



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

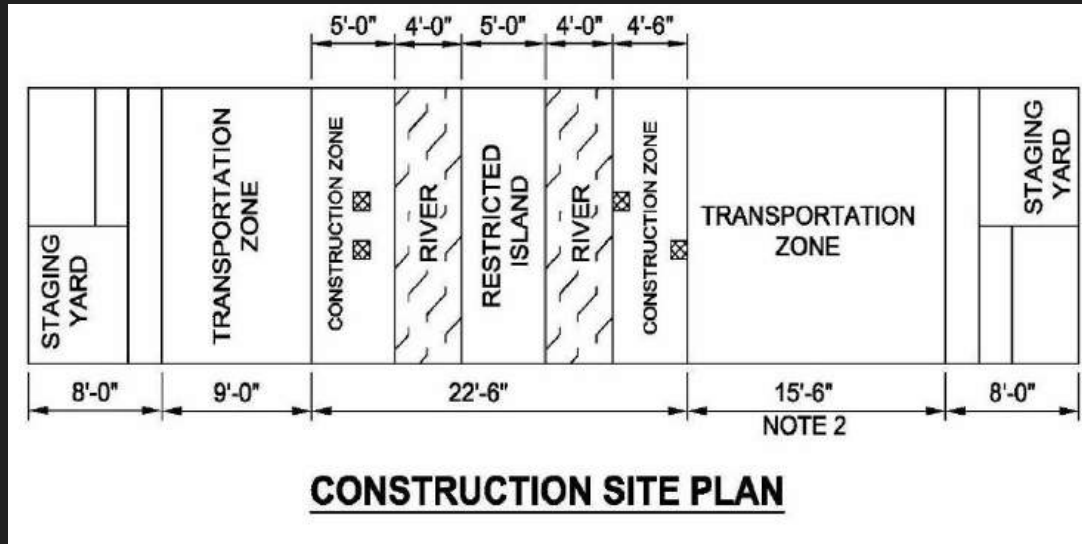
Location: Skunk River Water Trail, Story County, Iowa

Objective: Pedestrian bridge to connect walking trails

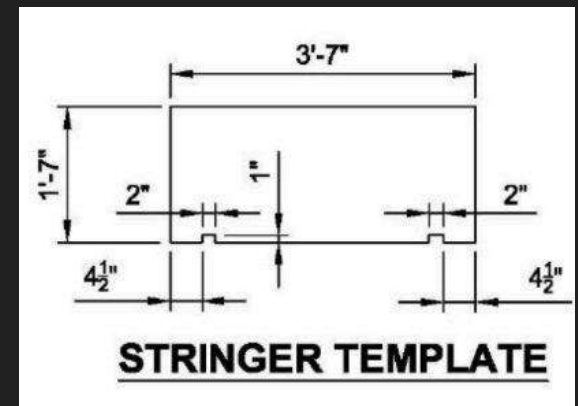
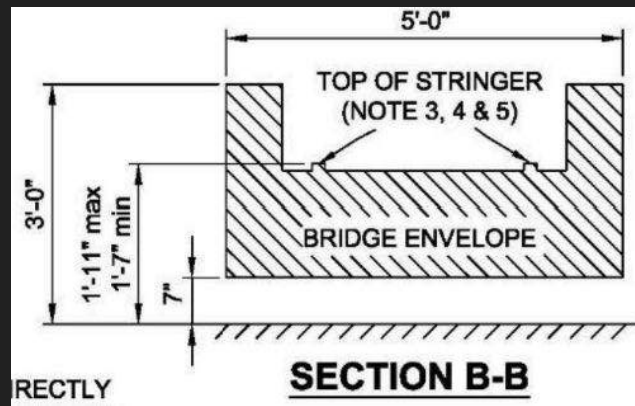
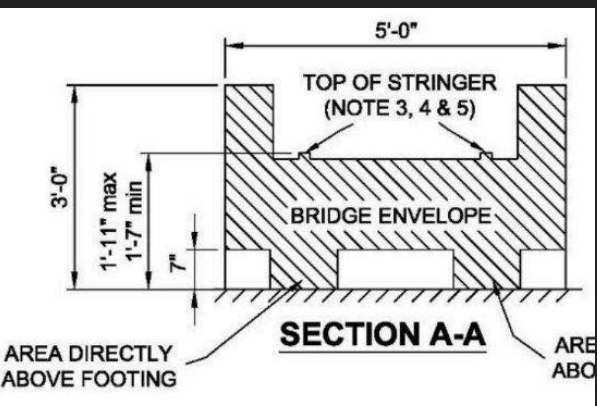
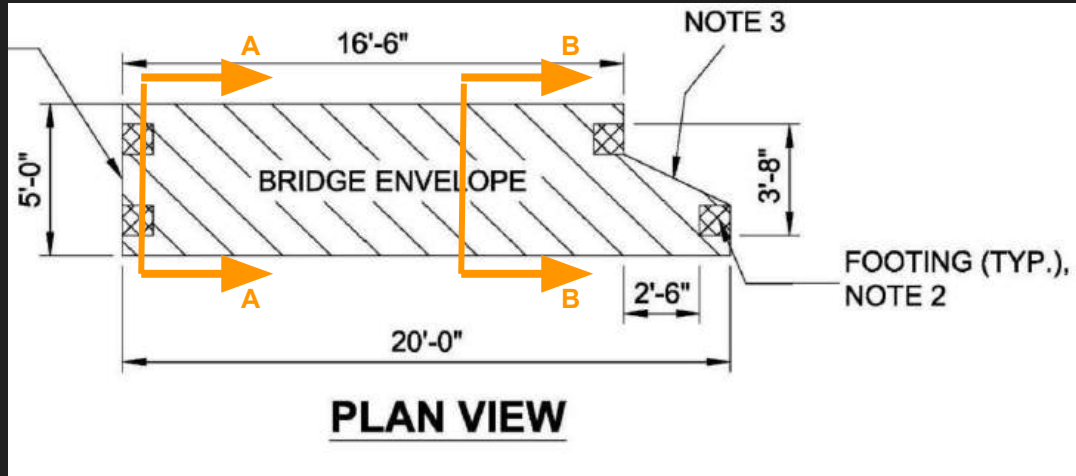


Realistic Constraints

- Restricted Island
- 2 Rivers
- Large Transportation Distance



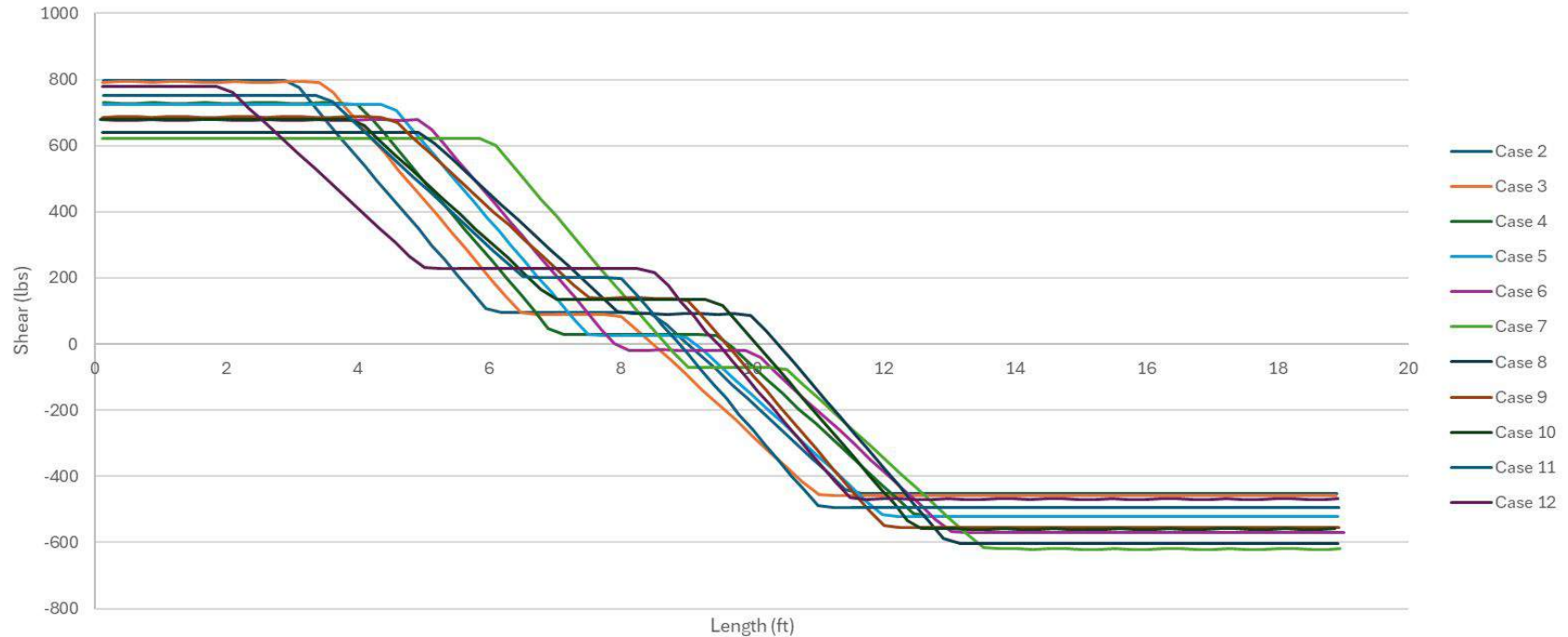
Design Constraints



Shear Diagram Envelope



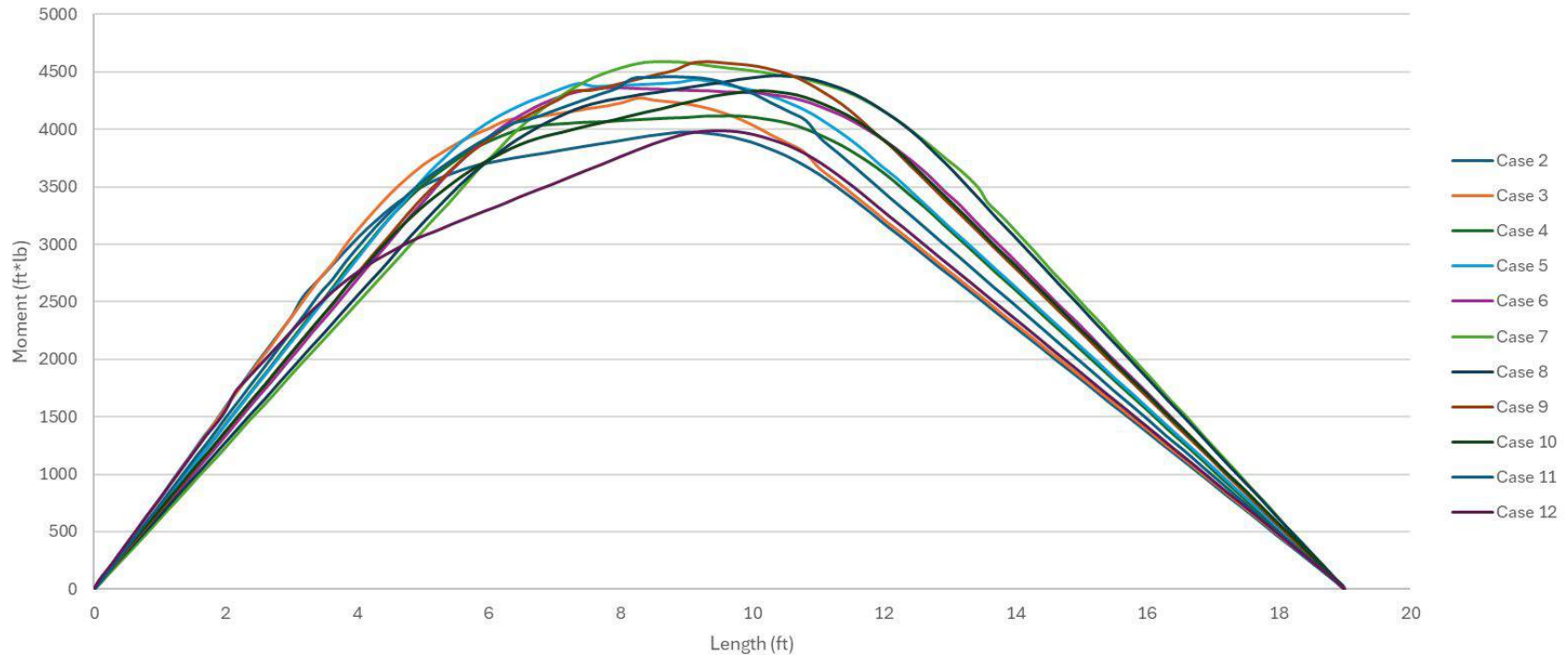
Shear Diagram Envelope



Moment Diagram Envelope

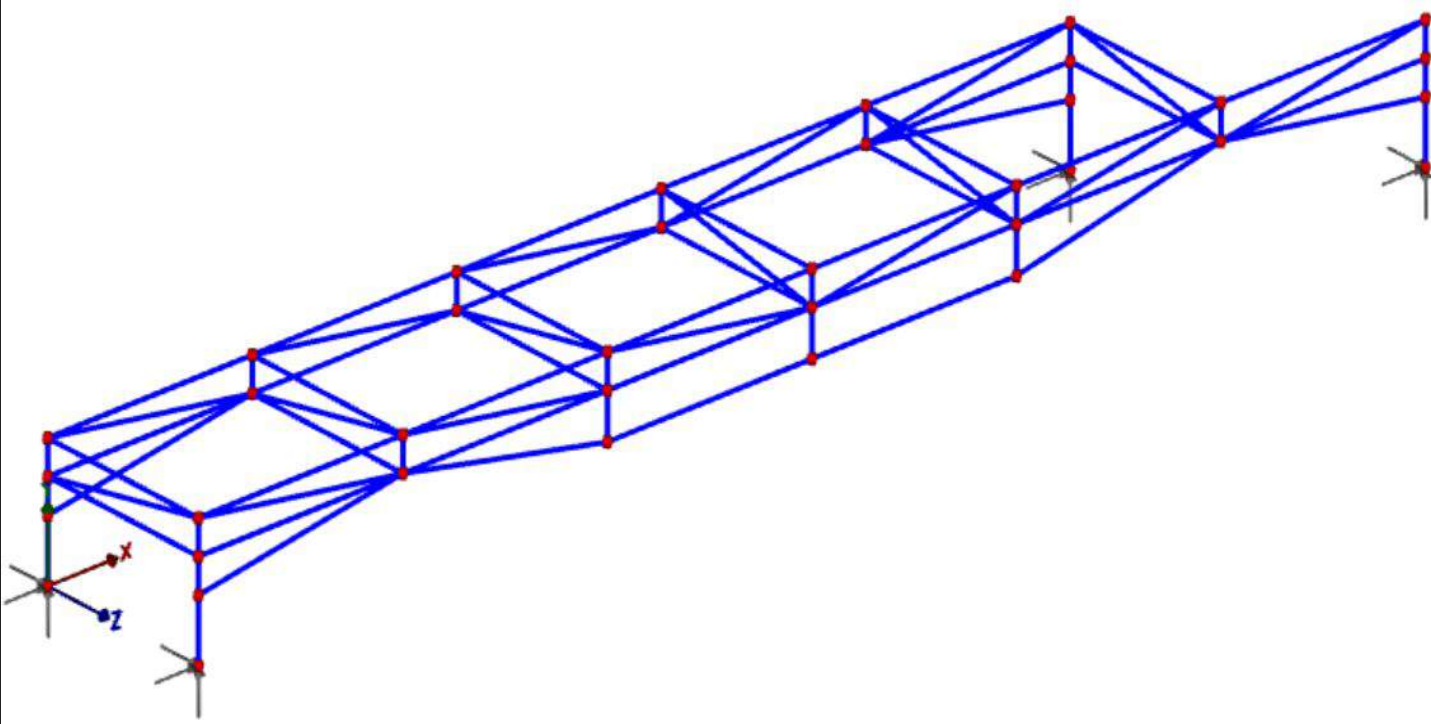


Moment Diagram Envelope



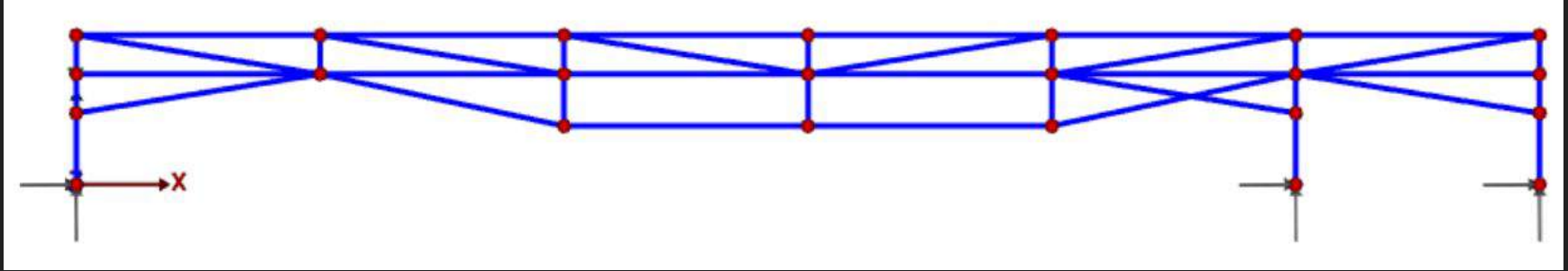
Design 1

Beam With Partial Under Truss



Design 1

Beam With Partial Under Truss



Pros

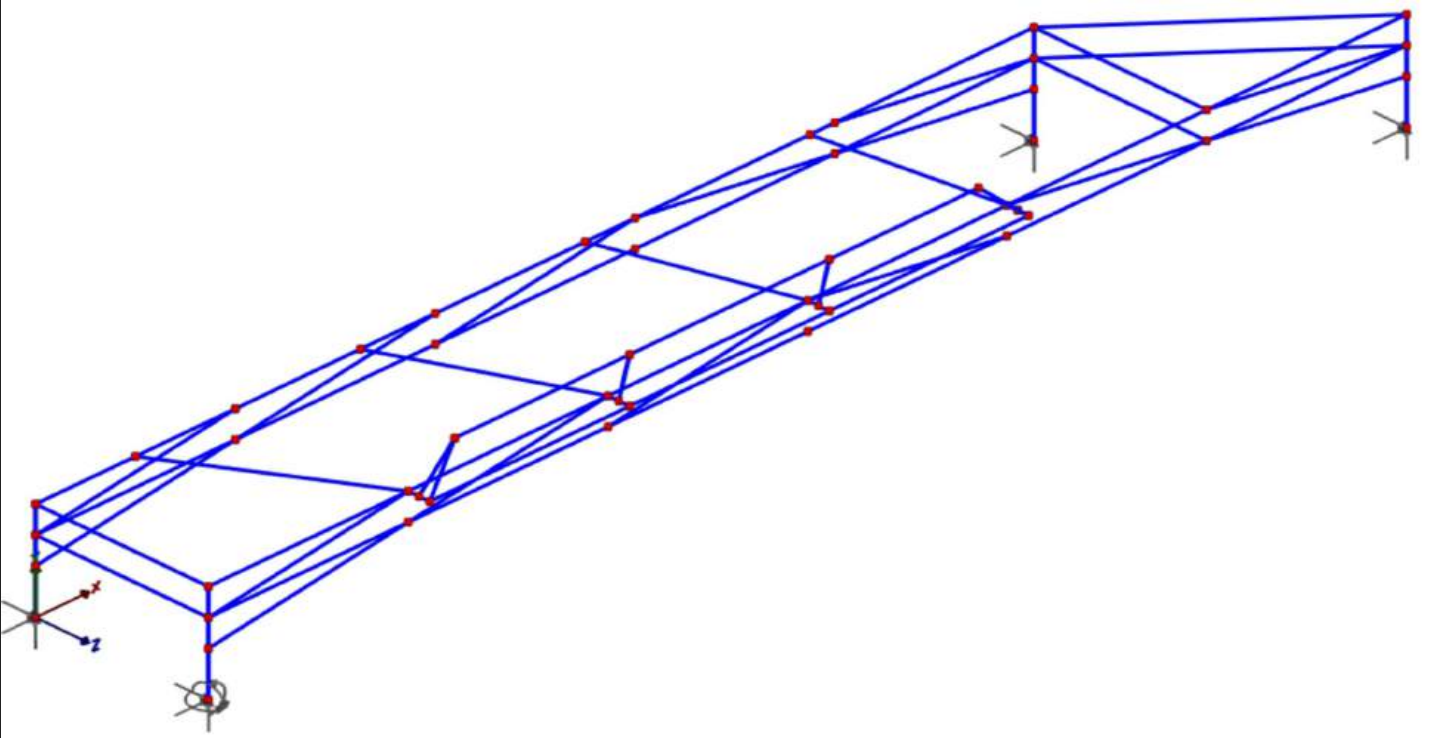
- Lightweight
- Minimal connections
- Constructability

Cons

- Deflection
- Fabrication

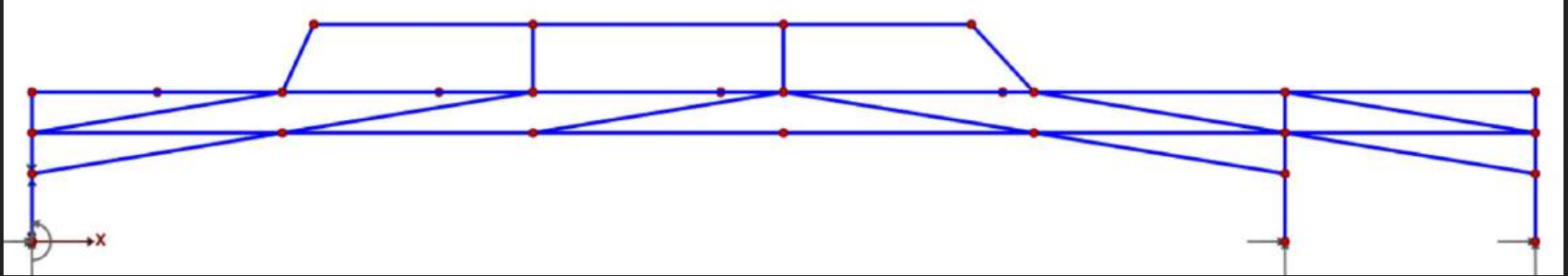
Design 2

Beam With Partial Over Truss



Design 2

Beam With Partial Over Truss



Pros

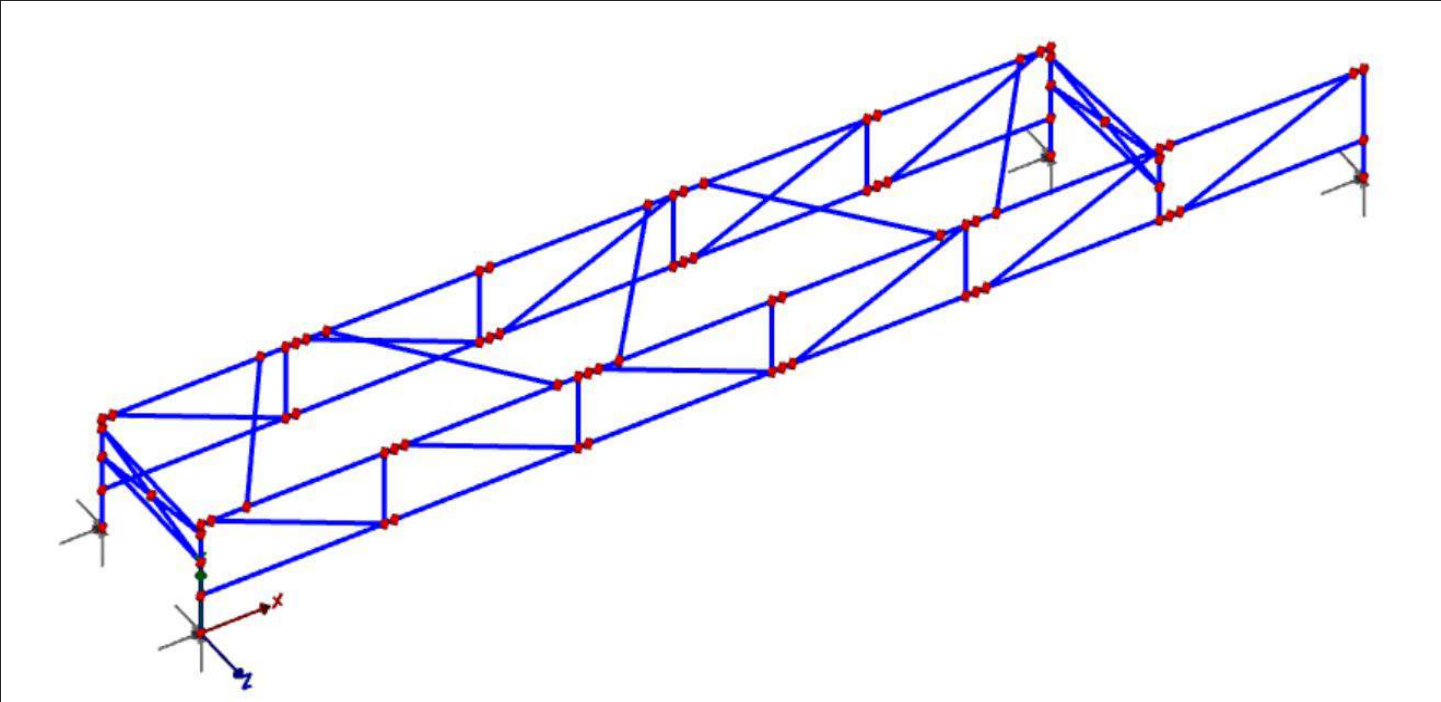
- Fabrication
- Minimal connections

Cons

- Self Weight
- Constructability

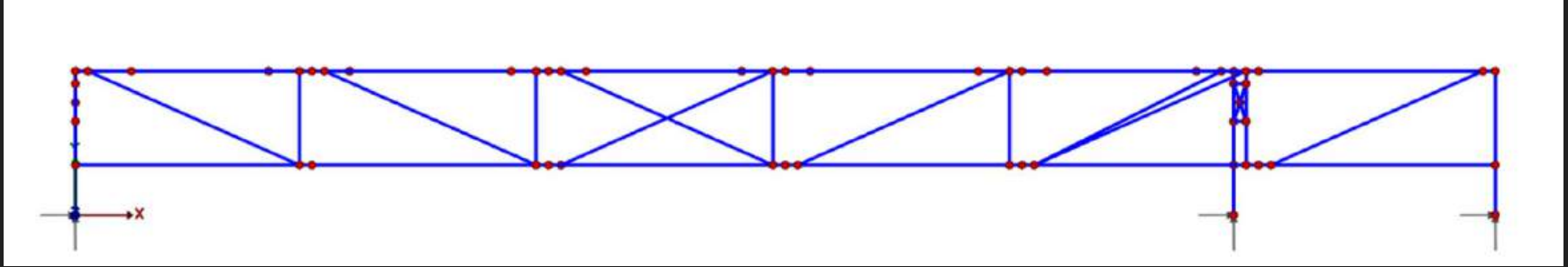
Design 3

Pratt Truss Beam Bridge



Design 3

Pratt Truss Beam Bridge



Pros

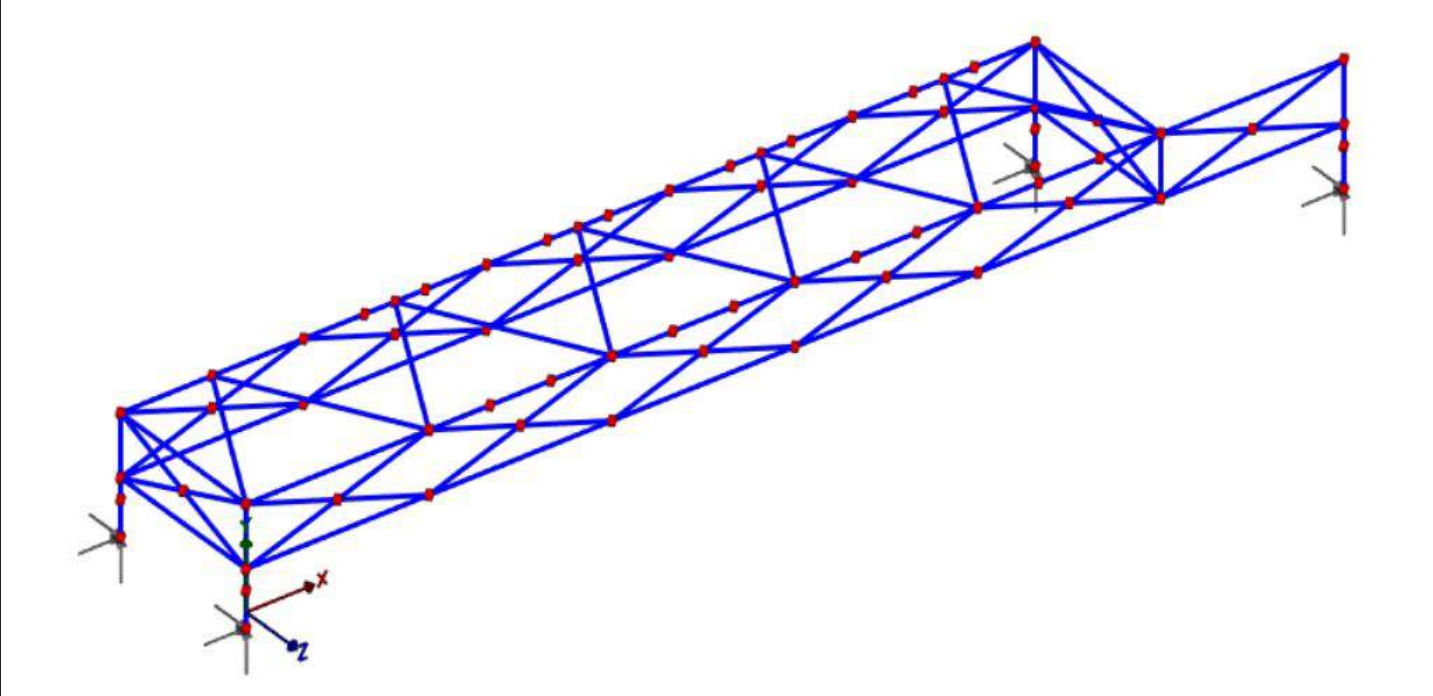
- Deflection
- Fabrication

Cons

- Self Weight
- Constructability

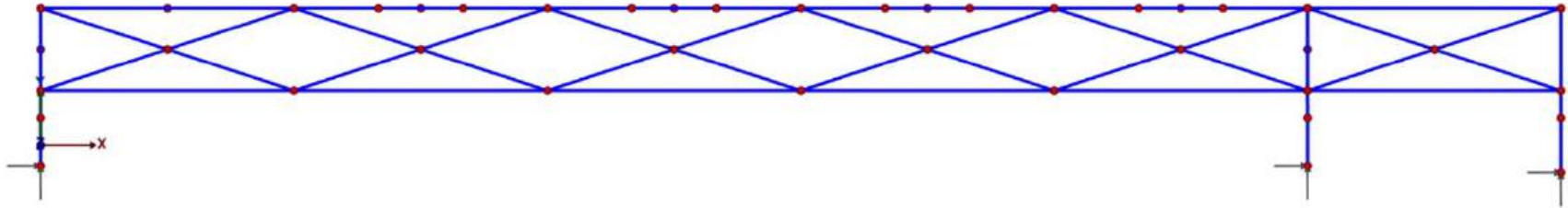
Design 4

Beam Bridge



Design 4

Beam Bridge



Pros

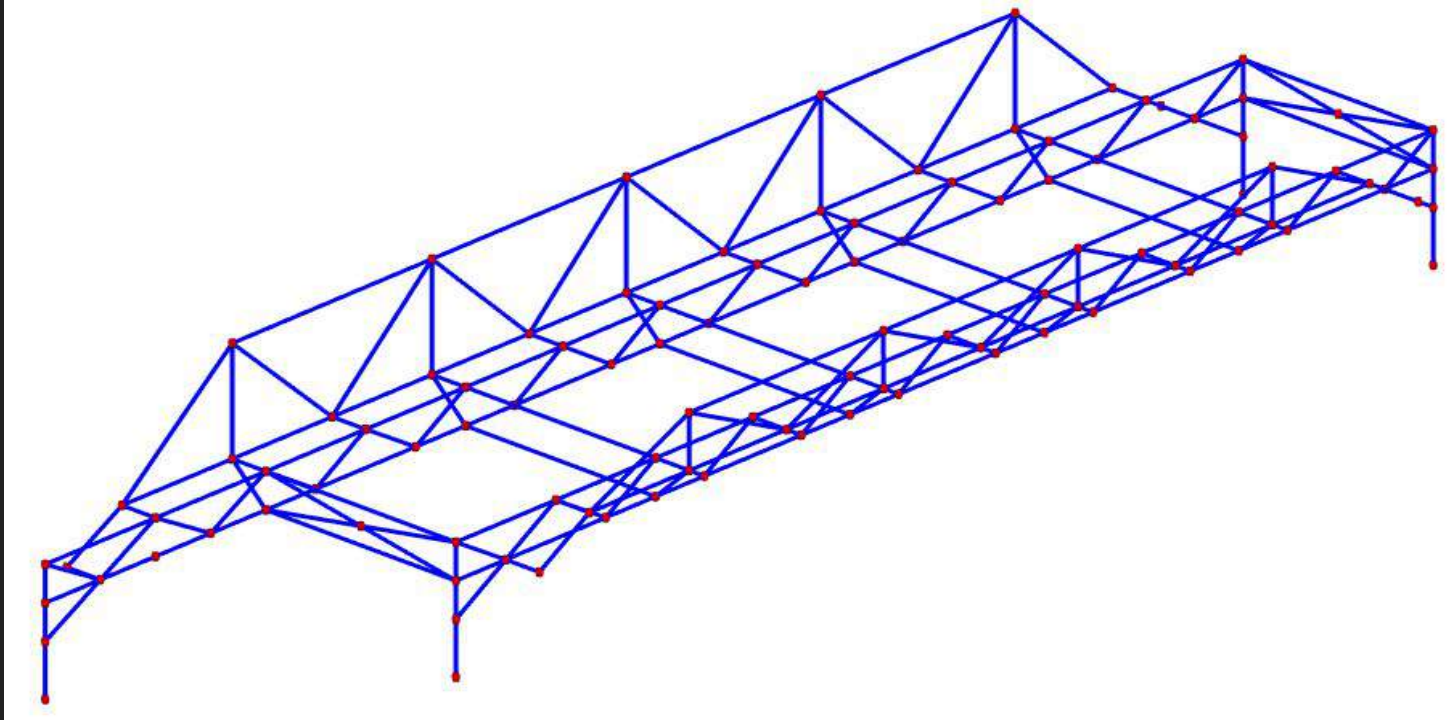
- Deflection

Cons

- Connections
- Self Weight

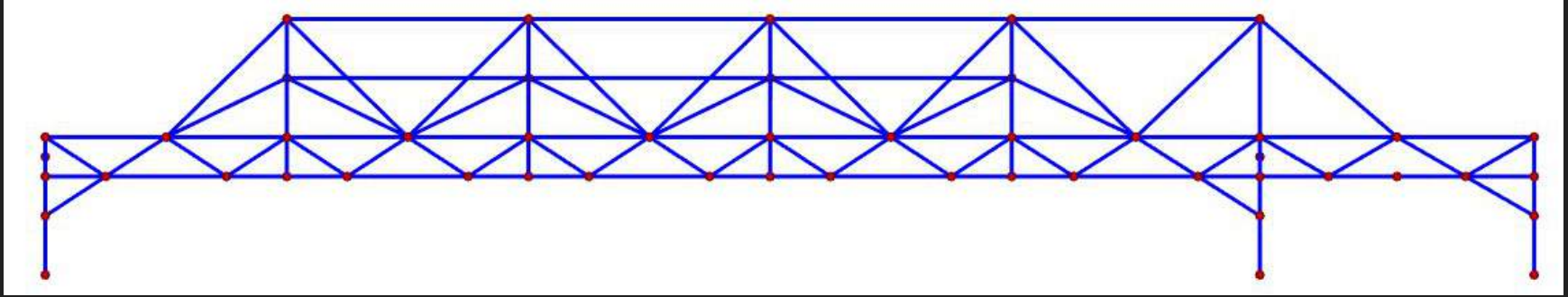
Design 5

Beam Bridge With Over Truss



Design 5

Beam Bridge With Over Truss



Pros

- Deflection

Cons

- Constructability
- Self Weight

Decision Matrix



$$C_c = (\$120,000 \times \text{time (min)} \times \text{non-barge-builders}) \\ + (\$270,000 \times \text{time (min)} \times \text{barge-builders})$$

$$C_s = (\text{Aggregate Deflection (in)} \times \$4,250,000) \\ + (\text{weight}^{2.11} \text{ (lbs)} \times \$15)$$

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

Decision Matrix - Sample Spreadsheet



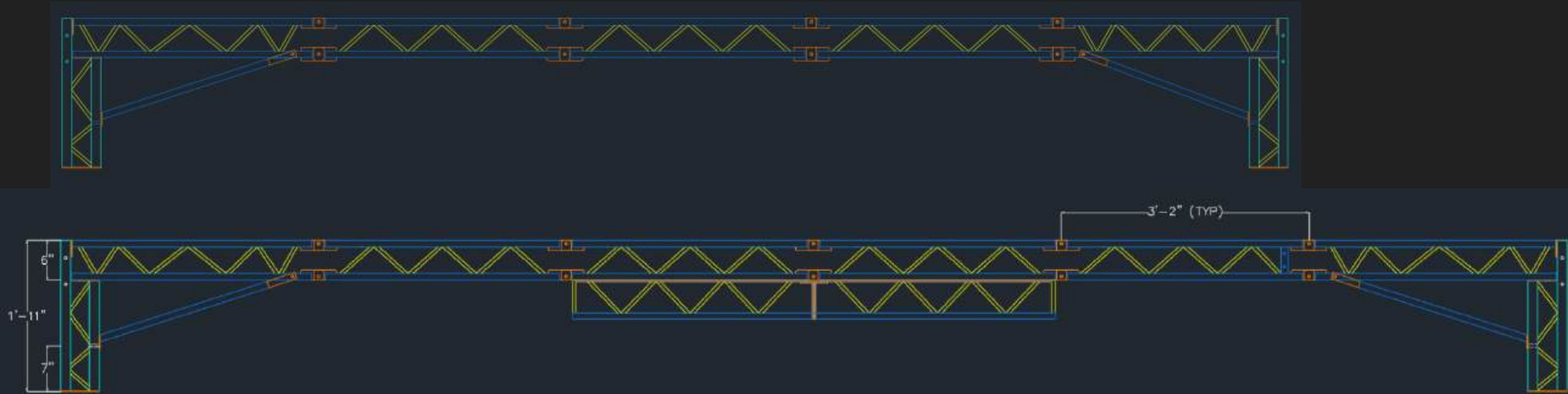
Inputs from Visual Analysis		Calculations and Estimations	
Long Stringer Deflection (in)	0.181	Aggregate Deflection (in)	1.585
Short Stringer Deflection (in)	0.136	Construction Time (min)	7.29
Lateral Sway (in)	0.09	Structural Efficiency (\$)	\$ 7,300,712
Total Weight (lbs)	184	Construction Economy (\$)	\$ 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



Materials



Members

- $1/2'' \times 1/2'' \times 16$ GA
- $1'' \times 1'' \times 11$ GA
- $1\frac{1}{2}'' \times 1\frac{1}{2}'' \times 16$ GA

Plates for Connections

- $1/8''$ thick
- $1/4''$ thick

Bolts

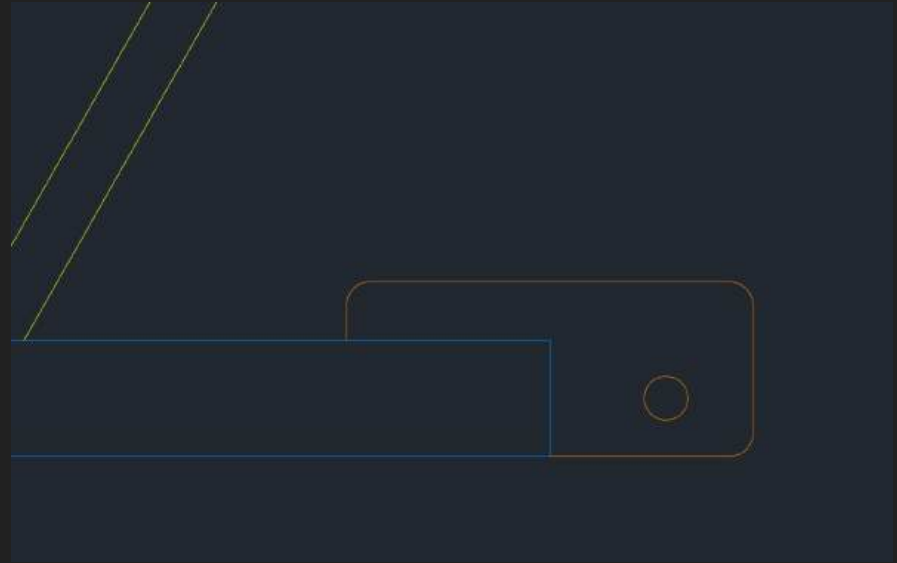
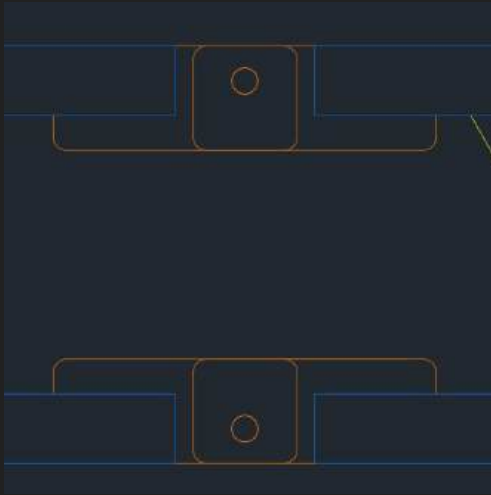
- $3/8''$ diameter Grade 8

Typical Connection Design



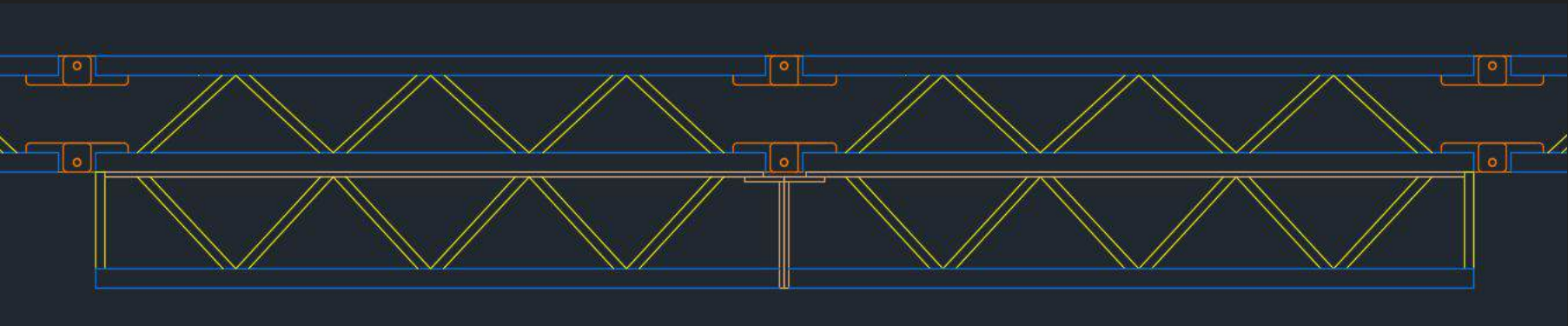
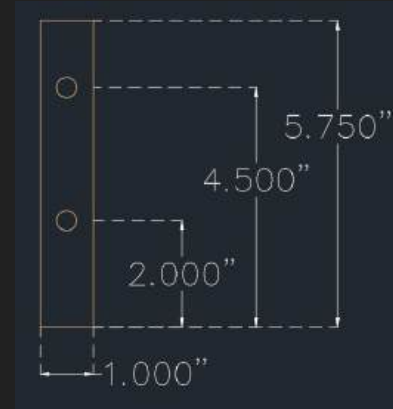
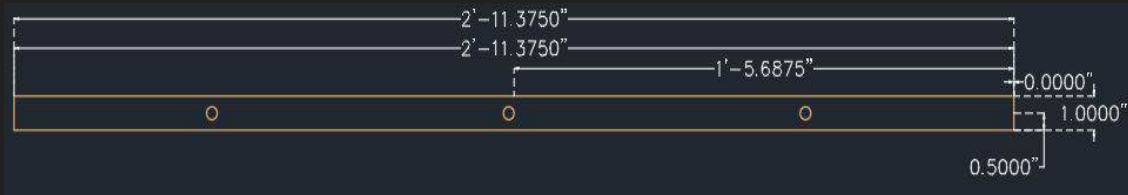
Span Connections

- Double Shear
- Quick & Strong



Truss Connections

- Carries shear
- $\frac{1}{4}$ " Plate



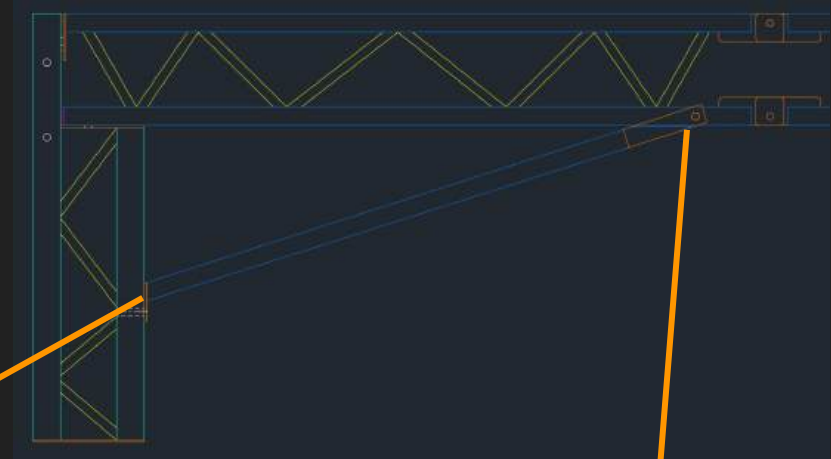
Angled Connections

Member Connection

- Double shear

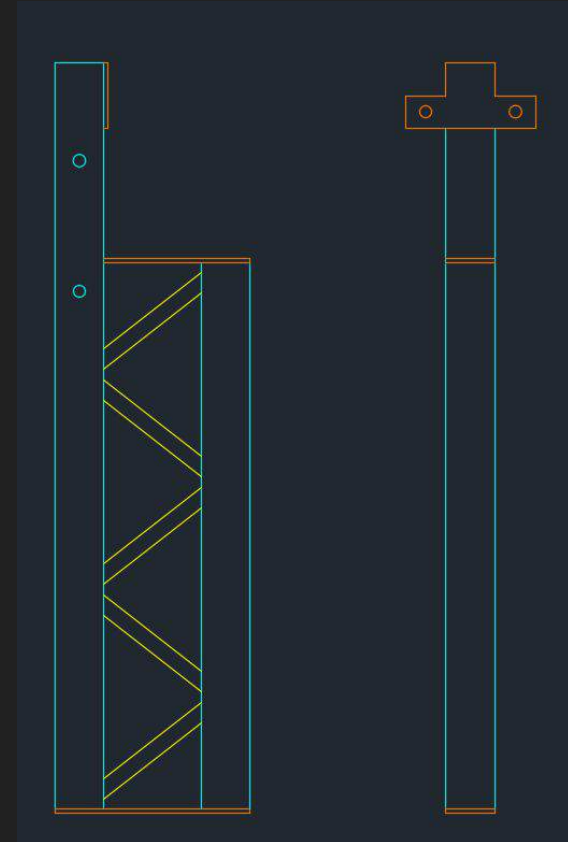
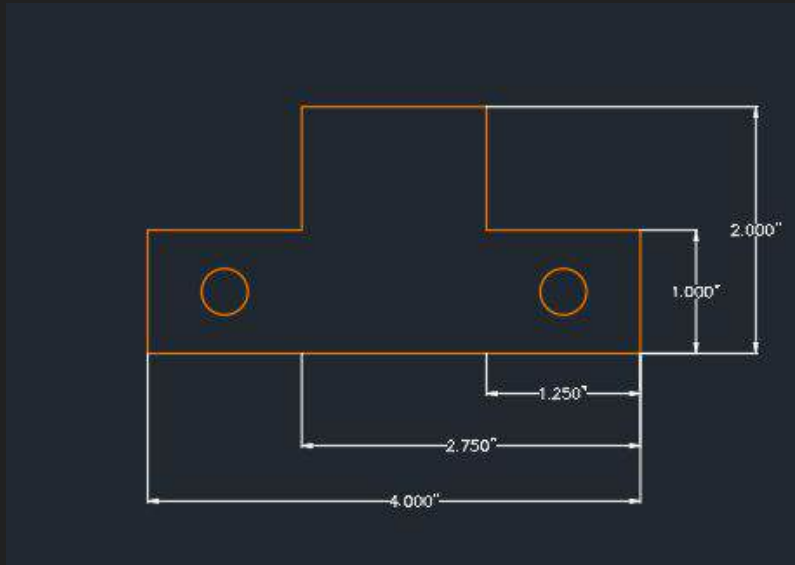
Footing Connection

- $\frac{1}{4}$ " Plate

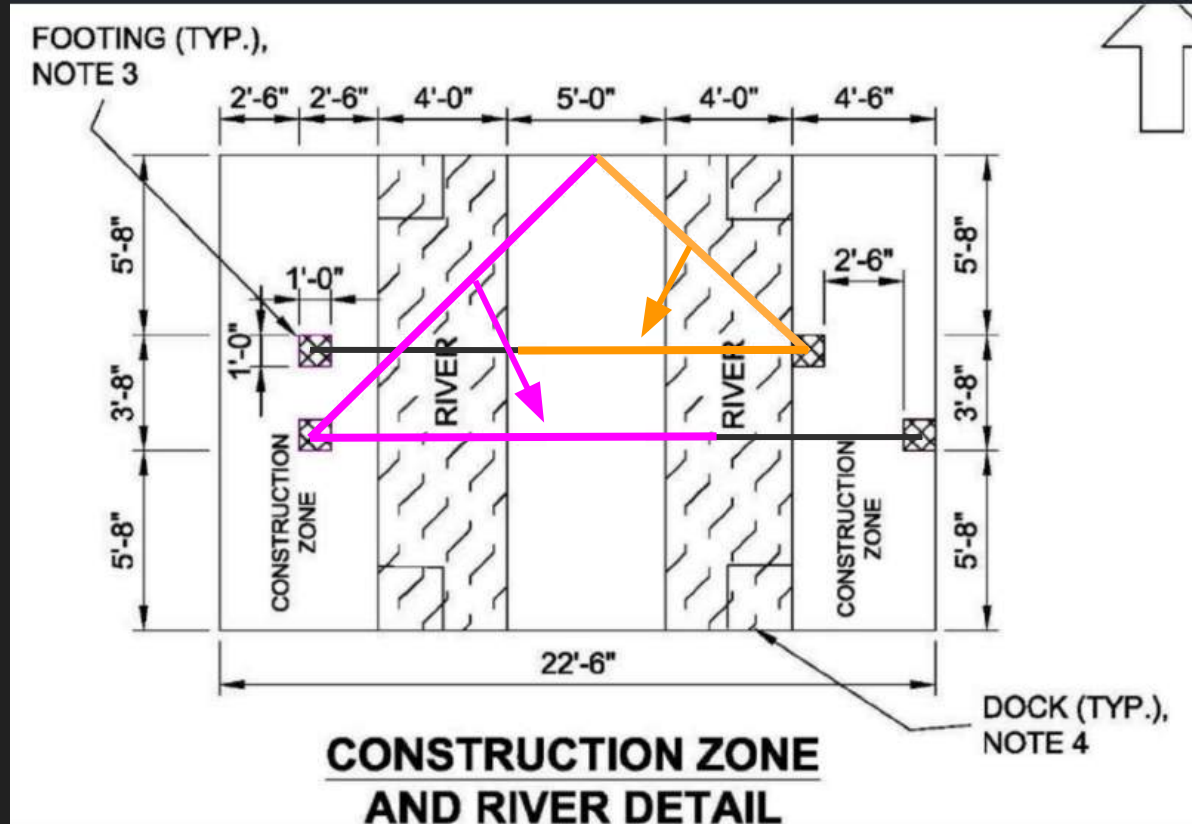


Footing Connections

- $\frac{1}{8}$ " Plate
- T-Shape



Construction



Cost Estimate and Fundraising



Category	Item	Cost
Fundraising	CME	\$500
	Capital Steel	\$571
	School of Eng.	\$3,956
Expenses	Steel sections	-\$571
	Steel Plate*	-\$250
	Shipping*	-\$150
	Bolts & Nuts*	-\$198
	Angle Bars*	-\$138
	Cart*	-\$200
	Impact Driver*	-\$650
	Registration	-\$1,350
	Transportation*	-\$176
	Hotel*	-\$250
	Competition Shirts*	-\$450
Total		\$644
*Cost is estimated		

Engineering Services



Task	Dr. Nabil Al-Omaishi	Joseph Zanetti	Jakob Ramos	Andrew Byrne	David Cardenas	Ethan Moyer	Matthew Nagy
	Faculty Advisor	Lead Machinist	Team Leader	Connections Lead	Members Lead	CAD Lead	Material Analysis/Fabrication Lead
	Engineer V	Machinist	Engineer II	Engineer I	Engineer I	Engineer I	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 Preparation			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 Hours	11	15	92	92	92	92	92
Total Hours							
Total Hours	34	64	280	274	274	274	274

Engineering Services Cost



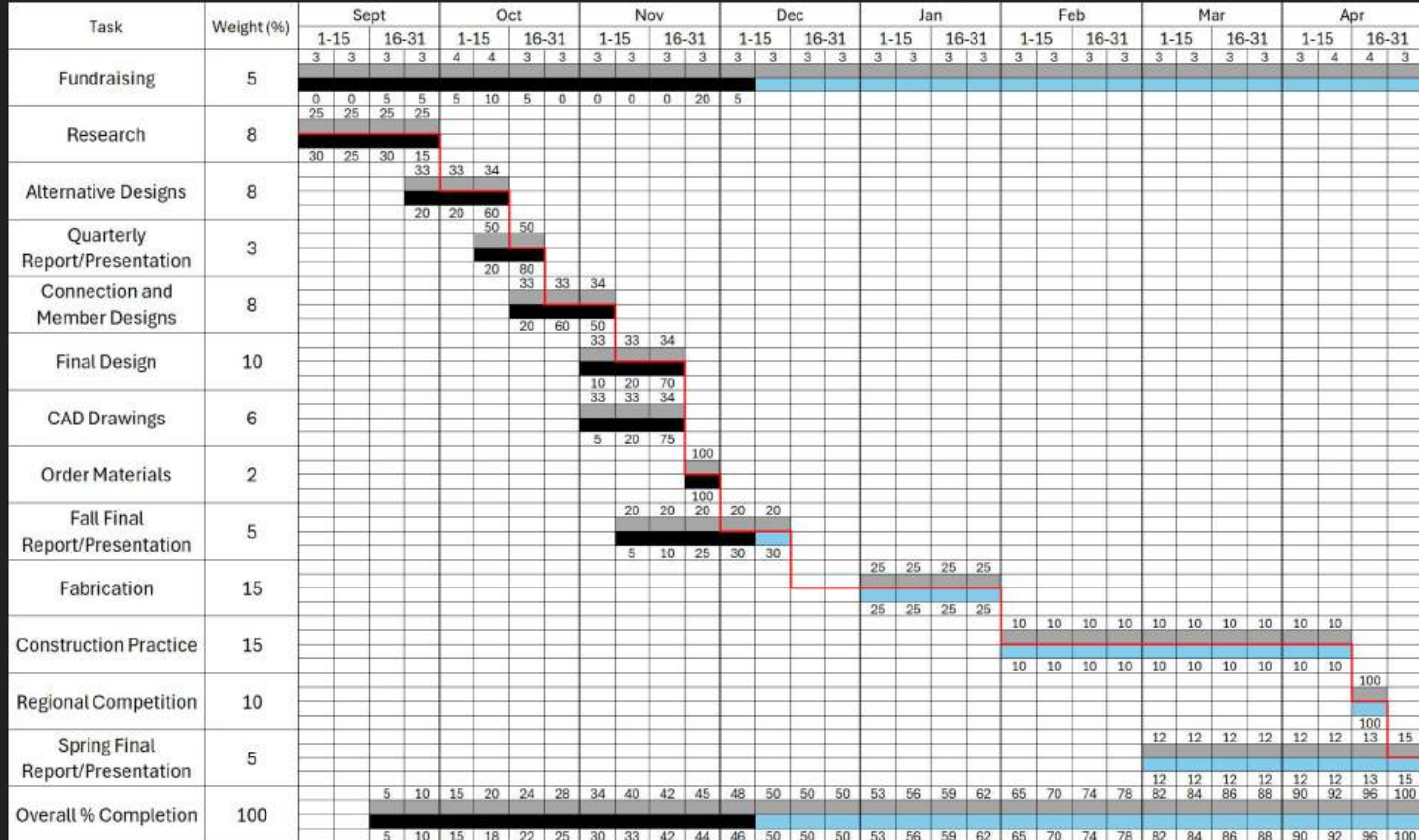
Team Member	Dr. Nabil Al-Omaishi	Joseph Zanetti	Jakob Ramos	Andrew Byrne	David Cardenas	Ethan Moyer	Matthew Nagy
Position	Faculty Advisor	Lead Machinist	Team Leader	Connections Lead	Members Lead	CAD Lead	Material Analysis/Fabrication Lead
Payroll Title	Engineer V	Machinist	Engineer II	Engineer I	Engineer 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

Estimated Timeline



Regional Competition

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



Acknowledgements



- Dr. Nabil Al-Omaishi
- Joe Zanetti
- Dr. Bechtel, Dr. Krstic, Dr. Horst, and Dr. Brennan
- Capital Steel LLC
- CME Associates



Questions?