Engineering firm, Cosentini Assoc. and architect, Sasaki Assoc. use air curtains and soffits built into the North Station train shed for traffic solution at home of Boston Bruins and Boston Celtics.

Because of aesthetic advancements in air curtain design and the Cosentini design team's attention to energy savings, the new mass transit rail station at the TD Banknorth Garden is a functional, aesthetic facility that provides commuters with indoor air comfort as well as energy savings for its owners.

Berner International Corp.

Boston Rail Station Retrofit's Aesthetic, Green Design Offers IAQ & Energy Savings.

BOSTON—Extending the TD Banknorth Garden's commuter foot traffic area 100 feet into the adjacent train shed relieved congestion, however it took innovative HVAC engineering and architecture to make the retrofit an energy-saving and aesthetic solution.

Previously, thousands of mass transit commuters were funneled into the cramped congested lobby/ walkway area of the Massachusetts Bay Transit Authority's (MBTA) renowned North Station terminal inside the TD Banknorth Garden, the home of the NHL Boston Bruins and NBA Boston Celtics professional sports franchises. The successful multi-million dollar expansion, developed and funded by Delaware North Companies, Inc., the owner the TD Banknorth Garden, now greets commuters with a very energy-efficient indoor environment thanks to air curtains, proper building pressurization, and an innovative, but aesthetic HVAC supply soffit system.

Previously, the MBTA's narrow 30-foot-wide lobby/walkway area's traffic spilled over into the automatic entry door sensor zones, thus exterior sliding double doors remained open continuously during rush hours resulting in significant energy losses into the open-ended train shed. While the renovation's main objective was better traffic flow and a roomier waiting area, controlling energy losses through more efficient doorways was also a major concern.

"We knew going into this project that one of the greatest challenges was saving energy for the client because many doors would be constantly open from continuous foot traffic," said Jeffrey Fleishman, HVAC project engineer, Cosentini Associates, Cambridge, Massachusetts.

The design team's solution to congestion relief was a build-out of the lobby 100 feet into the 200-foot-long x 260-foot-wide train shed. In the redesign, the existing 12 sliding commuter doors were moved out 100 feet and incorporated into a new curtain wall. Designed by architect firm, Sasaki Associates Inc., Boston, and built by the project's general contractor, Tishman Construction Corp., Boston, the innovative and aesthetic perimeter soffit aesthetically caps the curtain wall and also functions as a concealment for the necessary electric, HVAC piping, ductwork, fire safety, and other utilities.

The soffits also became perfect receptacles for housing 12 high-efficiency In-Ceiling Mount air curtains by Berner International, New Castle, Pennsylvania. The 72-inch wide In-Ceiling Mounts complemented Sasaki Associates' aesthetics for the new entrance area because they're completely recessed into the bottom of the soffit and appear only as decorative white aluminum grills. Each 3,624-cfm air door distributes a maximum 3,500-f/min. stream of air angled directly down toward the floor, thus cold (or hot in the summer) train shed air and fumes can't infiltrate the receiving area.

"Obviously energy savings and performance were important factors in choosing air curtains, but equally important was the aesthetics," said Fleishman, who had previously specified air curtains only for industrial applications. "The sliding doors can stay open for hours and very little train shed air infiltrates the space due to the combination of air curtains and space pressurization."

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Saving Energy and Creating Healthy, Comfortable Environments

How to Choose an Air Curtain.

Don't be fooled by air curtain manufacturer claims. All air curtains are not the same and performance statistics vary greatly from manufacturer to manufacturer. One place to look for certified air curtain performance statistics is the Air Movement & Control Association (AMCA), Arlington Heights, Ill., a nonprofit organization that creates standards for, and tests and rates everything from air curtains to dampers, louvers, outside air grilles, fans and other "air-side" HVAC equipment.

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Cosentini utilized Berner's factory-installed coil options offered on many of its models, thus the In-Ceiling Mount units all have coils that tap into the soffit's heating supply loop. The 95,600-Btu/h coils supplement the new entrance area's main HVAC system by providing thermostatically controlled heating near the door areas, when needed. The air curtains also include Berner's Comfort Plus Control Package, which includes a thermostat, three-speed fan with an easy access control panel, a timer delay function, and a low voltage relay for tapping compatibly into any direct digital control (DDC) building automation system such as TD Banknorth Garden's BAS system by Siemens Building Technologies, Buffalo Grove, Illinois, if needed. The control package offers TD Banknorth Garden two units for the price of one; an air curtain performance/wind stopping unit when the door is open, plus a cabinet heater or low velocity and low noise with high heat output when the door is closed.

Summer operation uses the air curtain's recirculation mode. Whereas most air curtain air inlet designs recirculate hot, humid air from above, in In-Ceiling Mount air inlet efficiently draws cooler tempered air from the floor area.

When the current TD Banknorth Garden arena replaced the former Boston Garden building in 1995, a heating loop was installed to supply conventional cabinet heaters, which were later cancelled because of the high equipment and operational costs combined with the inefficiency of that technology in that application. At a huge cost savings to the terminal retrofit, the Cosentini design team tapped off of that existing heating loop to supply the air curtains. An existing Bryant boiler and twin 40-hp. pumps by Bell & Gossett, Morton Grove, Illinois, supplies the loop. Cosentini also provided a performance study on the loop's capacity prior to construction.

The previous doorways were significant energy losers according to Fleishman's pre-construction energy observations. Conversely, keeping heat in and cold winter weather out with air curtains in the new terminal area is saving the building owner a significant amount of energy.

To heat/cool the entire new space, the Cosentini design team specified a 14,900-cfm McQuay International, Minneapolis, Minnesota make-up air handler that was installed by Walsh Mechanical, Abington, Mass., in the TD Banknorth Garden mechanical room, which already had an outdoor air shaft for easy access. The HVAC system installation's most difficult challenge was running the 200-foot long supply duct through a congested mechanical room and down an aisle of ice rink compressors that needed service accessibility clearance.

Exposed metal ductwork with registers distributes heating or cooling down the center of the new waiting area. The air handler is sized and designed to heat/cool the space to a design temperature of 72°F with a 200-person capacity occupancy. The air curtains' heating function supplements the indoor air comfort.

Part of the project's engineering work also included Cosentini's review and rebalancing of several existing supply pressurization fans controlled by carbon monoxide (CO) sensors. The fans needed calibration and rebalancing to keep the train shed's emergency ventilation system updated to ensure that they activate and provide a positive pressure when excessive CO is detected.

While the train shed's emergency ventilation system is designed with positive pressure, the new receiving area has also been designed with positive pressure. This pressurization is an engineering challenge, according to Fleishman, because there are no doors or barriers separating the new area from the rest of the TD Banknorth building.

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