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RETROFIT OF DEFECTIVE EXTERIOR BEAM-COLUMN CONNECTIONS

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The present work investigates the seismic vulnerability of in-situ concrete column-ceiling connections. To retrofit the said connection, steel plates in conjunction with bolts and straps are used. In this study, different parameters such as the dimensions of the steel plate, the number and the different pre-stressing percentages of the bolts, configuration of the steel straps and the selection of the suitable pre-stressing percentage for the bolts are studied. The actual behavior of the material through tests such as the Schmidt hammer and core extraction for the concrete and tensile tests for the steel bars. The method proposed by researchers to solve this problem was using FRP sheets crosswise (Chen et al., 2006; Said and Nehdi, 2008; Sharbatdar et al., 2012). In this study, the seismic vulnerability of beam-to-ceiling concrete connection in a defective by-side connection, in a school in Kermanshah has been studied.

In order to increase resistance and plasticity, nine plans were proposed. Moreover, all retrofitting tips were considered step by step by means of ANSYS finite element software. In this method, by changing and modifying the forces at the connection source of the plastic joint is separated from column-top and is transferred inside the beam and a lower share out of the total connection force reaches the column-to-ceiling connection point. In connection reinforcement, ductility increase, resistance, low costs and structure destruction are always considered; therefore, in nine promoted designs, these three factors have been included. The common characteristics of the samples have been shown in Table 1. All of the parameters described in Table 3 are shown in Figure 1. The relative strength percentages and the quasi ductility values of the models shown in Table 2.

Finally, model 9 showed the best results. A view of model 9 and moment of load carrying in model 9 shown in Figure 2.

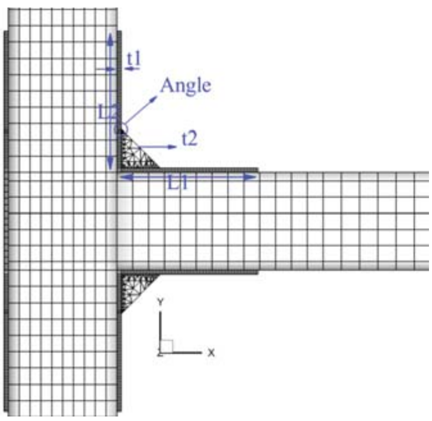

Figure 1. The overall view of the reinforcement.

Table 1. The overall specifications of the reinforcing models.

	L1 (mm)	L2 (mm)	t1 (mm)	t2 (mm)	Angle (degree)	Diameter of the inside bolts of the column (mm)	Diameter of the inside bolts of the beam (mm)	Diameter of the outside bolts of the column (mm)	Diameter of the outside bolts of the beam (mm)	Pre-stressing percentage (inside bolt)	Pre-stressing percentage (outside bolt)
Model 1	450	450	10	10	45	2 (20)	2 (20)	-	-	40	-
Model 2	450	450	10	10	45	2 (20)	2 (20)	-	-	70	-
Model 3	450	450	10	10	45	2 (18)	2 (18)	-	-	70	-
Model 4	450	450	10	10	45	-	-	3 (14)	3 (14)	-	-
Model 5	450	450	10	10	45	2 (18)	2 (18)	3 (14)	3 (14)	70	-
Model 6	450	450	10	10	45	2 (18)	2 (18)	3 (14)	3 (14)	70	70
Model 7	950	950	10	10	45	4 (18)	-	4 (14)	5 (14)	70	-
Model 8	450	450	20	10	22.5	2 (18)	2 (18)	3 (14)	3 (14)	70	70
Model 9-a	650	650	20	14	45	2 (18)	2 (18)	3 (14)	3 (14)	40	-
Model 9-b	650	650	20	14	45	2 (18)	2 (18)	3 (14)	3 (14)	70	-

Table 2. Relative strength percentages and the quasi ductility values of the models.

Initial		Model 1		Model 2		Model 3		Model 4		Model 5	
strength	Quesi Ductility	strength	Quesi Ductility	strength	Quesi Ductility	strength	Quesi Ductility	strength	Quesi Ductility	strength	Quesi Ductility
-	1.5	34.5	2.67	28.5	2.4	30.6	2.7	26.44	2.76	46.5	2.7

Model 6		Model 7		Model 8		Model 9-a		Model 9-b	
strength	Quesi Ductility	strength	Quesi Ductility	strength	Quesi Ductility	strength	Quesi Ductility	strength	Quesi Ductility
52.8	2.45	55	2.4	39.8	2.44	71	3.11	67.2	2.45

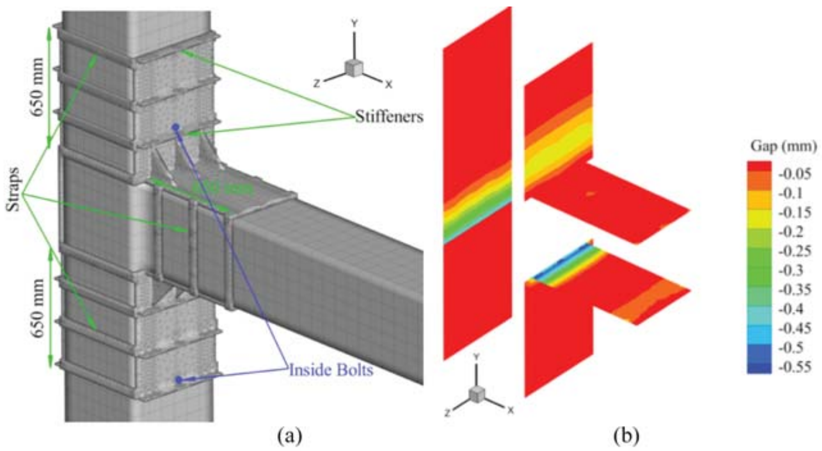

Figure 2. a) View of the proposed model 9, b) Final moment of load carrying in models 9.

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