

Fabric Air Duct Helps Make Possible Convention Hall's Cable Roof Design

Polyester duct flexes as the roof bows from snow loads

Pittsburgh's great tradition of suspension bridges is paid homage by internationally known architect Rafael Vinoly's sloping suspended cable roof design for the Sports and Exposition Authority's new \$354 million David L. Lawrence Convention Center.

While the soaring stainless-steel and glass crown made it possible for Rafael Vinoly Architects PC of New York and architectural partner HNTB of Kansas City, Mo., to design the nation's largest columnless exhibit hall, the roof's perpetual flexing presented HVAC designers with the nearly impossible challenge of effectively distributing heating and cooling throughout the 250,000-sq-ft space.

Because snow loads can flex the roof as much as 3 ft, polyester-based fabric duct manufactured by DuctSox was specified. The fabric duct not only floats with the roof's random flexing, but cost an estimated \$250,000 less than other duct materials would have, John L. Patten II, CIPE, principal of the project's mechanical/electrical/plumbing consulting engineering firm, Burt Hill Kosar Rittelmann Associates of Butler, Pa., said.

"We could have used double-walled spiral metal duct," Patten said. "However, that would have necessitated hundreds of expansion joints (to accommodate the flexing), which would have been costly and much less attractive than the sloped, continuous runs of duct we have now."

When Phase III of the project is completed in September, the entire exhibit space will have two-dozen 115-ft lengths of DuctSox's 32-in.-diameter Dura-Tex High-Throw duct. Each duct run, which is supplied by a series of Trane air handlers, begins and ends at approximately 24-ft high and bows to a 46-ft elevation



The David L. Lawrence Convention Center is the first major convention facility to use fabric duct.

in the middle while emulating the sloped contour of the roof cables.

Mechanical contractor Limbach Co. of Pittsburgh installed the DuctSox in pairs that run through a series of specially fabricated metal hoop hangers that not only hold light trusses between each duct pair to cut lighting glare, but eliminate any fabric deflation during off-peak operation. Burt Hill specified a translucent duct fabric that would help disseminate light.

Metal duct would have required hundreds of registers, which have proven to be less effective in even air distribution. Instead of registers, DuctSox CAD-engineered hundreds of patterned perforations that run the entire lengths of the ductwork. The perforations range from $\frac{1}{8}$ to $1\frac{1}{4}$ in. in diameter, with placement depending on the height of the duct. At the 46-ft level, the holes are largest and arranged mostly at the bottom of each duct run to maximize air throw in the draft-free air-distribution design.

Disregarding the roof flex, metal duct also would have necessitated heavy insulation to eliminate condensation, espe-

cially because the convention center's air conditioning is delivered at an unconventionally cool 34 F.

Using fabric instead of metal also saved natural resources and made maintenance more efficient.

The roof's sloped shape encourages natural cross-ventilation and draws fresh-air convection currents from the nearby Allegheny River. Also, the cooling system uses the roof to cascade water and reduce the cooling load.

The targeted 34-F air delivery minimized ductwork and fan capacity, thus reducing energy consumption. An underground aquifer is used as a partial condenser medium, thus reducing the required number of cooling towers.

Chilled water is supplied by a third-party source, Noresco of Westborough, Mass., which built a \$7 million, 6,000-ton chilled-water plant for the 1.5-million-sq-ft convention center.

The complex's air quality, temperature, humidity, and other HVAC parameters are monitored and controlled with a building automation system from Alerton.

Since the completion of Phase I over a year ago, the convention center has hosted home-and-garden, recreational-vehicle, and automobile shows. All 250,000 sq ft of exhibition space, plus another 100,000 sq ft of meeting rooms and additional basement space, will be available for the anticipated Sept. 20 grand-opening celebration.

Information and photograph courtesy of DuctSox.

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