Press Information

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Composite Bridges

Bridge builders have always been a conservative bunch – and perhaps rightly so, given the loads that bridges have to bear and their importance to our social and economic life. However, a revolutionary new method of making bridges from environmentally-friendly composite material may well make town planners and architects rethink their concepts.

The oldest surviving bridges date back to the third century BC. Their basic arch design continued to be used in a pretty much unchanged form until the late 18th century, when industrialization and in particular the advent of the locomotive steam engine called for tougher bridges made out of iron and steel. Even so, masonry bridges were still being used well into 20th Century and well after the introduction of reinforced concrete, which initially were regarded with some distrust.

Resins to be cheerful

Fast forward to the present day, where bridge materials look set for another quantum leap into the future. Amazingly, an estimated 7% of global CO_2 emissions come from the making and use of concrete. Scientists in the Netherlands have proven that vast energy savings are possible if bridges are made of lightweight glass-fiber-reinforced composite resin instead of concrete or steel. Building a small 12-meter long traffic bridge using composite material instead of concrete would save 1300 gigajoules, and compared to a steel bridge the energy saved would even be 2700 gigajoules. This is a massive improvement, making resin 3-5 times more energy-efficient than conventional materials.

To put this into context: if Amsterdam, the Venice of Holland, were to use composite resin rather than other materials when replacing its 2000 bridges, the energy saving would be equivalent to the total annual energy bill of 310,000 households.

Composite bridges not only offer extreme energy savings compared to their concrete peers; they are also stronger and require less maintenance. And on top of that, the virtually unlimited design freedom offered by composite materials allows these bridges to also look great, opening up vast new possibilities for architects and town planners to improve the look and feel of the urban environment. Construction companies also benefit from the very low cost of installation compared to concrete: in the Netherlands, an entire road bridge was maneuvered into position in less than an hour.

Environmental benefits in the Middle East

Interestingly, the environmental benefits of composite bridges are even bigger in hot regions such as the Middle East. Concrete needs to be cooled to a moderate temperature before it can be used for building, and in a hot environment this is a hugely energy intensive process. But there is more. The tough climate conditions in this region attack conventional materials, reducing their life expectancy. Water is a scarce resource in the Middle East, and the use of salt water from the sea speeds up the corrosion process in reinforced concrete. Moreover, although sand is abundantly available in the Middle East, it cannot be used in concrete because of its rounded structure.

The Middle East is under pressure to introduce greener building practices. His Highness Sheikh Muhammad Bin Rashid Al-Maktoum, vice president and Prime Minister of the UAE and Ruler of Dubai, stated at the end of 2007 that all new buildings in the area would have to be built via green building programs. Composites could play an important role in such programs.

A business spanning continents

FiberCore Europe, a Netherlands-based bridge construction company, uses composite resin material provided by DSM, the global Life Sciences and Materials Sciences company. So far, bridges based on this concept have been built mainly in the Netherlands, a country with more than its fair share of bridges, although new installations are also being considered in China, where the fast deployment potential of composite resins is well suited to the rapid pace of economic development.

In the future composites will not only be used as an alternative material to conventional materials but will also be used in conjunction with conventional materials in a hybrid scenario. Bearing in mind that composites have in the past been considered as a cosmetic material and excluded from infrastructure, the growth potential is sensational. And so are the environmental benefits. It is expected that 20 years from now, around 20% of all bridges will feature composite materials.

With a number of multinational construction companies now looking seriously at switching to composite resin for their bridges, it may not be long before they are a fixture of the urban environment near you.

Milestones in bridge history:

3rd century BC – one of the first Roman stone bridges is completed.

1779 – The world's first cast iron bridge is built. **The Iron Bridge** spans 100ft (30m) over the River Severn at Coalbrookdale (UK).

1826 – One of the world's first road suspension bridges, **Cowny Suspension Bridge**, spans across Cowny River, Wales.

1889 – The world's first concrete reinforced bridge is built, setting the trend for many concrete bridges to follow.

2005 – The world's tallest bridge is completed – **Millau Viaduct** in Southern France.

Some bridge facts:

World's most famous bridges:
Sydney Harbour Bridge, Australia 1932
Golden Gate Bridge, US 1937
Humber Bridge, UK 1981

World's longest bridge
Danyang – Kunshan Grand Bridge, 164,800 meters

America's longest bridge
Lake Pontchartrain Causeway, 38,422 meters

Europe's longest bridge
Vasco da Gama Bridge, 17,185 meters