

## ***INTRODUCTION:***

Bridge 9 on Smith Bridge Road was an innovative and historic project. Becoming only the third covered bridge still active in Delaware, its design was meant to replicate the original bridge first built in 1839 and destroyed by arson in 1961.

The final design was also a cooperation between the State Department of Transportation and the citizens of Centerville. They're decision to forego a standard bridge in lieu of a covered bridge combines the best of historic preservation and modern engineering and construction.

Issued by DelDOT for bid in March of 2002, the \$1.2 million contract involved the complete removal and construction of a new 145-foot span over Brandywine Creek, repair of the abutments and piers, and major reconstruction of the roadway approaches to provide safe visibility and traffic control.

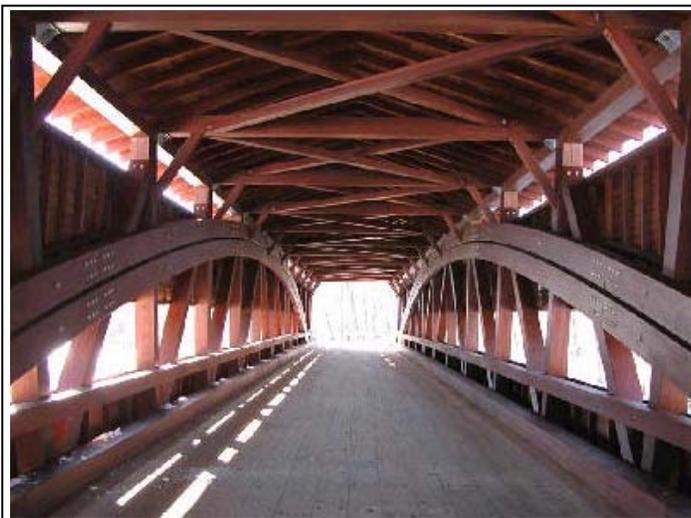


## ***DESIGN AND CRAFTSMANSHIP:***

The most striking part of the new Smith Bridge is the carpentry and lumber work involved in its construction. The timberwork is exceptional both in design and assembly. The project designer was Department of Transportation engineer, Calvin Webber.

To summarize his design, the bridge itself is basically two separate and independent structures. The first structure is the flat deck, which is designed to carry traffic loading. The second structure is two wood truss systems that support the walls and roof of the covered bridge.

Although this system is drastically different from the original bridge of 1839, it does allow for a number of advantages. First, the deck structure can be easily and economically built to support modern highway loading. This was accomplished with five steel I-beams spanning the entire 145-foot



length and supported by each abutment and the two existing center piers. Wood decking over the steel beams keeps with the look and feel of the original bridge design. Second, the arch truss structure, which only supports minor loads, can be more easily designed to match the aesthetic look of the original bridge.

To accomplish construction of such an intricate and large timber structure, it was important to find a qualified subcontractor to complete the work. During the bidding phase of the project, there were numerous companies attempting to sell the wood material required, but very few companies

that specialize in the detailed fabrication and carpentry work necessary for installation. The company selected was Pocopson Industries, Inc.

Pocopson Industries had a number of advantages over its competitors. Primarily, they were close to the project, with their office and wood shop only 15 miles from the project site in Pennsylvania. Second, this proximity allowed them to perform all the installation work with their own forces. Third, they offered an extremely modern and highly technical machine shop to design, cut and fabricate all the individual pieces of lumber required during assembly of the bridge.



The importance of the machine shop was vital in this case because of the choice of lumber material DELDOT selected for this project: an exotic wood called Bongossi.

### *INNOVATION IN CONSTRUCTION TECHNIQUES AND MATERIALS:*

Bongossi is a native lumber of the West African tropical rain forest. It is extremely expensive and rare but offers very unique qualities that make it ideal for the construction of Smith Bridge. It is an extremely dense and strong material. For comparison, bongassi wood is twice as dense as oak. Bongassi lumber is also naturally resistant to decay, insects and fire. This natural fire resistance is an important consideration since the original covered bridge was the victim of arson.

However, these advantages can become disadvantages during construction. After final shop drawing approval, ordering and receiving rough cut material took between 12-16 weeks. After receipt, each piece of rough lumber was sent through the machine shop to be robotically cut and drilled for assembly.

The heavy, dense material also presented challenges on site. First, the added weight of this type of lumber caused the use of exceptionally large cranes during construction. During the placement of the prefabricated truss pieces, a 500-ton crane was needed. Only two cranes of this size currently operate in the mid-Atlantic region, so schedule and coordination were vital. Contributing to the need for such a large crane was an engineer imposed restriction line behind the existing abutments which no crane could be used. This restriction line was meant to prevent heavy loads from damaging or moving the existing abutments, however, it also added over 30 feet to the distance the load was away from the crane.



Another reason the Bongassi wood presented challenges during construction was the difficulty to complete on-site carpentry work. Sawing and drilling the material with normal tools was impossible. Heavy-duty drill bits and saw blades were experimented with to see which blades performed the best with this unique material.

### ***EXCELLENCE IN PROJECT TEAMWORK:***

Even before our involvement as the project contractor, the teamwork for this project was evident. This was especially true between the State of Delaware and the Centerville Civic Association. Their communication and discussion changed the design of the bridge from a standard two-lane span to the beautiful and historic landmark that was finally constructed.



This open dialogue was part of the project as soon as Eastern States Construction joined the construction team. The lead DELDOT designer frequently visited the project site and was open to questions and ideas during construction. Local residents were cooperative with the bridge closure and showed much respect and interest with the work and our crews.

Our responsibility to coordinate the many subcontractors during construction became paramount to getting the project complete on time and budget. We made sure local utility companies had access to move and relocate utilities. Our effort emphasized getting each trade into the project before Pocopson Industries began the timber work. It was vital to the project schedule to allow the bridge work to take precedence over the minor trades required on each side of the bridge. This often meant rescheduling of trade contractors or activities.

Also as final completion of the bridge took place, coordinating other subcontracted trades like roofing, painting and utility work on the bridge was required.



### ***MEETING THE CHALLENGES OF A DIFFICULT JOB:***

The prime concern of our work involved the unknown factors during the timber construction. Even as work started on-site, the delivery date of the bongassi material was unknown. It was also unclear how long assembly of the structure would take. The team of contractors involved had little experience with covered bridges.

The first challenge was to quickly proceed through the preparation for the bridge. We aggressively scheduled the work activities in the first two months of the project with the intent to devote as much of the 136-calendar day schedule to the bridge erection. Major work items included demolition, utility work, abutment and pier repair, reconstruction of the roadways leading towards the bridge and the placement of new structural steel beams. During these activities it was also difficult because each work zone (each side of the bridge) was segregated. Getting materials or equipment from one side of the bridge to the other was a major undertaking.

When the deck was finally constructed and access was more available to both sides of the bridge, we started the lumber construction.

During preconstruction meetings with Pocopson Industries, it was evident some method of access to the outside of the bridge was necessary. Work over the Brandywine Creek was dangerous and difficult. It was agreed to add a scaffolding system to the outside of the bridge during construction. Supported by the steel beam under the bridge, the scaffolding supported work for the lumber, paint and roofing subcontractors. In fact this support system was not finally removed until two days before turning the bridge over to DELDOT for use.



### ***CONCLUSION:***

In total, the \$1.2 million project was completed on budget between August and December 2002. The grand opening, which involved the Governor, Secretary of Transportation and almost one thousand visitors, was held on January 11, 2003.

Smith Bridge will forever be recognized as a historic structure built with progressive ideas and cooperation between the State and its citizens. The decision to rebuild the covered bridge represents a dedication by the Department of Transportation to the historic preservation of Delaware.

It was an honor for Eastern States Construction to be part of such an interesting and unique construction effort. The challenges Smith Bridge presented provided a great opportunity to reveal our exceptional qualities as contractors. With the cooperation of those involved, we helped build a landmark that many future generations can enjoy.

**2003  
CONSTRUCTION  
EXCELLENCE  
AWARD**

*Smith Bridge  
Brandywine Creek  
Delaware*



Photos by Leslie W. Kipp

**SUBMITTED BY:**

**EASTERN STATES  
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