CESARE'22
3rd Coordinating Engineering for Sustainability And Resilience
May 6th – May 9th, 2022, Irbid, Jordan
ISSN:2788-6204

SHEAR AND THERMO-HYGROMETRIC PERFORMANCE OF STRUCTURAL INSULATED PANELS COMPRISING EPS CORE AND OSB SKINS

M. Serpilli[1*], F. Stazi[2], S. Lenci[1], C. Di Perna[3]

[1]Department of Civil and Building Engineering, and Architecture,
Università Politenica delle Marche, Via Brecce bianche, Ancona, Italy
m.serpilli@univpm.it, lenci@univpm.it
[2]Department of Materials, Environmental Sciences and Urban Planning,
Università Politenica delle Marche, Via Brecce bianche, Ancona, Italy
f.stazi@univpm.it
[3]Department of Industrial Engineering and Mathematical Sciences,
Università Politenica delle Marche, Via Brecce bianche, Ancona, Italy
c.diperna@univpm.it

ABSTRACT

In the last decades, the need for improved thermal-structural integrated solutions for building construction has significantly accelerated the development of Structural Insulated Panels (SIPs), a cost-effective wall system capable of transferring shear loads between panel layers and minimizing localized heat loss [1]. SIPs are commonly realized using two sheets of oriented strand board (OSB) with a rigid foam insulation core, for instance, Expanded Polystyrene (EPS). Although extensive research has been performed on lateral load resistance of wood-frame wall systems, studies on integrated performance design of such component are still lacking. Indeed, the evaluation of lateral load response in alternative wall applications has been addressed [2], without considering the implications on other aspects, such as thermal resistance and hygrometric performance. These aspects have been a deterrent in the widespread use of this integrated wall-system in seismic prone areas. This study explored the shear behaviour of SIPs, composed of an EPS core within two OSB sheets. Panels (1200x1200x170mm^3) were tested under in-plane horizontal load in two configurations: (i) single SIP wall; (ii) double SIPs wall, joined together with a block spline and metal connections. Both specimens were anchored to a lower steel metal beam through anchor bolts and hold-downs. Moreover, the panels were numerically characterized as regard the thermal conductivity and the water vapor transmission. The study demonstrated that this wall system is a viable solution for sustainable building constructions since it presents high shear strength, elevated ductility (in double SIPs configuration) and high thermal resistance.

References

[1] Y. H. Mugahed Amran, M. El-Zeadani, Y. Huei Lee, Y. Yong Lee, G. Murali, and R. Feduik, Design innovation, efficiency and applications of structural insulated panels: A review, *Structures*, **27**, 1358-1379, 2020.

[2] D. R. Rammer, T. Williamson, Performance of structural insulated panel walls under seismic loadings, *Research Paper FPL-RP-704*. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, 1- 60, 2020.