POLITECNICO DI TORINO

Honors thesis

COURSE OF SUSTAINABLE ARCHITECTURE AND DESIGN

Abstract

EVAPORATIVE COOLING OF BUILDINGS: Laboratory testing and PDEC system design in existing residential buildings.

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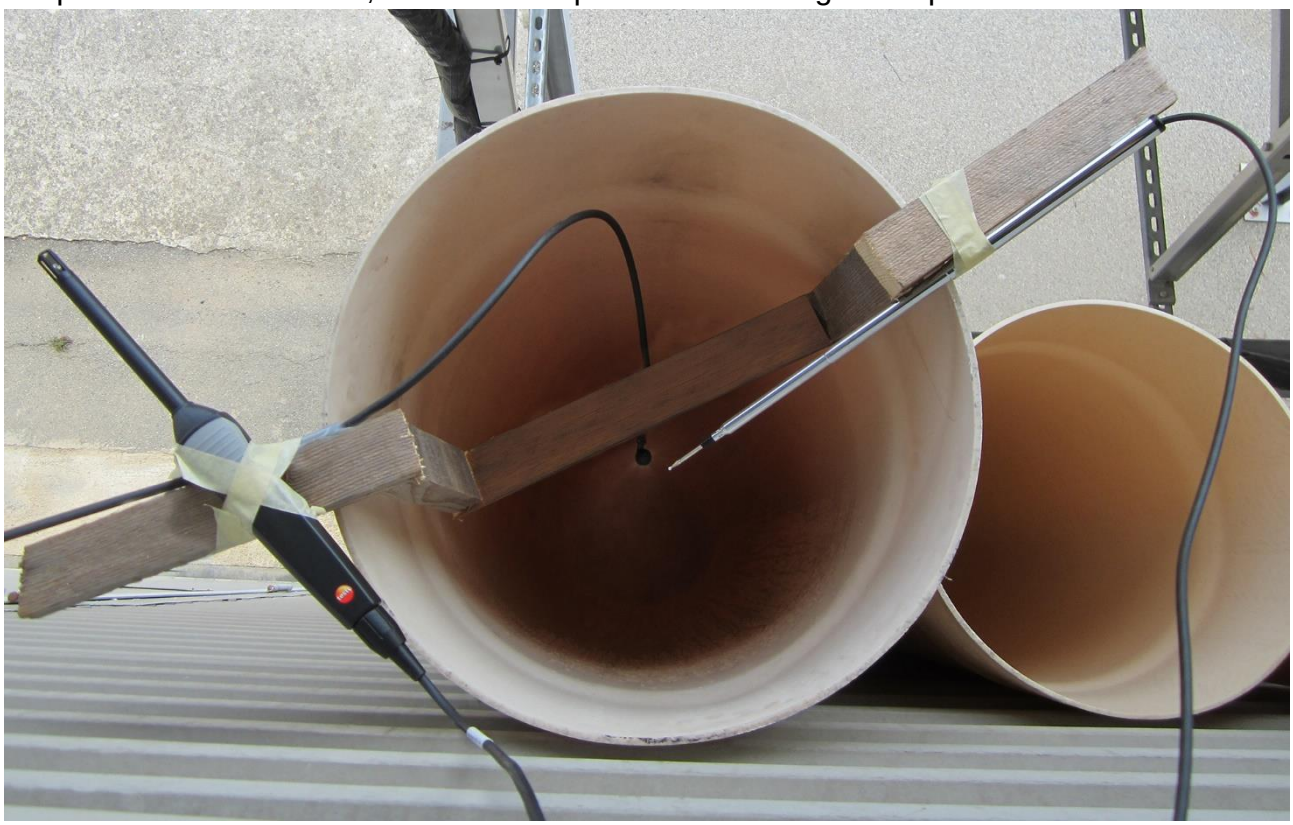
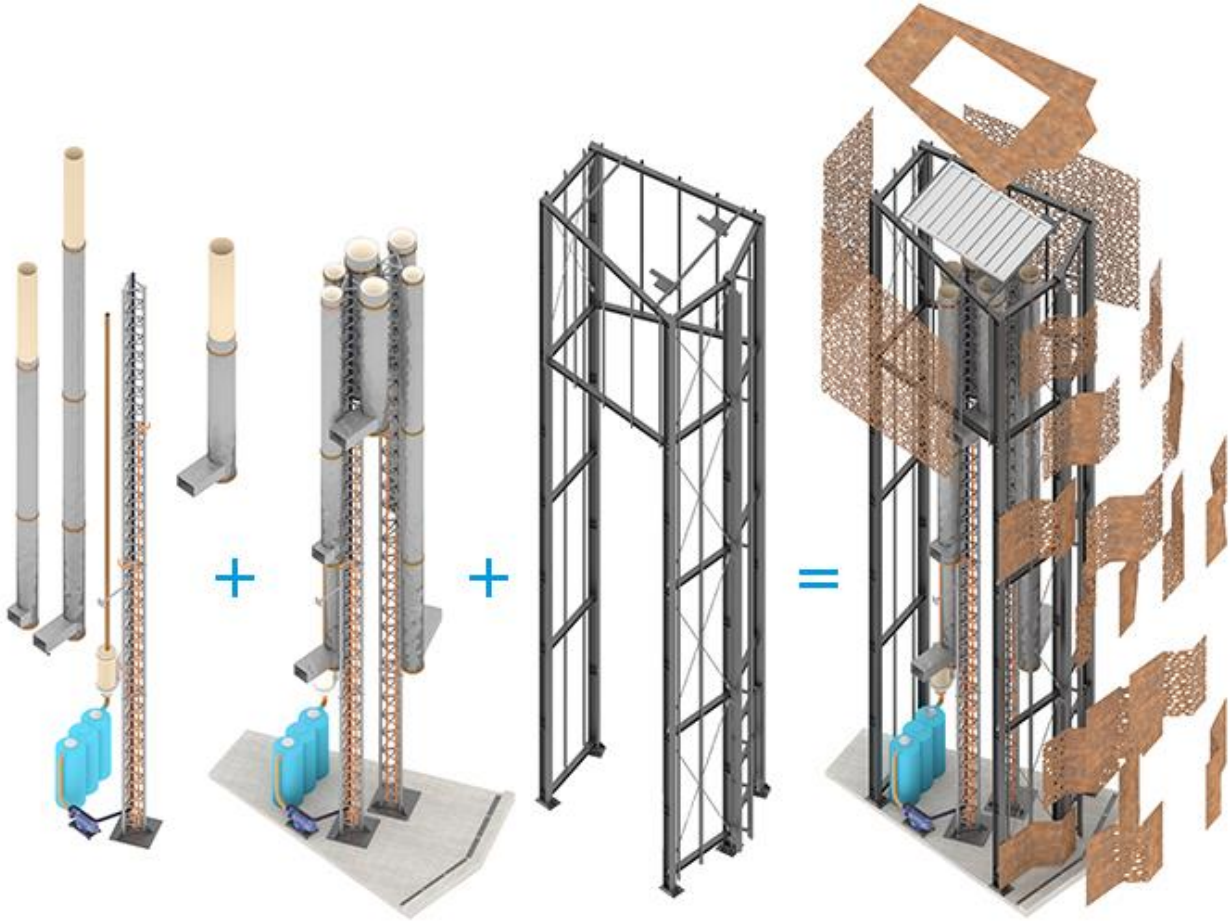
Global warming and climate seasonal imbalances are issues that have become protagonists, bringing not indifferent inconvenience.
The main object of elaborate is the valuation of architectural integration and the performance of passive downdraught evaporative cooling regard traditional mechanic systems in Turin context with a temperate weather.
Previous studies results that tended to theoretical models and lack of practical experiment with typical weather conditions of temperate climates, the expectation on wanted to highlight the efficient of this system in this area.
To do it this has become essential to install an outside PDEC experimental system, in contact with the atmospheric variables to examine the operation during summer period.
From data collected and analysed it has been possible refute a previous studies results, that highlighted the poor applicability in the northern Italian zone, finding considerable results over the initial expectations.
During the five days where the measurements went out it had been possible to determine a variable efficiency varies between 62% and 88%. Excluding the second day where the weather conditions were such as to eliminate the need for cooling, for the remaining days the average value of functionality consolidated around 86% with the average of outlet temperature around 24°C, the result is optimal considering the expectation.



Weighed the possibility of applicability of the passive downdraught evaporative cooling system, we thought about different options of integration into existing typical residential typologies in the Italian context.
The study leaded to the creation of a typological table where have been represented the possible theoretical approaches among different combinations of geometry and technology.
From this table 20 typological cards have been worked, for each of which have been described the characteristics and analysed the qualities and defects of integration and function.

Finally, to demonstration the positive result of the architectural integration and considering the achieved results, we examined a case study of a residential building existent in Beinasco municipality near Turin city.
The building has three floors and it's composed from four blocks of flats, it's fit in optimal way opportunity of application of the evaporative system. The typology inserted in the architectural complex (similar to the experimental model) showed optimum performance regarding the reduction of temperature, less regarding the air humidity output. However as the air flows output from the system and it mixes with air of opposite characteristics, the result of this combination is that in the habitat inside can create an optimal summer comfort condition.
The type of system and the geometric composition taken as a whole represent the best solution in terms of costs, quality and especially durability. The coating, for its pleasing appearance, is particularly suitable to meet the needs of the architectural language that characterizes the existing one.



Despite the limitations of the system, it's shown how this can ensure an optimum condition of comfort within the environment, satisfying fully the load of summer cooling. As part of sustainable development and eco-friendly aimed at saving resources and the attention of pollution, this particular technology, as it is able to maintain high health simultaneously both for local people and for the planet.
In conclusion, it was demonstrated how this system is valid to obtain significant energy savings, improve the indoor air quality and reduce pollutant production of carbon dioxide.

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