Light Steel Framing construction in the southern European context: indoor thermal environment challenges

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Given the proliferation of the Light Steel Framing (LSF) constructive system for residential buildings, it is crucial to characterise how these buildings perform in the southern European context, in terms of thermal comfort and energy efficiency. It is also important to compare LSF buildings with the typical southern European constructions, namely the masonry and reinforced concrete construction (HBM). Acknowledging the relevance of experimental studies for this matter, a long-term monitoring campaign was established. This campaign is founded on monitoring two identical experimental test cells (Fig. 1), representing the two constructive systems. The experimental campaign encloses four different set-ups: i) free-running conditions; ii) introduction of an insulation layer on the floor slab; iii) introduction of internal gains during a predefined occupancy period; and iv) measurement of the heating demand to achieve a pre-established temperature setpoint.

The comparison between the LSF and HBM test cells revealed that the indoor thermal environment of the former responds closer to the outdoor conditions, demonstrating higher indoor temperature fluctuations and more expressive maximum and minimum peak values (Fig. 2). LSF buildings have a limited capacity to store energy into the building fabric, constituting a possible drawback compared with traditional construction with a higher level of thermal inertia. Therefore, LSF buildings may be more prone to overheating during warmer months and discomfort due to overcooling during the winter.
On the other hand, the obtained results reveal significant opportunities for the LSF constructive system. In terms of energy efficiency, it was found that LSF buildings can provide sound advantages in reducing energy consumption for heating the indoor environment, if an intermittent use of the heating systems is considered. Moreover, the faster response of LSF to internal gains can be valued and contribute to improved thermal comfort.

a)

b)

c)

FIGURE 1
Experimental test cells: (a) External frontal view; (b) LSF test cell under construction; HBM test cell under construction.

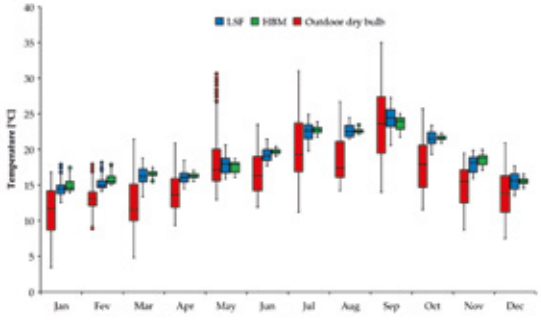

FIGURE 2
Monthly indoor air temperature profiles in both experimental test cells and outdoor dry bulb temperature profiles.