E.F. SIEGFRIED CO., INC.

"HOT AIR" NEWSLETTER

This quarter we will be addressing a design issue that can result in uncomfortable occupant conditions: an area with a glass exposure. Hopefully this issue will clear up some of the confusion surrounding this design dilemma. Read on!

Please distribute to all mechanical designers and engineers

Designing for a space that has glass exposures can be a difficult task. So many variables are present (type of glass, height of the glass, number of exposures) that to establish a rule of thumb is nearly impossible. Instead of defining ways to address the myriad situations one might encounter, this newsletter will suggest two preferred designs and one that should be avoided. It will be assumed that the space described is located in the Northeast U.S.

The two most extreme situations that can be encountered, involving glass, are the very hot/sunny day and the bitter cold day. If you are designing a central heating/cooling system (no baseboard heat), it is critical that the selection made is the best possible solution for both scenarios. This may seem obvious, but for the majority of systems the cooling mode is used as the basis of design and diffuser selection. However, if designed singularly around the cooling mode, the heating mode's air distribution can prove to be the Achilles heel of the system. While the following observations are aimed at heating/cooling systems, the performance described is that of the heating mode.

Common design practice states that linear slot diffusers or plenum slot diffusers placed in the ceiling (within 1 ft. of the glass wall) and blowing down the glass are an effective way of minimizing solar infiltration on a sunny day (and satisfying architectural needs). However, during the heating cycle, air that starts off hot can rapidly turn cold as it progresses down the glass. This is due to the heat lost to the low temperature of the glass, which is about 50?F when the outside air is 32?F. The cooled supply air picks up speed as it travels down the glass (due to buoyancy) and the result is high velocity cold air hitting the floor (see Fig.1).

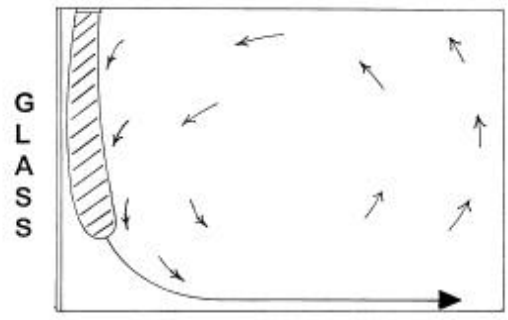

Fig. 1

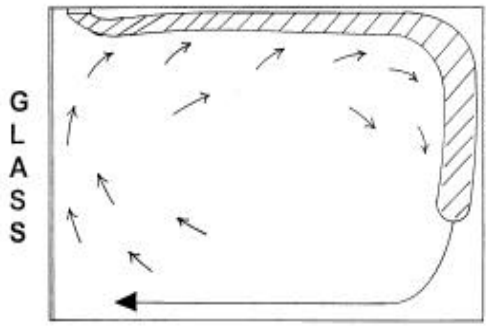

Fig. 2

(continued)

To avoid this situation, supply air should not be directed towards the glass. Therefore, it is recommended that air from slot diffusers (ceiling mounted and near the glass wall) be directed into the room. If sized properly, this design should provide a "rolling" effect in the room (see Fig.2).

A rolling effect is beneficial because it helps mix the air in the room. The room air near the window will now be drawn up by the supply air and motion of the larger mass of mixed air. This effect is desirable because the air motion doesn't produce drafts and the room temperature is more uniform. In Fig.2, the cold wash off the glass is being drawn up and out of the occupied zone as opposed to the higher velocity cold air being dumped into the occupied zone of Fig.1.

This configuration should work well in small rooms and large ones as well (large rooms, however, should have the perimeter area treated as a separate zone; ceiling diffusers should provide air to the central zone; see Fig.3).

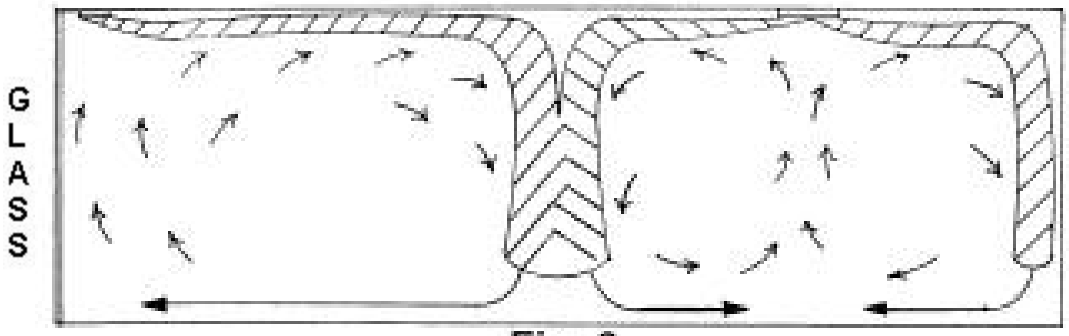

Fig. 3

An alternative method is to have a slot diffuser simultaneously blowing supply air downward, parallel to the glass, and into the room along the ceiling (the slot diffuser should be placed in the ceiling, 18"-30" away from the glass wall). This configuration will allow the supply air being directed downward to create a perimeter zone with the glass and form a barrier between the cold glass and occupied zone (see Fig.4). The supply air being directed along the ceiling will create the desired rolling effect. The percentage of the supply air being directed down versus that being directed into the room should be adjusted to zone loading requirements, but the overall air patterns will remain the same as shown in Fig.4.

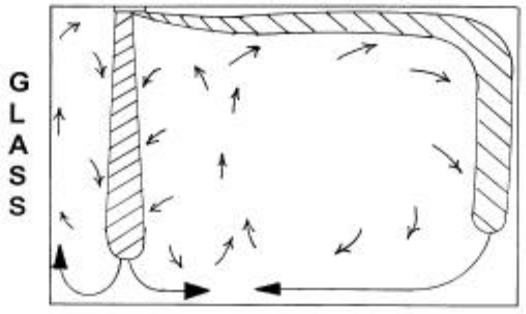

Fig. 4

While directing supply air in the cooling mode towards a glass window or wall may produce desirable effects, these effects become noticeably less desirable when the system is in the heating mode. Because of this, supply air directed down a glass exposure is not the recommended way of maintaining uniform temperature distribution throughout a space. The two methods described above create a much more comfortable atmosphere and still meet the aesthetic demands likely to be set forth by the architect.

If you have any questions, call me at 215-887-7244 or
e-mail me at: rkugler@efsiegfried.com
Robert L. Kugler