



Development of eSPAN140 & Short-Span Steel Bridge Design Standards

Karl E. Barth, Ph.D.

West Virginia University, Wadsworth Department of Civil and Environmental Engineering

kebarth@mail.wvu.edu

NSBA / SSSBA Steel Bridge Essentials Webinar Series
June 16, 2021



Outline of Today's Presentation

- Short Span Steel Bridge Design Standards
- eSPAN140 Example Project
- Questions & Answers

Short Span Steel Bridge Design Standards

Goals, Design Parameters, Weight Comparisons

Standards for Short Span Steel Bridge Designs

- Goals:
 - Economically competitive
 - Expedite & economize the design process
 - Simple repetitive details & member sizes.
- Bridge Design Parameters:
 - Span lengths: 40 feet to 140 feet (5-foot increments)
 - Girder spacing: 6 feet, 7.5 feet, 9 feet and 10.5 feet
 - For each of these increments, the following were designed:
 - Steel girders
 - Shear stud & stiffener layouts
 - Welding and fabrication details
 - Elastomeric bearings
 - Concrete deck design

Primary value is use as an estimating tool!

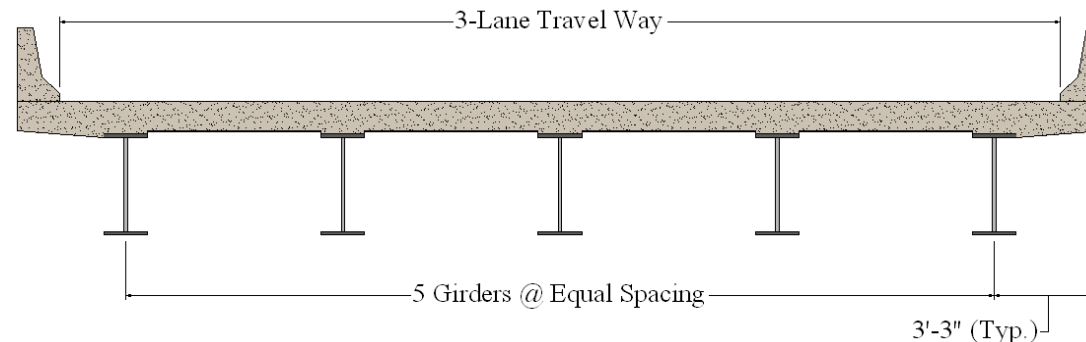
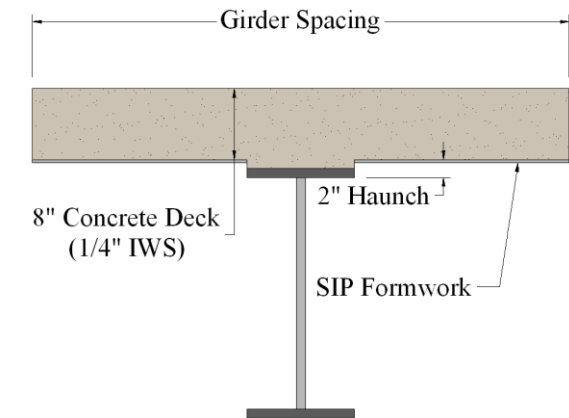
- Now have the ability to produce a valid steel bridge design in minutes
- Obtain a cost estimate from a fabricator within a day
- Can directly compete with concrete alternate
- Design can then be further optimized

Standards for Short Span Steel Bridge Designs (cont'd)

- Four types of girder types:
 - Homogeneous plate girders (50 ksi steel)
 - Hybrid plate girders
 - 50 ksi top flanges and webs, 70 ksi bottom flanges
 - Lightest weight rolled beams (50 ksi steel)
 - Utilizing the lightest weight girder necessary
 - Limited depth rolled beams (50 ksi steel)
 - Designed to meet a target L/D of 25
- In addition, girders were designed to accommodate commonly stockpiled plate thicknesses and rolled beam sizes.

Standards for Short Span Steel Bridge Designs (cont'd)

- Bridges were designed according to AASHTO LRFD Specs:
 - Strength I, Service II, Fatigue, Constructability, L/800 Deflection
 - HL-93 Vehicular Live Loading
- Additional Design Loads:
 - SIP Unit Weight = 15 psf
 - Future Wearing Surface = 25 psf
 - Concrete barriers = 520 lb/ft
 - Misc. Steel Wt. Increase = 5%
 - $f_c' = 4,000$ psi
 - Concrete Unit Weight = 150 pcf
 - Steel Unit Weight = 490 pcf
 - Concrete Haunch = 2 in
 - Constant Flange Width
 - Constant Web Height



Resulting Economical Standard Selections

- Based on weight comparisons of resulting designs, the following solutions are recommended for the span ranges shown:

Solution Type*	Bridge Span Length								Skew Angle	Overhang Width
	0'	20'	40'	60'	80'	100'	120'	140'		
Rolled Beam (40' to 100')**			█						+/- 20 degrees	3'3" or less
Homogeneous Plate Girder (60' to 140')**				█					+/- 20 degrees	3'3" or less
Hybrid Plate Girder (80' to 140')**					█				+/- 20 degrees	3'3" or less

eSPAN140 Example Project

Step-By-Step Process for Obtaining a Steel Solution

- eSPAN140 provides:
 - Standard designs and details for short span steel crossings
 - Rolled Beam and Plate Girders
 - Buried Soil Steel Bridge Structures
 - Manufacturers' Steel Solutions (SSSBA Partners)
 - Coatings Solutions
 - Industry Contacts
 - Contacts can provide budget estimates and pricing information

Free and easy to use!!!

<https://www.espan140.com/>



Step 1.

Create a User's Account



Step 2.

Input Your Specific Project Details



Step 3.

View Your Instant Customized Solutions Books

eSPAN140 Example Project

- Start new project:

My Projects

Welcome to eSPAN140. If this is your first time here, please click on "Start New Project" to begin.

If you have already created a project, please use the table below to view past projects, complete previous existing inputs you provided, please click on "Duplicate". This will allow you to create a new project (I have multiple bridges to design and have only a few input values to change).

A green rectangular button with rounded corners and a white border. The text "Start New Project" is centered in white, bold font.


Start New Project

eSPAN140 Example Project (cont'd)


- Step 1: Project Information

Project Name*
Sample Bridge

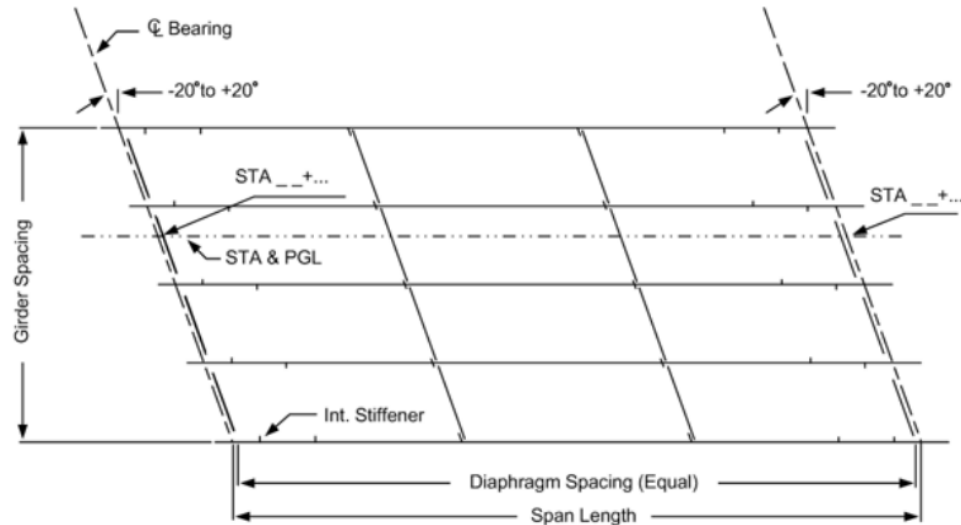
City/County*
Morgantown

State/Province* 
West Virginia

Roadway Name
Main Street

Bridge Span Length* 
82 Feet 4 Inches


[Next >](#) [Return to Projects](#)




eSPAN140 Example Project (cont'd)

- Step 2: Project Details (general dimensions)


of Striped Traffic Lanes*

Roadway Width* 

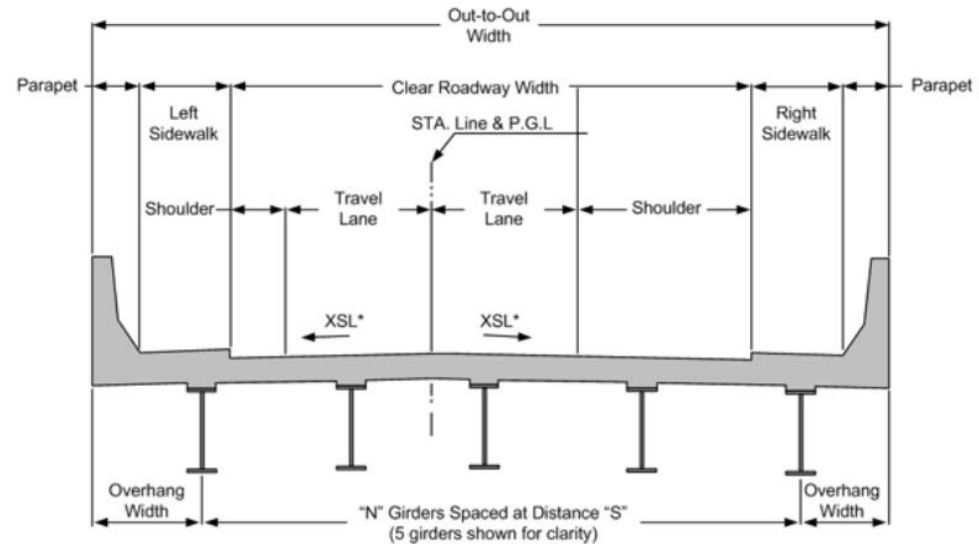
Feet Inches

Individual Parapet Width 

Feet Inches


Individual Deck Overhang Width 

Feet Inches



eSPAN140 Example Project (cont'd)

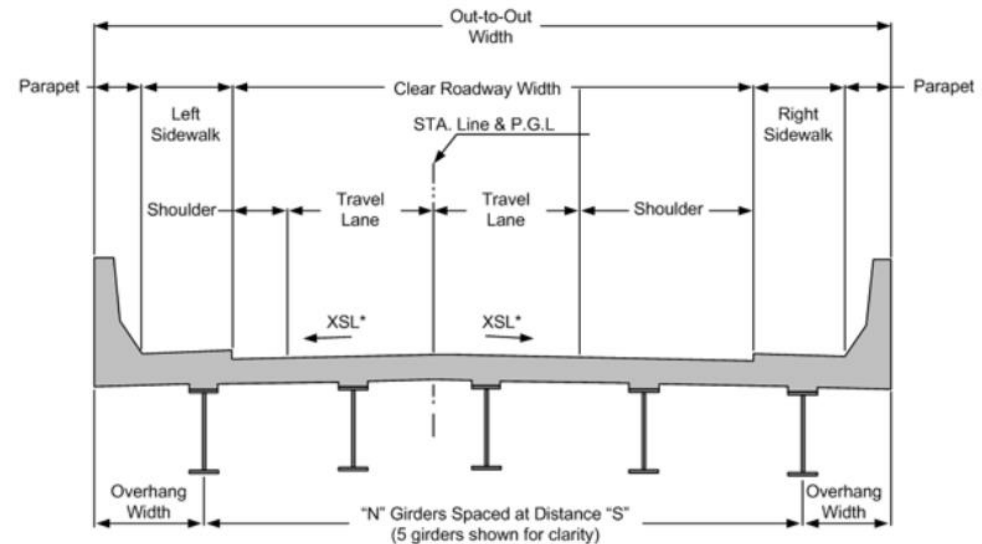
- Step 2: Project Details (pedestrian access option)

Pedestrian Access? 

Number of Sidewalks


Sidewalk One Width
 Feet Inches

Sidewalk Two Width
 Feet Inches




eSPAN140 Example Project (cont'd)


- Step 2: Project Details (remaining details)

Skew Angle 

Degrees

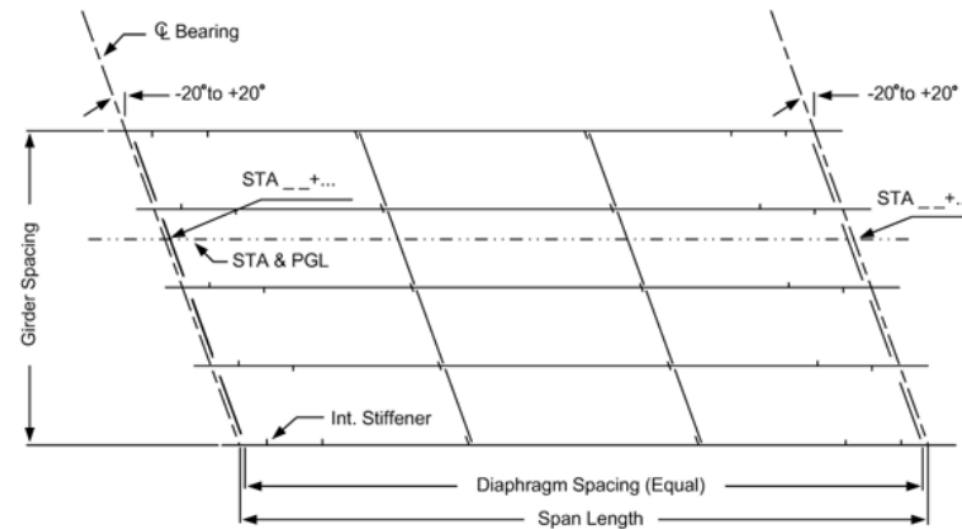
Average Daily Traffic 

 ▾

Design Speed 

 ▾

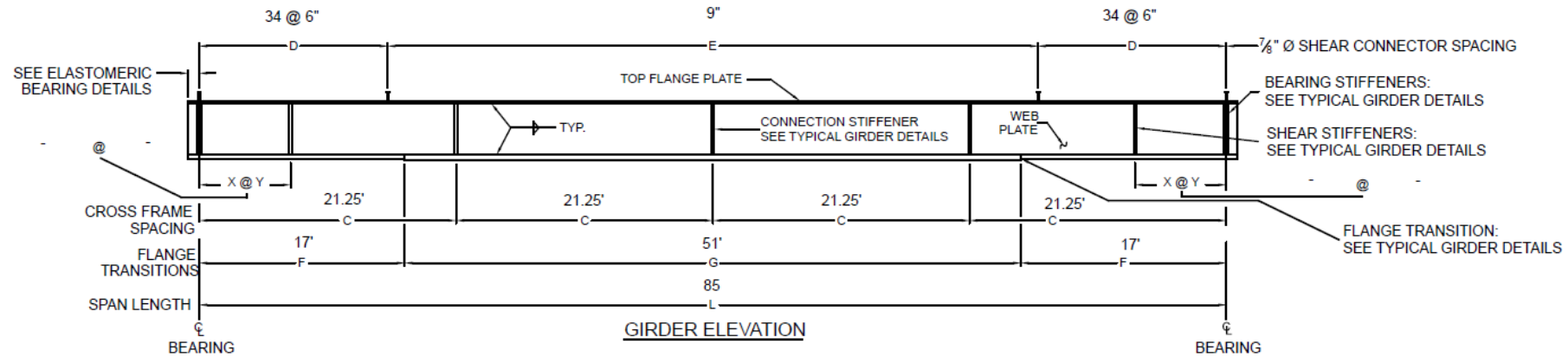
[< Back](#) [Next >](#) [Return to Projects](#)



eSPAN140 Example Project (cont'd)

- Example output (sample plate girder elevation):

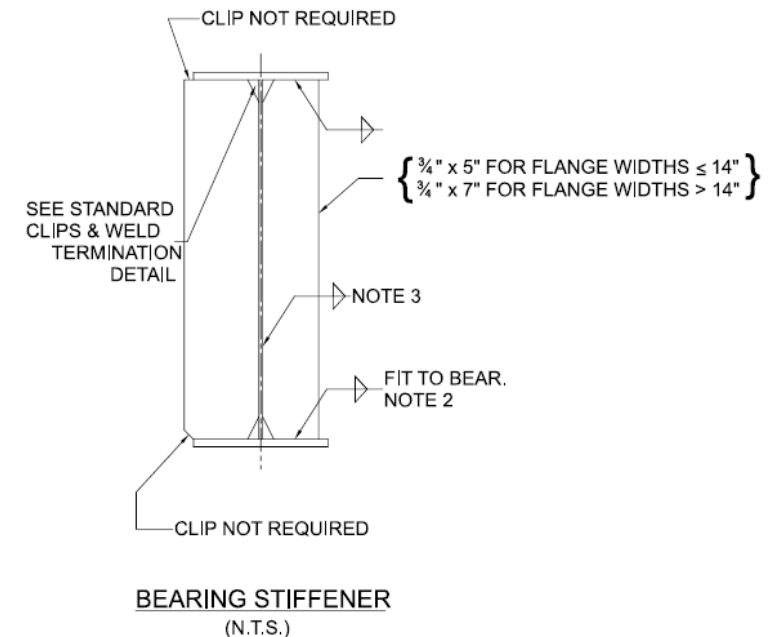
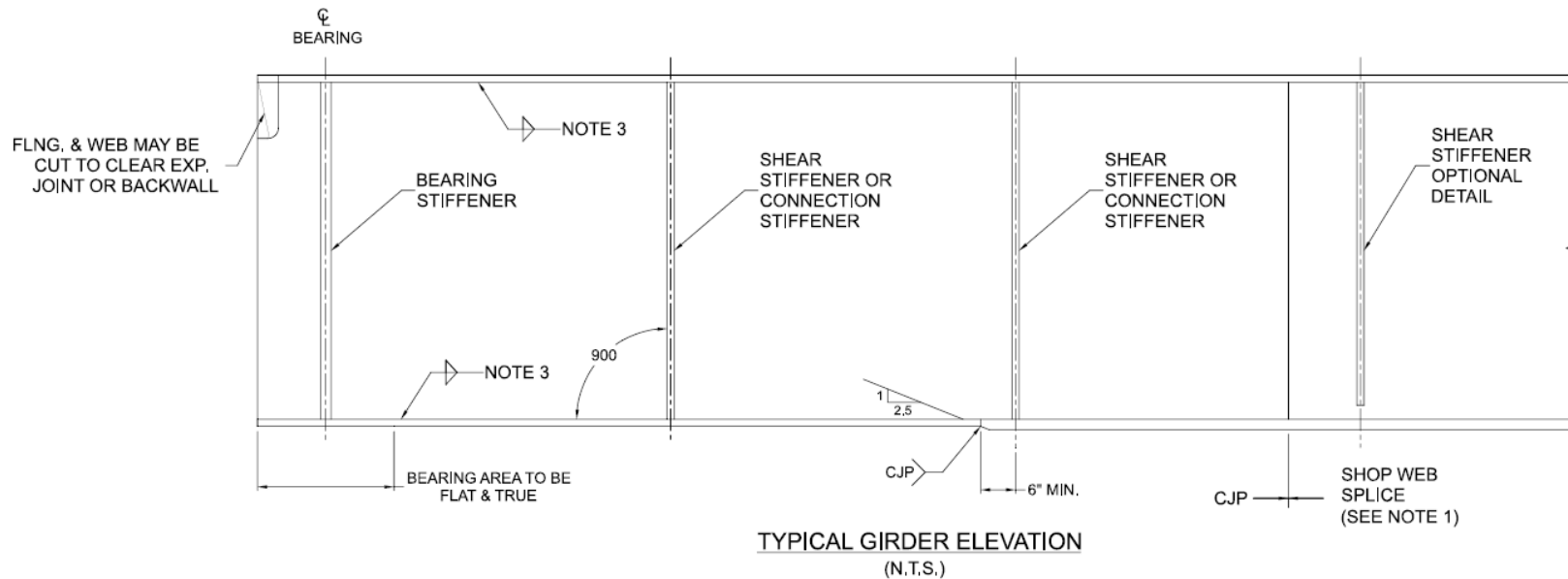
COMPOSITE PLATE GIRDER WITH PARTIALLY STIFFENED WEB - 4 GIRDERS AT 8' 10" GIRDER SPACING, HOMOGENEOUS



SPAN (L) - ft	PLATE GIRDER SIZE						DIAPHRAGM SPACING (C) - ft	SHEAR STIFFENERS		SHEAR CONNECTOR MAX. SPACING		INDIVIDUAL GIRDER WEIGHT
	TOP FLANGE - in	BOTTOM FLANGE (F)		BOTTOM FLANGE (G)		WEB PLATE - in		X (NO. REQ'd)	Y - ft. (SPACING)	D	E	
		PLATE - in	LENGTH - Ft	PLATE - in	LENGTH - Ft							
85	14 x 3/4"	14 x 1"	17'	14 x 2"	51'	32 x 1/2"	21.25'	-	-	34 @ 6"	9"	14,144 lbs

eSPAN140 Example Project (cont'd)

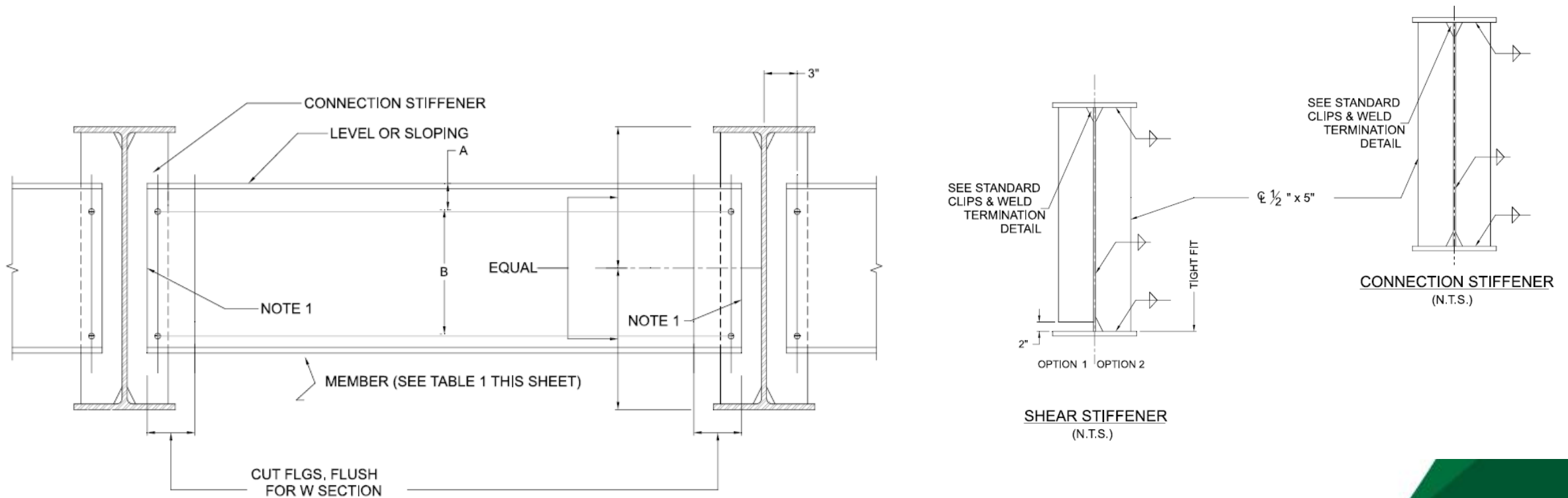
- Example output (typical fabrication details):



BEARING STIFFENER TO FLANGE WELDING IS REQUIRED IF A DIAPHRAGM OR CROSS FRAME IS ATTACHED TO THE STIFFENER

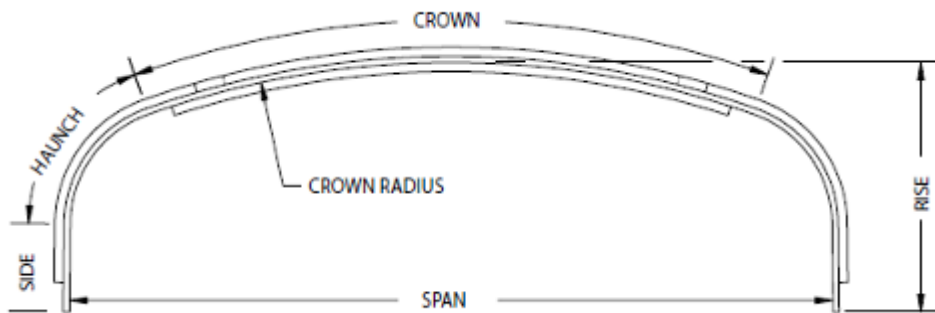
eSPAN140 Example Project (cont'd)

- Example output (typical fabrication details, cont'd):



eSPAN140 Example Project (cont'd)

- Buried Bridge Solutions



eSPAN140 Example Project (cont'd)

- Manufacturer Solutions



- Durability Solutions

- Painted, galvanized, weathering



Questions & Answers

Thank You!

Karl E. Barth, Ph.D.

kebarth@mail.wvu.edu