

### Amish Sawmill Bridge: An Innovative Steel Solution for Short Span Bridge Design

#### Project Overview

Visitors traveling near Fairbank, Iowa take a step back in time as they pass by large farms and horse-drawn buggies operated by the area's large Amish population. At 1358 Dillon Avenue, they cross an unnamed creek via the Amish Sawmill Bridge. Newly constructed, this structure is the first of its kind in the United States and considered by experts to be the future of short span steel bridge design.



Built in 1966, the Amish Sawmill Bridge was deemed structurally deficient and functionally obsolete.

#### A New, Cost-Effective Solution

Prior to the summer of 2015, the Amish Sawmill Bridge was a 24-foot by 30-foot timber structure with full concrete abutments and pier built in 1966 on the abutments from a prior bridge. Deemed structurally deficient and functionally obsolete by certified bridge inspectors, it was one of several bridges slated for replacement by Buchanan County, Iowa Engineer Brian Keierleber, P.E. and his team.

Through his involvement in the Short Span Steel Bridge Alliance (SSSBA), Keierleber learned about a new technology being developed for short span bridges (defined as 140 feet or less) that incorporated press-brake-formed steel tub girders and met the requirements for the Federal Highway Administration's (FHWA) Innovative Bridge Research and Deployment (IBRD) program. In 2014, he applied for the \$350,000 IBRD grant to replace the Amish Sawmill Bridge and received it on the basis of using a trapezoidal



The new structure includes GRS abutments with a sheet piling face.

bent steel girder section supported on Geosynthetic Reinforced Soil (GRS).

The project included the construction of GRS abutments (which accelerates construction) with a sheet piling face and the placement of trapezoidal bent plate beams on the abutments. Stay-in-place forms were used prior to casting a deck in place. Local contractors were presented with different composite deck options for the bridge. The winning bid elected to utilize a cast-in-place option.

Construction on the Amish Sawmill Bridge began in late summer 2015 and was completed in December 2015. A local crew was not used since it was federally funded, but Keierleber notes: “The beauty of this project is that even though we were working with a new technology, no special expertise was required—it was standard bridge construction which could be undertaken by a local crew.”

The design was a collaborative effort between the SSSBA, the Iowa Department of Transportation and Buchanan County, Iowa. The bridge was built by Taylor Construction Inc. of New Vienna, Iowa. Funding was provided through the IBRD grant and supplemented by Buchanan County.



The new Amish Sawmill Bridge is the first press-brake-formed steel tub girder bridge constructed in the United States. Additional projects are in the planning stages in Ohio and West Virginia.

Brian Keierleber oversaw all aspects of the construction and installation of the new bridge, which is 52 feet long and 30 feet wide, and is pleased with the results. “We’re always looking for ways to cut costs because we have limited funding and lots of short span bridges that need replacing,” he said. “Some of

the bridges in Buchanan County were in service when General Custer was alive, and we've had instances where they've collapsed under the weight of farm equipment. Press-brake-formed steel tub girder bridges offer us a durable and very cost-effective solution to meet our increasing transportation demands."



The new bridge was dedicated on a snowy January 8, 2016.

The Amish Sawmill Bridge was dedicated on January 8, 2016, with several local and state legislators and media representatives present to witness bridge history.

### **About Press-Brake-Formed Steel Tub Girder Technology**

The press-brake-formed tub girder system consists of modular shallow



trapezoidal boxes fabricated from cold-bent structural steel plate. Steel shapes are available in either hot-dipped galvanized or weathering steel options. Once the plate has been formed, shear studs are then welded to the top flanges. A reinforced concrete deck is then cast on the girder in the fabrication shop and allowed to cure, becoming a

composite modular unit. Modules are then longitudinally joined using Ultra-High Performance Concrete (UHPC), a relatively new class of advanced cementitious composite materials.

The system offers several advantages over traditional short span steel bridge



solutions. The girder itself, which is available from the steel mill in standard plate thicknesses and widths, is simple to fabricate, requiring very little welding — one girder can be produced in 45 minutes. Because of the system's modular composite design, there is a reduced need for additional details such as stiffeners or

cross-frames. Due to the system's modular nature, the composite unit can be easily shipped to the bridge site, allowing for accelerated construction and reduced traffic interruptions.

While modular precast concrete decks are recommended, multiple deck options are available, such as the use of full-depth/partial-depth precast concrete deck panels, cast-in-place concrete decks, or more advanced composite decks such as the Sandwich Plate System, a structural composite material comprising two metal plates bonded with a polyurethane elastomer core.

The system offers significant cost savings. It is recommended for single spans up to 60 feet in length (due to plate availability and typical press-brake lengths), but girders can easily be spliced for spans up to 80 feet.

### **Ongoing Testing Documents Strength and Opportunity for Design Efficiencies**

The new Amish Sawmill Bridge is providing valuable data to researchers from West Virginia University, Marshall University, the University of Wyoming and Iowa State University. Additional testing is being conducted to measure performance and identify further efficiencies that can be realized for future designs.

Testing initiated in June 2016 is demonstrating the strength and durability of the new technology, which exceeds AASHTO requirements for capacity. Based on early results, the researchers are confident that future design efficiencies can be achieved with this system.



### **New Project Opportunities**

Several state Departments of Transportation have expressed interest in constructing press-brake-formed steel tub girder bridges in their jurisdictions. The Ohio Department of Transportation and Muskingum County, Ohio were awarded an FHWA Accelerated Innovation Deployment (AID) grant to replace a bridge on County Road 7 – Cannelville Road. The \$557,600 AID grant will be used to install a press-brake-formed steel tub girder system with a Sandwich Plate System deck.

The West Virginia Department of Highways is planning to construct two press brake-formed steel tub girder bridges in 2016.

Buchanan County, Iowa will likely see more of these bridges in the future based on the experience of Brian Keierleber and his team. “This new technology offers excellent long-term performance and economical design,” he says.

With its many benefits — including cost savings in construction and labor, design efficiencies in the use of material and welding practices, ease of transportation and installation, and satisfaction from bridge owners and crews — press-brake-formed steel tub girder bridges provide the potential for widespread use in helping to meet America’s critical infrastructure challenges.

***Note:** The innovators and researchers responsible for developing and testing this technology are available to provide presentations and workshops to state and federal Departments of Transportation, county engineers, and other interested groups. For more information or to schedule a presentation/workshop, please contact Rich Tavoletti at [rtavoletti@steel.org](mailto:rtavoletti@steel.org) or 412.458.5822.*

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## **Amish Sawmill Bridge Project Team**

### **County Engineer**

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### **Bridge Contractor**

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### **Press-Brake Forming**

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## **Short Span Steel Bridge Alliance**

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### **About the Short Span Steel Bridge Alliance**

The Short Span Steel Bridge Alliance (SSSBA) is the industry resource for information related to short span steel bridges in North America. The SSSBA's objective is to provide essential information to bridge owners and designers on the unique benefits, innovative designs, cost-competitiveness and performance related to using steel in short span installations up to 140 feet in length. SSSBA partners include bridge and culvert industry leaders, including manufacturers, fabricators and representatives of related associations and government organizations. To learn more, visit [www.shortspansteelbridges.org](http://www.shortspansteelbridges.org) or email [sssba@steel.org](mailto:sssba@steel.org).

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