



# Four Steel Bridge Case Studies for 4 C's

## Cost, Convenience, County Built and Construction (ABC)



Association of  
Conservation Engineers  
2022  
Cheyenne, WY  
October 11, 2022

Short Span Steel Bridge Alliance

Dr. Michael G. Barker, PE  
University of Wyoming &  
SSSBA Education Director



# Today's Presentation

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## Presentation Overview

Short Span Steel Bridge Alliance (SSSBA)

Simple Design Tool eSPAN140

Bridge Case Studies

Buried Steel Bridge – Big R

Modular Beam Bridge - Contech

Modular Beam Bridge – BigR

Press-Brake Tub Girder – Valmont

**Cost**

**Convenience**

**County Forces Built Bridges**

**Construction (ABC)**

Short Span Steel Bridge Alliance: [www.ShortSpanSteelBridges.org](http://www.ShortSpanSteelBridges.org)

# Short Span Steel Bridge Alliance

*A group of bridge and buried soil structure industry leaders who have joined together to provide educational information on the design and construction of short span steel bridges in installations up to 140 feet in length.*



# Short Span Steel Bridge Alliance

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Education (webinars, workshops, forums, conferences)

Technical Resources (standards, guidelines, best practices)

Case Studies (economics: steel is cost-effective)

Simple Design Tools (eSPAN140)

Answer Questions (Bridge Technology Center)

Prefabricated Bridge Manufacturers (industry contacts)

Innovative & ABC Design



**eSPAN140™**



# eSPAN140 - Standard Designs for Short Span Steel Bridges

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[www.ShortSpanSteelBridges.org](http://www.ShortSpanSteelBridges.org)

## Goal:

- Economically competitive (repetitive details and member sizes)
- Expedite the design process
- Homogeneous plate girders
- Lightest weight rolled beams
- Limited depth rolled beams

## AASHTO LRFD Bridge Design:

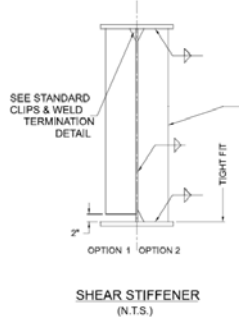
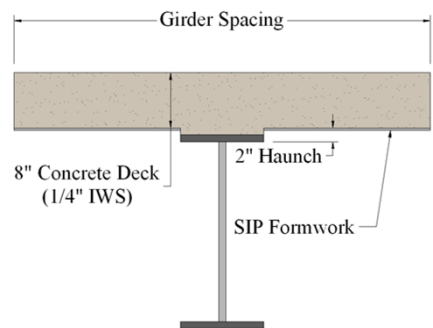
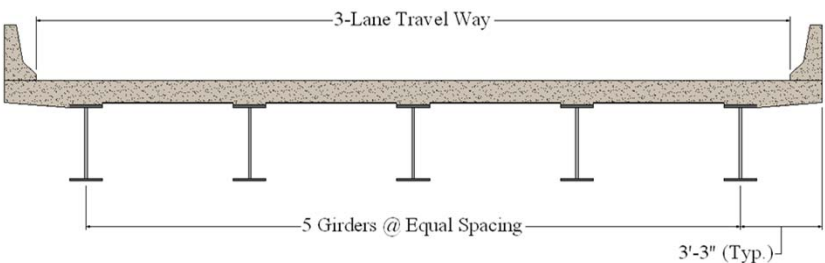
- Strength I,
- Service II,
- Fatigue,
- Constructability,
- L/800 Deflection
- HL-93 Vehicular Live Loading

# eSPAN140 - Standard Designs for Short Span Steel Bridges

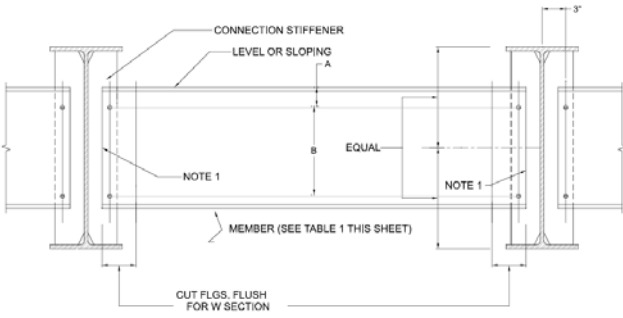
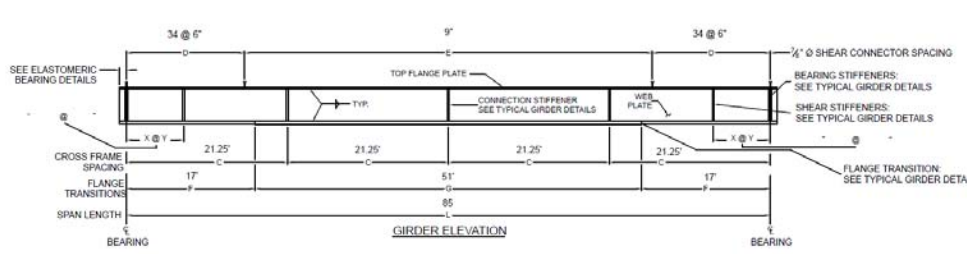
[www.ShortSpanSteelBridges.org](http://www.ShortSpanSteelBridges.org)

Span lengths 20 ft to 140 ft (in 5 ft increments)  
 Four girder spacing: 6'-0", 7'-6", 9'-0" and 10'-6",

For each of these increments: Steel girders, Shear stud & stiffener layouts, Welding and fabrication details, Elastomeric bearings, and Concrete deck design



COMPOSITE PLATE GIRDER WITH PARTIALLY STIFFENED WEB - 4 GIRDERS AT 8' 10" GIRDER SPACING, HOMOGENEOUS



# Pre-Fabricated Bridges

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Steel bridges meet owners' and the public's desire for economy, aesthetics, performance and accelerated construction.

## Benefits (FHWA Resource Center: Prefabricated Bridge Elements & Systems)

**Time Savings:** concurrent fabrication, construction & less weather issues

**Cost Savings:** reduced construction time, reduced traffic delays

**Safety Advantages:** reduced exposure to hazards

**Increased Constructability:** elements constructed off-site and put in place

**Cost**  
**Convenience**  
**County Forces Built Bridges**  
**Construction (ABC)**

**Now for the Showcase of Bridges**

# Super/Sub Structure Buried Steel Structures

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## Corrugated Steel Pipe

- Due to newly developed steel grades with many beneficial properties, a steel superstructure like this can be lightweight, strong and cost efficient.



## Corrugated Steel Plate

- Formed in such a way to support the rest of the bridge structure and still allow for the traversed travel way to be usable
- Aesthetically Pleasing





# Buried Steel Bridge - Corrugated Steel Plate – Contractor Built

VT Route 2B Bridge Replacement, St. Johnsbury, VT

Contractor: JP Sicard

Fabricator: Big R Bridge

28 day max. trail closure / 50 day road closure for all work

**47'11" span x 26'9" rise Arch**



Greeley, CO

**BIG R**  
BRIDGE



# Buried Steel Bridge - Corrugated Steel Plate

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# Deep Corrugated Steel Buried Bridges



I-44 over Entrance Ramp from Route 96



I-44 over CR 1147



# Buried Steel Bridge - Corrugated Steel Plate

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VT Route 2B Bridge Replacement, St. Johnsbury, VT

# Modular Beam

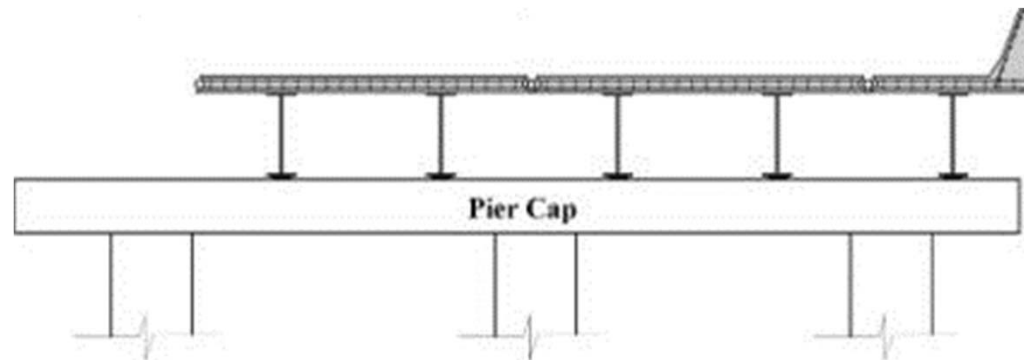
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Shop Fabricated Quality

Shipped as Modules

Lifted into Place

Gravel Surface, Cast-in-Place Deck or Pre-Decked with Closure Joint



# Pre-Fabricated Modular Beam – County Crew Built

Seltice-Warner Bridge, White Road, Whitman County, WA

Fabricator: BigR/Contech Engineered Solutions  
Contractor: Whitman County Crew  
Design Engineer: Mark Storey, County Engineer



Existing Structure – 30 ft Span, 20 ft Wide

Built/Rebuilt 1952/1986

Wood with Wood Piles & Wood Backwalls

Wood Deterioration & Susceptibility to Scour

Replacement Structure Requirements

Increase Hydraulic opening – 30 ft Channel

Raise Clearance for 100 yr Flood

Gravel Roadway

Piles with Alluvium Soils / Scouring



# Pre-Fabricated Modular Beam

Foundation and Abutment

County Owned Pile Driver (44 ton/pile)

H12x53 Pile Cap



# Pre-Fabricated Modular Beam

## Bridge Structure

35 ft Span x 28 ft Wide

2-Girder Modules / 3 Modules

Shipped on One Truck

Fully-Assembled

CSD and Dams

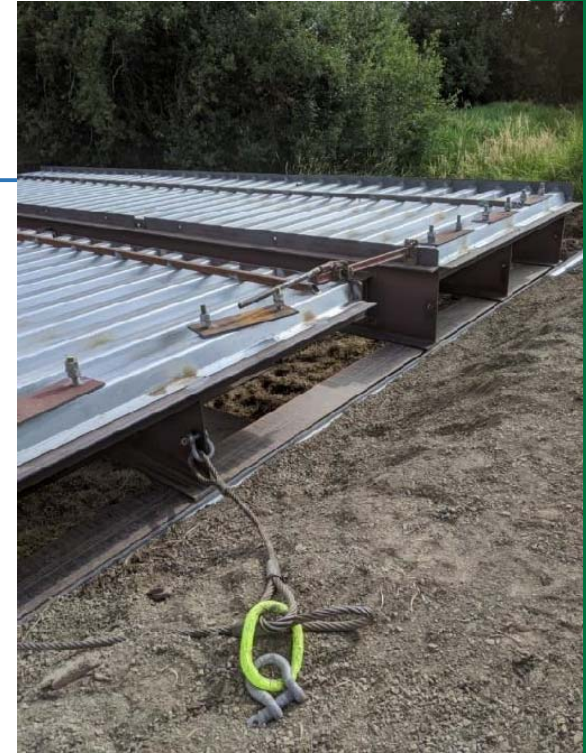
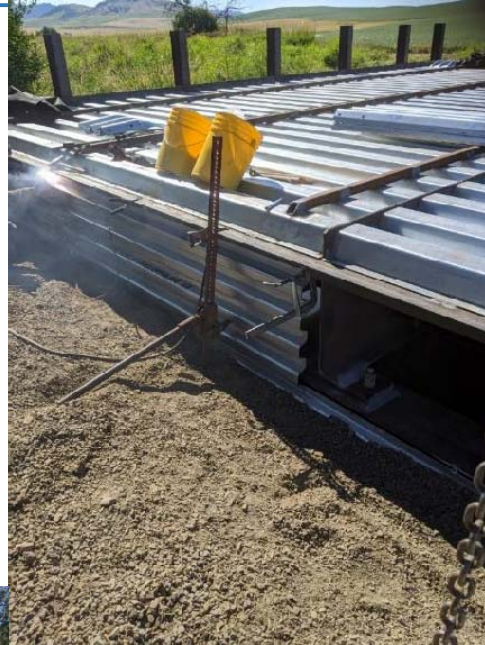
Simple Connections





# Pre-Fabricated Modular Beam

## SuperStructure Erection



# Pre-Fabricated Modular Beam

## Timing

Excavation, Stream Restoration &  
Bridge Installation ~ 4 Weeks

## Costs

Steel Superstructure	\$ 59,000
Labor & Equipment	\$ 70,000
Pile Foundations	\$ 20,000
Permitting	\$ 10,000
Total	\$159,000

\$ 162.25 / ft<sup>2</sup>

Concrete Superstructure Alternative \$ 82,000



# Pre-Fabricated Modular Beam – Contractor Built

Brookfield 100 Road, Hancock Forest Management, Cathlamet, WA

Fabricator: BigR/Contech Engineered Solutions

Contractor: Quality Excavation

Design Engineer: Pacific Forest Resources



## Existing Structure – 36” Pipe

Barrier to fish movement

Restricts 6+ feet of natural stream width

Inundated by Columbia River tidal influence zone

## Replacement Structure Requirements

Increase Hydraulic opening

Needed 55 – 60 ft span

Poor soil bearing capacities

Large equipment difficult in forest setting

Special logging U-80 Vehicle



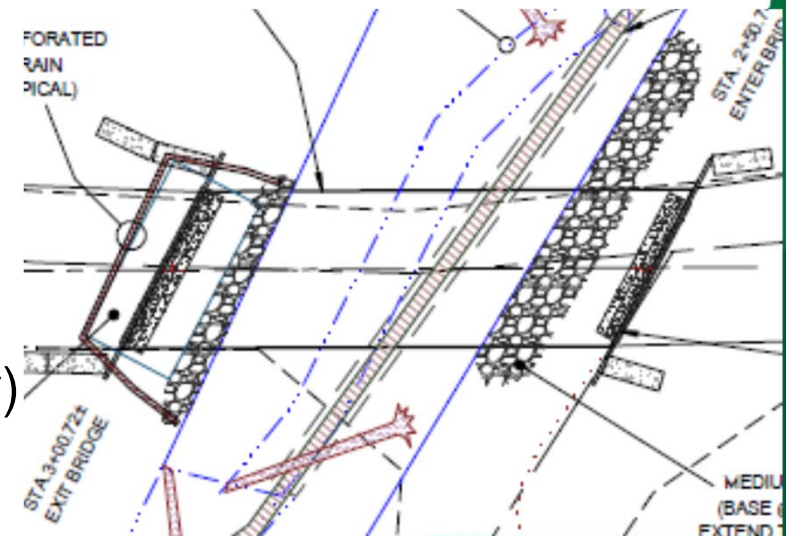
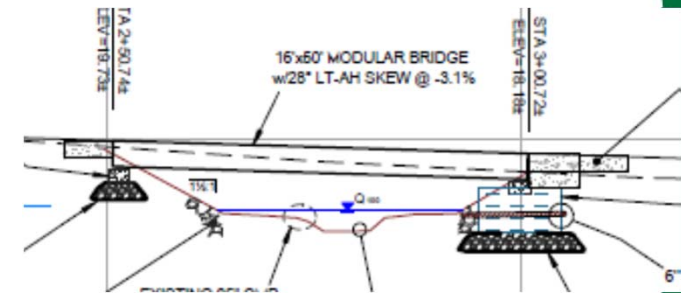
# Pre-Fabricated Modular Beam

## Structure Considerations

- Poor Soils on Right End
- Steel-Bin Abutment
- Vertical Abutment Allowed 50 ft Span
- Light Superstructure

- Gravel Roadway for Forest Service
- Control of Debris into Creek

- Erection Equipment
  - Two Excavators (~15 kip capacity)
  - Modular Superstructure



# Pre-Fabricated Modular Beam

## Substructure Considerations

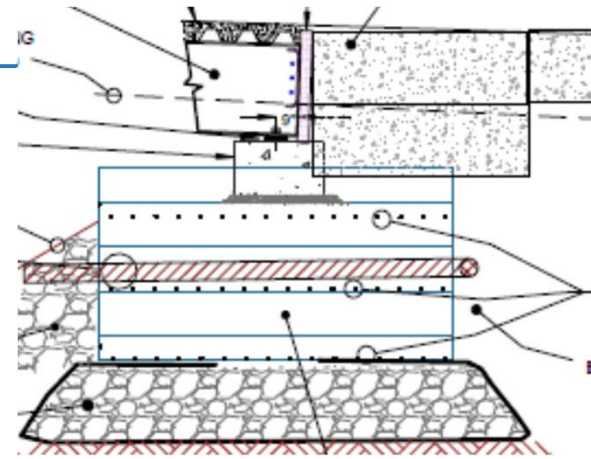
Poor Soils on Right End  
Equipment – Piles Difficult

## Steel-Bin Box Abutment

10 ft x 20 ft x 6 ft Bin  
Geogrid Layers at 16"  
Precast Sill  
Rip-Rap Protection

## Left Abutment Better Material

Precast Sill  
Rip-Rap Protection



# Pre-Fabricated Modular Beam

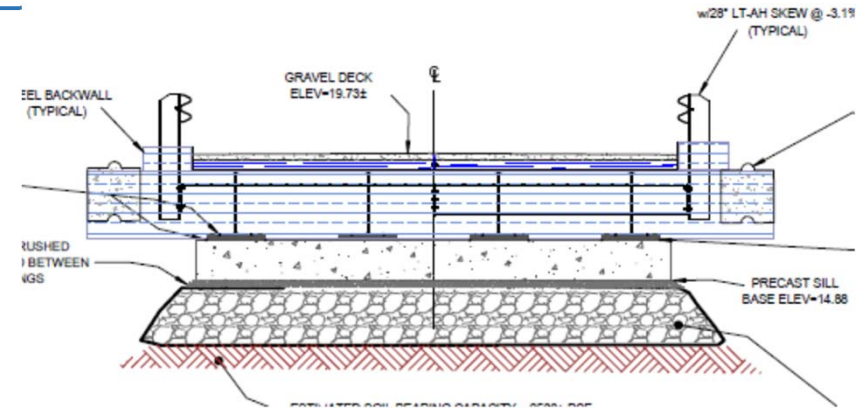
## Substructure Construction



# Pre-Fabricated Modular Beam

## Superstructure Considerations

- Abutment Capacity
- Equipment Capacity
- Handling
- Convenience



## BigR/Contech Modular Bridge

- 2-Girder Modules
- Fully-Assembled
- 19.5 kip each
- CSD and Dams
- Simple Connections



# Pre-Fabricated Modular Beam

## Superstructure Erection





# Pre-Fabricated Modular Beam

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## Timing

Excavation, Stream Restoration &  
Bridge Installation - 2 Weeks

## Costs

Bridge, Sills, & Steel-Bin	\$ 68,500
Labor (Prevailing Wage)	\$ 77,500
Engr, PM, Survey, Misc	\$ 17,000
Total	\$163,000

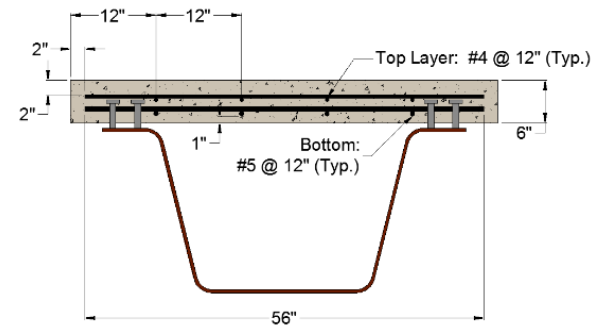
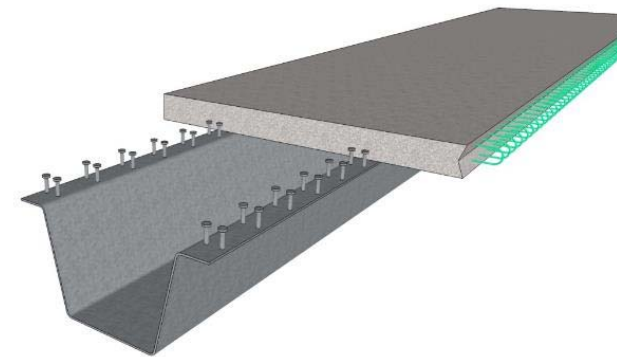
\$ 203.75/ft<sup>2</sup>



# Press-Brake Tub Girders / Folded Plate Systems

## Press-Brake-Formed Steel Tub Girders

- Developed within the technical working group of the Short Span Steel Bridge Alliance.
- Modules are joined using UHPC longitudinal closure pours
  - Girders can be galvanized or comprised of weathering steel.
- Modules can be shipped to site pre-topped or with a variety of deck options



# Press-Brake Tub Girder – Contractor Built

## Henry Road Bridge, Mercer County, PA

Fabricator: Valmont/Con-Struct  
Contractor: Jett Excavating  
Deck Precaster: Faddis Concrete Products

**valmont** 

**CON-STRUCT™**

### Existing Structure

55 yr old, 42 ft Span Beam Bridge  
Deterioration and Deficient  
Closed to Traffic for 2 yrs

### Replacement Structure Requirements

Use Existing Abutments (Limited Capacity)  
60° Skew on Abutments  
Superstructure Only Replacement  
Design-Build thru PennDOT  
County Funds (Local Funding)



# Press-Brake Tub Girder

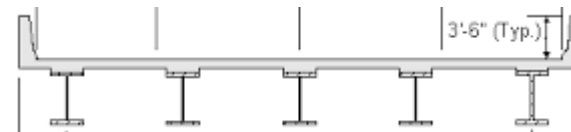
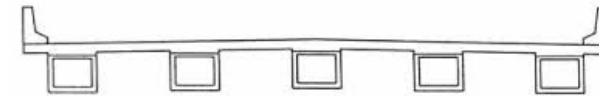
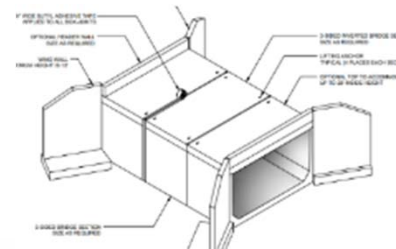
Bids Range \$327,750 to \$730,870

## Concrete:

- 1 – Box Culvert  
Highest Bid
- 1 – 4 P/C Spread Box Beams  
Mid-Range Bid

## Steel:

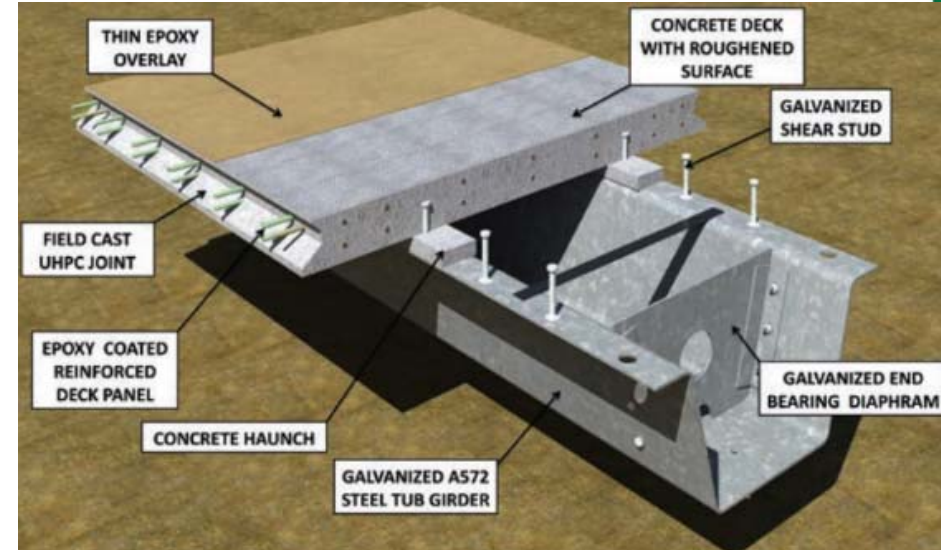
- 2 – 7 Steel Beams  
Mid-Range Bids
- 2 – Press-Brake Tub Girder  
Lowest Two Bids  
Within \$ 2,985 of each other



# Press-Brake Tub Girder

Con-Struct / Valmont  
Winning Bid \$ 327,750

Press-Brake Tub Girder  
4 PBTG Units  
8 Precast Concrete Deck Panels  
CIP Curbs w/ Railings  
Epoxy Overlay



# Press-Brake Tub Girder

## Fabrication



# Press-Brake Tub Girder

## Finishing Fabrication – Two Methods

### Pre-Decked - Composite

- PBTGs Pre-Decked
- Closure Pours
- CIP Curbs



### Field Assembly - Composite

- PBTGs no Deck
- Precast Deck Panels
- Grouted Shear Pockets
- Closure Pours
- CIP Curbs



# Press-Brake Tub Girder

Field Assembly - Composite  
PBTGs (undecked)  
Precast Deck Panels





# Press-Brake Tub Girder

Field Assembly - Composite  
Grouted Shear Pockets  
Cast-in-Place Curbs & Closure Pours



# Press-Brake Tub Girder

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Field Assembly - Composite  
Completed Bridge

Economical  
Ease of Erection  
Sustainable



# SSSBA Solutions



High Quality Beautiful Bridges  
Economical  
ABC



[www.ShortSpanSteelBridges.org](http://www.ShortSpanSteelBridges.org)

# Pre-Fabricated Steel Bridges

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## Take-Aways – Steel Bridges

Economical

- Lighter Superstructure

- Lighter Equipment

- Lighter Abutments

Ease of Erection

- Modular

- Accelerated Bridge Construction

- Match-Fit Fabrication

Sustainability


- Recyclable

- Reusable / Movable




# 5 Ways to Keep Learning About Steel Bridges


1. Subscribe to the Weekly Newsletter



**7-Part Bridge Series Available On-Demand**  
The free video series presented by industry experts on steel bridge-related topics is now available on-demand.  
[Watch Videos](#)

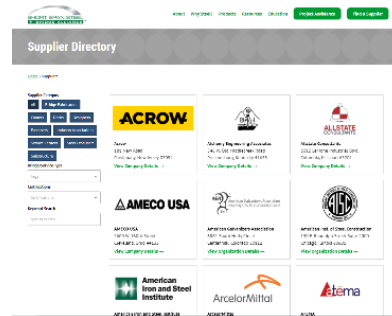


**Buried Steel Bridge Wins ASCE Award**  
A "signature" buried steel bridge located in California wins the local ASCE Plans & Spec Project of the Year.  
[Read More](#)



**Steel Plate Girder Bridge Built Using eSPAN140**  
The free online tool saved time by providing preliminary plans for a bridge constructed in Boone County, Missouri.  
[Read More](#)

2. Find a Supplier



Supplier Directory

ACROW

AMECO USA

American Iron and Steel Institute

ArcelorMittal

Beina

3. Design a Bridge in 5-Minutes

eSPAN140™

4. Receive Free Project Assistance



5. Schedule a Workshop/Webinar



[www.ShortSpanSteelBridges.org](http://www.ShortSpanSteelBridges.org)

Questions? Dan Snyder, Director, SSSBA, [dsnyder@steel.org](mailto:dsnyder@steel.org), (301) 367-6179



Website: [ShortSpanSteelBridges.org](http://ShortSpanSteelBridges.org)

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