A Comparison Investigation into Analysis Methods to Determine the Buckling Capacity of South African Cold-Formed Steel Lipped Channel Sections

Johan van Vuuren\textsuperscript{1}, Jeffrey Mahachi\textsuperscript{2}
\textsuperscript{1}University of Johannesburg, Johannesburg, South Africa
\textsuperscript{1}johanvanvuuren026@gmail.com; \textsuperscript{2}jmahachi@uj.ac.za

\textbf{Abstract} - This paper presents a comparison investigation into analysis methods to determine the buckling capacity of South African cold-formed steel lipped channel sections. The research considers the evaluation of buckling capacities of five different column lengths using five different methods: 1. experimental tests; 2. the Direct Strength Method (DSM) as prescribed in SANS 10162-2; 3. Eurocode 3; 4. simplified Finite Element Analysis (FEA), i.e. only beam modelling elements; and 5. finely refined FEA, i.e. plate modelling elements. All columns have a 75 x 50 x 20 x 2.0 (h x b x c x t mm) cold-formed lipped channel cross-section. A comparison of the experimental buckling results to the aforementioned methods shows that the Eurocode 3 and DSM buckling resistance values overestimate the buckling loads by 23.8\% and 12.7\%, respectively. For the two Finite Element Model (FEM) buckling analyses; the simplified FEA method yields an overestimation of 76.9\% and the finely refined FEA yields an overestimation of 74.8\%. It is recommended that the DSM is used to calculate the buckling resistance of cold-formed lipped channels.

\textbf{Keywords}: Buckling, thin-walled, cold-formed, Direct Strength Method, Finite Element Analysis.