
**In search of a solution to satisfy both smoking and non-smoking patrons, one concessionaire at the Richmond International airport built a new food and beverage concession area equipped with state-of-the-art ventilation**

# The Power of Ventilation:
## An Airport Smoking Area that Works

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In June 1998, a new food and beverage concession area opened at the Richmond International Airport—a busy, regional airport in Virginia. The airport recently implemented an updated smoking policy by arranging with the concessionaires in the airport to set aside certain areas for smoking. One concessionaire saw an opportunity in this and built a new concession area equipped with state-of-the-art ventilation on the "air side" of the terminal near the gates after travelers clear security. The concessionaire expressed his enthusiasm for the success of the ventilation system by saying, "A non-smoker can sit next to a lit cigarette without catching a whiff."

This article describes the numerous challenges and opportunities that arose as this project unfolded. The evolution of the ventilation system design for this airport food and beverage concession area is traced from programming through design, bid, construction, and startup.

The ventilation system complements the concessionaire's vision for the new operation, which offers a wide range of bar selections, quality foods, laptop power and telephone ports, and an attractive décor—all conveniently located at the gate area of a major airline. Both the airport authority and the concessionaire were determined to make this new concession area successful. They paid great attention to the ventilation system throughout the project and continue to do so today.

The ventilation design concepts evolved as the project plans unfolded. During the initial programming phases of the project, the first version of the design emerged based on initial discussions and some assumptions about the final layout of the space. As the architectural plans for the space were clarified, the system continued to evolve. Finally, the design concepts were incorporated into the final mechanical systems to determine the final as-built version of the system.

### Preliminary design concepts

With the focus on ventilation system performance, effective HVAC design concepts were sought early in the initial phases of the project. At the initial con-

ceptual design development meetings, the concession was planned as a plain rectangular area of about 1275 sq ft, with no cooking hoods. An occupancy limit of about 90 persons was expected at the busiest time—a figure that dropped later in the project as food service fixtures were added. An open-entry portal to the concourse corridor on one side was planned. The airport authority wanted the space available to travelers at all times, not just when the concession area is open for business. The ventilation design goal was to move air across the open doorway, from the concourse into the concession area, to help contain odors within the concession area. The fixed opening simplified the ventilation design. An operable door that could be opened or closed would have led to variable conditions that could starve the exhaust system in the concession area when the doors were shut. Since the space is small, no separate areas for smoking and non-smoking were planned.

Based on these operational requirements, the goals for planning the ventilation system were:

- *Goal A*—Improve the separation of the concession area from the adjacent concourse with ventilation.
- *Goal B*—Ventilate the concession area to accommodate both smoking and non-smoking customers.

Along with the two ventilation goals, minimum ventilation system design guidelines were determined from the initial space size and layout. These initial ventilation recommendations were developed based on experience with similar facilities at airports throughout the U.S. The recommendations emerged from a series of steps that are applicable to almost any bar, restaurant, or other project in the hospitality industry where ventilation to improve the accommodation of smokers and non-smokers is important (see accompanying sidebar).

The initial guidelines used during the programming phase were later adjusted to reflect lower expected occupancy. The initial guidelines were:

- 5400 cfm direct exhaust (for 90 persons).
- 2600 cfm total makeup air delivered within the concession area.
- 3400 cfm of additional outdoor air delivered to the corridor imme-

## STEPS TO DEVELOPING VENTILATION DESIGN CRITERIA

- Determine minimum ventilation requirements based on applicable codes and standards.

The BOCA code versions governing this project included the National Mechanical Code that incorporates ANSI/ASHRAE Standard 62-1989 by reference. This ASHRAE standard provides three different ventilation rates that were considered for this project. For dining rooms, the standard requires 20 cfm per person of outdoor air. For bars, the required rate is 30 cfm per person of outdoor air. But, another requirement met by this project was the strictest: 60 cfm per person for smoking lounges, which ASHRAE 12 states in a comment to Table 2, "Normally supplied by transfer air, local mechanical exhaust; exhaust with no recirculation recommended."

■ Plan to create directional air flow by over-supplying non-smoking areas—resulting in positive pressure. Similarly, plan to under-supply smoking areas to create negative pressure. As a result, air flows from non-smoking areas toward smoking areas. Two different aspects of directional air flow are crucial for successful ventilation:

•Set up directional air flow at entryways to help separate the space from adjacent areas.

Transferring air into an area is accomplished by means of an overall supply air deficit in the space (total return and exhaust cfm is greater than total supply cfm). At what speed should the transfer air flow into the concession area? Building dynamics in airports, including wind effects and the opening and closing of jetways, are variable. This project targeted a transfer air velocity of 50 fpm. This is at the upper end of the comfort range for air motion in the summertime, so selecting a higher velocity could have created excessive draft near entryways. Transfer air at 50 fpm velocity has proven effective at capturing cooking odors in doorways of kitchens in limited service (fast food) restaurants. In smoke pencil tests at this airport concession area, 50 fpm is fast enough to recapture smoke outside of the entryways, even several feet away from the door. To induce 50 fpm of transfer air flow through a doorway, determine the transfer air flow rate by multiplying the square footage of the opening by 50 fpm or your own design transfer air velocity. Avoid disrupting intended transfer air flow with misplaced supply air diffusers or registers.

• Set up directional air flow within the space to improve smoke and odor removal.

In many rectangular spaces, supply air can be delivered toward the front of the space, and all exhaust can be located at its rear. If the space has designated smoking and non-smoking areas, the front of the space can be designated non-smoking, and the rear of the space can be designated as a smoking area. This approach utilizes ventilation to help separate smoking areas from adjacent areas.

■ Adjust ventilation requirements up from code minimums as required to achieve the desired directional air flow.

If 90 persons were the planned occupancy, 5600 cfm

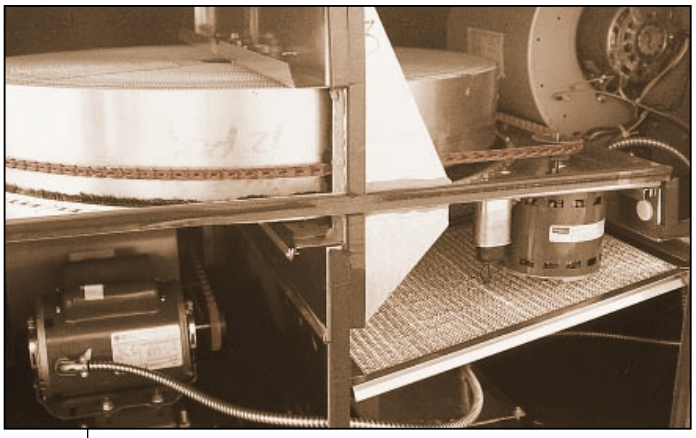

**Photo 1 Interior view of energy recovery wheel system.**

diately outside the entrance to the concession area (2800 cfm for transfer air and 600 cfm for surplus to offset potential concourse depressurization).

- Directional air flow into concession area from surrounding areas at 50 fpm velocity across entire opening to area (50 fpm by 8 ft by 7 ft = 2800 cfm).

Additional recommendations that were made during the programming phase, for consideration during later phases of the project, included:

- Evaluation of energy recovery ventilation to reduce required HVAC capacity and to improve humidity control, particularly during the summer.
- Documented commissioning of all HVAC systems in and around the concession area to design goals, including directional air flow and pressure relationships.
- Rigorous, regimented, and documented HVAC operations and maintenance procedures.
- Reduction of porous surfaces: replace acoustic tile with metal or other cleanable lay-in tile, remove carpet, install continuous and cleanable floor surface with water-resistant baseboard, and use nonporous seating and furnishings.
- Rigorous, regimented cleaning procedures and inspections.

## Project turbulence

After the initial recommendations were developed and rationalized, considerable effort was required to ensure that they were reflected in the final ventilation system design. The first HVAC concept that the design team developed was simply a conventional HVAC system that was supplemented with some local air cleaners and ceiling fans. On this project, the performance of the local air cleaners, even if it were adequate initially, would have depended heavily on proper maintenance. The ceiling fans would have actually defeated the

of direct exhaust is indicated at 60 cfm per person for smoking lounges. (Remember, the most conservative of the three possible ventilation rates was met by this project.) If the entryway is 8 ft by 7 ft, or 56 sq ft, 2800 cfm of transfer air is required for 50 fpm transfer air velocity. If the entrance is larger, more transfer air is required. For example, if the entrance is 20 ft long and 7 ft high, the open area of 140 sq ft requires 7000 cfm of transfer air to provide 50 fpm velocity into the space. If such a large opening size is called for, the direct exhaust from inside the concession area can be increased to maintain the target transfer air velocity.

■ Apply adequate filtration.

Good filtration always pays off for designers and contractors. Good filters are extra insurance that coils are kept clean, preserving cooling and heating capacity and improving occupant comfort. Two in. filters are now available with 65 percent ASHRAE dustspot ratings, and even 1 in. filters are now available with ratings higher than 40 percent. The excessive pressure drops formerly associated with these higher-grade filters have been reduced to normal, due to new filter types.

■ Evaluate HVAC technology for possible system enhancements to improve system value.

On many projects where an exhaust air stream is adjacent to an outdoor air intake, energy recovery ventilation can be applied as an advantage. The cost of an enthalpy wheel for energy recovery is partially offset by the reduced cost of a smaller HVAC unit. The energy savings can make payback acceptable on many projects with substantial operating hours. Also, the sensible heat ratio of the cooling load, including the outdoor air intake, is often outside the range of available stock rooftop units, particularly at part-load conditions. Applying the enthalpy wheel means that such a unit can still be selected, while maintaining humidity control.

■ Incorporate results of these steps into straightforward systems.

Installations that are readily operable and maintainable will continue to give good service throughout their life time. Increasingly, simple system components and controls are available that incorporate new technology. While enhancing system performance, these components and controls are simply an addition to familiar systems such as the traditional rooftop-packaged unit.

In addition to these ventilation considerations, consider recommending non-HVAC measures that will help achieve the project goals. Often, proper cleaning and operation routines can help the ventilation system to meet project expectations. For example, material and furnishing selections can reduce porous surfaces, increase cleanability, and avoid water damage from cleaning. Examples include metal or other cleanable lay-in tile such as tile graded for food preparation areas, continuous and cleanable floor surface with water-resistant baseboard, and seating and furnishings with minimal fabric or cleanable coverings. Helping clients to develop best cleaning, operating, and maintenance practices can also help the ventilation system perform successfully.

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