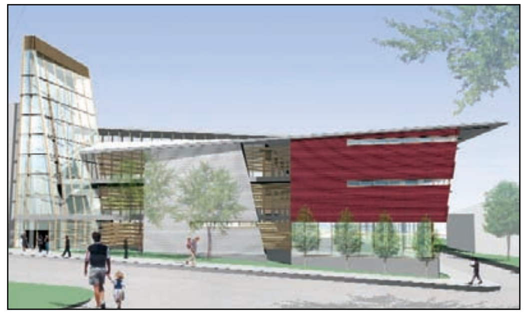
Shooting the Breeze in Pittsburgh



A schematic of the proposed addition

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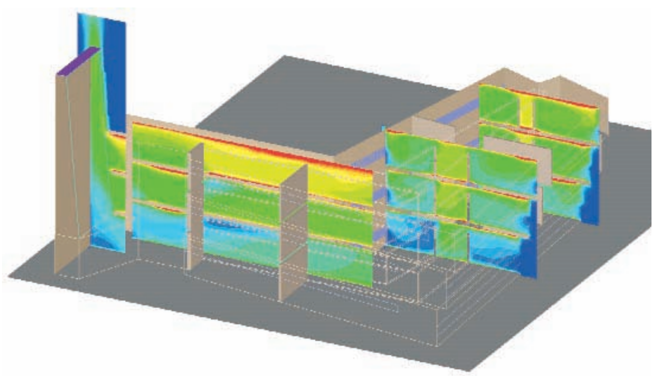
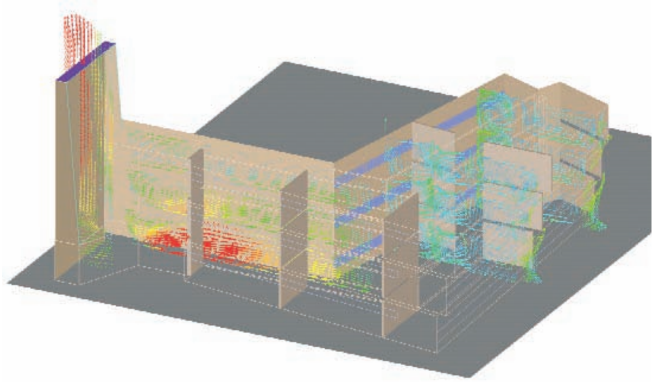
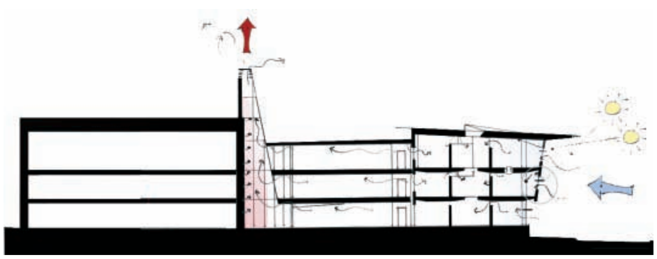


Temperature contours on selected planes in the proposed addition show the range of temperatures that can be expected with natural ventilation



Velocity vectors show the airflow through the building, driven by natural convection



A section view of the proposed addition, showing the original building at left, the glass tower in the middle, and the proposed addition at right

A multidisciplinary team of architects and engineers applied Airpak airflow modeling software to develop their award-winning entry in the first annual U.S. Green Building Council (USGBC) Design Competition. The team from Chicago-based OWP/P was the third-place winner in this competition for emerging green builders.

Entrants designed a theoretical addition to the existing facility for The Pittsburgh Project, an urban, neighborhood-based, Christian community development organization serving the north side of Pittsburgh. Submissions were required to meet the stringent requirements needed to earn a Platinum rating under the USGBC's LEED (Leadership in Energy and Environmental Design) green building rating system, while also meeting the aggressive target budget of $100 per square foot. To enhance occupant comfort, minimize the building's energy use, and keep the project cost low, the team designed a naturally ventilated building with no mechanical ventilation or cooling.

The design concept relied on buoyancy-driven flow developing within a solar-heated cavity created between the brick exterior of the existing building and a new, three-story plane of glass located at one end of the new building. This solar tower pulls air through the operable windows of each individual room, down the corridors, and out of an exhaust stack at the top of the building. The thermal mass of the brick wall maintains warm temperatures in the solar tower through the night, driving cool night air through the building to remove heat built up during the day.

The team used Airpak to verify and develop the design concept. The Airpak model was developed from very early hand sketches and computer-based architectural models in order to confirm that sufficient ventilation would be provided by this design. Early models showed that openings between the three levels outside of the solar tower allowed too much air to rise from floor to floor, bypassing the tower and creating uneven temperatures and air quality in the building. These openings were closed off from airflow with suspended pieces of glass, allowing light transmission and visual communication between levels. The final model shows large amounts of air flowing in through all windows and out through the solar tower, in keeping with the design intent.

This type of early design stage modeling exercise allows concepts that might be considered unrealizable to be explored and tested. Unviable concepts can be rejected, while promising concepts can be refined. ■

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