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Lessons learned from Recent Lateral Torsional Buckling Research

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Lateral torsional buckling (LTB) is a key failure mode that governs the bending capacity of long span laterally unsupported beams. Design standards recognize LTB as a mode of failure and provide guidance to quantify the LTB strength for simple idealized cases. Outlined first are the philosophies and main features of relevant design provisions, underlying classical solutions, and their limitations in practical design.

Identified then are a number of practical design problems that fall outside the scope of standard provisions. Applications include the Gerber beam system commonly used in single storey commercial buildings, laterally unsupported frames and pipe racks encountered in industrial structures, and wide flange beams strengthened with cover plates or channels used in crane girders. The limitations of classical solutions in providing reliable estimates for the LTB strength in such applications is illustrated and the importance of accounting for non-conventional behavioral aspects such as web distortion, pre-buckling deformation effects, and the precise modelling of eccentric braces is demonstrated through examples.

The philosophy of design by advanced analysis is then introduced as a promising approach to tackle lateral torsional buckling design. A number of modern analysis tools are introduced within the framework of the methodology, with emphasis on solutions that preserve the simplicity of one-dimensional beam analysis while successfully capturing complex three-dimensional behavioural characteristics involved in LTB (e.g., warping, web distortion, pre-buckling deformation, etc.). Means of integrating the model predictions within standard-based design checks are then illustrated with examples.