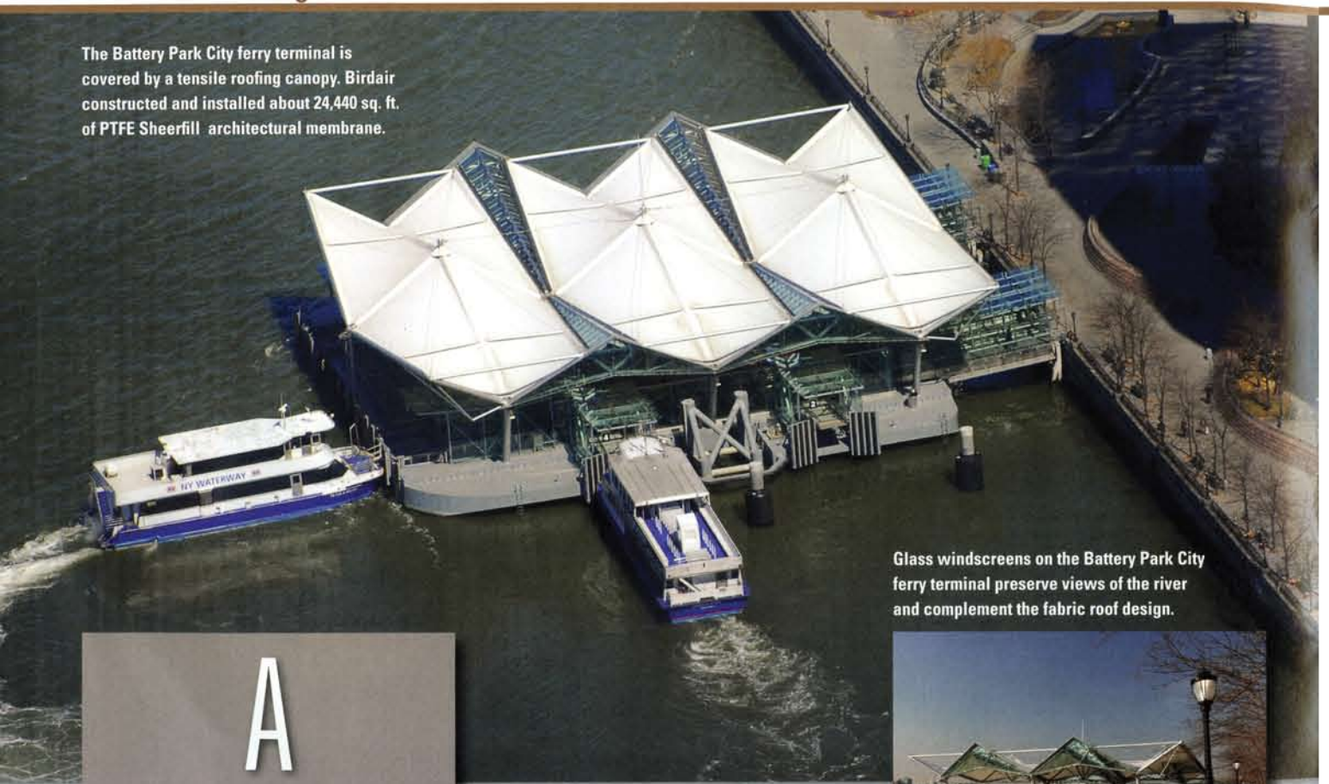


The Battery Park City ferry terminal is covered by a tensile roofing canopy. Birdair constructed and installed about 24,440 sq. ft. of PTFE Sheerfill architectural membrane.

Glass windscreens on the Battery Park City ferry terminal preserve views of the river and complement the fabric roof design.

A Functional Fabric

While a tensioned fabric membrane creates a stunning roof, the material also provides an energy-efficient solution for commercial buildings.

Michele Roth, Birdair Inc.

Tensioned fabric membrane roofs are visually stunning. Besides beauty, their attributes include durability, longevity, energy-efficiency, and reduced maintenance requirements. Smooth, flexible fabric membrane roofing integrates tension for support and can be attached to any building envelope. Fabric membrane can be formed into a multitude of shapes, depending on project specifications. This makes it a practical choice for long-span roofing systems, exterior shading systems, canopies, and other applications. It is suitable for new construction and retrofit installations.

The newly built Battery Park City ferry terminal in New York City features a tensile roofing canopy comprised of 26,426 sq. ft. of PTFE (polytetrafluoroethylene) Teflon-coated fiberglass membrane. With as many as 8,000 passengers traveling through the terminal daily, the permanent floating ferry terminal and sea-taxi station required a roofing material that was durable and visually appealing. Tensioned fabric membrane offered the ideal solution. Aesthetically, the sweeping design of the fabric membrane recalls canvas sails, while functionally the fabric provides cover for terminal patrons. The structure was designed with as much glass as possible—installed as windscreens—to preserve views from the Battery Park City Esplanade, while complementing the fabric roof design.

Reduced maintenance

Tensioned membrane structures retain their brilliance over time. The fabric has a high level of resistance to staining, soiling, and moisture. For example, a tensioned membrane roofing system installed in 1973 covers the Sports Science and Athletic Pavilion at the Univ. of LaVerne, LaVerne, CA. The curved roof design, comprised of four billowing cone-shaped fabric membrane peaks, continues to function as a durable, visually appealing addition to the campus.

"The roof has held up surprisingly well," said Robert Beebe, the university's assistant director of facilities. "We've received a lot of positive feedback from the university, as they've had to do extremely little maintenance on the structure over the past 35 years."

In that time, the roof has proven to be an economical roofing choice, requiring only minimal maintenance. It exceeded its lifecycle by five years.

"We've cut samples out periodically over the past 30 years to test the fabric membrane's durability," said David Ricci, director of customer service and warranty for Birdair Inc., Amherst, NY. "The fabric's strength and ability to weather well are reasons that the university has no plans to replace it any time soon, despite considerable renovations to the structure's interior."

Advances in technology

Recent upgrades to membrane products help the fabrics retain their brilliance, with even less maintenance than before. TiO_2 (titanium dioxide) is a coating developed by Taiyo Kogyo, Tokyo (parent company of Birdair). The coating breaks down dirt on the surface of the membrane, allowing it to be washed away by rain, thus improving the way in which the fabric membrane performs.

Photocatalytic TiO_2-coated membranes function like the leaves of a tree, providing shade and comfort while actively neutralizing airborne pollutants and odors. The sun's radiation, along with oxygen and water vapor in the air, create active oxygen ions. These ions decompose organic dirt into natural components through an oxidation-reduction reaction. Rain washes away the decomposed material without leaving streaks.

Another new development is Kenafine, a fully recyclable fabric membrane. Developed by Taiyo Kogyo, Kenafine can be recycled into paper products at the end of its lifecycle. The membrane is derived from kenaf, a type of annual hibiscus. The fast growth of the plant makes it a sustainable material choice.

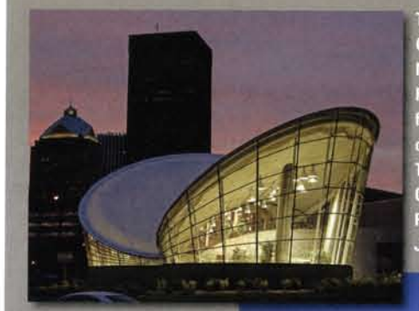
Energy efficiency

As building owners and architects look to meet green building codes, tensioned membrane roofing's attributes make it a practical roofing choice. The roofing system uses fewer materials and requires less structural steel support to hold the roof in place. Minimizing the amount of structural steel reduces a building's carbon footprint.

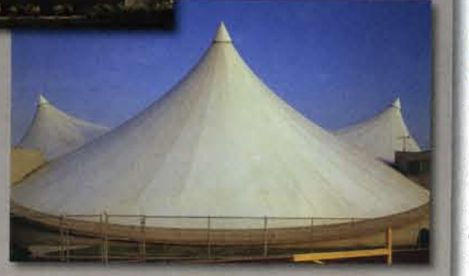
Fabric membrane roofing systems offer the energy-efficient benefits associated with cool roofing: high solar reflectance and thermal emittance, durability, natural daylighting, and reduction of building cooling. Fabric membranes filter the amount of sunlight entering a facility and effectively reduce the need for artificial light during the day. The roofing contributes to U.S. Green Building Council (Washington) LEED credits in the categories of insulation, green materials, daylighting, and innovation.

A recent expansion to the Strong National Museum of Play in Rochester, NY, demonstrates these energy-efficient benefits. The facility incorporated more than 4,000 sq. ft. of PTFE fiberglass membrane as roofing for the Dancing Wings Butterfly Garden. The unique structure stretches 30 ft. high and 50 ft. in diameter to form the architectural equivalent of a butterfly's wings.

The roof's high degree of translucency allows ample light to filter through the facility, significantly reducing costs for supplemental interior lighting. In addition, the fabric membrane reduces thermal gradient differences between developed and undeveloped areas of the building, known as the heat island effect, minimizing the impact on human and wildlife habitats. These features enabled the entire Strong National Museum of Play to earn LEED silver certification.



The Dancing Wings Butterfly Garden (left) is part of the National Museum of Play, Rochester, NY. It uses a PTFE fabric membrane and steel cable structure technologies. The architect was Macon Chaintreuil Jensen & Stark, Rochester, and the engineer Jensen Engineering, Rochester.



The Sports Science and Athletics Pavilion (nicknamed the Super Tents) at the Univ. of LaVerne, LaVerne, CA, (right) was the world's first permanent tensioned-membrane structure. It remains in good condition after 35 years.

Operational advantages

It used to be that to insulate tensioned membrane structures, contractors would first install a fabric membrane (which had no insulative value), and then install traditional insulative materials to block sunlight. A new product, Tensotherm with Nanogel, has changed that. The material insulates and permits daylight to pass through. It has two layers of fabric membrane on either side of a feather-light insulation layer that significantly enhances the material's thermal performance. The insulative Nanogel layer consists of aerogel with an air content of 95%, making it the lightest solid material in the world. This layer reduces solar heat gain in warm exterior conditions and retains warmer air in cold exterior conditions. The material's high degree of translucency allows the fabric to maintain its natural daylight-transmitting qualities.

Dedmon Center, a 5,000-seat multi-purpose athletic facility at Radford Univ., Radford, VA, is the first building to use the Tensotherm roofing system. The new roof replaced a single layer, air-supported fabric membrane roof. (The building re-opened in January 2009.) The insulated system has allowed the entire sports complex to be air conditioned. The roof regulates temperature inside the structure, while improving the internal environment and overall energy efficiency of the arena.

"From the outside, the roof is very similar to what was there before," said Roy Saville, the university's director of facilities planning and construction. "On the interior, the trusses now create a nice aesthetic with a unique focus."

Functionally, the Tensotherm system will contribute significantly to overall cost savings in mechanical systems and long-term operational cost reductions due to increased efficiency. The aerogel impedes the growth of mold, mildew, and fungus. In addition, the new roof enhances the building's acoustic performance by trapping noise to create an effective sound dampener.

Selecting a specialty contractor

The variety of long-term functional, aesthetic, and energy-efficient benefits that fabric membrane roofing offers makes it a wise choice for almost any commercial facility. It is important to choose an experienced contractor who is skilled in the design and installation of long-span roofing systems and tensile structures. Birdair is a contractor that offers full-service and warranty support throughout the lifecycle of the roofing system. The company's experience in working with LEED standards can help owners meet the most current LEED credit requirements. cbp

Michele Roth is marketing manager for Birdair Inc., Amherst, NY, a specialty contractor of lightweight, long-span roofing systems and tensile structures. The firm provides design-build solutions for architects and clients in all aspects of project design, engineering, installation, and maintenance.

For more information about tensioned fabric membrane roofs from Birdair, circle 3 or visit www.cbpmagazine.com