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Progressive collapse analysis of stainless steel composite frames with beam-to-column endplate connections

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ABSTRACT

This paper carries out the progressive collapse analysis of stainless steel composite beam-to-column joint sub-models and moment-resisting frames under column removal scenarios. The static flexural response of composite joint sub-models with damaged columns was initially explored via finite element methods, which was validated by independent experimental results and discussed in terms of moment-rotation relationships, plastic hinge behaviour and catenary actions. Simplified finite element methods were then proposed and applied to the frame analysis which aimed to elaborate the progressive collapse response at the frame level. Nonlinear static and dynamic analysis were employed to evaluate the dynamic increase factor (DIF) for stainless steel composite frames. The results suggest that the catenary action effect plays an important role in preventing the damaged structure from dramatic collapse. The beam-to-column joints could be critical components that influence the capacity of composite frames and dominate the determination of dynamic increase factor. The current design guidance is non-conservative to provide proper DIF for stainless steel composite frames, and thus new DIF curves are expected to be proposed.

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