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Title: Active thermal mass enhancement using phase change materials

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1 Active thermal mass enhancement 2 using phase change materials

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8 **ABSTRACT**

9 Buildings account for around 40% of energy consumption in the UK. For over twenty years active thermal mass
10 systems have been a feature in low-energy buildings in northern Europe. By passing ventilation air, and
11 utilising night ventilation, through the hollow core structures efficient heating and cooling has been achieved.
12 Despite the success, such systems suffer from space overheating and efficiency losses during extended hot
13 periods. Control strategies have largely mitigated this effect however low cost retrofit solutions that enhance
14 the system are of interest. This research therefore investigates the benefit of using innovative phase change
15 material (PCM) solutions to enhance thermal comfort and reduced energy usage of traditional active thermal
16 mass systems.

17 A prototype PCM enhancement was constructed, with energy saving and comfort benefits investigated under
18 controlled laboratory conditions. In absolute terms the PCM solution offered an additional 12.5% energy
19 storage capacity and a 29% increase in active surface area, coupled with the existing sensible thermal mass.
20 Under laboratory conditions the PCM addition saved an additional 0.1kWh per day, delayed AC onset by 1.2
21 hours and offered an average 1.0°C reduction in room temperature during eight hours of fixed internal heat
22 gain, contrasted against the original active thermal mass system.

23 **KEY WORDS**

24 Active thermal mass, phase change materials, thermal mass, free cooling, night cooling, energy-efficient
25 cooling

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