

Development of design criteria of bolted endplate connection with reduced beam section in Iranian profiles

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Nowadays, the reduced beam section (RBS) connections are widely used in constructional buildings because of appropriate ductility and strength. Applying of bolted-type RBS connections, in addition to improve their performance, is cost-effective and can be opened and reused. Although extensively research has been done on the RBS connections by using American profiles, to design connections, however, little research has been conducted on the bolted RBS or RWS (reduced web section) connections by utilizing Iranian profiles that their ultimate and yield strength is much lower than that of American profiles. In this study, three bolted end-plate connections with reduced section, one connection with a radial-cut in the flange (RC-RBS), and the other two connections with vertical slits in the web (VS-RWS1 and VS-RWS2), were tested experimentally under the cyclic loading. In order to validate, their numerical model was analyzed in ABAQUS software and the results were compared with experimentally results that had acceptable agreement. By performing a parametric study, desirable ranges were suggested for the parameters of the reduced region to improve the connection performance in terms of ductility, and reduce the stress in the location of the beam-to-column connection. Lastly, the original VS-RWS is replaced with an equivalent constant-cut depth RBS (CC-RBS), to obtain the deflection of the frame caused by the VS beam flexural deformation by using the conjugate beam method, and to provide a simple design procedure for VS-RWS connections according to the optimum ranges recommended for the reduced region. The results of this research showed that the VS-RWS1 connection has a better cycle performance than the RC-RBS connection and its capacity flexural is about 10% higher. Lateral-torsional buckling was also clearly seen in the RC-RBS specimen, whereas this phenomenon did not occur in the slotted specimens. The result of the parametric study showed that, if the parameters of the reduced region are properly considered in VSRWS connections, their behavior is suitable in terms of flexural strength, energy dissipation, and ductility level, and meet the seismic criteria for use in special moment resistant frames.

Keywords: Bolted RBS connections, Reduced web section, Vertical slit, Moment resistant frames, Cyclic loading, Experimentally analysis, Finite element analysis.