ABSTRACT

This research investigated compressive and flexural strengths exhibited by cold-formed steel (CFS) members with channel and Z-profiles. The study encompassed a comprehensive investigation of 500 CFS members. Numerical analysis utilizing finite-element (FE) models based on ABAQUS is conducted. Existing experimental test results were used to validate the accuracy of the FE models, which were then utilized to assess the influence of various parameters on the capacities of these CFS members. Parameters such as the member length-to-depth ratio, the section depth-to-width ratio, the plate slenderness ratio, the lip-to-flange width ratio, and material yield stress were analyzed in detail. The results obtained from FE models were comparatively analyzed against those derived from the codified Effective Width Method (EWM), as specified in current design standards, and the newly progressed Direct Strength Method (DSM). The North American Specification, Eurocode-3_part1.3, and the Egyptian Code of Practice have been used as an example of the EWM. Appendix 1 in the North American Specification is utilized as an example of the DSM. To improve the computational and calculation process, a graphical user interface (GUI) is developed to program the EWM and DSM calculation procedures. This advancement streamlined the analysis, enabling more efficient and accurate evaluations of the innovative CFS profiles' capacities. This research offers valuable insights into the performance of innovative CFS channels and Z-profiles, facilitating a deeper understanding of their structural capacities and providing a foundation for potential applications in modern engineering design and construction practices.

Keywords

Cold-formed steel; Axial load capacity; Flexural strength; Finite element model; Effective Width Method; Direct Strength Method; and Codes.