

Use of Shipping Containers as Office Buildings in Brazil: Thermal and Energy Performance for Different Constructive Options and Climate Zones

Authors : Lucas Caldas, Pablo Paulse, Karla Hora

Abstract : Shipping containers are present in different Brazilian cities, firstly used for transportation purposes, but which become waste materials and an environmental burden in their end-of-life cycle. In the last decade, in Brazil, some buildings made partly or totally from shipping containers started to appear, most of them for commercial and office uses. Although the use of a reused container for buildings seems a sustainable solution, it is very important to measure the thermal and energy aspects when they are used as such. In this context, this study aims to evaluate the thermal and energy performance of an office building totally made from a 12-meter-long, High Cube 40' shipping container in different Brazilian Bioclimatic Zones. Four different constructive solutions, mostly used in Brazil were chosen: (1) container without any covering; (2) with internally insulated drywall; (3) with external fiber cement boards; (4) with both drywall and fiber cement boards. For this, the DesignBuilder with EnergyPlus was used for the computational simulation in 8760 hours. The EnergyPlus Weather File (EPW) data of six Brazilian capital cities were considered: Curitiba, Sao Paulo, Brasilia, Campo Grande, Teresina and Rio de Janeiro. Air conditioning appliance (split) was adopted for the conditioned area and the cooling setpoint was fixed at 25°C. The coefficient of performance (CoP) of air conditioning equipment was set as 3.3. Three kinds of solar absorptances were verified: 0.3, 0.6 and 0.9 of exterior layer. The building in Teresina presented the highest level of energy consumption, while the one in Curitiba presented the lowest, with a wide range of differences in results. The constructive option of external fiber cement and drywall presented the best results, although the differences were not significant compared to the solution using just drywall. The choice of absorptance showed a great impact in energy consumption, mainly compared to the case of containers without any covering and for use in the hottest cities: Teresina, Rio de Janeiro, and Campo Grande. This study brings as the main contribution the discussion of constructive aspects for design guidelines for more energy-efficient container buildings, considering local climate differences, and helps the dissemination of this cleaner constructive practice in the Brazilian building sector.

Keywords : bioclimatic zones, Brazil, shipping containers, thermal and energy performance

Conference Title : ICBS 2019 : International Conference on Building Simulation

Conference Location : Rome, Italy

Conference Dates : January 17-18, 2019