FORM FUNCTION FABRIC

Kate Fletcher of the Textile Environmental Network, looks at textiles as environmentally-considered building materials

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FABRICS have been giving shelter from the sun, wind and rain since ancient times – housing nomadic tribes and spanning a diameter of more than 150 metres at the Colosseum. A far cry from the days of the Roman Empire, the late 20th century is witnessing renewed interest in textile architecture, but how do textile fabrics used as building materials shape up on green criteria?

Normally restricted to garden party marquees or big tops, textile fabric structures are strong and lightweight, covering a maximum area with minimum materials. Doing 'more with less' – providing more shelter with fewer materials and components – brings environmental benefits, yet the use of structural fabrics in permanent buildings is rare – a surprise, bearing in mind the rich heritage of textile architecture, where the true origins of the wall are traced to woven fabrics; the earliest carpets acting as visible boundaries of space.

'Breaking out of the box' and designing buildings with fabrics creates a highly adaptable structure – an essential element of a durable and environmentally responsible building. Designing a permanent core which can easily be added to or taken away from allows 'a building to function as a living organism, growing and contracting in a truly flexible way.' Architectural fabrics are not only temporary additions to a building; they have an average lifespan of 15-20 years (comparable to materials used for flat roofing), but their low materials and energy intensity allows them to be replaced or reused at a relatively low environmental cost.

For the fabric membrane, traditional textile buildings use locally produced materials. The Romans favoured hemp cables and linen canvas; Bedouin tents rely on fabric woven from goat and camel hair and vegetable fibres; latter-day tensile structures, which can span distances almost twice that of the Colosseum, most commonly use a new generation of fabrics such as PVC-coated polyester and Teflon-coated glass fibre.

From an environmental point of view, the coatings and fibres are suspect. PVC emits dioxins and furans on incineration, and most famously is thought to be a hormone polluter – phthalates (the plasticisers in PVC) leak out of the plastic during use and disposal, contaminating land, water and entering the food chain. Polyester production emits methyl bromide – a greenhouse gas, Teflon used to be restricted in the UK for reasons of fire safety , and glass fibre is energy intensive in production. But the membranes bring a number of environmental benefits, ranging from resource savings due to high durability, to reduced maintenance costs from the coatings' self-cleaning properties. Natural fibre alternatives to these hi-tech, hi-performance fabrics – canvases made from cotton, linen or hemp – are heavier and also have to be treated (most effectively with synthetic coatings) to withstand weathering. While linen and hemp can both be grown organically in the UK and are considered to be environmentally sound raw materials, cotton cultivation consumes vast quantities of water and pesticides.

Thin fabric membranes have a huge surface area and experience large and rapid fluctuations in temperature. The fabric provides little thermal mass or insulation, so in order to optimise solar gains and minimise heat loss, combinations of fabric membranes can be used to trap insulating air between the layers. This fabric sandwich allows both heating and cooling; by switching the position of reflective or transmissive membrane layers relative to the sun, the tensile structure can act as either a solar collector or solar reflector.

The fabric's optical properties are crucial in determining heat loss and gain. They can diffuse sunlight, and act as a buffer zone, protecting adjacent spaces from external conditions. Fabrics can also filter harmful UV rays, blocking out up to 70 per cent of incoming UV light, and may eventually come with an SPF (sun protection factor) rating if technical textiles follow the lead taken by sun-protective clothing.

While only giving a brief description of the use of textiles as building materials, it is evident that fabrics can provide genuine, low-impact alternatives. Used in combination with more conventional materials and adaptive building designs, their thermal and light diffusing properties can be exploited. Fibres and fabrics in buildings are not only limited to tensile structures, they have long been used for insulation; from rag draught excluders, insulation materials now include baled flax (linen) straw and sheep's wool, the latter having high thermal properties and excellent fire resistance. So next time you think buildings and the environment, there is every reason to think fabrics too. ed