



Innovative construction system for sustainable buildings

Cristiano Loss, Maurizio Piazza, Riccardo Zandonini

Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy

Contact: cristiano.loss@unitn.it

Abstract

This paper deals with a contemporary integrated and sustainable construction technology for new residential buildings. Specifically, this research aims at developing innovative steel-timber hybrid structures which allow a rapid assembly of the individual prefabricated components, minimizing the construction times and limiting the costs of the work. The numerical analyses performed on a multi-storey building for social housing will be presented and discussed. The in-plane behaviour of the floors and shear walls will be analysed, considering in particular the types and arrangement of the different timber- and steel-timber joints. The connections to be used among the construction elements will be selected in order to develop a sufficient stiffness, ductility and bearing capacity according to the design criteria for seismic-resistant structures. These connections allow to enhance the on-site assembly operations, therefore working effectively also under harsh climatic conditions.

Keywords: Hybrid structures; Composite structures; Wood-based structures; Modular construction; Prefabrication; Cross laminated timber panels; Sustainability; Green design; Steel-timber connections;

1 Introduction

In Europe, in accordance with the 'Horizon 2020' Project -research and innovation programme for strategic development- the buildings have to drastically reduce the energy consumed during the whole life cycle, as well as their related emission of carbon dioxide (CO₂) into the atmosphere [1]. As part of this process, the building industry is promoting construction technologies for buildings developed according to an energy-efficiency perspective.

In this paper we refer to a contemporary integrated and sustainable construction technology with a modular and prefabricated steel-timber structure. It is a flexible solution with regards to the changing housing needs over time, with the possibility to modify the internal and

external distribution of spaces, and therefore it allows to respond to a wide range of housing needs. In the field of steel-timber hybrid construction systems some recent works can be cited: Tesfamariam and Stierner [2], Asiz and Smith [3], Dickof et al. [4], Bhat et al. [5], He et al. [6] and Okutu et al. [7]. However, this research aims at developing innovative hybrid building systems which allow a rapid assembly of the individual prefabricated building elements, minimizing the construction times and limiting the costs of the work.

This document includes some of the results obtained from the numerical analyses performed on a multi-storey residential building. In particular, the aspects that affect the in-plane behaviour of the floors and shear walls are studied. Several arrangements of the connections will be analysed