FloVENT Guides Design of Australian School's Novel Passive Cooling System

Design Challenge

Australia's State of Victoria is implementing an ambitious program to replace aging schools with modern structures that are cost-effective and that embody the latest sustainable technologies, including passive heating and cooling. Melbourne's winters are cool enough to require heating and its hot summers demand effective cooling and ventilation. Yet current local Government policy does not provide for the use of conventional air conditioning equipment, and evaporative systems are not up to the cooling task.

Based on past experience with a much smaller project, NOWarchitecture proposed a scheme using underground water reservoirs to cool air for the classrooms. Flow effects in both water and air (the room's open space) had to be studied.

Moreover, the whole innovative concept had to be explained and justified to school district and governmental authorities.

Solution and Benefit

NOWarchitecture took a holistic approach and designed the building's modular classrooms to use air's natural buoyancy to draw outside air through cooling tubes within water-filled tanks that formed part of the foundation, and then to pass upward through the classroom to outlets near the ceiling.

Architects used FloVENT to "prototype" their ideas. Early concepts using small diameter PVC cooling tubes were quickly ruled out but a single large diameter tube (300mm/12") delivered a higher airflow and more uniform temperatures across all of its outlets. FloVENT thermal and flow plots detailed these characteristics and enabled examination of other variables such as inlet dimensions, ambient temperatures, etc.

The NOWarchitecture team, citing the FloVENT plots as proof of concept, got approval to proceed as planned. The accepted proposal predicted a steady supply of air at nominally 20° C (68° F) from the cooling outlets with an outdoor ambient temperature of 35° C (95° F). And this is without the cost of pumps, fans, or "coolants" in the usual sense. Winter heating costs are reduced as well, since the system warms the incoming air to a temperature above the ambient.

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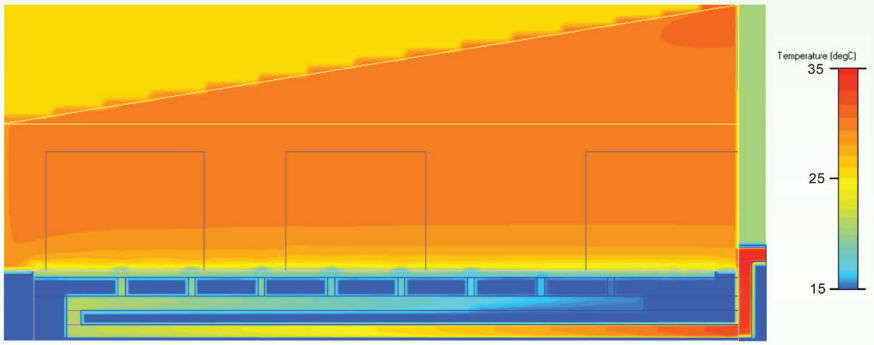
"Will it (the proposed design) work? It's good just to get the actual computer model and prove it, and go through all the different scenarios and fine-tune to get the best outcome we can. It takes these (FloVENT simulation) images to… see what it all means..."

— DANIEL COOMBER
DESIGN ARCHITECT
NOWARCHITECTURE



System with single 300 mm pipe with return & 150 mm upstands