Full Scale Measurements and CFD Simulations of Diffuse Ceiling Inlet for Ventilation and Cooling of Densely Occupied Rooms

Spaces with high occupant densities result in high heat gains and need for relatively high air change rate. By means of traditional mechanical ventilation diffusers it becomes a challenge to supply large amounts of fresh air into the space without creating a local discomfort for occupants. One solution to this problem is using a diffuse ceiling inlet supplying a fresh air into the room through a large area of perforated ceiling. The aim of this paper was to report the research conducted on diffuse ceiling inlet installed in the fullscale test outdoor facility. The diffuse ceiling inlet based on gypsum boards with airtight connections was created utilizing the full potential of diffuse layer without undesirable crack flow reported by other authors. The measured values were used to validate the detailed Large Eddy Simulation model of testroom created in CFD software with aim to evaluate an indoor comfort numerically. Results of our investigations have shown that diffuse ceiling inlet is a suitable solution for the spaces with high density occupancy. The results have shown that transient calculations using Large Eddy Simulation models can predict well temperatures and velocity magnitude of air flow in the room.

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