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Performance Evaluation of RC Beam-Column Connections Using Strut and Tie Method

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ABSTRACT

This paper presents an application of nonlinear strut-and-tie model (NSTM) for analysis of reinforced concrete (RC) external beam-column joints under lateral loading. The conventional STM is a calculation based on the force method exhibiting the internal forces in each component, it is unable to capture an inelastic response when RC beam-column joints undergo large displacement. Test results of three external beam-column sub assemblage frames with seismic and non-seismic detail in the joint region, were used to verify the applicability of the NSTM, respectively. In the joint region, nonlinear links of concrete and steel bar were applied to simulate a load-displacement response. The results, such as maximum loading capacity, lateral load-story drift relation and failure mode, obtained from both NSTM models and laboratory experiments were compared. It was found that the results from the analyses using the NSTM agreed well with the experimental results. Furthermore, the demand-to-capacity ratios of the nonlinear links, which represents the distribution of the internal force in the NSTMs' joint region, exhibit the failure location and the failure mode that compatible with the experimental result. Hence, the proposed model is capable of predicting the strength of external beam-column joint of RC frames under lateral loading.

Keywords:

RC beam-column joint, Seismic retrofitting, Prestressed joint enlargement, Strut and tie model, Non-seismic detailing.