Plastic Mechanism and Elastic Analyses in the Strength Estimation of an Axially Compressed-Thin-Walled Channel Steel Section Beam

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ABSTRACT
This paper presents the study of an analytical model to estimate the strength of a thin-walled channel steel section beam subjected to axial-compressive loads. The model is based on two different methods of analysis, which are performed by analysing a plastic failure mechanism and elastic behaviour of the beam. These analytical methods can be used to establish plastic-unloading and elastic-inclining-theoretical load-deflection behaviour of the beam. Meanwhile, the axial-compressive strength of the beam is estimated by directly measuring the value of load at an intersection point between two different curves of the theoretical load-deflection behaviour. The accuracy of using this analytical model is also verified by comparing its estimated data of the strength to the one obtained from a number of tests on 38 specimens of thin-walled channel steel section under the test loads of axial compression. It is clearly shown that deviation of the analytical data from the experimental one is still scattered within acceptable limits of ± 20%. A statistical analysis of the scattered data indicates that its mean value is 1.03 with standard deviation of 0.058. This certainly means that the estimated strength, on average, displaces from the actual one by 3% and mostly tends to be conservative.

KEYWORDS
Channel section, local buckling, plastic mechanisms, effective width, moment capacity and axial-compressive strength