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INDICEE - International Doctorate in "Civil and Environmental Engineering"
Dottorato Internazionale Ingegneria Civile e Ambientale

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Workshop

COLD FORMED STEEL FOR CIVIL AND INDUSTRIAL STRUCTURES

Prof. Maurizio Orlando

16,30 - 18,30

Aula 35 – Scuola di Ingegneria
Via S. Marta 3 - Firenze

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Abstract

Thin-walled cold-formed steel (CFS) is more and more adopted worldwide as a structural material in civil and industrial structures because of lightweight and ease of transport.

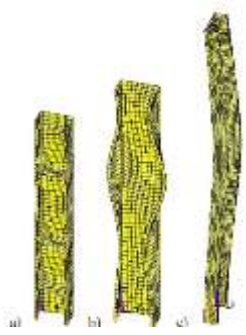
CFS frames can exhibit a high flexibility and second order effects can influence remarkably their performance. Mono-symmetric cross-sections are usually utilized for members, which results in an eccentricity between the shear centre and centroid. CFS cross-sections commonly belong to class 4, because of the high width-thickness ratios of webs and flanges, so they can undergo local, distortional, and global buckling.

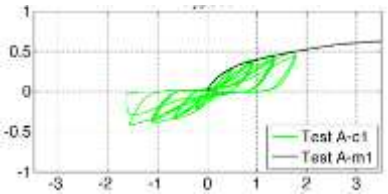
Moreover, because of the cold forming process, their use is not recommended in earthquake resistant structures designed according to the capacity design approach.

In civil construction, CFS members are used in conjunction with plasterboard panels in stud wall partitioning to form thin robust walls specially adopted in prefabricated houses. Another important application is the construction of high capacity warehouses, which are commonly used worldwide to store goods on pallets, and are mainly built using CFS members. In down-aisle direction, bracings are usually not installed to make palletized goods, stored on horizontal beams, always accessible. Along the down-aisle direction, racks behave like moment resisting frames whose stability and seismic resistance depend on the performance of the beam-to-column connections. In cross-aisle direction, racks are typically braced, with uprights connected by diagonal braces, to improve the stability and seismic response.

The seminar is motivated by the need to increase the knowledge of the mechanical behavior of CFS members

and to highlight its effect on the global static and seismic response of steel structures. The proposed goal is achieved highlighting the peculiarities of CFS members. The possibility of design CFS structures according to the capacity design approach is investigated, showing results of experimental tests on boltless rack joints (down aisle direction) and diagonal braces (cross aisle direction), which highlight the ductility of investigated members. To promote utilization of CFS structures in seismically active areas, the seminar concludes with some recommendations for designers.





Summary

- Cold formed steel members:
  Applications (Prefabricated steel structures – Steel storage pallet systems)
  Cold forming process (Roll forming – Folding and press braking)
  Effect of cold forming process (Increase of mechanical properties – Reduction of ductility)
  Cross section class 4 (Local - Distortional - Global buckling)
- Houses
  Factory-built wall-panels
  Factory-built 3D modules
- Steel storage pallet racks
  Static capacity
  Seismic capacity in down-aisle and cross-aisle directions
  Experimental results (beam to upright joints, diagonal braces with holes)