INVESTIGATING EFFECTIVE PARAMETERS ON SEISMIC BEHAVIOR OF RC BEAM-COLUMN JOINTS

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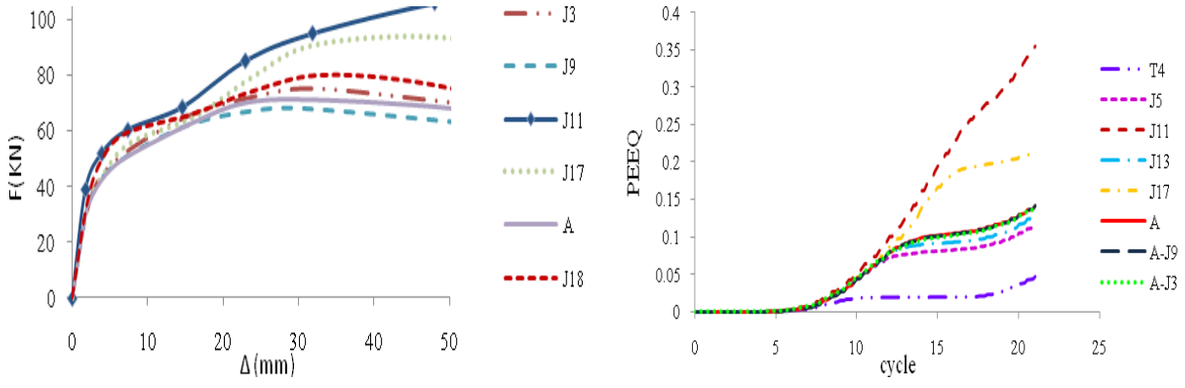
Observed effects of the earthquake and the results of experiments and analytical studies indicate that seismic loads cause decrease in strength and stiffness and nonlinear behavior of RC beam-column joints. This matter reduces the whole lateral resistance and will lead to collapse of whole structure. In current structural analysis and seismic analysis of moment resisting frames for in-situ concrete structures, beam-column joints are often considered as rigid joint zone and modelled with assumption fully rigid. In this assumption there are not any relative rotation between the beam and the column and connection is considered as a node. In this case, it is assumed that the joint is enough resistant and strong to transfer moment and shear due to the applied loads to the structure. Although these assumptions make easier the analysis, but it validity is the following question with respect to the actual behaviour of the structure. Because according to the actual behaviour of concrete and steel and their ductility characteristics, is provided some ductility for connection. The tasks of joints are transfer all of the bending moments, tensional and axial and shear forces between members. Creation slight deformation in the joint cause does not completes this task. Rotation connection increases the deformation of the frame in lateral load. This reduces the stiffness of frame and impact on the natural period and dynamic response of structures to the earthquake motion. Rotation of connection is impressive on distribution of interior forces and moments in beam and column. Some analysis that ignored the effect of deformation connection, cannot predict failures and non-elastic stresses in the structure.

These results has made clear important of joints in reinforced concrete structures. Therefore, this is essential identifying the actual behavior of the RC beam-column joints and the methods for modeling and design of seismic -resistant connection. Hence, is required identify the effective parameters on behavior of the connection and ways to increase the strength and ductility. Wide range of factors, affect on behavior of the RC beam-column joints. Some of these parameters are chosen in this study. The variables include: details of Stirrups in joint, the longitudinal reinforcement of beam and column, transverse reinforcement of beam and column, axial load, strength of materials, the special stirrups of beam and column adjacent to joint. Was discussed the effect of each variable with finite element modeling of reinforced concrete beam-column joint under cyclic loading. For Modelled specimens, was considered characteristics as determinant behaviour of joint and compare the results of these characteristics. These characteristics include: the ultimate capacity, ductility, joint deformation (joint rotation), yield of column and beam reinforcement and joint. Specimens of connection are type of external connection. These specimens chosen because have critical condition of joint due to lower confining conditions than other types of connections in shape and position. In order to study effect of confining and role of shear strength of transverse reinforcement in the joint were considered 4 different states of stirrups. Parameters associated with beam and column and axial load and material strength for 18 samples were considered. Summary of results is shown in Figures 1 and 2.



(a) (b)

Figure 1. (a) Load - displacement curves of specimens
(b) Plastic strain of joint

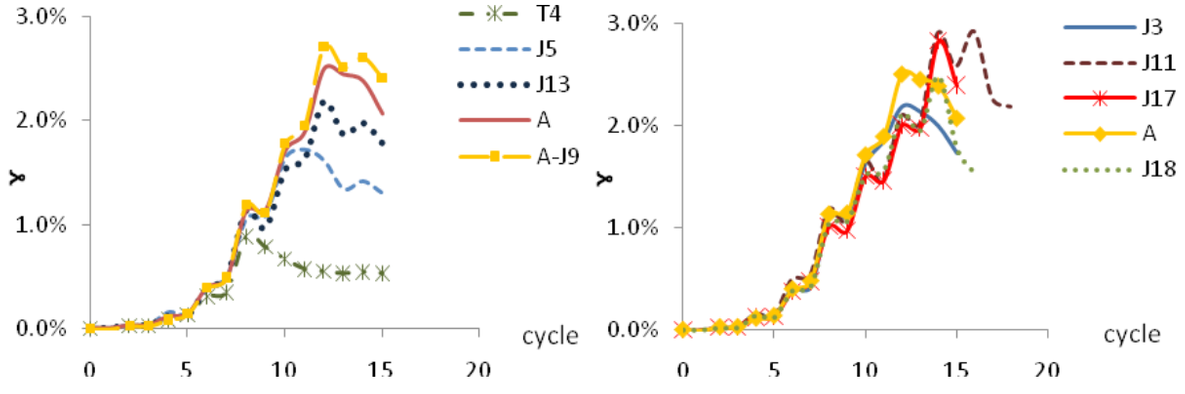


Figure 2. Rotation and shear deformation

According to the obtained results, it can be said that factors which decrease ductility too much, provides tendency of failure joint mode and brittle failure more than other factor. And any factor that Lead to not respected criterion of poor beam -strong column provides tendency of development of damage in joint and brittle and suddenly failure. So, to achieve the appropriate performance of joints, should consider the needs and expectations of the structure and features for joint. Then by obtained these features must be identified effective parameters and applied them in design and implementation of joint.

REFERENCES

Alva GMS, Ferreira MA and Eldebs ALHC (2009) Partially restrained beam-column connections in reinforced concrete structure, Ibracon structures and materials journal, 2(4): 356-37

Amanat KhM and Enam Badre (1999) Study of the semi-rigid properties of reinforced concrete beam-column joints, *Journal of Civil Engineering the Institution of Engineers*, Bangladesh, 27(1): 59-69

Falah Ziarani M and Tasnimi AA (2006) Behaviour of Internal beam - column joints in special reinforced concrete moment frames at different performance levels, MSc Thesis, Tarbiat Modares University, Tehran, Iran

Mitra N, Sudeshna M and Lowes LN (2011) Probabilistic model for failure initiation of reinforced concrete interior beam–column connections subjected to seismic loading, *Journal of Engineering Structures,* 33: 154–162

Shin M and Lafave JM (2004) Testing and modeling for cyclic joint shear deformations in r-c beam-column connections, *13th World Conference on Earthquake Engineering,* Vancouver, B.C., Canada