An innovative and sustainable building system using structural insulated panels

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Dates: 1st November 2007 – 31st October 2010

Funding bodies: EPSRC and ErgoHome Ltd.

Introduction

Structural Insulated Panels (SIPs) are high performance building panels which are considered to be the next generation of timber construction. A typical make-up of SIPs comprises insulating core materials adhesively bonded to outer skins such as oriented strand board (OSB). As a novel structural material, they offer key advantages including satisfactory structural strength, excellent thermal performance, high strength-to-weight ratio and environmental friendliness. The knowledge of SIPs is still very limited and it considerably hinders their application. Below is the summary of the knowledge gap of SIPs which will be considered as part of the research project:

- SIP performance subjected to various load combinations;
- Effects of opening areas;
- Effects of long-term loading; and
- SIP connections.

Aim and objectives

The aim of this project is to investigate the structural performance of SIPs and to develop design/assessment methods of the connections between adjacent panels, and SIPs with other construction materials.

To achieve the aim of the project, the specific research objectives are as follows:

- Experimental and numerical investigation of the structural performance of SIPs under various loading conditions together with various geometric configurations and edge conditions;
- Development of the connections of adjacent panels and the panels with other construction materials;
- Testing the developed connections and quantifying the structural performance; and
- Proposing design/assessment methods of the developed connections.

Research Methodology

This research project will address the knowledge gap as previously described and present the research findings to both research and engineering communities. To do this, experimental and numerical investigation of the structural performance of SIPs under various loading combinations with and without the effects of the opening areas, and effects of long-term loading will be undertaken. This will be followed by the investigation of panel connections and panel/frame connections in order to quantify the structural performance. The above work forms the first phase of the present project.

On the basis of the knowledge obtained in the first phase, the new development of the connections will then be considered which aims to be of improved structural performance, thermal efficiency and economy. Finally, a design/assessment method of the developed connections, which should be versatile, sound and easy to use, will be developed and presented to both research and engineering communities.

Presentation in the first research students conference at the University of Birmingham