Application of Quasi-Brittle Material Model for Analysis of Timber Members

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Author:	Khorsandnia, Nima
	Crews, Keith
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Summary:

Over the last two decades many constitutive models with different degrees of accuracy have been developed for analysis of sawn timber and engineered wood products. However, most of the existing models for analysis of timber members are not particularly practical to implement, owing to the large number of material properties (and associated testing) required for calibration of the constitutive law. In order to overcome this limitation, this paper presents details of 1D, 2D and 3D non-linear fi nite element (FE) models that take advantage of a quasi-brittle material model, requiring a minimum number of material properties to capture the load-defl ection response and failure load of timber beams under 4-point bending. In order to validate the model, four tapered timber piles with circular cross-section (two plains and two retrofi tted with steel jacket) were tested and analysed with the proposed 3D FE modelling technique; and a good correlation between experimentally observed and numerically captured ultimate load was observed. Consequently, it was concluded that the developed FE models used in conjunction with the quasi-brittle constitutive law were able to adequately capture the failure load and load-defl ection response of the fl exural timber elements.

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