The effect of infill walls made by eco materials on mechanical response, energy performance and CO_2 print of residential and non-residential low-rise buildings

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Abstract
With the aim of both reducing environmental footprint and improving technological properties, several construction materials have been successfully manufactured using using waste. However, the assessment has commonly been based on comparing technological behaviors, while the overall assessment of the so made building has been commonly overlooked. Thus, this papers shows the energy and mechanical performance of buildings with same structure design, building shape and envelopes characteristics but with different types of infill walls (IWs) which have been modelled by considering traditional materials (i.e. adobe and perforated fired clay bricks) and eco-materials, such as adobe and bricks made by using up to 10% and 17.5% of biomass bottom ashes, respectively. Building models have been designed in accordance with building codes, in terms of seismic and energy savings criteria. In addition, residential (RB) and non-residential (NRB) uses have been also considered for calculations. IWs had in all cases similar equivalent thermal transmittance, achieved by varying the air gap length between layers in order to establish a common comparative framework. Otherwise, IWs showed a different thermal capacity depending on used material within the wall construction. The analysis concluded that the mechanical behavior was similar in all cases, regardless the excess of weight added by adobes. Besides, in low height buildings the increasing of stiffness possesses an advantage for lateral loads resistance. In addition, by using adobe with ashes, 5% of equivalent CO_2 footprint (i.e. from cradle to gate) and 4% of energy consumption may be saved. These savings must be even lower when the entire life cycle is considered, since adobes may be easily collected and reused without any treatments while fired clay bricks require further treatments.

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