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INFLUENCE OF CLOSURE SYSTEM AND VOLUME ON AUDITORIUM THERMAL AND ACOUSTIC PERFORMANCE

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Structured steel buildings require closure systems that have the same prefabrication philosophy as used for the steelwork. An inappropriate selection of these systems can result in the need for further interference and resistance against the adoption of steel-structured construction. In the Brazilian market, there are several industrial closure systems, which, being lighter, have questionable heat and sound insulation. It is important to research closure materials that present integrated thermal and acoustic performance solutions.

In this study, we evaluated the influence of closure systems consisting of cement slabs (PLC) panels, autoclaved cellular concrete (CCA) and expanded polystyrene (EPS), applied in multilayers with sound absorbing material such as glass wool (LVI) between panels, and masonry ceramic bricks (ATC) in thermal and acoustic performance of an auditorium, considering the three different volumes: the original volume (V2), its half (V1) and its double (V3) (Fig. 1, 2) [1].

This study involves a large number of thermal and acoustic variables and the numerical simulation approach is an appropriate and efficient tool allowing the evaluation in pre-project phase or in using building [2, 3].

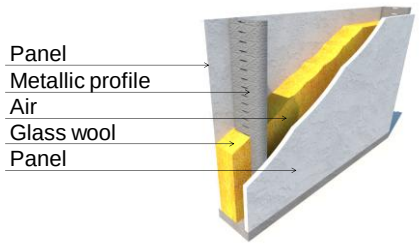

Figure 1: A multilayer closure system

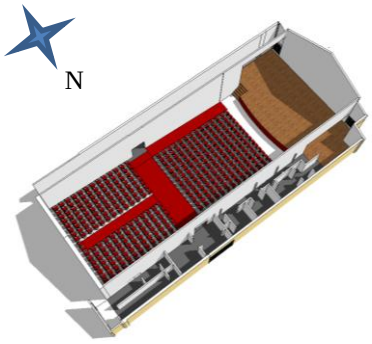

Figure 2: Auditorium perspective

Thus, for this proposed assessment the ESP-r (Energy Simulation Program-research) software is applied to determine the temporal variation of the internal temperature (Ti) and

reverberation time (RT) versus frequency with numerical simulation. The effect of temperature variations in the volume and reverberation time of the room as well as the variation of the sound absorption due to the air is also analyzed.

The thermal and acoustic simulations are integrated, because storage of the thermal effect of the closure elements, translated into temperature and humidity of the internal air, obtained in thermal simulation contributes to the calculation of sound absorption due to the air used in the determination of RT calculated by the Sabine method in acoustic simulation [3, 4], Fig 3, 4.

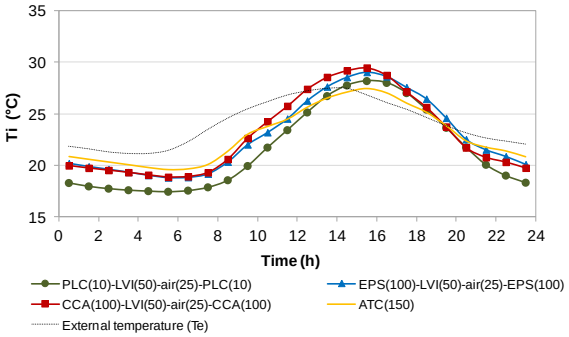

Figure 3: Ti using closings of PLC, EPS and CCA, with LVI, and ATC, to V2

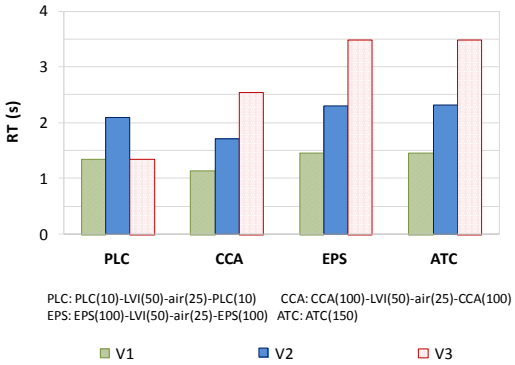

Figure 4: RT using closings at 1000 Hz frequency to V1, V2 e V3

The results (Fig. 3, 4) show that the closure systems meet the minimum criterion for thermal performance ($T_{i,máx} \leq T_{e,máx}$) adopted by the Brazilian standard NBR 15575 [3] and the value of RT is near the reference value of 1.0 s [5, 6], allowing you to evaluate how much a closure system is more efficient than the other in terms of thermal and acoustic comfort, and highlighting the relevant parameters when choosing such systems.

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