

UGent LMO Project sheet

Research project : Instability of steel beams with large web openings

Image :



Researchers involved :

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Time span :

2008-ongoing

Description :

Cellular members are steel I-section beams with large circular web openings appearing in a regular pattern. Due to the openings, these members have a number of advantages compared to classical I-section members, the main one being the optimized material usage: for the same amount of steel, they perform better in bending. Other advantages are the possibility of reducing the total building height by making service ducts pass through the openings instead of under the beams and the ability to let light through. Consequently, the use of cellular beams has increased steadily over the last decade.

Because of their high performance when loaded in bending about the strong axis, cellular members are used for applications with high bending moments, such as simple bending or a large bending moment combined with an axial compression force. Because of the presence of the web openings, the failure behaviour in these applications, differing from that of classical I-section beams, is still largely unknown and should be investigated.

Fig. 1: Lateral-torsional buckling of a cellular member in pure bending.

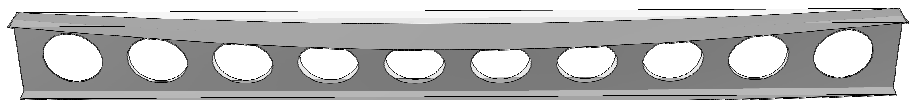
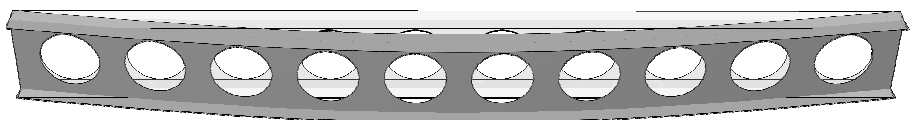


Fig. 2: Lateral buckling of a cellular member in pure compression.



This research focuses on the failure behaviour of cellular members loaded in bending and in compression. The two limiting loading cases, pure bending (Fig. 1) and pure compression (Fig. 2), will be examined as well. The objective of the research is to develop a resistance check for a cellular member loaded in compression and bending about its strong axis. In order to achieve this objective, both finite element simulations and experiments will be used. Numerical simulations in Abaqus will be utilized to determine the failure load for a wide variety of cellular member geometries and load combinations. The goal of the experiments is to validate the finite element simulations and to determine certain properties which are needed for the numerical simulations.

Most important publications :

- SONCK, Delphine; VANLAERE, Wesley; VAN IMPE Rudy
Elastic lateral-torsional buckling of cellular beams
Proceedings of the International Symposium "Steel Structures: Culture & Sustainability 2010 (in press)
- SONCK Delphine, VANLAERE, Wesley; LAGAE, Guy; VAN IMPE, Rudy
Influence of web openings on failure by lateral-torsional buckling of cellular beams
XV Lightweight Structures in Civil Engineering : contemporary problems (2009)
- SONCK, Delphine; BELIS, Jan; LAGAE, Guy; VANLAERE, Wesley; VAN IMPE, Rudy
Lateral-torsional and lateral-distortional buckling of I-section members with web openings
8th National Congress on Theoretical and Applied Mechanics, Proceedings (2009)

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