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The Bullitt Center Bulk Airflow Analysis

October 4, 2011 » By: Tim Elley, LEED AP

Air flow modeling helps target key aspects of design to keep occupants comfortable and energy bills low. Over the past decade, computer simulation has become increasingly ubiquitous for targeting energy saving design measures. In today's most progressive designs, the scope of computer modeling includes natural ventilation air flow and occupant comfort analysis.

PAE created a computer-based model of the The Bullitt Center using the thermal and airflow analysis software Bentley Tas v 9.1.4. Tas is used to perform hourly analysis of building loads and interior space temperatures – accounting for local weather, the building geometry and construction, the airflow in to and out of the building through operable windows, the airflow between spaces within the building, and the anticipated use of the facility by its occupants.

The building is equipped with motorized window actuators that are controlled for night ventilation and natural ventilation during the day. The windows are assumed to open when the space temperature exceeds 70?. If the outside temperature exceeds the inside space temperature, the windows close. The windows are assumed to operate in this fashion 24 hours per day, 7 days per week. This operation is the ideal control of operable windows for passive cooling and can easily be achieved when all windows are automatically actuated. The building is also equipped with cooling of ventilation air using a chilled water coil and radiant slab cooling. The cooling capacities were not designed to maintain specific thermostat set-points in the spaces, but rather, as a tempering device for the hottest days of the year.

The results of the comfort analysis show that the high performance envelope, radiant slab and ventilation air cooling are expected to be capable of maintaining the space temperatures below 80?F in all occupied spaces. Figure 1 shows the number of hours the zone temperatures are expected to fall in 1?F temperature ranges throughout the year – both without any radiant and ventilation air cooling and with radiant and ventilation air cooling. The results shown are for four zones on floors 1, 2, 4, and 6.

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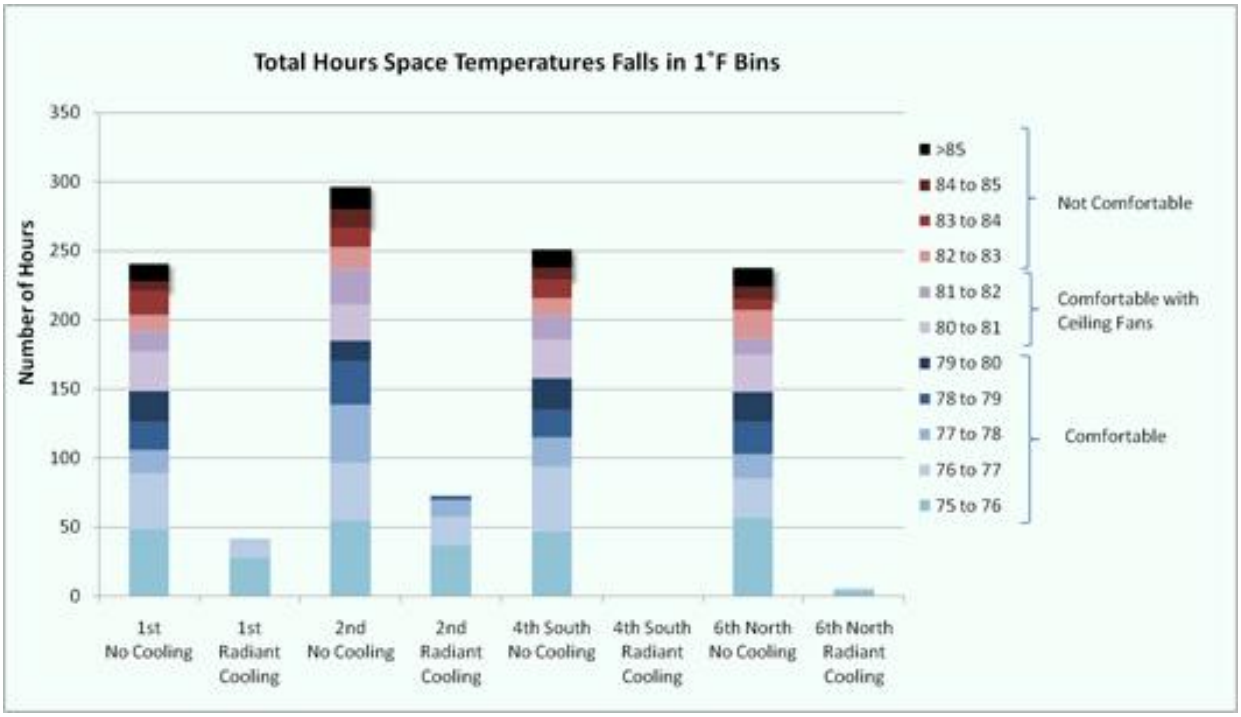

Factors such as occupant clothing levels, occupant activity levels, radiant surface temperatures, and local air speeds all contribute to occupant comfort. These factors can be also modeled to produce predicted comfort levels of occupants.

Results from the DOE2 energy study indicate the electricity requirement for the ventilation and radiant slab cooling to keep the space temperatures at or below 80?F is about 5,000 kWh/year, or only about 2% of building energy. The results of the airflow/comfort analysis combine with the DOE2 energy results to become a powerful tool in designing high performance buildings to save energy without prohibitive sacrifices to occupant comfort.