

# WOOD-BASED SANDWICH PANELS WITH PAPER HONEYCOMB CORE IN MULTI-STORY BUILDINGS

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One noticeable trend in urbanisation is increasing the number of multi-story buildings. On the other hand, environmental requirements are now becoming a leading topic in the construction market, with sustainable and environmentally friendly materials being most in demand. Wood-based composite panels may be the answer to this call.

## Description of the topic

Currently, due to rapid urbanization and the formation of compact cities, the demand for multi-story buildings is growing. The response to the growing expectations of customers in terms of environmental protection, as well as requirements for sustainable development, might be the greater use of wood-based materials. To achieve this, it is necessary to propose new materials and construction solutions based on wood to meet the current standards. One of the new material solutions is sandwich panels. A sandwich panel is usually made of three layers: a low-density core, and thin outer layers. In bending the outer layers resist the tensile and compressive stresses, while the low-density core provides shear stress resistance and maintains a distance between outer layers ensuring resulting in a higher moment of inertia. That provides a relatively high stiffness and strength capacity, keeping the weight low. The company Ecocell® has introduced sandwich panels into the Swiss market. Their product consists of paper-honeycomb core and outer layers made of natural wood or wood-based board. Although this technology is already used in low-rise single-family housing, there is currently no use of wooden-based sandwich panels in multi-story buildings. Due to the development of high-rise construction and the possibility of using sandwich panels in this type of construction, this system can be tested and adapted to the corresponding expectations and requirements.

## Goals/Objectives

The aim of this study is to analyze the feasibility of using wood-based sandwich panels with paper honeycomb core as a load-bearing floor element in multi-story buildings, based on products manufactured and provided for testing by the company Ecocell®. The expected goals are contained in three points:

- Determination of the global flexural modulus of elasticity, maximum bending, and shear stresses of six different compositions of wood-based sandwich

panels with paper honeycomb core, delivered by the company Ecocell®.

- Determination of applicability of tested sandwich panels including their maximum span in multi-story buildings based on the fulfillment of limit state criteria, considering assumed load models.
- A comparison of the results with other timber systems commonly used in multi-story buildings nowadays.

## Methods/Results

A large part of this thesis was to conduct mechanical tests including bending and shear test, and analysis of the results. A modeling process was also carried out to simulate the tested sandwich panels in the case of loads that could occur in multi-story buildings, and on this basis, the maximum possible span was determined. Then a comparison was made with the requirements of multi-story buildings, as well as with other timber construction systems. It is observed that selection of materials, and mechanical properties of these materials, as well as the appropriate thickness of the element, are key to making wood-based sandwich panels with paper honeycomb core competitive with currently used systems. The results of the research should allow better planning of further research in the field of the potential of sandwich panel as load-bearing elements in multi-story buildings.



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