6.325	1.163	5.005	1.035
	0.2	4.481	1.601	6.241	1.377	6.843	1.112	5.717	0.983
0.1	0.05	3.553	1.507	3.738	1.318	3.536	1.113	2.736	0.998
	0.1	3.563	1.505	3.800	1.305	3.604	1.100	2.882	0.978
	0.2	3.582	1.502	3.900	1.284	3.709	1.081	3.069	0.955
0.15	0.05	2.900	1.449	2.813	1.277	2.529	1.098	2.014	0.970
	0.15	2.908	1.447	2.854	1.265	2.578	1.088	2.114	0.956
	0.3	2.920	1.444	2.910	1.249	2.645	1.081	2.222	0.953
0.2	0.1	2.455	1.434	2.284	1.275	2.005	1.110	1.633	0.967
	0.2	2.459	1.433	2.308	1.268	2.038	1.107	1.685	0.965
	0.4	2.468	1.430	2.356	1.258	2.106	1.107	1.786	0.977
0.25	0.05	2.149	1.449	1.929	1.346	1.657	1.142	1.340	0988
	0.15	2.152	1.448	1.948	1.300	1.684	1.139	1.379	0.987
	0.25	2.155	1.447	1.968	1.295	1.713	1.139	1.419	0.990
	0.35	2.158	1.446	1.988	1.291	1.743	1.141	1.462	0.997
0.3	0.1	1.940	1.481	1.702	1.340	1.440	1.178	1.165	1.014
	0.2	1.943	1.480	1.721	1.337	1.467	1.178	1.201	1.017
	0.3	1.945	1.480	1.740	1.334	1.496	1.180	1.238	1.023
0.35	0.05	1.787	1.525	1.518	1.387	1.256	1.222	1.003	1.048
	0.2	1.792	1.525	1.314	1.235	1.295	1.221	1.050	1.051
	0.35	1.797	1.524	1.577	1.382	1.341	1.225	1.106	1.061

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