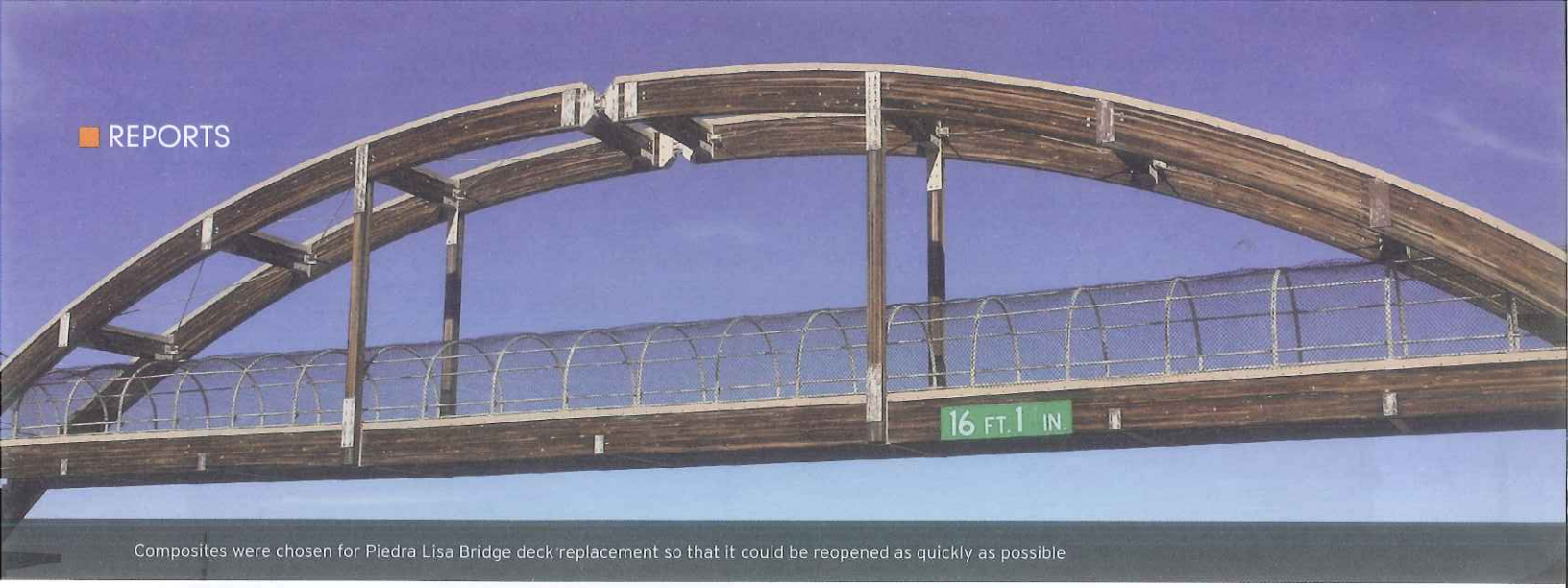


Composites were chosen for Piedra Lisa Bridge deck replacement so that it could be reopened as quickly as possible

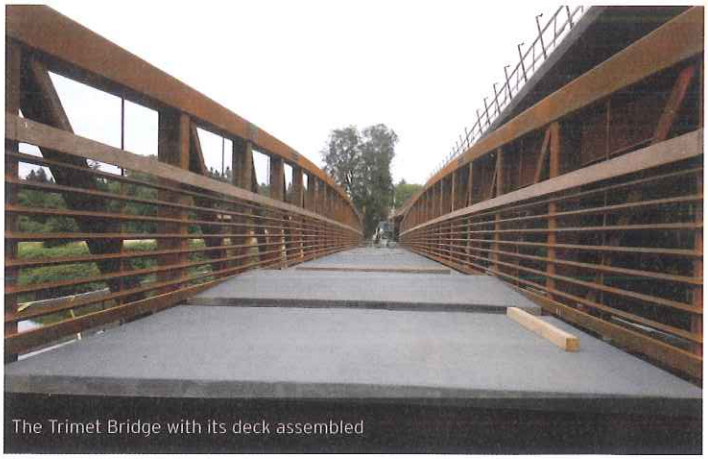
TRIM TRAIL

The expanding network of hiking and biking trails is offering opportunities for light weight, maintenance-free bridges such as those made of fibre-reinforced polymers

The growing popularity of hiking and other outdoor pursuits, along with demands that access to public land is opened up, are just two of the factors driving national governments around the world to improve recreational trails and accessibility. In the USA, for example, the Recreational Trails Program administered by the Department of Transportation's Federal Highway Administration, provided matching funds of more than US$68 million in 2012 for the development and maintenance of recreational trails and trail-related facilities. This funding has been reauthorised through the new fiscal year.

Southwest Ohio boasts the largest number of bike trails in the USA; more than 536km of trails intersect Ohio's cities and rural areas. Bridges to carry trails across highways, waterways or railways are a crucial component as the national network of scenic pathways continues its spread across state lines and into more remote areas.

The trend toward trail, urban and pedestrian bridges emerged some decades ago, says Jim Schneider, president of Trail-Works, but is continuing to pick up speed. "Our trail system in Ohio is expanding daily," he says. Activity in Ohio indicates potential for a stronger market for fibre-reinforced polymer composites, Schneider adds.



The Trimet Bridge with its deck assembled

His firm currently has open bids on projects that will add another 25km to the Miami Valley trail system, and Schneider says that the push for healthy recreation and a growing awareness of green activities that support a lighter environmental footprint make FRP a good fit for trail bridge applications. But he also adds that cost is now making FRP structures more attractive.

"The easy fruit has been picked," says Schneider. "Bridge projects are becoming a little more difficult and greater difficulty means higher costs. Agencies are looking for ways to cut total costs and FRP composite bridges offer an alternative because they last longer than steel or wood and require virtually no maintenance."

Specialist manufacturer Composite Advantage prefabricates its FRP bridge structures in the factory to include features like curves, drainage scuppers and railing systems. "The customer receives a nearly-finished product at the work site for faster, easier installation," says president Scott Reeve. "Construction time is reduced and the amount of time the bridge is closed to the public is significantly shorter."

This year the company has introduced a range of new trail bridge and bridge deck products under its Fiberspan brand. It is able to fabricate FRP structures to any size or shape but also offers trail bridge owners standard products that include pedestrian bridge decks, trail bridges up to 12m and pedestrian bridges from 12m to 30m.

"FRP is a good fit because it is 80% lighter than concrete structures," says Reeves. "Lighter weight is especially desirable when FRP decking is used on long-span steel truss bridges because it allows the entire bridge to be fully assembled on-site and lifted into place." The fibreglass sandwich construction is engineered for reinforcement, strength and stiffness. Polymers protect the fibres from extreme environmental conditions, fresh water, salt water and chemicals. "Because our structures don't degrade, they have an expected life of 75 years," Reeve says. "Eliminating maintenance alleviates a huge cost for agencies that don't have deep pockets."

The manufacturer's trail and pedestrian bridge technology is also helping owners overcome another obstacle. "Agencies need material that can carry required load weights," says Schneider. "Composite Advantage was able to demonstrate this with a local project using an FRP deck on steel beams. As load specifications are consistently met, use of composites will grow, especially as DOTs recognise the cost benefits associated with these types of structures."

Bridge owners in a number of states have sourced FRP structures to solve different problems. Trimet provides bus, light rail and commuter rail transit services in the Portland, Oregon, metro area. The Portland-Milwaukie Light Rail Transit Project which was first initiated in 2008 aims to expand transit access and make improvements to bicycle and pedestrian facilities. As part of this US$1.5 billion project, Trimet needed a lightweight solution for its new Kellogg Lake pedestrian bridge that could provide fast installation and reduce steel truss costs.

"The bridge owner wanted a clear span bridge with no intermediate support, weathering steel and a solid deck," says David Rogers, vice president engineering for supplier Big R Bridge. "Concrete was initially specified for the deck," he adds. "Due to the bridge's 71m-length, we were already maxed out on the outer dimension and wall

Trail bridges such as this one at Beaver Creek are seeing an increased use of advanced composites

thickness for hollow structural section steel tubing that we could source from a US mill. The tubing, 305mm by 305mm OD and 13mm thick, couldn't support the weight of a concrete deck and still meet a clear span bridge requirement of that length."

Big R Bridge quoted the project with an FRP composite deck instead. "FRP composite material allows you to achieve longer lengths with clear span bridge construction than you could traditionally get with a concrete deck," Rogers says. Big R Bridge sourced a Fiberspan deck from Composite Advantage which shipped it in seven sections. Big R Bridge's factory assembled a portion of the FRP panels with the weathering HSS truss sections before transporting it to heavy civil contractor Stacy & Witbeck. "In this case, FRP composite material was the right answer," Rogers says.

Reeve notes that final installation of the bridge decked out with Fiberspan is under way. "We expect it to be completed this month," he adds.

In Albuquerque, New Mexico, FRP's capability to provide fast installation gave the DOT a quick fix solution when the Piedra Lisa pedestrian bridge crossing Tramway Road burned in 2013. Part of the Sandia mountains trail system, the Piedra Lisa bridge is heavily travelled by pedestrians, bicyclists and rollerbladers. "You would be surprised how many people use this bridge," says NMDOT project manager Emiliano Martinez. "We wanted to minimise the amount of time the bridge was closed so we needed input on the best way to repair the structure as quickly as possible."

The NMDOT consulted with the original bridge design engineer who suggested FRP. "We also wanted to reduce maintenance costs," says Martinez. "The long life-cycle of FRP composite material was a big selling point for us."

Composite Advantage's Fiberspan pedestrian bridge deck product was sourced with a non-slip wear surface and a custom beige colour to blend seamlessly with the glulam wood understructure and the scenic surroundings. "The wear surface gave us just the right amount of rough texturing needed to meet accessibility requirements and prevent the bridge deck from becoming slick," Martinez says.

FRP panels 9m by 2.4m wide were used to span pier to pier at each end of the bridge's approach. "Accessing the bridge itself required a long approach made up of seven landings and seven spans," Reeve explains. "FRP panels were used for the ramps themselves and covered with a non-slip surface. Fabricating these long composite panels also minimised the number of transitions pedestrians and individuals in wheelchairs had to negotiate."

The FRP panels for the overpass section were 2.1m by 2.4m "Since this was an arched bridge, large FRP panels could not be inserted by a crane from above," Reeve notes.

For the NMDOT, the light weight of the FRP panels made installation efficient and cost effective. "A forklift would pick up a bridge deck panel and move it up the approach to the bridge opening where a handful of guys would lift it, walk it onto PVC pipes and roll it into place," Martinez says. "The deck was then connected to the glulam beams with purlins. It was so much easier handling these panels versus other types of more conventional material. Because of the FRP deck's quick installation we were able to open the bridge on schedule." Installation was completed May 2014

Bridge Design

SOFiSTiK
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QUEENSFERRY CROSSING

Client: Transport Scotland
Contractor: Forth Crossing Bridge Constructors

Project Development: Arup, Jacobs Engineering UK
Design Joint Venture:
Gifford · Grontmij · Leonhardt, Andrä und Partner · RAMBOLL
Independent Checker: AECOM, Scott Wilson

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