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IMPROVEMENT OF THE PERFORMANCE OF REDUCED-LEVEL STEEL BEAMS (RBS), BY A NEW TYPE OF STIFFENER, UNDER CYCLIC LOADING

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Bending joints before the earthquake of the Northeastern were fitted with a beam to the column. This clamping is done by welding the entire beam between the beam and the column or the welded wing of the beam to the column head and twisted round beam to the wing column. At that time, it was thought that these fittings would perform well against earthquake forces. After the Northridge earthquake in 1994 in Los Angeles, most of the structural failure was due to weakness in its joints, so researchers proposed two ways to enhance the bond strength and the local weakening of the beam in the vicinity of the RBS connection. In the connection boosting strategy, the goal is to reduce tensions in the connection. The purpose of creating a plastic joint in the beam is deliberately designed in the direction of the local weakening of the beam in the vicinity of the connection, in order to avoid the plasticity of the connection and failure in it.

Today, the use of beams with reduced sections of sections has been very much considered. The purpose of this study was to investigate the effects of type and location of stiffeners on the connection between the beam and the column under the influence of cyclic loading. In the present study, a laboratory model of reduced cross section beams was used to validate the paper. The specification of the model sampled simulated in the ABAQUS software is exactly the same as the laboratory article. A sample of a dropped IPE has been shown, as shown in Figure 1.

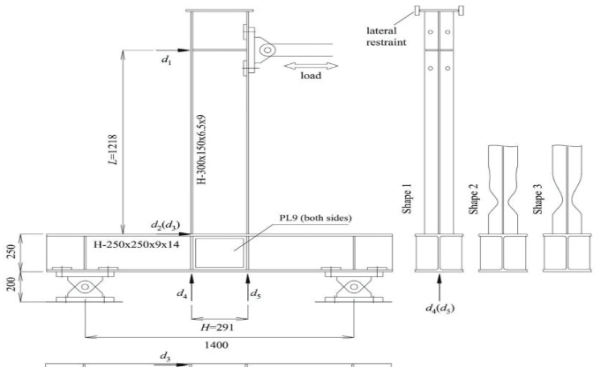

Figure 1. Geometry of the specimen and the locations of the loading and measuring devices.

To load the model built in ABAQUS software, the hysteresis chart obtained from the experimental model of the back bone graph is taken and moved to the beam, shown in Figure 2.

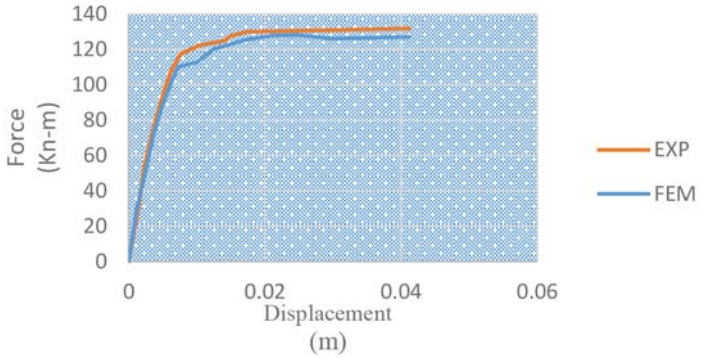

Figure 2. Back bone graph.

In the present study, most of 20 models of RBS sections with height and cross section dimensions each of which have a make-up and a specific type of stiffeners, have been examined by the software of the ABAQUS limited components under axial loading (in the form of hysteresis according to the ATC24 protocol). After analyses, it has been observed that the use of stiffeners improves the performance of reduced steel sections of steel beams, the stiffeners placed in the wing of the beam are better than the stiffener joints in the cross section. In Figure 3, an example of the models studied in this study is shown.

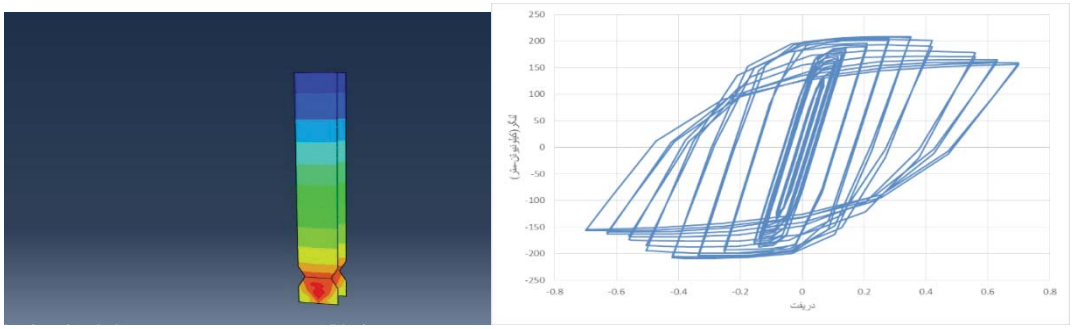

Figure 3. Part of the results of the test.

REFERENCES

Chen, S., Yeh, C., and Chu, J. (1996). Ductile steel beam-to-column connections for seismic resistance, *Journal of Structural Engineering*, *122*(11), 1292-1299.

Sheng, J., Chen, J., Chu, J., Chu, Z., and Chuo, L. (2001). Analytical modeling and seismic design of steel moment connections with welded straight haunch. *Journal of Structural Engineering AISC*, *127*(9).

Pachoumis, D., Galoussis, E., Kalfas, C., and Christitas, A. (2009). Reduced beam section moment connections subjected to cyclic loading: Experimental analysis and FEM simulation. *Journal of Engineering Structures*, *31*, 216-223.

Wilkinson, G. and Crowther, A. (2006). A moment resisting connection for earthquake resistant structures. *Journal of Constructional Steel Research*, *62*(3), 295-302.

Hedayat, A., Saffari, H., and Eghbali, A. (2011). Behaviour of steel reduced beam web (RBW) connections with drilled voids. *5th SASTech*.

Ohsaki, M., Tagawa, H., and Pan, H. (2019). shape optimization of reduced beam section under cyclic loads. *Journal of Constructional Steel Research*.

Federal Emergency Management Agency (2000). Recommended seismic design criteria for new steel moment-frame buildings, FEMA-350, Technical report.