Balsa bridges, with a twist

October 19 2012, by Jan Overney

A bridge with a balsa wood core was built in Bex, Switzerland. The prefabricated bridge deck was mounted in a single day. Credit: 2012 EPFL - Alain Herzog

(Phys.org)—How much weight can a bridge made of balsa wood carry? When encased in a layer of fiber-reinforced resin, much more than you would expect, say engineers from EPFL. On October 12th, a composite bridge deck with a balsa wood core replaced an almost 100 year old concrete bridge in Bex, Switzerland. The new bridge, one lane wider than its predecessor and designed to last a century, was ready to carry traffic only a few days later, after having been covered by a layer of

asphalt. The road will, however, be closed for construction work until October 24.

Replacing the concrete deck with a composite one comes with several advantages. "Besides being lighter, this composite construction is not subject to corrosion, the main cause of deterioration of concrete structures," explains Thomas Keller from the Composite Construction Lab (CCLab) at EPFL. Prefabrication in a factory further increases its quality, improving safety and longevity, while speeding up the onsite installation.

The core of the composite deck is composed of a new balsa based product called Banova developed by the Swiss company 3A Composites, Keller's industrial partner handling the production of the prefabricated elements. "We may not have 100 years of experience working with this material, but drawing on 50 years of use in maritime construction as well as extensive accelerated ageing tests, we are confident that these structures perform just as well as concrete ones," says Sébastien Lavanchy of 3A Composites.

Credit: 2012 EPFL - Alain Herzog

Research at Keller's lab focused on improving the longevity of the composite elements. "At 3A Composites we built a first permanent balsa composite bridge deck using a similar approach in Louisiana in the United States in 2009, but including reinforcing composite webs within the structure," says Lavanchy. Since these webs could reduce the durability of the deck in the long run, the bridge in Bex was designed to meet the technical requirements without them.

Building a bridge in a day

In Bex, the deck was mounted in a single day. The entire replacement, which would normally take months, was achieved in weeks. Prefabrication of the lightweight elements makes such rapid installation possible. The three composite elements that make up the deck - 40

square meters each and only 30cm thick - were produced by 3A Composites in Altenrhein, Switzerland, before being transported across the country by truck. It took five days to assemble the structure at the construction site before its installation.

This composite technology has many potential applications. Throughout the country, bridges are being adapted to include cycling lanes and sidewalks. By using lightweight composite materials, bridges can be widened without strengthening the pillars the rest on. And when a bridge's support structure outlives its deck, the heavy concrete deck can be replaced with a light composite one, giving the support structures a second life.

While critics argue that the technology is still quite expensive, Thomas Keller says that, taken over the lifetime of the structure, the costs are comparable. "The total installation cost is competitive, and given that composite bridges are not subject to corrosion, increased durability further reduces maintenance costs."

The Bex bridge will serve as a test site to study the feasibility of this type of construction, and its suitability for other similar rehabilitations in the region. And while concrete bridges have come to dominate the landscape, this technology brings the wooden bridge back to life, albeit hidden beneath a modern skin.

Provided by Ecole Polytechnique Federale de Lausanne