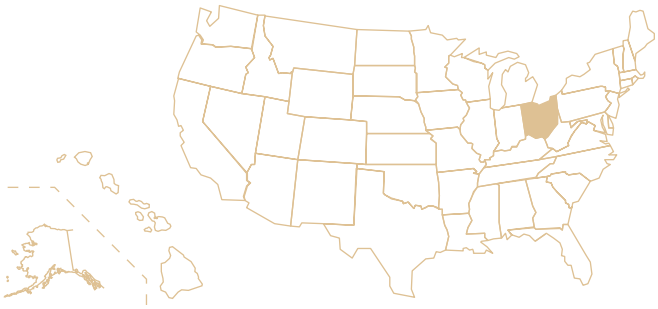
OHIO BUILDS BETTER BRIDGES



The three sets of bridges along U.S. 23 south of Waverly —crossing the flood plain of the Scioto River— are typical of tens of thousands of **reinforced concrete slabs** that span our country's creeks, roads, railroad tracks, and swales, making them one of America's true "bread-and-butter" bridge types.

Two of the original U.S. 23 bridges were comprised of a total of 80 continuous reinforced concrete slab bridges, each spanning 25 or 26 feet, supported on cast-in-place concrete pile bents. The third was a 98-foot-long steel girder span over Pee Pee Creek.

With the exception of some slab edge deterioration, the original reinforced concrete bridges —built in 1939 (northbound) and 1953 (southbound)— were in reasonably good condition. However, the steel girder section over Pee Pee Creek had structurally deteriorated and the entire segment of U.S. 23 needed to be widened from 33 feet to 42 feet.

Therefore, the Ohio Department of Transportation (ODOT) decided to replace the entire superstructure —including the steel bridge— with new cast-in-place reinforced concrete slabs built at the site. A new pier was also built to shorten the span over Pee Pee Creek.

Advances in reinforced concrete technology —including the use of high-performance concrete— in combination with proven technologies such as epoxy-coating of reinforcing steel, are continually enabling bridge engineers to create stronger, more durable bridges able to withstand the harsh conditions that bridges so typically endure.

"Instead of relying on ODOT's standard slab bridge design, we incorporated 4,500 psi concrete and 60 ksi steel. "

— David Jones, P.E., Jones-Stuckey Ltd.

"We're building extra durability into all of our bridges now. We believe that high-performance concrete in combination with epoxy-coated reinforcing steel will reduce maintenance and greatly increase the lifespan of our bridges."

— Lawrence Wills, P.E.,
ODOT Bridge and Pavement
Design Engineer

Pee Pee Creek Flood Plain Bridges

Owner:	***Ohio Dept. of Transportation District 9, Chillicothe, Ohio***
Engineer:	***Jones-Stuckey Ltd., Inc. Columbus, Ohio***
Contractor:	***C.J. Mahan Grove City, Ohio***

Reinforced Concrete Slab Bridges

A cast-in-place reinforced concrete slab bridge is still one of the most economical and easily constructed bridges that exist today. Concrete slab type bridges have no beams under the deck, but instead utilize the longitudinal reinforcing steel in the relatively thick concrete deck slab to carry the loads.

Reinforced concrete slabs are suitable for spans of 20 to 60 feet in length with conventional strength concretes, longer with higher strengths. Slab bridges have a lower profile (vertical thickness) than deck-and-beam bridges, allowing more hydraulic clearance for flood conditions and more vehicle clearance underneath. Concrete slabs can be formed into almost any shape to accommodate changing road geometries and are easily supported on simple foundations.

Concrete slabs are also relatively easy to maintain, but it's of primary importance to keep chlorides and moisture from reaching the reinforcing steel. That's why using high-performance concrete and epoxy coated reinforcing steel are considered so effective in improving the longevity of a slab bridge.

CRSI UPDATING DESIGN TOOLS

"We used CRSI's slab design software (SLABBRDG v1.2) to design the three sets of Scioto River flood plain bridges," says David Jones, P.E., manager of Jones-Stuckey Ltd.'s Structural Section. By using CRSI's software, we were able to justify reducing the slab thickness, thereby making the design more economical."

CRSI is developing an updated version of v2.0 SLABBRDG, the popular software for designing simple and continuous span reinforced concrete slab bridges. SLABBRDG will become a more powerful tool that enables engineers to select the most economical slab bridge configuration quickly and easily.

The updated SLABBRDG v2.0 will allow engineers to work in both english and metric units. It will also incorporate AASHTO's (American Association of State Highway and Transportation Officials) new Load and Resistance Factor Design (LRFD) standards.

SLABBRDG v2.0 will be available from CRSI in early 2002.

Density for Durability

Concrete has always been famous for its bridge-building abilities: strength, durability, versatility, and aesthetics. But high-performance concrete makes a good thing even better.

ODOT has specified the use of high-performance concrete in their bridges since the early 1990s. ODOT's "Mix 4" contains 440 pounds of cement, 190 pounds of ground granulated blast furnace slag, and 30 pounds of microsilica.

Along with a low water/cement ratio, a concrete compressive strength of 4,500 psi or higher is achieved. "It's the Cadillac of concrete for bridge decks," says Jim Barnhart, with the Ohio Ready Mixed Concrete Association and formerly a senior bridge engineer with ODOT.

Cement has the consistency of flour. Microsilica is 100 times finer, filling in the micro-voids within the concrete mix and creating a much denser, less permeable product. Superplasticisers are often added to improve workability, instead of additional water.

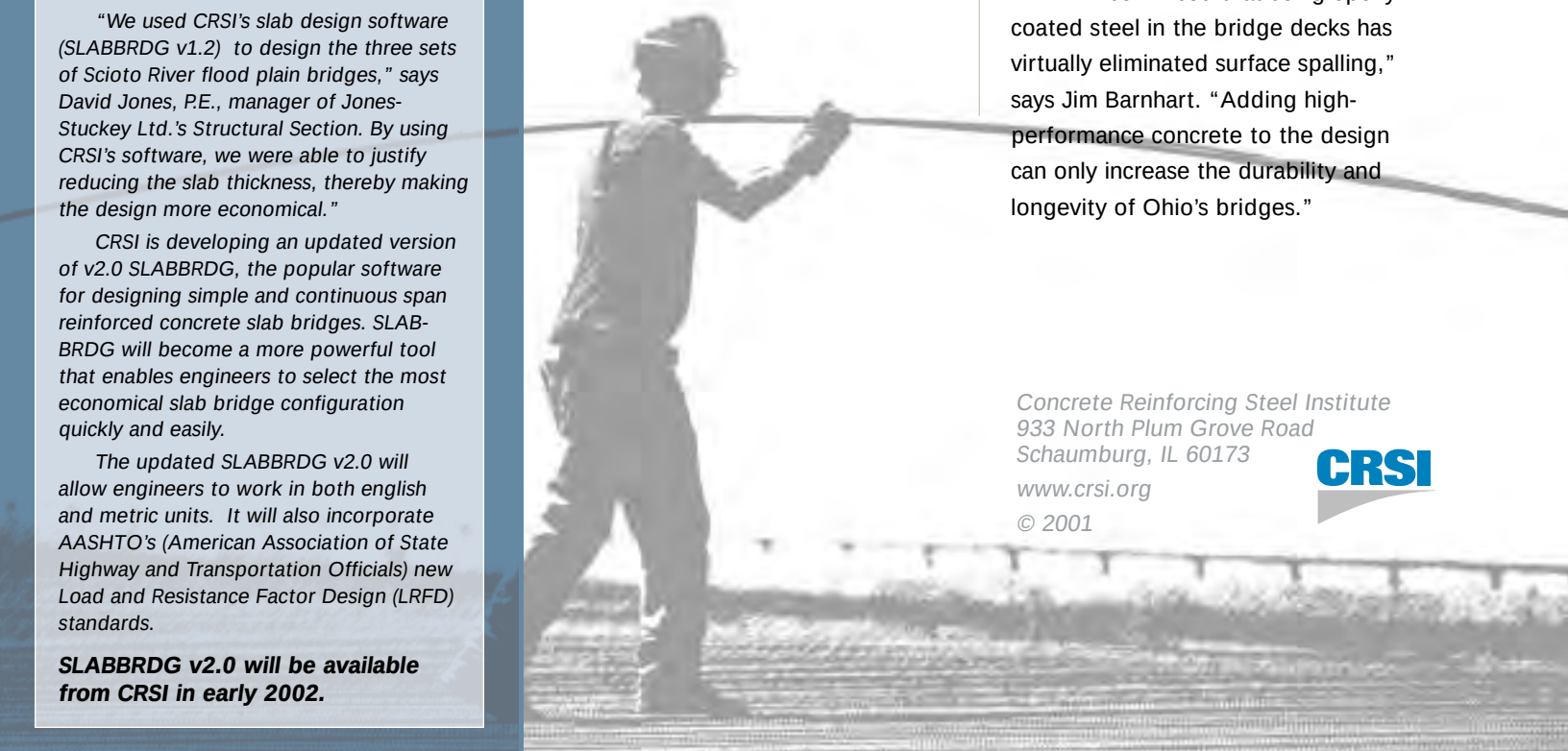
The lower permeability of high-performance concrete reduces the chance for water and road salt infiltration that can ultimately damage the reinforcing steel. High-performance concrete is also stronger, giving slab bridge designers options: longer spans, fewer supports, or shallower sections. The slab thicknesses for the bridges range from 17 to 26 inches.

Coating for Corrosion Protection

ODOT's routine use of epoxy-coated reinforcing steel in all of its bridges —superstructure and substructure combined— started in the mid-1970s in response to chronic problems with reinforcing steel corrosion caused by chloride ion infiltration.

But Ohio now has over 25 years of experience with epoxy-coated reinforcing steel and none of the bridges built with epoxy-coated reinforcing steel have experienced any of the typical problems associated with steel corrosion.

"I'm convinced that using epoxy coated steel in the bridge decks has virtually eliminated surface spalling," says Jim Barnhart. "Adding high-performance concrete to the design can only increase the durability and longevity of Ohio's bridges."



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