2025 AISC/ASCE Student Steel Bridge Competition

Team Members: Jakob Ramos (Team Leader), Andrew Byrne, David Cardenas, Ethan Moyer, Matthew Nagy

Faculty Advisor: Dr. Nabil Al-Omaishi

Problem Statement

Location: Skunk River Water Trail, Story County, Iowa

Objective: Pedestrian bridge to connect walking trails

Realistic Constraints

Economic:

- Fundraising and Budget

Standards:

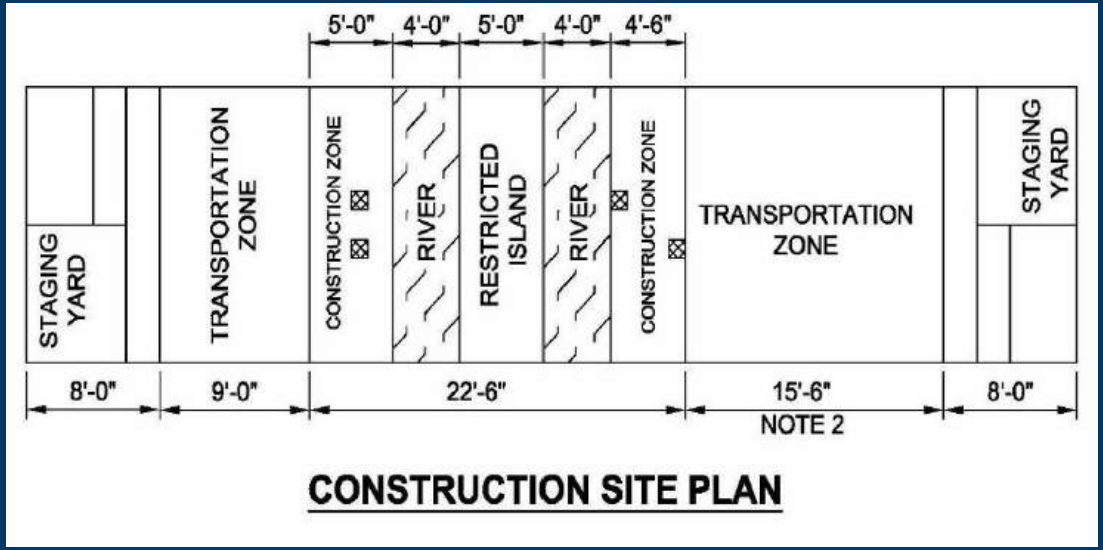
- AISC/ASCE Rules

Health and Safety:

- Fabrication and Construction Practices

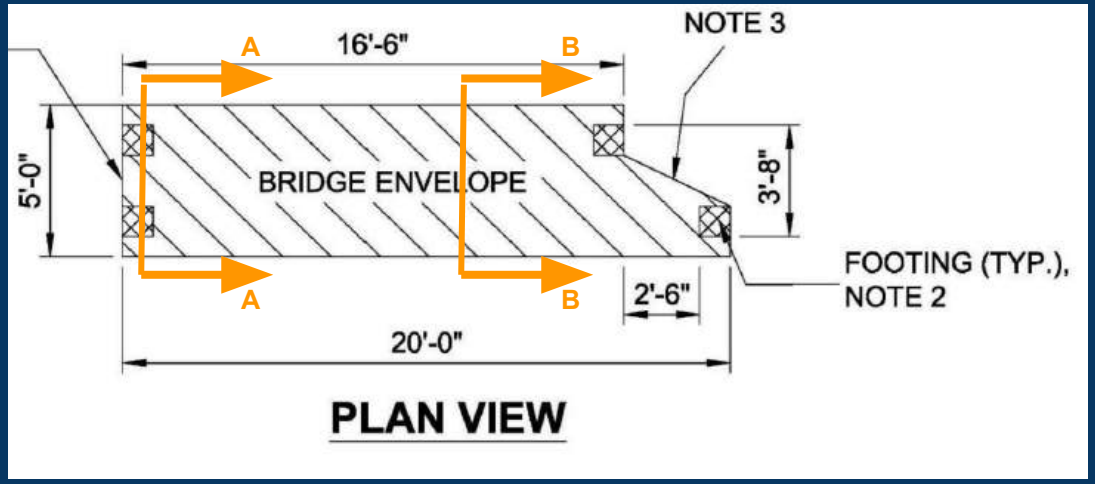
Design Constraints

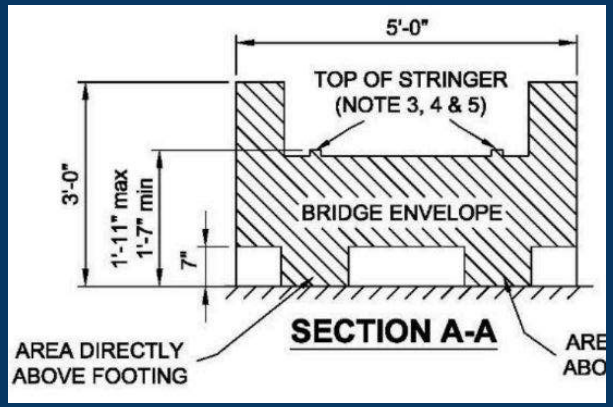
- Restricted Island
- 2 Rivers
- Large Transportation Distance

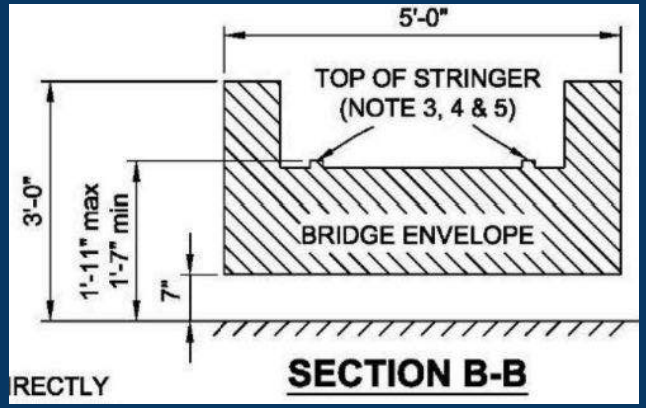


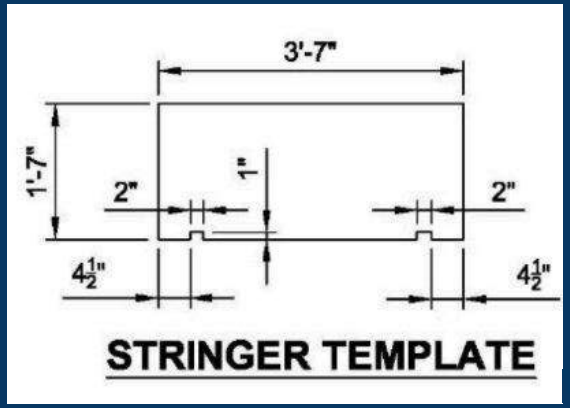
CONSTRUCTION SITE PLAN

Design Constraints

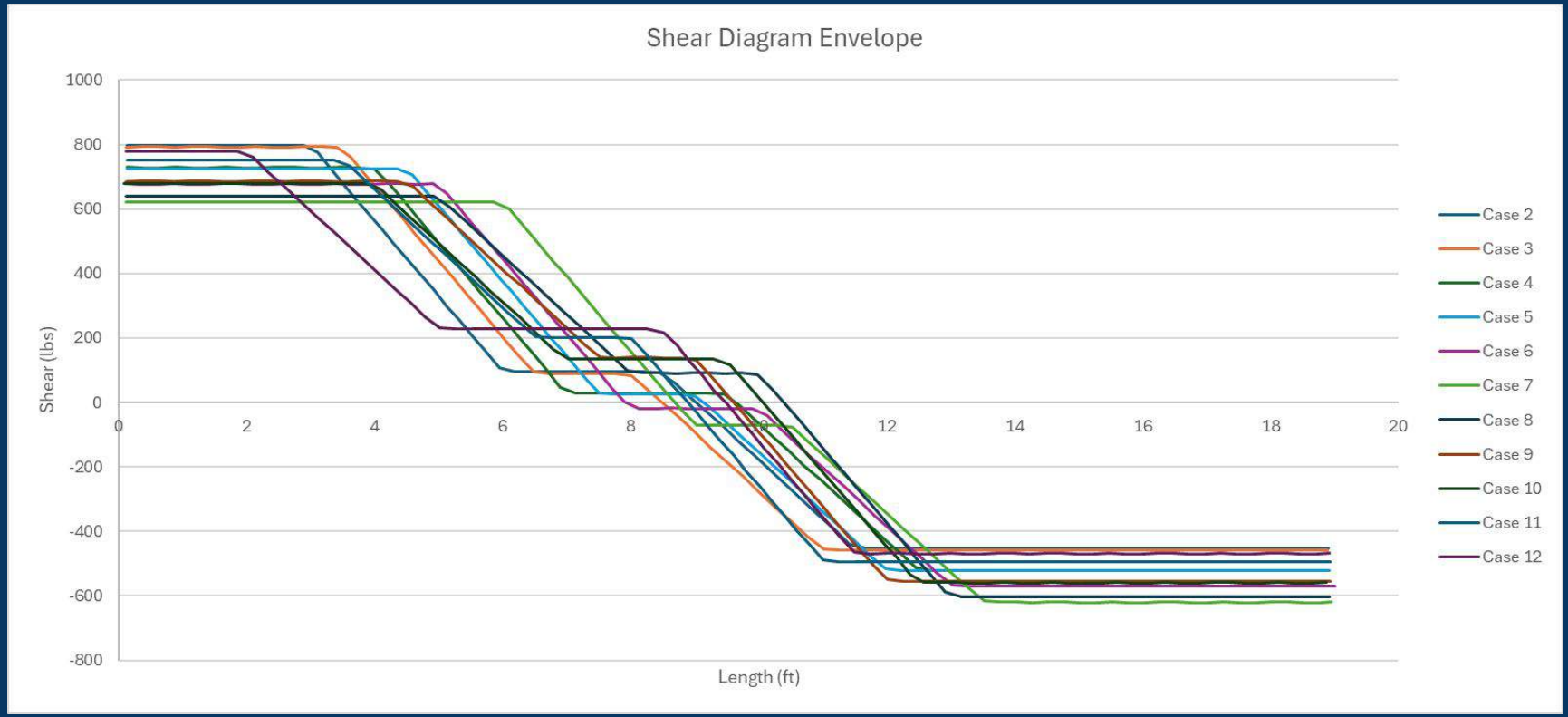




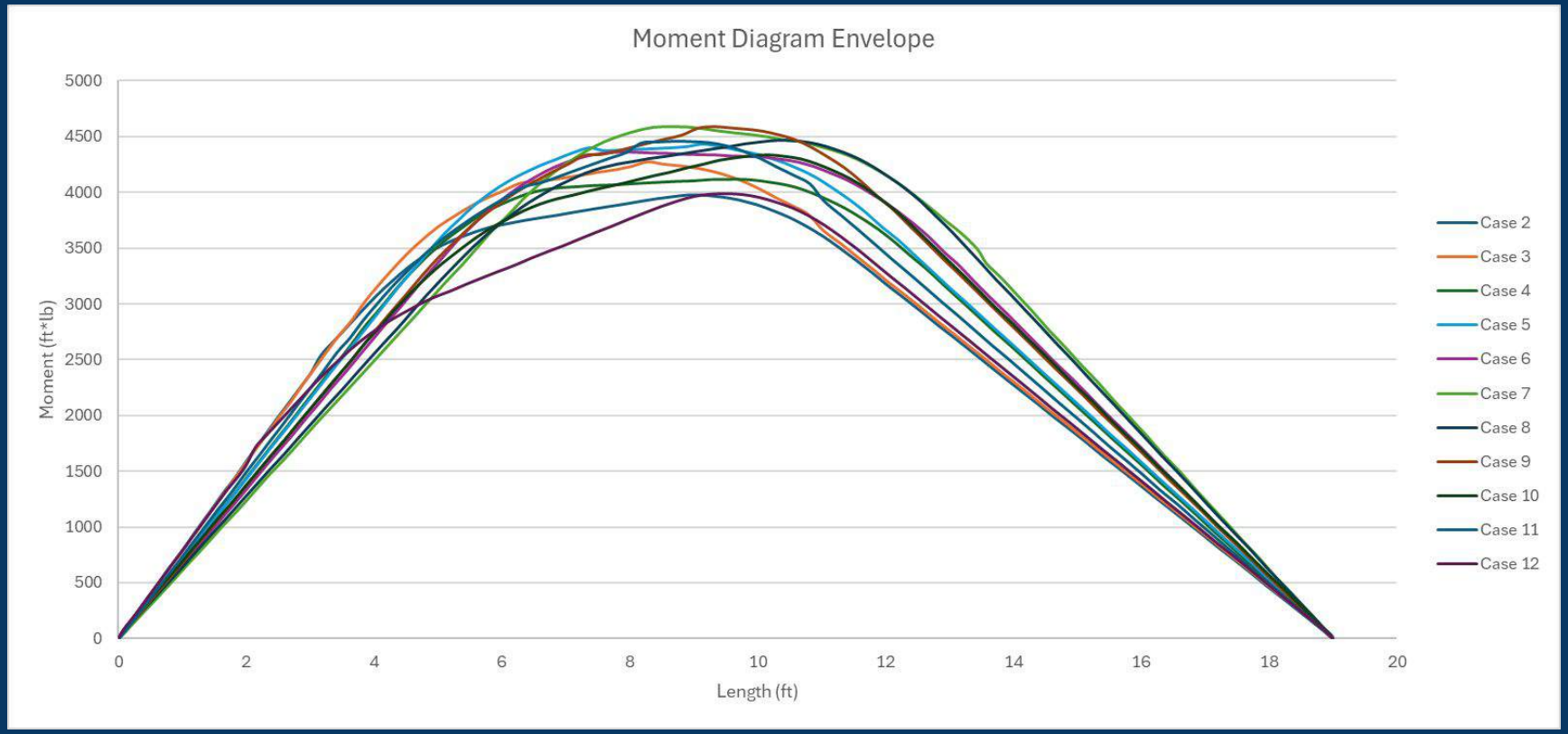




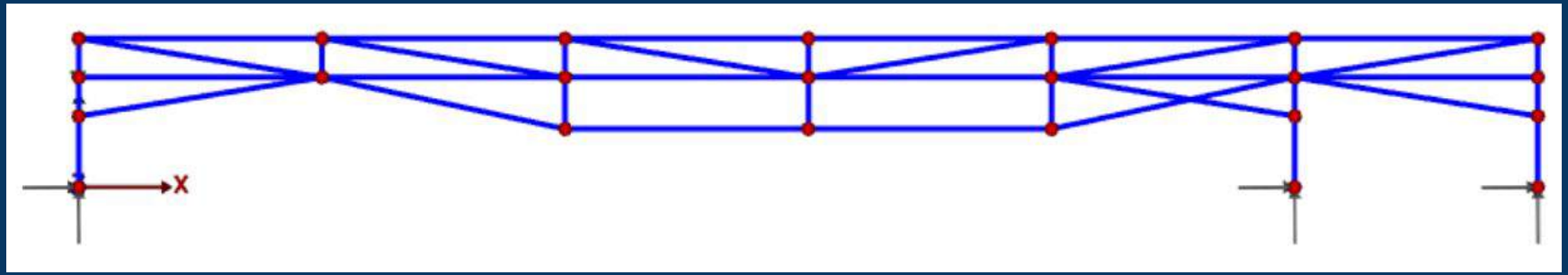
Shear Diagram Envelope



Moment Diagram Envelope



Design 1
Beam With Partial Under Truss



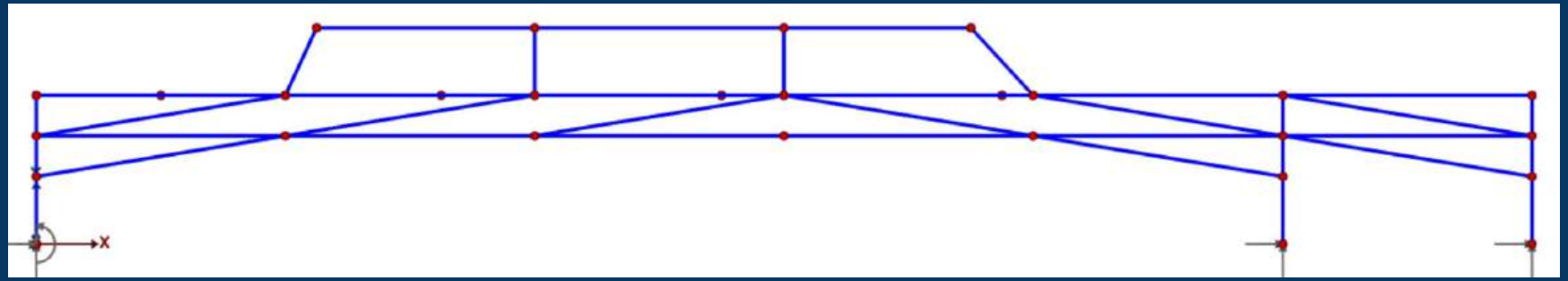
Pros

- Lightweight
- Minimal connections
- Constructability

Cons

- Deflection
- Fabrication

Design 2
Beam With Partial Over Truss



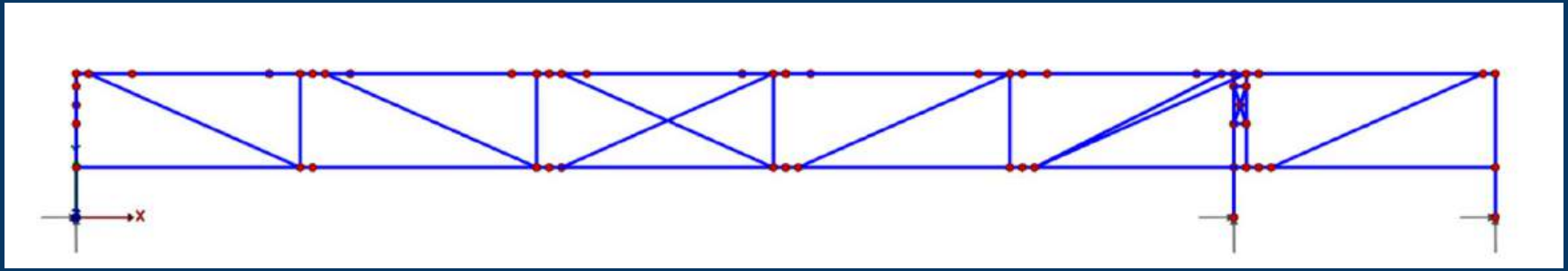
Pros

- Fabrication
- Minimal connections

Cons

- Self Weight
- Constructability

Design 3
Pratt Truss Beam Bridge



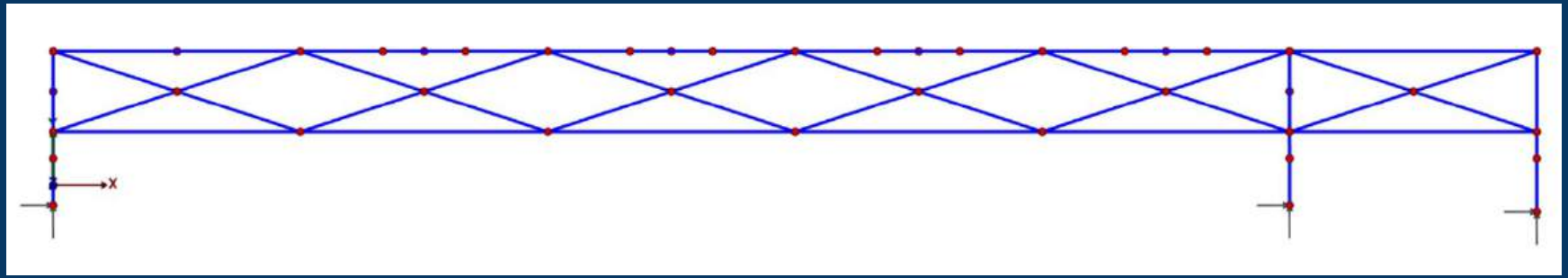
Pros

- Deflection
- Fabrication

Cons

- Self Weight
- Constructability

Design 4
Beam Bridge



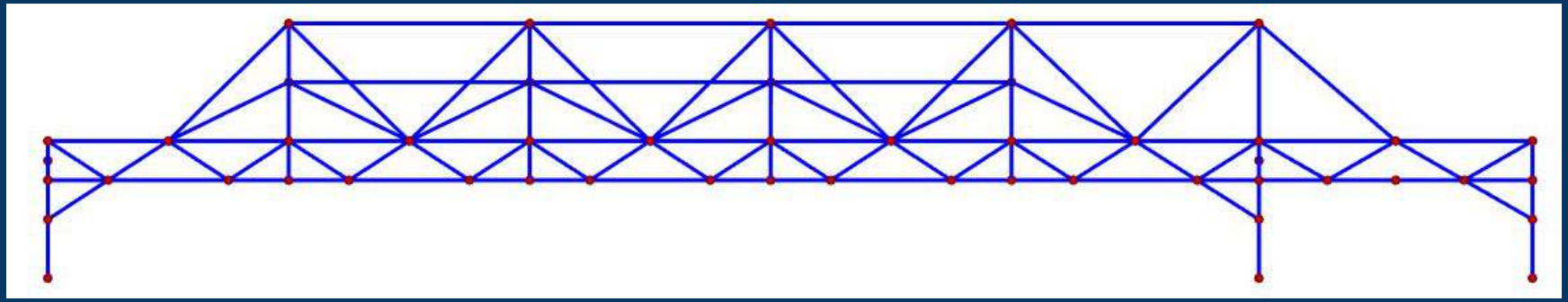
Pros

- Deflection

Cons

- Connections
- Self Weight

Design 5
Beam Bridge With Over Truss



Pros

- Deflection

Cons

- Constructability
- Self Weight

Decision Matrix

C_c = ($120,000 x time (min) x non-barge-builders)

\+ ($270,000 x time (min) x barge-builders)

C_s = (Aggregate Deflection (in) x $4,250,000)

\+ (weight$^{2.11}$ (lbs) x $15)

- Estimated Competition Score: $C_c + C_s$
- Constructability Factor

Decision Matrix - Sample Spreadsheet

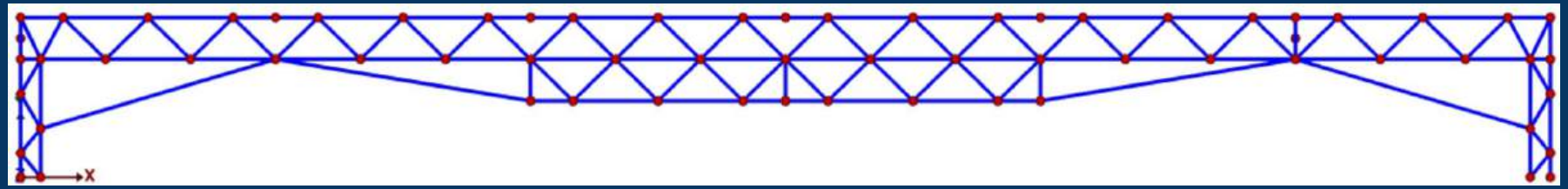
Inputs from Visual Analysis		Calculations and Estimations	
Long Stringer Deflection (in)	0.181	Aggregate Deflection (in)	1.585
Short Stringer Deflection (in)	0.136	Construction Time (min)	7.29
Lateral Sway (in)	0.09	Structural Efficiency ($)	$ 7,300,712
Total Weight (lbs)	184	Construction Economy ($)	$ 5,467,500
Number of Connections	50	Constructability Factor	11,148,084
Number of Members	31	Deflection > 2" penalty	$0.00
Builders (best guess)	4	Cum. Bridge Score	**23,916,295**
Barges (best guess)	1	Competition Cost	**$ 12,768,212**

Design Analysis

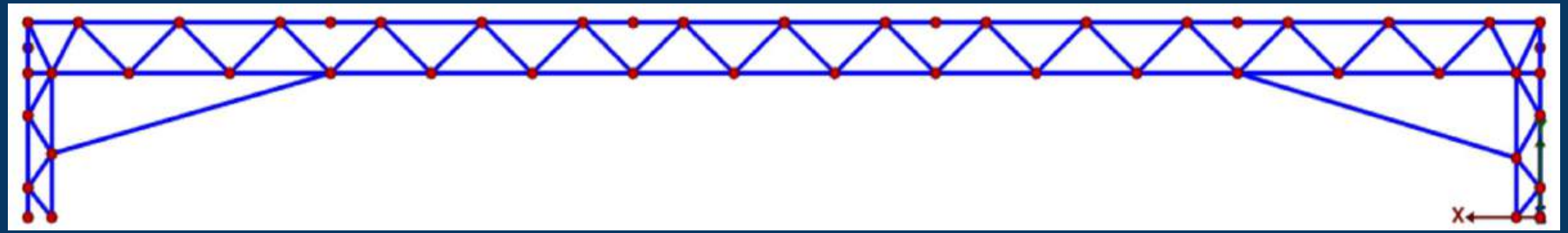
Design	Constructibility Factor	Estimated Competition Score
1	23,916,295	$ 12,768,212
2	61,924,588	$ 39,915,860
3	35,992,523	$ 17,278,733
4	33,990,359	$ 15,445,744
5	106,867,271	$ 53,881,257

Final Decision

Long Span:



Short Span:



Final Design

Materials

Members

- 1/2” x 1/2” x 16 GA
- 1” x 1” x 11 GA
- 1½” x 1½” x 16 GA

Plates for Connections

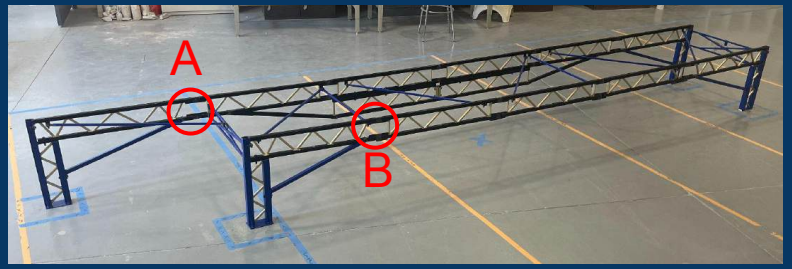
- ⅛” thick
- ¼” thick

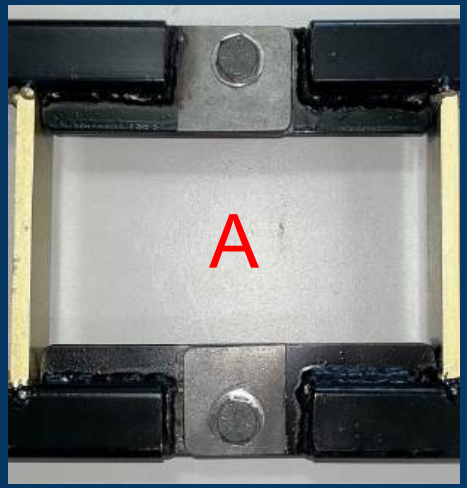
Bolts

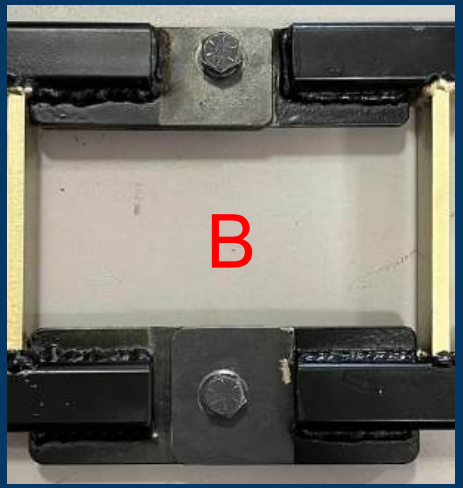
- ⅜” diameter Grade 8 (varying size)

Typical Span Connection Design

- Double Shear
- Quick & Strong
- ⅛” thick plate

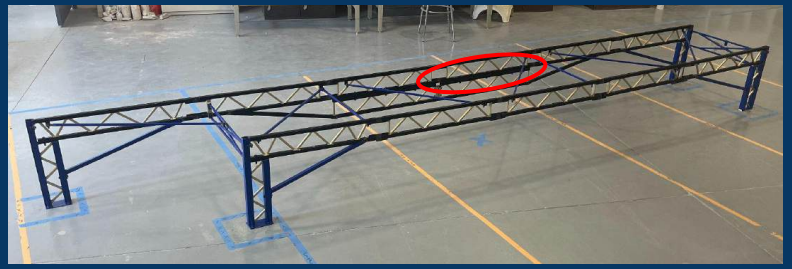






Truss Connections

- Carries shear
- 1”x1”x 11 GA tube



Footing Connections

- Resists Twist
- T-Shape
- ⅛” thick Plate

Budget and Fundraising

Item	Budgeted	Expended	Difference
Steel sections	$571	$0	$571
Steel Plate	$250	$0	$250
Bolts & Nuts	$198	-$118	$80
Angle Bars	$138	$0	$138
Cart	$200	-$133	$67
Tools	$650	-$1,190	-$540
Registration	$1,350	-$675	$675
Transportation	$176	-$60	$116
Hotel	$250	-$604	-$354
Other	$150	-$195	-$45
	$3,933	-$2,975	$958

Fundraising	
CME	$500
Capital Steel	$571
McCormick Taylor	$1,000
Whiting-Turner	$500
AISC	$750

Engineering Services

Task	Dr. Nabil Al-Omaishi Faculty Advisor Engineer V	Joseph Zanetti Lead Machinist Machinist	Jakob Ramos Team Leader Engineer II	Andrew Byrne Connections Lead Engineer I	David Cardenas Members Lead Engineer I	Ethan Moyer CAD Lead Engineer I	Matthew Nagy Material Analysis/Fabrication Lead Engineer I
Fall Semester							
Research	2		8	8	8	8	8
Fundraising			5	3	3	3	3
Proposal Presentation	1		10	8	8	8	8
Alternative Designs	8	2	25	25	25	25	25
Quarterly Report	2		10	10	10	10	10
Final Design Improvements	3	2	18	18	18	18	18
Member Designs	2	1	5	5	6	7	6
Connection Designs	5	1	12	16	12	12	15
CAD Drawings		1	6	6	7	8	6
Material Ordering			4	2	2	2	2
Competition Preperation			8	4	6	4	4
Welding Clinic		2	2	2	2	2	2
Fabrication		10	25	25	25	25	25
Total Fall Semester Hours	**23**	**19**	**138**	**132**	**132**	**132**	**132**
Winter Semester							
Fabrication		30	50	50	50	50	50
Spring Semester							
Fabrication		10	15	15	15	15	15
Construction Practice	1	5	45	45	45	45	45
Student Symposium	8		12	12	12	12	12
Final Report	1		10	10	10	10	10
Final Presentation	1		10	10	10	10	10
Total Spring Semester Hou	**11**	**15**	**92**	**92**	**92**	**92**	**92**
Total Hours							
Total Hours	**34**	**64**	**280**	**274**	**274**	**274**	**274**

Engineering Services Cost

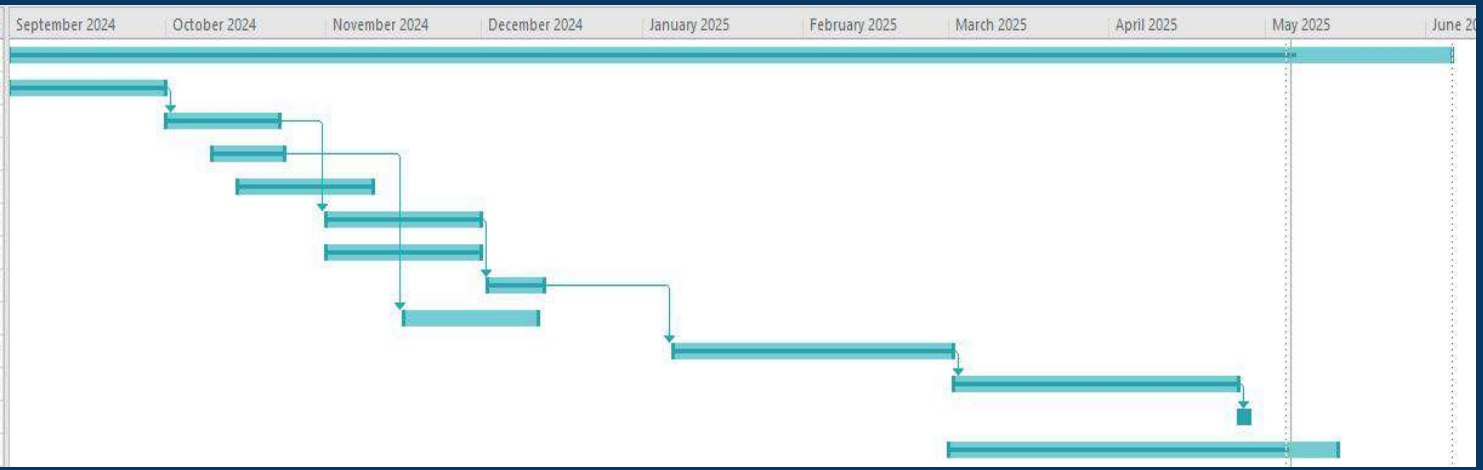
Team Member	Dr. Nabil Al-Omaishi	Joseph Zanetti	Jakob Ramos	Andrew Byrne	David Cardenas	Ethan Moyer	Matthew Nagy
Position	Faculty Advisor	Lead Machinist	Team Leader	Connections Lead	Members Lead	CAD Lead	Material Analysis/Fabrication Lead
Payroll Title	Engineer V	Machinist	Engineer II	Engineer I	Engineer I	Engineer I	Engineer I
Hourly Rate	$100	$70	$40	$38	$38	$38	$38
Fall Total Hours	23	19	138	132	132	132	132
Salaries	$2,300	$1,330	$5,520	$5,016	$5,016	$5,016	$5,016
Winter Total Hours	0	30	50	50	50	50	50
Salaries	$0	$2,100	$2,000	$1,900	$1,900	$1,900	$1,900
Spring Total Hours	11	15	92	92	92	92	92
Salaries	$1,100	$1,050	$3,680	$3,496	$3,496	$3,496	$3,496
Total Salaries	**$3,400**	**$4,480**	**$11,200**	**$10,412**	**$10,412**	**$10,412**	**$10,412**

Engineering Services Cost

Engineering Cost		
Fall Total		$29,214
Overhead Fee	150%	$43,821
Fixed Fee	10%	$2,922
Fall Total Engineering Cost		**$75,957**
Winter Total		$19,814
Overhead Fee	150%	$29,721
Fixed Fee	10%	$1,982
Winter Total Engineering Cost		**$51,517**
Spring Total		$19,814
Overhead Fee	150%	$29,721
Fixed Fee	10%	$1,982
Spring Total Engineering Cost		**$51,517**
Year Total Engineering Cost		**$178,991**

Timeline

Task Name	% Complete
Fundraising	89%
Research	100%
Alternative Designs	100%
Quarterly Report/Presentation	100%
Connection and Member Design	100%
Final Design	100%
CAD Drawings	100%
Oder Materials	100%
Final Fall Presentation	100%
Fabrication	100%
Construction Practice	100%
Regional Competition	100%
Spring Final Report/Presentation	86%



Regional Competition

- Hosted by NJIT on the 25th-27th of April

Competition Estimates

Construction Time: 10 minutes

Worst Load Case: IX

Weight: 215 pounds

Deflection: 1.8 inches

Construction Cost: $21,136,179

Construction Timelapse

Competition Results

Construction Time: 9 Minutes 35 Seconds

Load Case: XIII

Weight: 205.1 pounds

Total Weight: 425.1 pounds

Deflection: 1.48 inches

Construction Cost: $16,393,784.12

Awards

First Place: Aesthetics

First Place: Construction Time

Second Place: Construction Economy

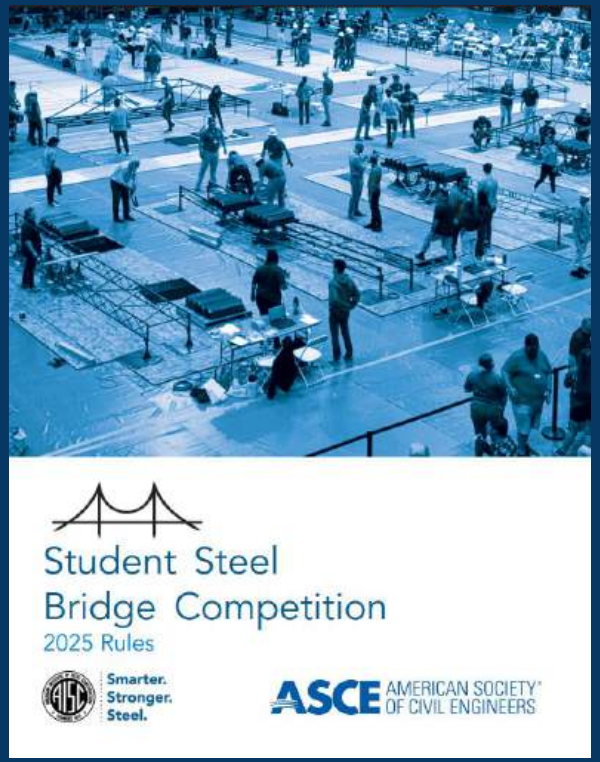
Second Place: Overall

National Competition

- Hosted by Iowa State University on the 30th-31st of May

Recommendations

- Geometric Design
- Simplicity
- Connection Design



Acknowledgements

- Dr. Nabil Al-Omaishi
- Joe Zanetti
- Civil Engineering Faculty
- Capital Steel LLC
- CME Associates
- Whiting-Turner
- AISC

Questions?