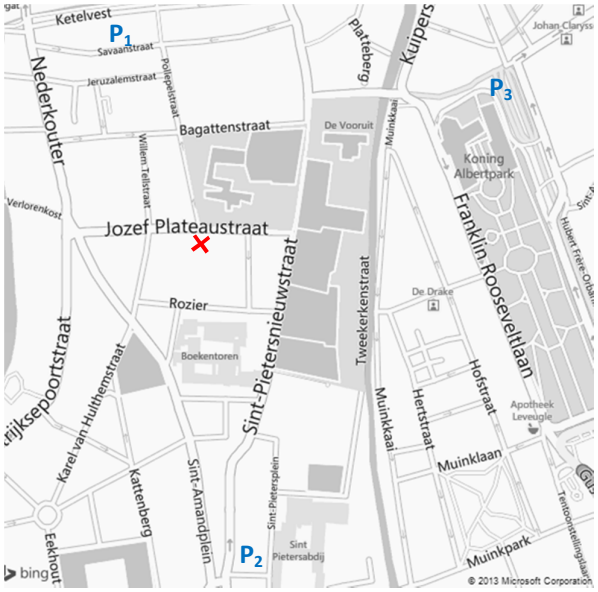
The public PhD defence
will take place on:

Tuesday January 14th, 2014
at 17:00

In the **Jozef Plateauzaal** of the
Faculty of Engineering and Architecture
Jozef Plateaustraat 22
9000 Gent



P1 Savaanstraat; **P2** Sint-Pietersplein; **P3** Gent-Zuid

You are kindly invited to a reception after the defence

Please confirm your attendance before Tuesday, January 7th

E: Delphine.Sonck@UGent.be

GLOBAL BUCKLING OF CASTELLATED AND CELLULAR STEEL BEAMS AND COLUMNS

Delphine Sonck

dissertation submitted
for obtaining the degree of:

Doctor of Philosophy in Structural Engineering

Academic year 2013-2014

Supervisors:

Professor Rudy Van Impe
Professor Jan Belis

Other members of the examination committee:

Professor Luc Taerwe (chairman)
Pro dean FEA UGent - EA14
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Professor Nicolas Boissonnade
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Professor Benedict Verhegghe
UGent – EA06
Professor emeritus Guy Lagae
UGent - EA14
Professor Robby Caspeele (secretary)
UGent - EA14

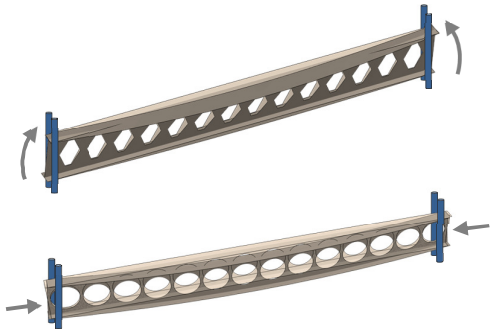
UNIVERSITEIT GENT

INVITATION

to the public PhD defence of

Delphine Sonck, MSc Eng

Global buckling of castellated and cellular steel beams and columns



Laboratory for Research on Structural Models
Department of Structural Engineering
Faculty of Engineering and Architecture
Ghent University

Summary

Castellated and cellular members are steel I-section members with round or hexagonal web openings. They are made starting from hot-rolled I-section members using a cutting and welding procedure. Their main advantage is their economic material use when loaded in bending about their weak axis, but they are also being used out of aesthetic considerations or to decrease the necessary floor-to-floor height.

The global buckling behaviour of these members will be similar to the buckling behaviour of I-section members without web openings. However, the buckling resistance will be influenced by the modified geometry and the effect of the fabrication procedure on the already present residual stresses. Current design rules for the global buckling behaviour contradict each other, and the effect of the modified residual stress pattern was never considered. This could possibly have very unsafe consequences.

In this work, the influence of the production method of cellular and castellated members on the residual stress pattern is determined experimentally. It is shown that the fabrication process has a detrimental influence on the residual stresses and the corresponding buckling resistance. A residual stress pattern for cellular and castellated members, taking into account this detrimental influence, is proposed.

Subsequently, the global buckling behaviour is studied numerically in an elaborate parametric study. Based on the results of this investigation, a first design rule proposal is made, fitting in the Eurocode 3 approach used for the design of steel structures.

Curriculum

In 2008, Delphine Sonck (°Aalst, March 27th, 1985) graduated from Ghent University as a Master of Science in Civil Engineering, with a major in Construction Design.

Delphine has been working on her PhD at the Laboratory for Research on Structural Models of the department of Structural Engineering since September 2008. In her function as teaching assistant, she has taught exercises for 'Structural Analysis I' and 'Non-linear and Plastic Methods of Structural Analysis'. Additionally, she has taught classes for, among others, 'Passive Fire Protection', 'Metal Structures' and 'Structural Analysis III'. Furthermore, she has given guidance or seated in the examination committee of 15 master theses. Lastly, Delphine assisted in several external scientific industrial projects.

Delphine is the main author of 13 scientific publications and presented her work at 8 international congresses and symposia. She is a member of E25003/04, the Belgian mirror committee for Eurocodes 3 en 4, and of the CEN/TC250/SC3&4/Ad-hoc group for beams with large web openings.

Currently, Delphine still works at the Laboratory for Research on Structural Models, where she continues her research on the buckling behaviour of castellated and cellular members.