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Supporting Sustainable Design with Fabric Structures

Sustainable Design is not just a veneer applied to the design of buildings. It is a key ingredient in the design and construction process. Today Architects who design with green and sustainable building methodologies use the LEED Process (Leadership in Energy & Environmental Design) developed by the US Green Building Council. This reference guide affects a project from initial concept design through to test results on the energy systems of the completed facility.

Besides certain prerequisites, the LEED process uses a point based system which gives points to six different areas: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation & Design. Many of these areas while critical to the energy use and sustainability of a site do not directly engage the use of fabric structures, however several do. There are five areas that can use lightweight and fabric structures including the following:

1.Under Sustainable Sites, reducing the *heat island effect* on non-roofing (Credit 7.1) gives one credit if 30% of the of the site's non-roof impervious surfaces are shaded with light colored reflective materials. Light colored fabrics which are either mesh or solid can provide this reflectivity. Parking shade structures, walkway shade structures, covered plazas, shade structures at pools can all contribute to the necessary 30%. Many of these shade structures are being used presently as sun and hail protection and are available as off-the-shelf items from LSA manufacturers.

2. Under Sustainable Sites, reducing the light pollution (Credit 8) by shielding all the outdoor fixtures to meet IESNA full cutoff, gives one credit. Fabric has a wonderful lighting quality that is a "volumetric light" which is by nature very even and balanced. By using fabric as a lighting diffuser, low levels of lighting can be used. Backlit fabric by nature reduces glare and allows for a more even lighting and better perception. This translates as a strategy which can lower light levels while maintaining equivalent visibility.

3. Under Sustainable Sites, alternative fuel refueling stations (Credit 4.3) can give one credit if they consist of 3% of the total vehicle parking. Photovoltaic shade parking structures can serve as a structure for this credit. Some of these structures such as the ones we've designed, use PV's embedded into fabric structures to give energy to electric or hybrid cars (fig 1).

4. Another use of the PV fabric structures is under the category of Energy & Atmosphere where if you can use 5% of a building's total energy use through the use of renewable energy systems (Credit 2.1), you can receive one point. This can be PV system mounted on the roof, other parts of the building or free standing. Additional points are available for greater than 5% of the total energy use.

5. Under the final category, Innovation in Design (Credit 1), Architects are encouraged in using innovative sustainable new technologies. Here one can receive up to 4 points for strategies that have significant environmental impact and occupant benefits or strategies that exceed the requirements of existing LEED credits. Fabrics can be used as an excellent material in this category, however one needs understand the

environmental qualities of the site to know which type of fabric is best to use as an environmental tool. In hot dry climates where shade is critical, the open mesh materials shine (fig 2), while in wet and warm climates, solid fabrics with air movement are important to keep the rain off and allow a breeze to move through. In more northern cold climates, the clear and fritted ETFE foil cushions make the most sense as they provide a controllable solar gain and give insulation values comparable to glass panels and a reduced cost.

Another area where the industry is making some headway is in the recycling of PVC polyester fabrics. European suppliers such as Ferrari have developed recycling systems which separate the coating from the base fibers and reuse them in secondary markets. Although doesn't provide a cradle to grave cycle it is a closed loop system which reuses the fabric recycled into other products.

The LEED credits system creates opportunities for Architects to use fabric elements in their work which can be rewarded as points towards LEED certification. Until the fabric structure industry has an internal system for rating its own products, it remains for the consultants and manufacturers in this industry to help Architects use fabric elements in their sustainable design process.

The above article was written by Nicholas Goldsmith, Senior Principal of FTL Design Engineering Studio, New York, USA. It was published in UrbanLand, October 2005.