CERIS : Civil Engineering Research and Innovation for Sustainability

Research of local buckling behaviour of composite thin-walled steel-concrete structures

PhD student
Deividas Martinavicius

PhD program
Civil Engineering (KTU Kaunas University of Technology, Lithuania)

Supervisor
Mindaugas Augonis (KTUKaunas University of Technology, Lithuania)

Co-supervisors
Mário Rui Arruda (CERIS, IST, University of Lisbon)

Period
2017-2022

Funding
KTU scholarship

Summary

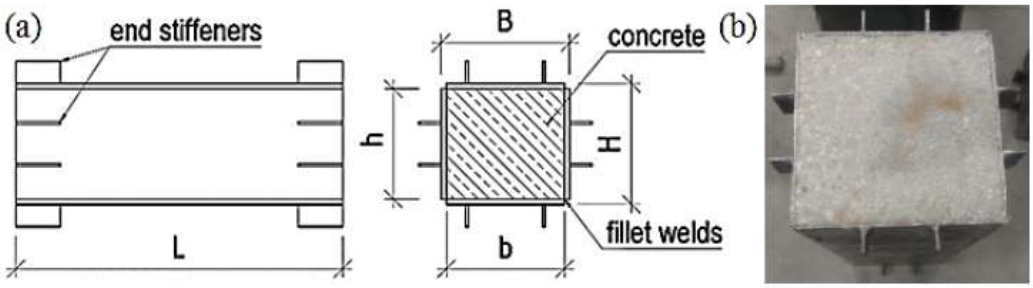
Welded thin-walled concrete-filled steel stub columns and beams are analysed in this work. The main object of this research is the local buckling phenomena in such structures. Global buckling effects are ignored. Due to stub columns being short, they do not undergo the flexural buckling. On the other hand, closed section steel beams filled with concrete are not susceptible to lateral torsional buckling. In accordance with the obtained results, analytical methods are proposed for the calculation of the critical buckling stress, ultimate stress and development of the average normal stress of the compressed steel panels in welded thin-walled concrete-filled steel structures. Experimental, analytical and numerical methods of research are used in this work.

The aim of the thesis is to propose the expressions for the calculation of the critical buckling stress and ultimate stress of the compressed steel panels in thin-walled welded concrete-filled steel structures and to develop the model evaluating the average normal stress state as a function of strain. In accordance with the obtained experimental and numerical results of the thin-walled welded concrete-filled steel structures, the analytical model for the calculation of the average normal stress state as a function of strain is proposed for the compressed steel panels in steel-concrete columns and beams.

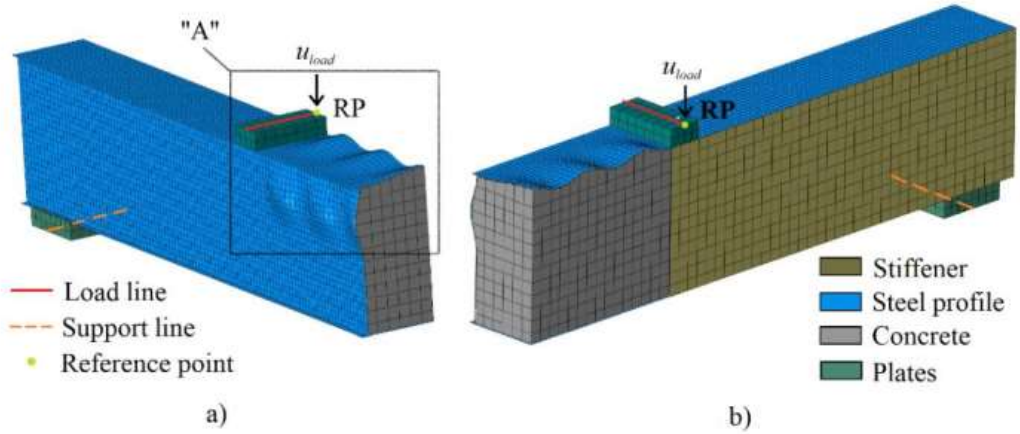
The proposed analytical model for the development of the average normal stress of compressed steel panels in composite structures can be used for the iterative calculation methods in order to obtain the full load-axial shortening or moment-deflection curves of the thin-walled welded concrete-filled steel structures. Proposed critical buckling stress and ultimate stress expressions can also be used for the manual calculation of the critical load and ultimate strength of such columns.

Keywords

Steel-concrete columns, local buckling, effective width, steel-concrete bond, critical stress.



Principal drawing (a) and view of the composite column (b)



Assembly of the beam model with geometrical imperfections.