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Modelling of beam response for progressive collapse analysis

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ABSTRACT

A fundamental aspect of the progressive collapse behaviour of building structures is the response of axially restrained beams following partial or total loss of the loadbearing capacity of a supporting member. Owing to the various complex effects involved such as material and geometric nonlinearity, advanced numerical approaches tend to be the most effective tools for modelling performance. Such approaches, however, lack the simplicity needed for common use and may provide only limited capability for understanding structural behaviour. For such purposes, more limited analysis approaches that can address adequately the basic features of performance are likely to be more productive. One such method for modelling the response of axially restrained steel and composite beams following column loss is presented in this paper. The method involves explicit modelling of the connection behaviour and employs conventional structural analysis principles to describe beam performance using accessible spreadsheet calculations. Following careful verification against detailed numerical analyses and validation against available experimental results, the proposed method is deemed capable of modelling the various complex features of response with excellent accuracy. Therefore, it may form a promising advance in studying and understanding the basic mechanics of the problem.

Keywords: analytical method; arching action; catenary action; column loss; composite structures; robustness

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