World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:14, No:12, 2020

Effective Slab Width for Beam-End Flexural Strength of Composite Frames with Circular-Section Columns

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Abstract : The calculation of the ultimate loading capacity of composite frame beams is an important step in the design of composite frame structural systems. Currently, the plastic limit theory is mainly used for this calculation in the codes adopted by many countries; however, the effective slab width recommended in most codes is based on the elastic theory, which does not accurately reflect the complex stress mechanism at the beam-column joints in the ultimate loading state. Therefore, the authors' research group put forward the Compression-on-Column-Face mechanism and Tension-on-Transverse-Beam mechanism to explain the mechanism in the ultimate loading state. Formulae are derived for calculating the effective slab width in composite frames with rectangular/square-section columns under ultimate lateral loading. Moreover, this paper discusses the calculation method of the effective slab width for the beam-end flexural strength of composite frames with circular-section columns. The proposed design formula is suitable for exterior and interior joints. Finally, this paper compares the proposed formulae with available formulae in other literature, current design codes, and experimental results, providing the most accurate results to predict the effective slab width and ultimate loading capacity.

Keywords : composite frame structure, effective slab width, circular-section column, design formulae, ultimate loading capacity
Conference Title : ICCCBE 2020 : International Conference on Computing in Civil and Building Engineering
Conference Location : Auckland, New Zealand
Conference Dates : December 01-02, 2020