HOW TO BUILD A BETTER BRIDGE

Carbon fiber technique could bring jobs to Mich.

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The Pembroke Avenue overpass will look like other any other new highway span in metro Detroit when it reopens this fall, but it will be part of an experiment to build bridges that last twice as long as they do now.

If it works, it could lead to new industry and jobs in Michigan and cut the long-term costs of bridge upkeep.

The bridge, one of 24 being replaced or repaired as part of the $800-million upgrade of the Southfield Freeway, will use carbon fiber to reinforce and strengthen its concrete.

The plastic-like carbon fiber doesn’t rust like steel and could increase the life span of bridges to 800 years.

The bridge design is the brainchild of Nabil Grace, dean of engineering at Lawrence Technological University, who has received more than $15 million in grants during the last decade for his research in uses of carbon fiber.

About 28% of the nation’s 600,000 bridges are in poor shape, according to the American Society of Civil Engineers.

If the Pembroke bridge proves to be a success, it could mean big things for Lawrence Tech, for Michigan — and for U.S. infrastructure.

But for now, Grace said, “the bottom line is to create bridges that last much longer.”

Nabil Grace, dean of engineering at Lawrence Technological University in Southfield, shows a sample of carbon fiber. The material is used as a steel substitute for concrete beams in bridge construction.

Carbon fiber could double the life span of bridges
Use of super-strength material could be boost for Mich.

The black strands of carbon fiber are thinner than hair, but when woven into rods and cables, Nabil Grace said, they are stronger and lighter than steel — and they don’t rust.

The Lawrence Technological University professor contends that carbon fiber — a petroleum-based super-strength plastic material used in products ranging from cars and bicycles to golf clubs and fishing rods — can replace steel in bridges, doubling their life span to 100 years.

The Michigan Department of Transportation is giving Grace’s designs a try this summer in a new expressway overpass on the Southfield Freeway.

If it proves more durable than steel — and its prices come down with more widespread use — Grace said he hopes carbon fiber will transform bridge construction nationwide and save taxpayers money in reduced maintenance and repair costs.

Concrete reinforced with the high-tech fiber will be used to rebuild the Pembroke Avenue overpass in Detroit, one of 24 bridges the state will upgrade as it reconstructs 9 miles of the Southfield Freeway this summer in Wayne and Oakland counties.

The bridge, which tentatively will close from late April to late August, was selected because it is smaller and carries less traffic than other nearby overpasses, so long-term monitoring and inspections will be less disruptive to drivers.

Built-in electronic sensors will track the wear and tear on the bridge for at least several years, measuring how well the new material helps delay inevitable deterioration brought on by weather and corrosive road salt.

Technology looks promising

Grace, dean of engineering at Lawrence Tech, said the outlook is promising, and his study of uses of carbon fiber has attracted more than $15 million in grants from federal military and transportation budgets, the National Science Foundation and Michigan Economic Development Corp.

Widespread use of carbon fiber could lead to new industry and jobs in Michigan potentially with manufacturers making the material in the state — and money and prestige for Lawrence Tech, Grace said.

Carbon fiber strands are used in the test bridge, which features Decked Bull T-Beam technology.

The Michigan Infrastructure and Transportation Association estimates that 28% of Michigan’s more than 10,000 bridges are in poor condition, either functionally obsolete or structurally deficient. MDOT plans to spend about $325 million through 2015 fixing and replacing bridges.

The MEDC is watching the developments. The agency provided a $600,000 grant for Grace’s research in 2006 in hopes it might spur new industry and job growth, said Antoinio Łoś, project manager at the MEDC’s 21st Century Jobs Fund.

The Pembroke overpass will be the second bridge in metro Detroit to be built with Grace’s designs. The first was the Bridge Street bridge over the Rouge River in Southfield, built a decade ago with traditional steel in one direction and carbon fiber on the other.

Grace said both sides are holding up well.

Because the ultimate measure of durability is reduced long-term corrosion, it will be years before fuller results are known, Chynoweth said.

Grace noted that hundreds of freeway overpasses in metro Detroit have plywood beneath them to prevent crumbling concrete from falling onto traffic.

That happened in spectacular fashion during a morning rush hour in 2007, when concrete chunks rained down from the Groove Road overpass above I-94 in Warren. No one was hurt. The state repaired the bridge and plans to replace it this summer.

“Sometimes you wonder if we are in the United States or somewhere else,” Grace said.

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