



**E&B PAVING**

## **Cost Reduction Incentive – Steel Edition**

*R-41565 SR 22 Reconstruction & Bridge Rehabilitation -  
Grant County, IN*  
**February 17, 2026**



# INTRODUCTIONS



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**Bobby Steele**  
Bridge Estimator & Project Manager



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Bridge Design Production Manager



# OVERVIEW OF PROJECT (AS-BID)



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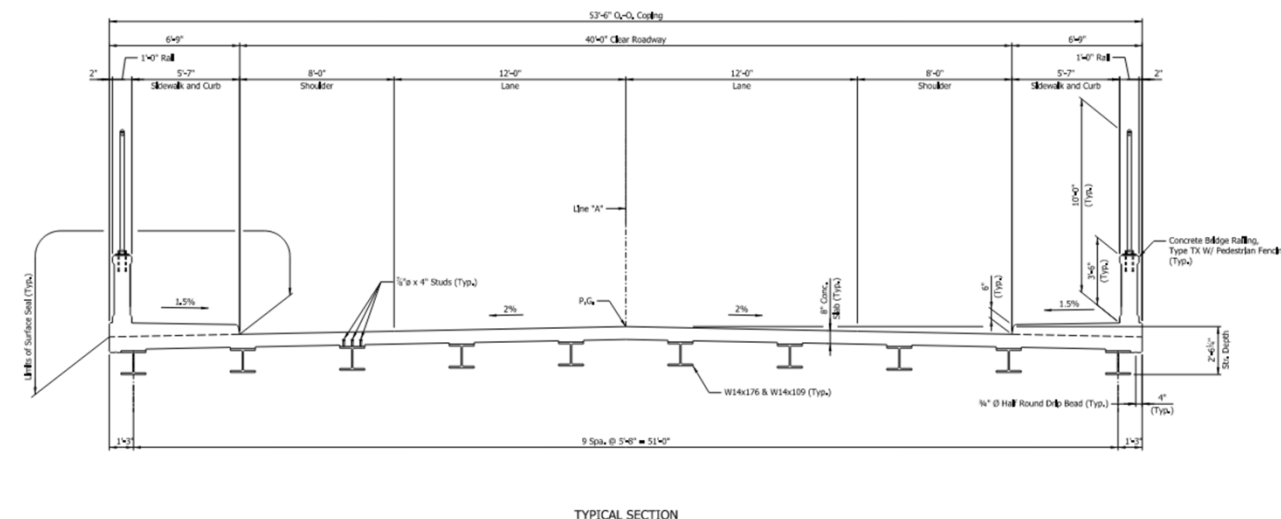
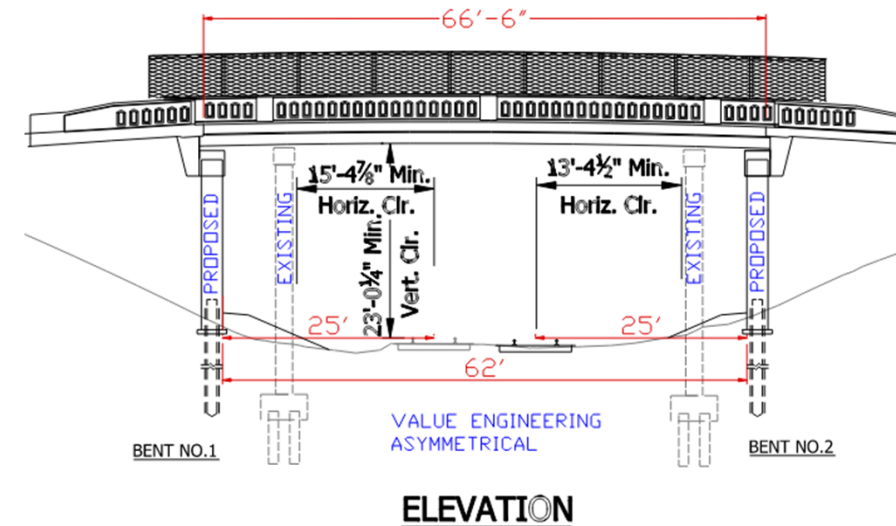


# VALUE ENGINEERING SOLUTION



- **Timing**
  - March 2023: Letting and Award
  - 2023: Utility Relocation
  - 2024: Road Work
  - 2025: Road and Bridge Work

- **Constructability**
- **Risk Assessment**

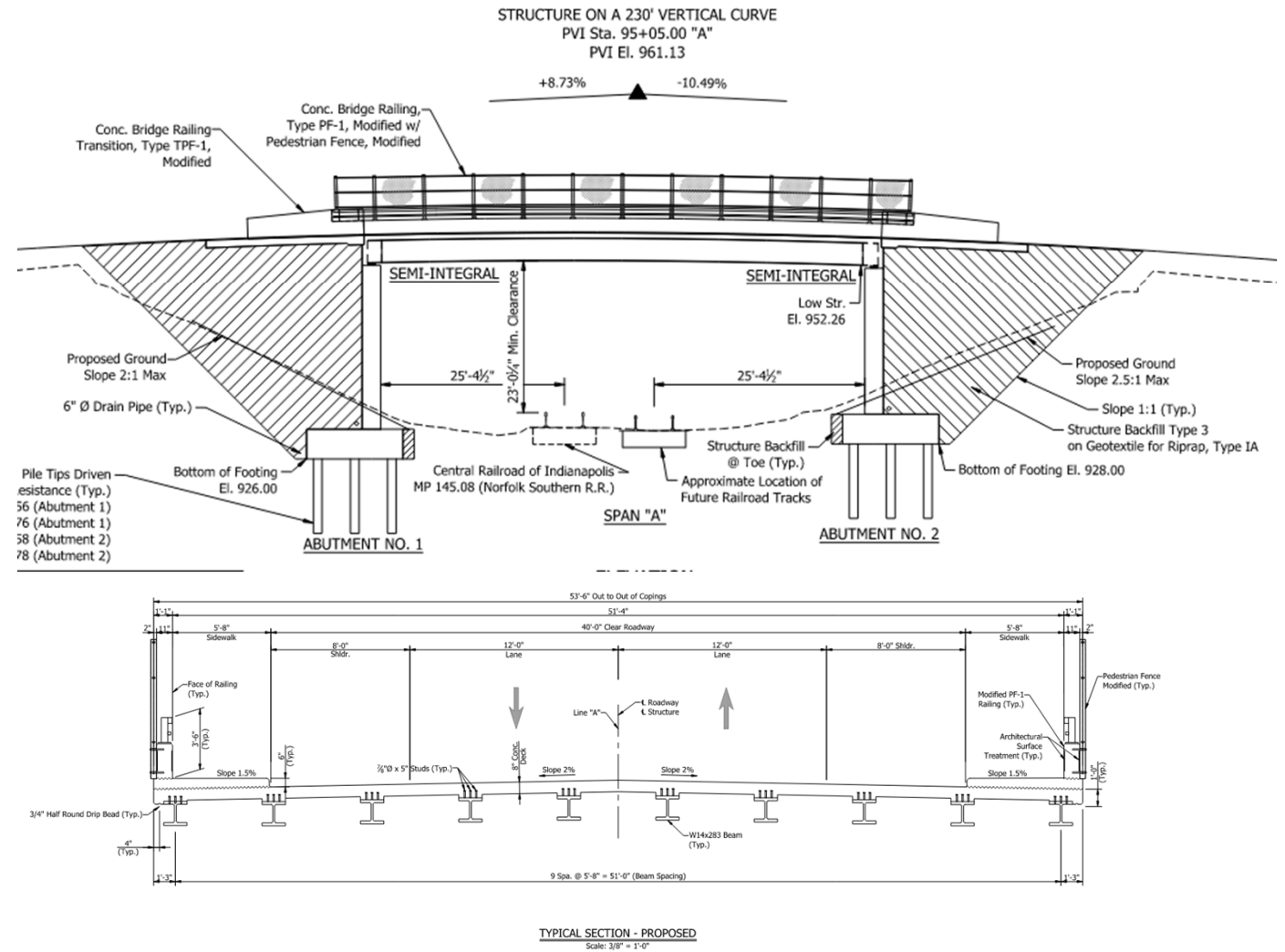


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# DESIGN GOALS

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1. Simple-span bridge replacement
2. MSE walls not permitted by railroad
3. Meet railroad clearance (horizontal & vertical)
4. Include clearance for future track line
5. Match as-bid profile grade as closely as possible

## Typically Consider Four Alternatives for Superstructure Type

1. Cast in-place concrete
2. Prestressed Precast Concrete Beams
  - AASHTO I-Beams
  - Bulb Tee Beams
  - Box Beams
  - NEXT Beams
3. Rolled Steel Beams
4. Steel Plate Girders

Material	Superstructure Type	Typical Span Length (ft)
Precast Concrete	3-Sided Structure	12 – 48
Cast-in-Place Concrete	Continuous Reinforced Slab	20 – 45
Prestressed Concrete	Box Beams, Depth 12 in. through 27 in.	30 – 60
	Box Beams, Depth 27 in. through 42 in.	60 – 85
	I-Beams, AASHTO Type I	35 – 50
	I-Beams, AASHTO Type II	40 – 65
	I-Beams, AASHTO Type III	55 – 85
	* I-Beams, AASHTO Type IV	70 – 110
	Bulb-T Beams, Top-Flange Width 48 in. or 60 in.	80 – 140
	Bulb-T Beams, Top-Flange Width 49 in. or 61 in.	65 – 165
Structural Steel	Post-Tensioned Bulb-T Beams	140 – 200
	Post-Tensioned Slab	50 – 80
	Steel Rolled Beams	< 100
	Steel Built-Up Plate Girders	> 70

\* These are generally used only in rehabilitating a structure. Bulb-T beams are preferred for a new or replacement structure.

### ECONOMICAL STRUCTURE-TYPE SELECTION

Figure 402-5A

# CONCRETE & STEEL OPTIONS FOR REDESIGN



Type	Structure Description	Cross Section
A	Reinforced, Cast-In-Place Concrete Slab	
B	Longitudinally Post-Tensioned, Cast-In-Place Concrete Slab	
C	Longitudinally Post-Tensioned, Cast-In-Place Concrete Box Girders	
D1	Two-Way Post-Tensioned, Cast-In-Place, Solid Concrete Spine-Beam with Cantilevers	
D2	Two-Way Post-Tensioned, Cast-In-Place, Volded Concrete Spine-Beam with Cantilevers	
E1	Prestressed Precast Concrete I-Beams or Bulb-Tees	
E2	Prestressed Precast Concrete Open or Closed Box Beams	

SUPERSTRUCTURE TYPES  
Figure 402-8A  
(Page 1 of 3)

Type	Structure Description	Cross Section
F	Post-Tensioned Concrete Bulb-Tee Beams	
G1	Jointed, Prestressed, Precast Longitudinal Concrete Single Tees	
G2	Jointed, Prestressed, Precast Longitudinal Concrete Double Tees	
G3	Jointed, Prestressed, Precast Longitudinal Concrete Boxes	
G4	Jointed, Prestressed, Precast Longitudinal Concrete Slabs	
H	Segmental Concrete Box Girders	
I	Composite Steel Rolled Beams	

SUPERSTRUCTURE TYPES  
Figure 402-8A  
(Page 2 of 3)

Type	Structure Description	Cross Section
J	Composite Steel Plate Girders	
K	Composite Steel Boxes	
L1	Wood Panel Decks with Spreader Beams	
L2	Stressed Wood Decks	
L3	Composite Native Wood Stringers	
L4	Glulam Beams	
M	Structure Under Fill	

SUPERSTRUCTURE TYPES  
Figure 402-8A  
(Page 3 of 3)

# CONCRETE OPTIONS FOR REDESIGN



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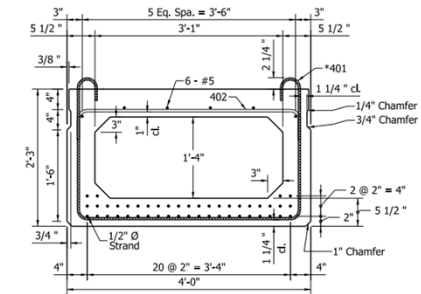


## Prestressed Precast Beam Options

**BEAM PROPERTIES**

$A_g = 713 \text{ in}^2$   
 $I_g = 66,216 \text{ in}^4$   
 $S_{TB} = 4,865 \text{ in}^3$   
 $S_{GB} = 4,945 \text{ in}^3$   
 $Y_{TB} = 13.61 \text{ in}$   
 $Y_{GB} = 13.39 \text{ in}$   
 $Wt. = 743 \text{ lbs/ft}$

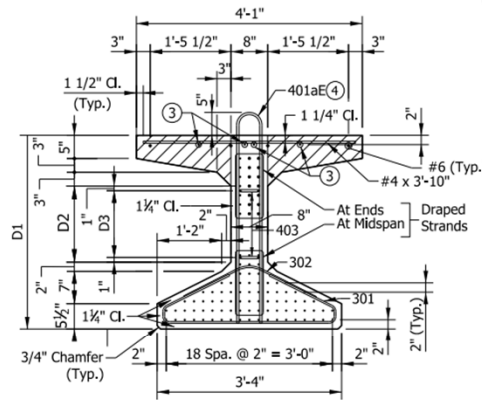
**NOTES:**  
 1. ■ \*DENOTES EPOXY-COATED BAR



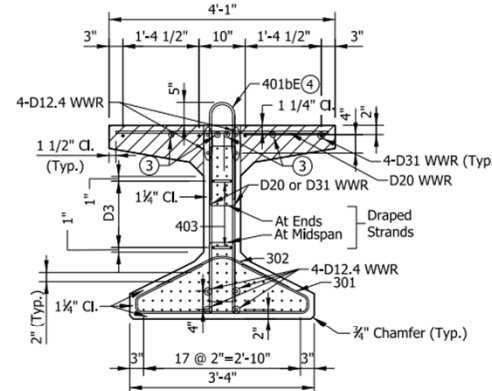
**BOX BEAM**  
 TYPE CB 27 x 48  
 Figure 406-15J

Beam Type	D1	D2	D3
BT 36 X 49	3'-0"	10 1/2"	1 Spa. @ 8 1/2"
BT 42 X 49	3'-6"	1'-4 1/2"	1 Spa. @ 1'-2 1/2"
BT 48 X 49	4'-0"	1'-10 1/2"	1 Spa. @ 1'-8 1/2"
BT 54 X 49	4'-6"	2'-4 1/2"	2 Spa. @ 1'-1 1/2"
BT 60 X 49	5'-0"	2'-10 1/2"	2 Spa. @ 1'-4 1/2"
BT 66 X 49	5'-6"	3'-4 1/2"	2 Spa. @ 1'-7 1/2"
BT 72 X 49	6'-0"	3'-10 1/2"	2 Spa. @ 1'-10 1/4"
BT 78 X 49	6'-6"	4'-4 1/2"	3 Spa. @ 1'-4 1/2" (+)
BT 84 X 49	7'-0"	4'-10 1/2"	3 Spa. @ 1'-6 1/2" (+)

- NOTES:**
1. Bars 301 and 302 combined to form one stirrup.
  2. "E" denotes epoxy coated reinforcing bars.
  3. 0.5"  $\emptyset$  or 0.6"  $\emptyset$  Prestressing Strands. See IDM 406-10 for guidance related to prestressing strands.
  4. Projection of 401aE or 401bE bar should be verified and one projection should be used for the entire length of the beam. See Figure 406-12D for fillet reinforcing.
- ▨ Indicates top flange notch at end bent when required to provide clearance to pavement ledge.



**SECTION SHOWING MILD REINFORCEMENT**  
**WIDE BULB-TEE BEAM, 49" TOP FLANGE**  
 Figure 406-14BB  
 (Page 1 of 3)

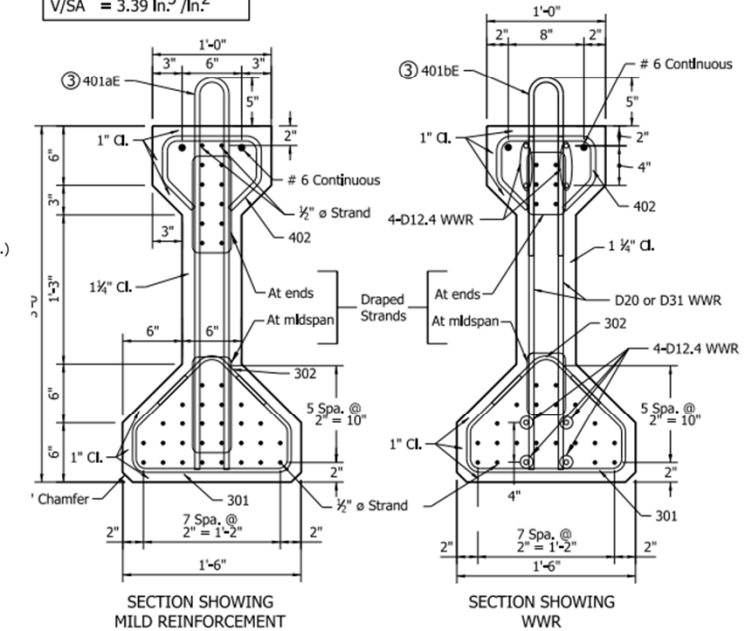


**SECTION SHOWING WWR**

**BEAM PROPERTIES**

$A_b = 368 \text{ in}^2$   
 $I_x = 50,842 \text{ in}^4$   
 $I_y = 5,289 \text{ in}^4$   
 $S_t = 2,524 \text{ in}^3$   
 $S_b = 3,207 \text{ in}^3$   
 $Y_t = 20.1 \text{ in}$   
 $Y_b = 15.9 \text{ in}$   
 $Wt. = 384 \text{ lb/lf}$   
 $V/SA = 3.39 \text{ in}^3 / \text{in}^2$

- NOTES:**
1. Bars 301 and 302 combined to form one stirrup.
  2. "E" Denotes epoxy-coated bar
  3. Projection of 401aE or 401bE bar into the deck should be verified and one projection should be used for the entire length of the beam. See Figure 406-12D for fillet reinforcing.



**SECTION SHOWING MILD REINFORCEMENT**

**I - BEAM TYPE II**  
**Figure 406-13B**  
 (Page 1 of 3)

## Prestressed Precast Beam Options

1. The design compressive strength of normal-weight and lightweight concrete at 28 days,  $f'_c$  should be in the range as follows:
  - a. prestressed box beam: 5 to 7 ksi
  - b. prestressed I-beam: 5 to 7 ksi
  - c. prestressed bulb-tee beam: 6 to 8 ksi

An exception to the range shown above will be allowed for a higher strength if the higher strength can be documented to be of significant benefit to the project, it can be effectively produced, and approval is obtained from the Director of Bridge Engineering.

### 406-4.04 Prestressing Steel [Rev. Sep. 2022]

Prestressing strands should be of the low-relaxation type with a minimum tensile strength of 270 ksi. Unless there is a reason to do otherwise, only the following three-strand diameters should be used.

1. Nominal 3/8 in.,  $A_s = 0.085 \text{ in}^2$ , for use in a stay-in-place deck panel.
2. Nominal 1/2 in.,  $A_s = 0.167 \text{ in}^2$ , for use in an I, bulb-tee, or box beam, or post-tensioned member.
3. Nominal 0.6 in.,  $A_s = 0.217 \text{ in}^2$ , for use in a in a bulb-tee beam or post-tensioned member.

## Rolled Steel Options

- 38 – W14 sections & 29 - W12 Sections
  - Total beam depths from 13.7” to 23.6” (W14) and 11.9” to 16.8” (W12)

## Welded Plate Girder Options

- Any geometry we want but...
  - Would welding equipment fit between flanges of 14” deep beams?

**Table 2 Overview of Bridge Steels Available in the A709 Specification**

M270 A709 GRADE	ASTM Specification	Description	Atmospheric Corrosion Resistance	Product Categories			
				Plates	Shapes	Bars	Sheet Piles
36	A36	Carbon Steel	No	X	X	X	
50	A572	HSLA Steel	No	X	X	X	X
50S	A992	Structural Steel	No		X (***)		
QST 50	A913	HSLA Steel (QST*)	No		X (***)		
QST 50S	A913	HSLA Steel (QST*)	No		X (***)		
50W	A588	HSLA Steel	Yes	X	X	X	
HPS 50W	A709	HSLA Steel (**)	Yes	X			
50CR	A1010	Martensitic Stainless Steel	Yes	X			
QST 65	A913	HSLA Steel (QST*)	No		X (***)		
QST 70	A913	HSLA Steel (QST*)	No		X (***)		
HPS 70W	A709	Heat Treated HSLA Steel (**)	Yes	X			
HPS 100W	A709	Q&T Cu-Ni Steel (**)	Yes	X			

(\*) High Strength Low-Alloy Steel shapes produced by quenching and self-tempering process (QST)

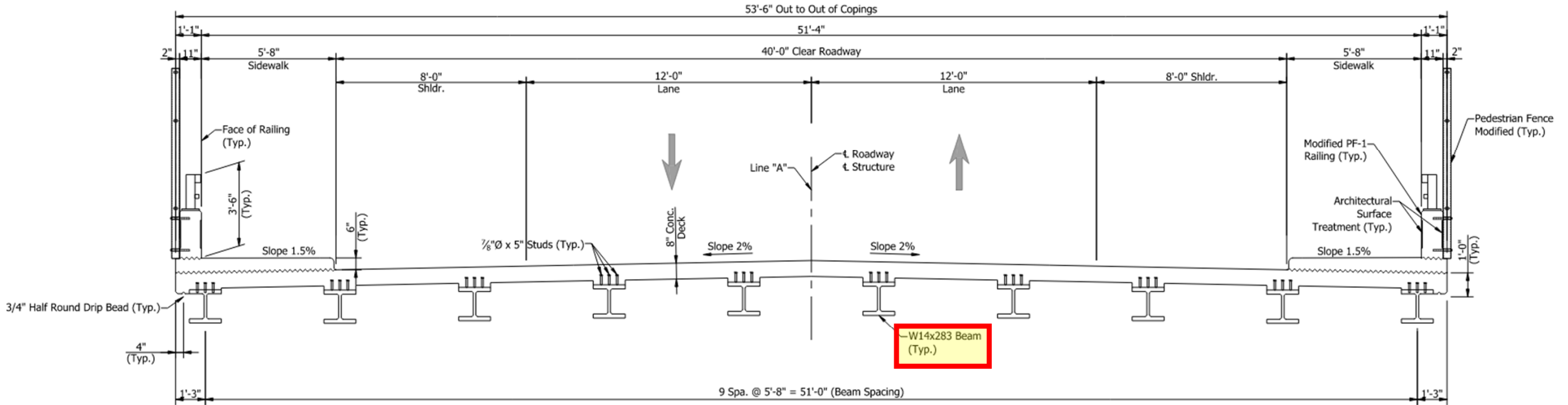
(\*\*) High Performance Steel (HPS) grades with enhanced weldability and toughness

HSLA - High Strength Low-Alloy

Q&T - Cu-Ni Quenched & Tempered Copper-Nickel Steel

(\*\*\*) Rolled I-sections and tee-sections only

# SELECTED STEEL BEAMS



TYPICAL SECTION - PROPOSED  
Scale: 3/8" = 1'-0"

## MATERIAL DESIGN STRENGTHS:

Class "C" Concrete	$F'_c = 4,000$ p.s.i.
Class "B" Concrete	$F'_c = 3,000$ p.s.i.
Class "A" Concrete	$F'_c = 3,500$ p.s.i.
Reinforcing Steel (Grade 60)	$F_y = 60,000$ p.s.i.
ASTM A709 Structural Steel (Grade 50W T2, Modified)	$F_y = 70,000$ p.s.i.
ASTM A709 Structural Steel (Grade 50W)	$F_y = 50,000$ p.s.i.

## Modified A709-50WT2 with restrictions:

Minimum yield of 70 ksi

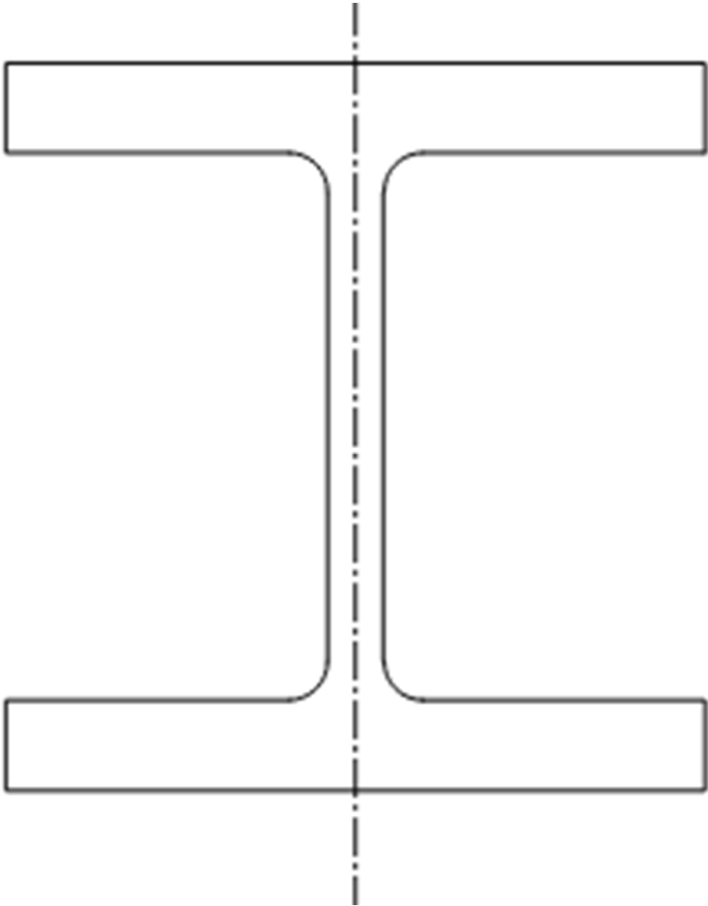
Tensile of 85-110 ksi

Minimum Elongation of 16% with 8in gage length

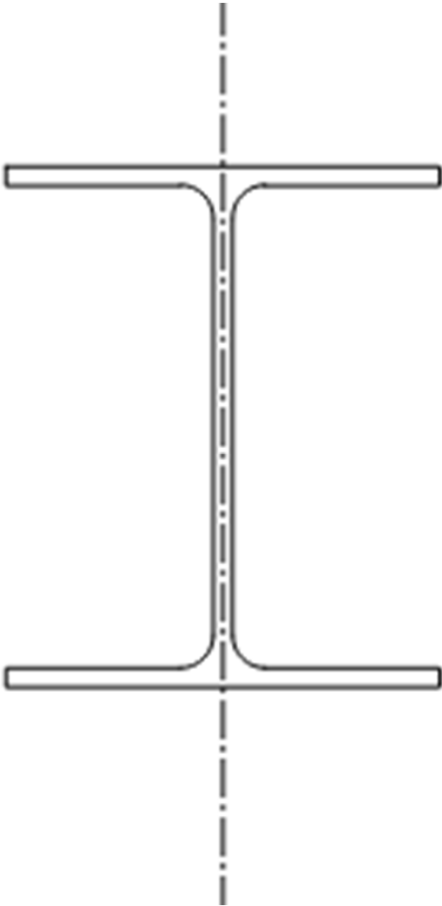
25 ft.lbf @ -10°F, H-Frequency, Flange Location CVN

Chemistry Restrictions to meet that of A709-HPS70W

# SELECTED STEEL BEAMS



**W14x283**



**HP12x53**

# SELECTED STEEL BEAMS



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# SELECTED STEEL BEAMS



TABLE OF CAMBERS (EXTERIOR GIRDERS)			
	¼ PT.	½ PT.	¾ PT.
DEAD LOAD STEEL	0.94"	1.31"	0.94"
DEAD LOAD CONCRETE	1.63"	2.31"	1.63"
DEAD LOAD RAILING	0.31"	0.44"	0.31"
SUBTOTAL	2.81"	4.06"	2.81"
GEOMETRIC CAMBER	4.38"	5.81"	4.38"
TOTAL	7.25"	9.88"	7.25"

TABLE OF CAMBERS (INTERIOR GIRDERS)			
	¼ PT.	½ PT.	¾ PT.
DEAD LOAD STEEL	0.94"	1.31"	0.94"
DEAD LOAD CONCRETE	2.19"	3.06"	2.19"
DEAD LOAD RAILING	0.31"	0.38"	0.31"
SUBTOTAL	3.38"	4.81"	3.38"
GEOMETRIC CAMBER	4.38"	5.81"	4.38"
TOTAL	7.76"	10.62"	7.76"

# SELECTED STEEL BEAMS

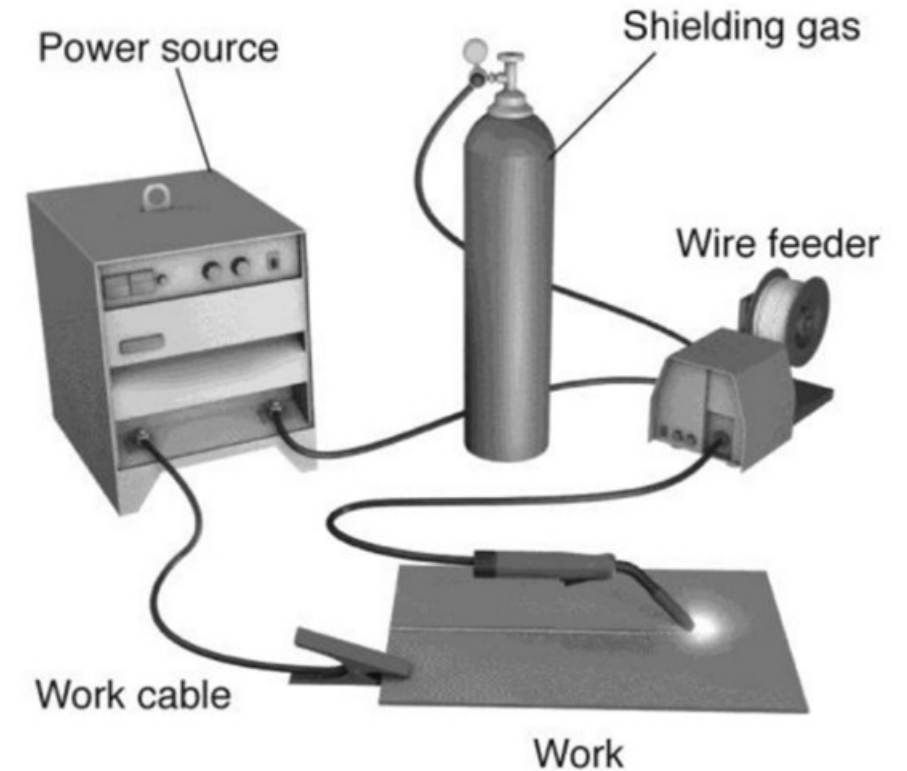


## SAW



Source: FHWA

## FCAW



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## Flux Core Arc Welding

# QUESTIONS?



MAIN STREET BRIDGE, UPLAND, IND.

