AOC®
World Leader in Resin Technology

CASE HISTORY

Low-Cost Bridges

Market Segments:	Construction Infrastructure
Composite Applications:	Bridge Deck
Resin:	Vipel® F701 Isophthalic Polyester
Manufacturing Process:	Hand Lay-up
Length:	23.25 feet long by 27 feet wide (7.1 by 8.2 meters)
Installed:	1996
Location:	Russell, Kansas

KSCI manufactures composite bridge components with AOC's Vipel® F701 Isophthalic Polyester resin.

A composite bridge installed in the autumn of 1996 is still serving the people of Russell County, Kansas, USA. The bridge uses an ingenious design that optimizes the ability to engineer fiber-reinforced polymer (FRP) composites into an efficient structural system. The design results in a bridge that weighs about 20% less and cost almost 50% less than other composite bridges meeting the same American Association of State Highway and Transportation Officials (AASHTO) requirements, says Russ Ricker, of Kansas Structural Composites Inc. (KSCI).

The effectiveness of the design helped KSCI earn a grant from the National Academy of Sciences to help build the Russell County structure as a demonstration. Since then KSCI has used the proven design to build bridges and bridge decks for installations in Missouri, New York and West Virginia as well as other locations in Kansas.

KSCI's design efficiency is based on a composite construction that sandwiches a core with a sine wave cross section between two flat facing panels. The pattern is

similar to the way cardboard uses corrugation to provide higher stiffness with less material. The big difference with KSCI is that high strength engineered composites are used instead of paperboard.

Most KSCI bridges and decks come with a wear surface made of polymer concrete, a mixture of thermoset resin and aggregate. The aggregate specifications are provided by the state or local authority who orders the bridge. Compared to conventional Portland cement concrete or asphalt surfaces, polymer concrete has higher elongation, greater impact and abrasion resistance, and longer service life. KSCI manufactures composite bridge components by hand laying resin-impregnated fiberglass materials in an open mold. When the liquid resin cures into a solid state, FRP composite is formed in the shape of the mold. The reinforcements are chopped strand mat for the sinusoidal core and a combination of chopped strand mat and bidirectional fabrics for the flat panels. The resin and reinforcements are supplied by the Kansas City location of distributor Composites One.

Right from the start with the demonstration bridge, KSCI bridge components have been manufactured using thermoset resins from AOC. "For the demonstration project, we used three different AOC resins," Ricker says. "One resin was for the core and face panels, another wasfor bonding cores and face panels together, and the third was for the polymer concrete. As we gained more experience, we've gone to a single resin - Vipel® F701 - to get a very good combination of processability, performance and value."

Integral System

To create an integral system, KCSI eliminates the need for an adhesive by wet-laminating the Vipel F701 resin-impregnated cores and facing panels to each other. System integration is further enhanced by using the Vipel resin for the polymer concrete as well as the composite components.

"For the demonstration project, we used three different AOC resins," Ricker says. "One resin was for the core and face panels, another wasfor bonding cores and face panels together, and the third was for the polymer concrete. As we gained more experience, we've gone to a single resin - Vipel® F701 - to get a very good combination of processability, performance and value."

Russ Ricker, Kansas Structural Composites Inc.

"Vipel F701 series resins are high molecular weight isophthalic unsaturated polyesters, says AOC Business Manager Emilio Oramas. "For the composite manufacturer, Vipel F701 resins help build to a high quality structure by providing the excellent wet out, cure and handing characteristics of a general purpose resin. For the highway engineer, Vipel F701 offers excellent corrosion resistance, high elongation and long-term durability."

KSCI uses Vipel F701 to make a range of bridges and bridge deck components. The Russell County bridge was 23.25 feet long by 27 feet wide (7.1 by 8.2 meters). It served as the prototype for KSCI's rapid, low-cost replacement structure for failed bridges and culverts over short spans. KSCI's longest self-spanning unit to date is 32 feet (9.8 meters) long. The design is also adapted to make bridge deck modules. The largest use of the KSCI structures for this purpose is a 150 feet long by 36 feet wide (45.7 by 11 meters) bridge that uses 40 composite decks. The deck modules are bolted together.

KSCI bridges and decks are strong enough for vehicular traffic yet lightweight enough to allow major sections to be factory-built and shipped to the site on a flatbed trailer. Installation of KSCI structures on properly prepared foundations is similar to that of prestressed concrete panels. However, because the composite is lighter weight, smaller cranes can be used and installation is quicker and easier.

About KSCI

Kansas Structural Composites, Inc is a first-rate manufacturer of high strength, cost-effective FRP composites for civil infrastructure and other applications. KSCI has the capability to manufacture bridge and deck structures with an L/D of 800 and an AAHSTO HS25 load rating. For more information, contact Russ Ricker, Kansas Structural Composites Inc., 2649 E. Wichita, Russell, KS 67665, USA. Phone (785) 483-2589; fax (785) 483-5321, e-mail: ksci@ksci.com.

About AOC

AOC is a leading global supplier of resins, gelcoats, colorants, additives and synergistic systems for composites and cast polymers. AOC knows technology, lives quality and delivers service better than any other resin supplier. For more information regarding corrosion resins, e-mail corrosionresins@aoc-resins.com, phone (901) 854-2800 or go to www.CorrosionResins.com.

Vipel® CORROSION RESISTANT RESINS