2026 AISC/ASCE Steel Bridge Fall Presentation

Team Members: Max Dawson, Steven Ioannidis (Team Leader), Joseph Ricciani, Phil Sambucci, Hannah Shepkosky

Faculty Advisor: Dr. Al-Omaishi PEng, PE
Fabrication Specialist: Joe Zanetti

Overview

1. Problem Statement
2. Realistic Constraints
3. Design Constraints
4. Shear and Moment Envelopes
5. Alternate Designs
6. Decision Matrix
7. Final Design Selection
8. Materials
9. Connections
10. Method of Construction
11. Engineering Service Hours
12. Engineering Service Costs
13. Estimated Schedule
14. Regional Competition

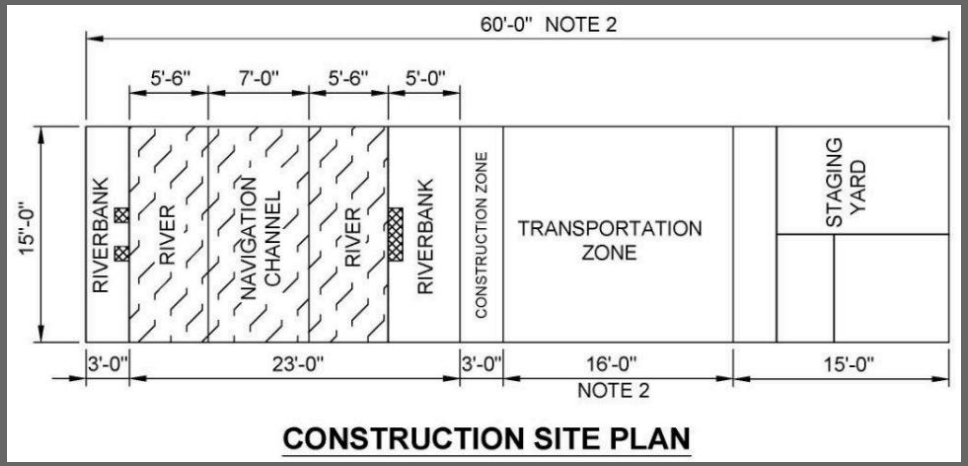
Problem Statement

Location: Rio Grande River Park Trail, El Paso, Texas

Objective: Pedestrian bridge that connects two communities

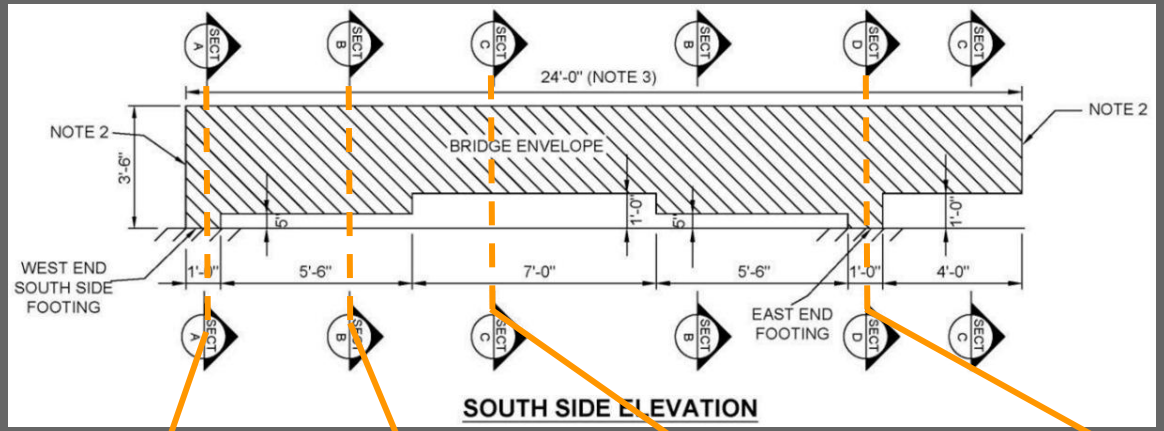
Realistic Constraints

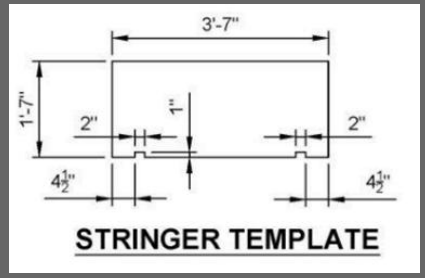
- Navigation Channel and two Rivers
- Riverbanks
- One Construction Zone
- Large Transportation distance



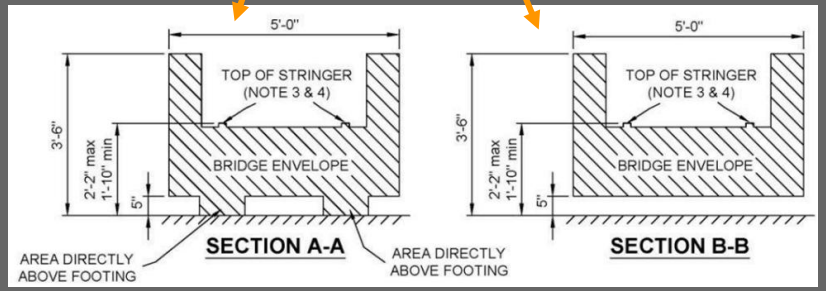
CONSTRUCTION SITE PLAN

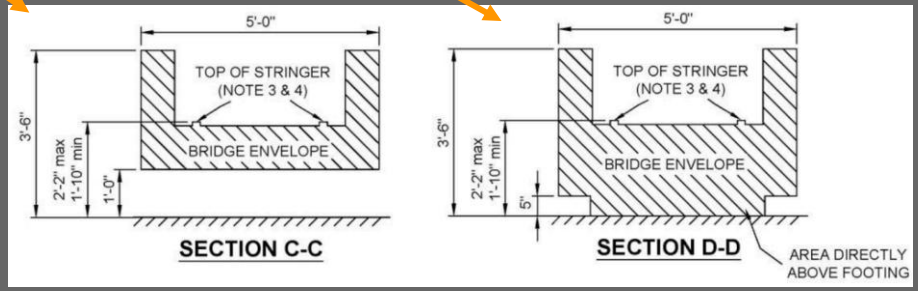
Design Constraints





Maximum Member Size = 3.5'x6"x4"



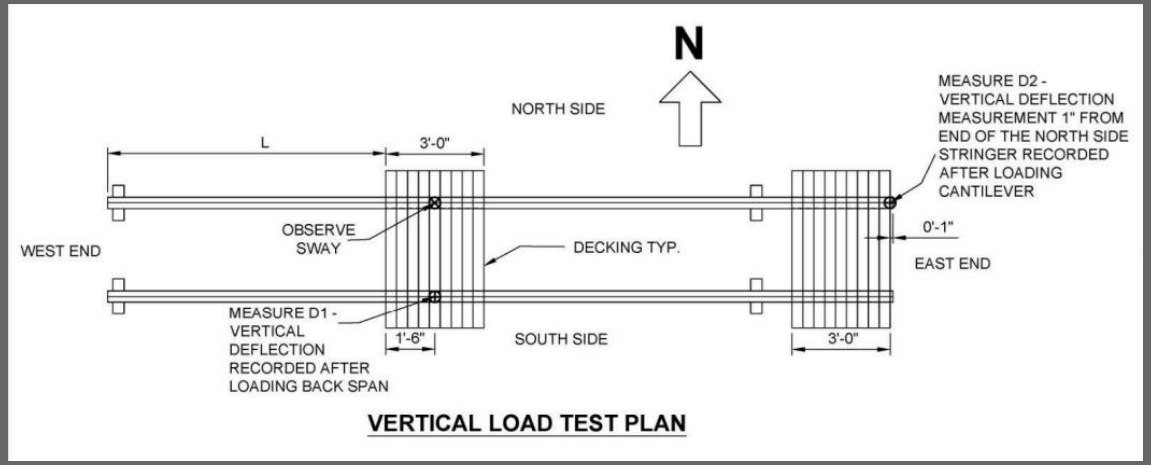


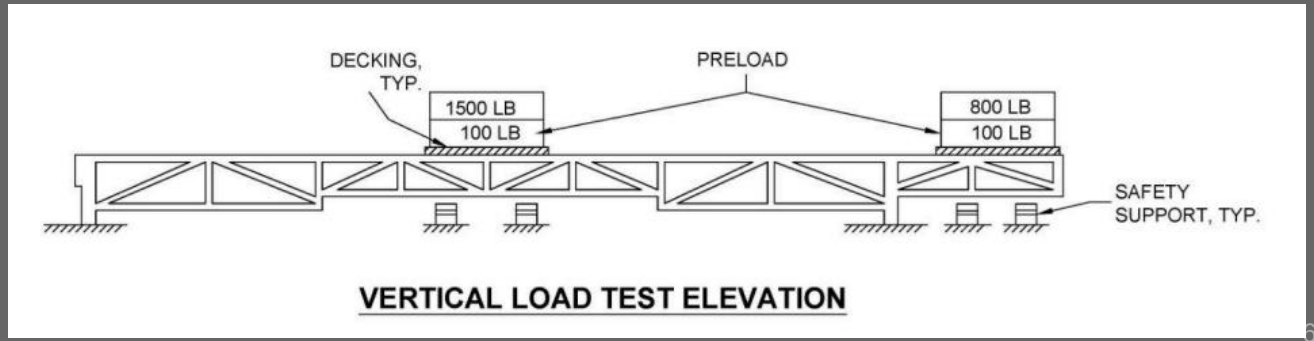
Loading

L is determined by the rolling of the dice.

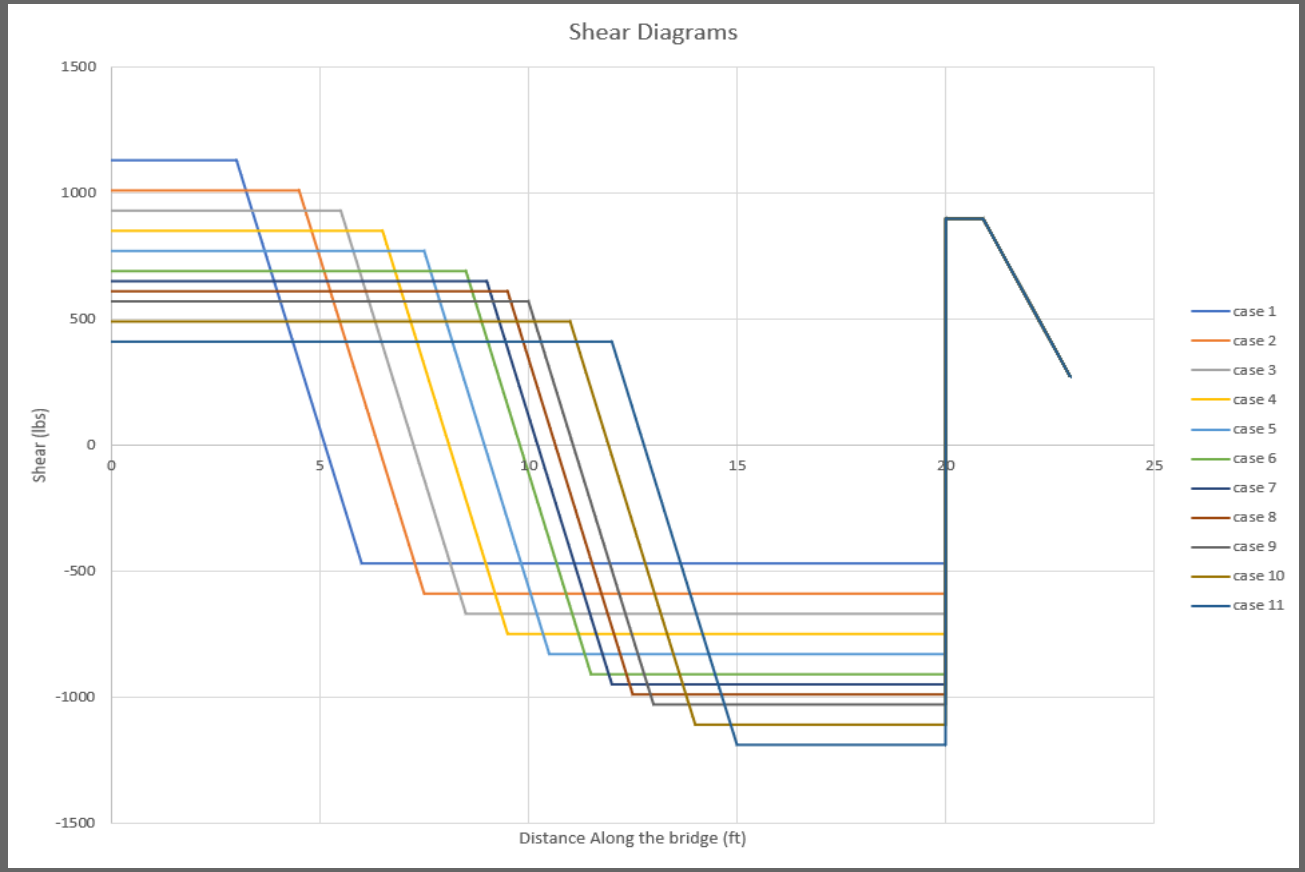
TABLE 7.1 Determination of *L*

N	*L*	*Lateral Loading (DWG #)*	*Vertical Loading (DWG #)*
2	3'-0"	3	5
3	4'-6"	4	6
4	5'-6"	3	5
5	6'-6"	4	6
6	7'-6"	3	5
7	8'-6"	4	6
8	9'-0"	3	5
9	9'-6"	4	6
10	10'-0"	3	5
11	11'-0"	4	6
12	12'-0"	3	5

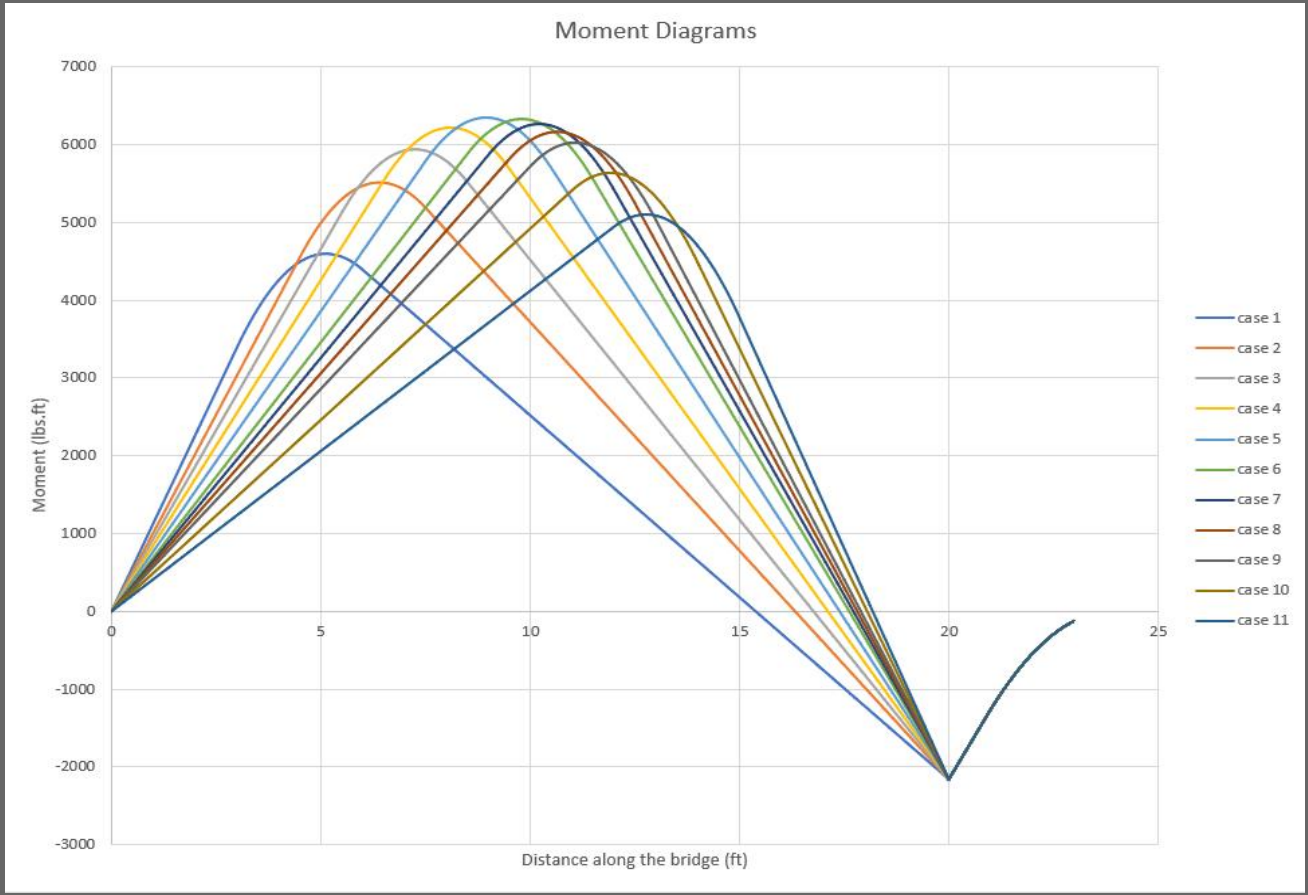




Shear Diagrams



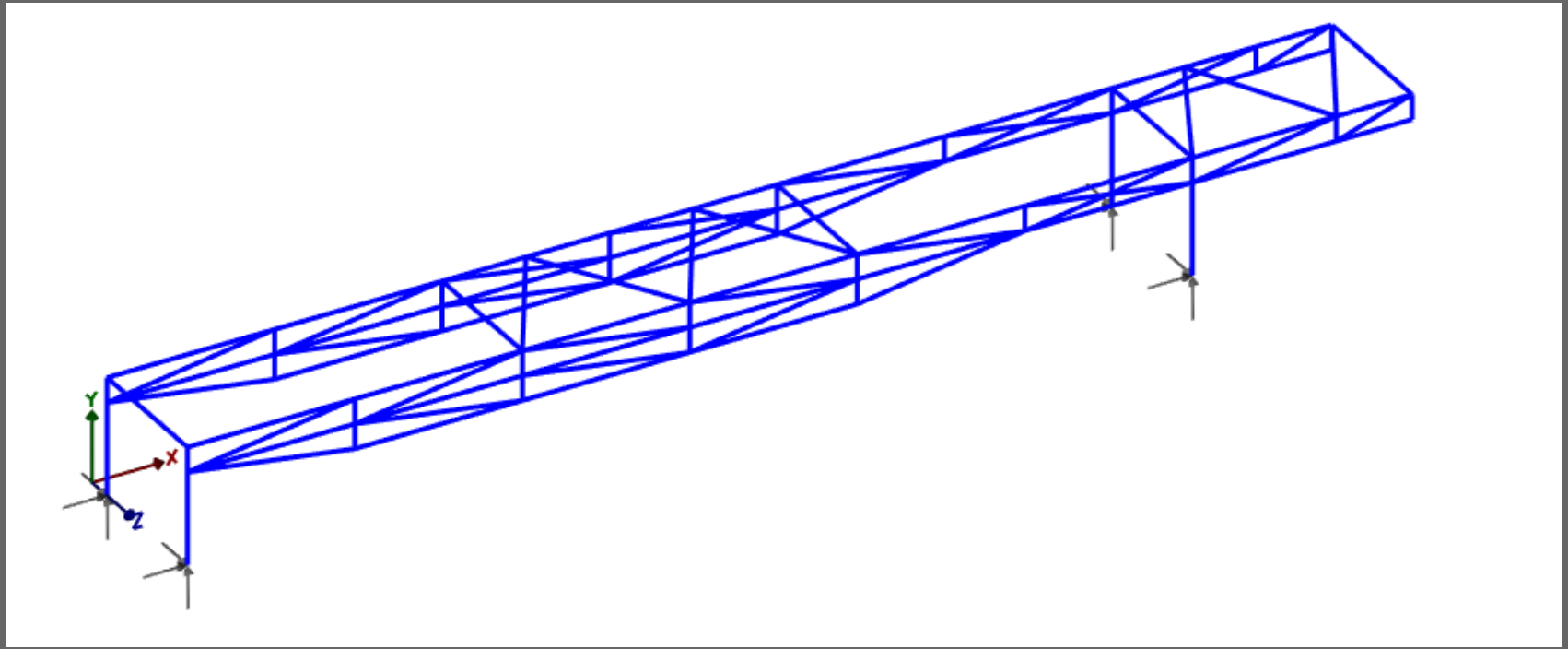
Moment Diagrams



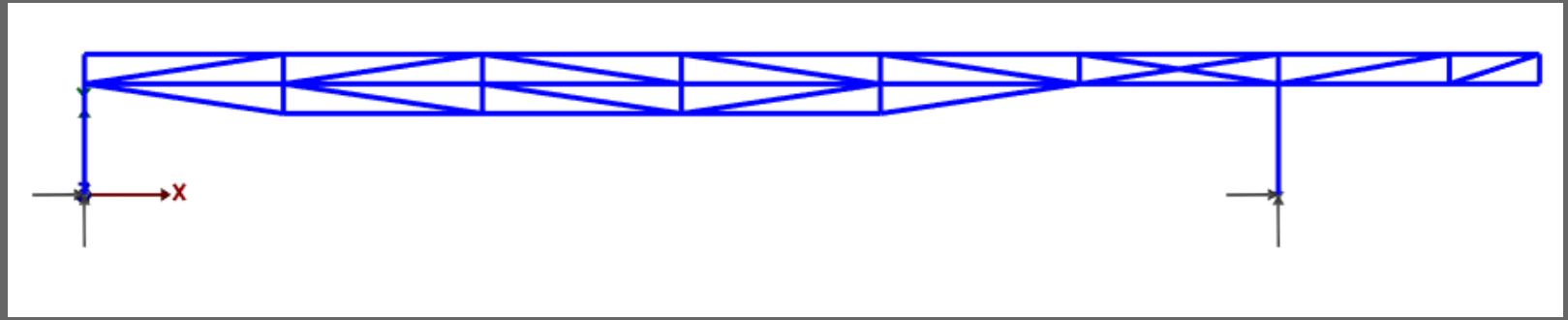
Engineering Tools

- AutoCAD Civil 3D
- Visual Analysis

Design 1 - Beam with Howe Under Truss



Design 1 - Beam with Howe Under Truss



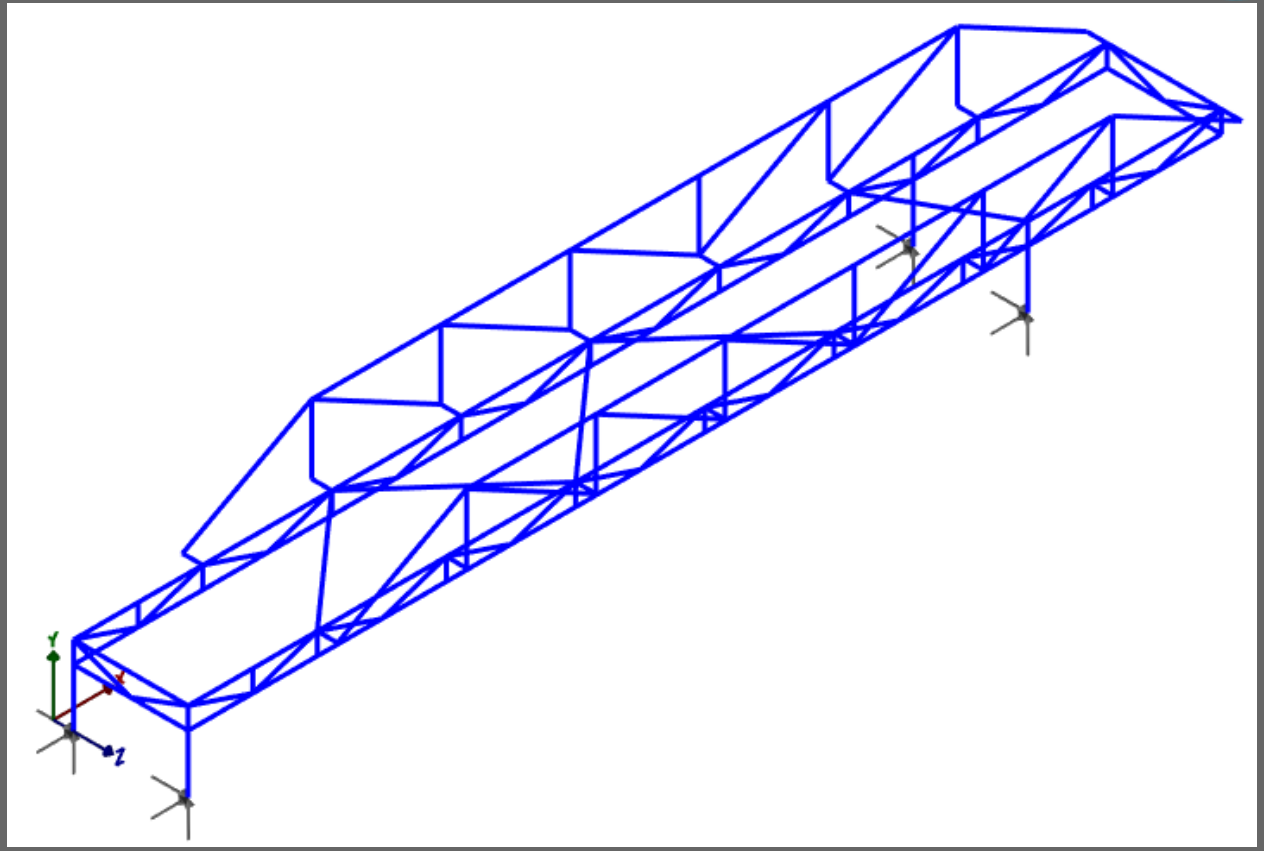
Pros

- Members
- Constructability
- Weight

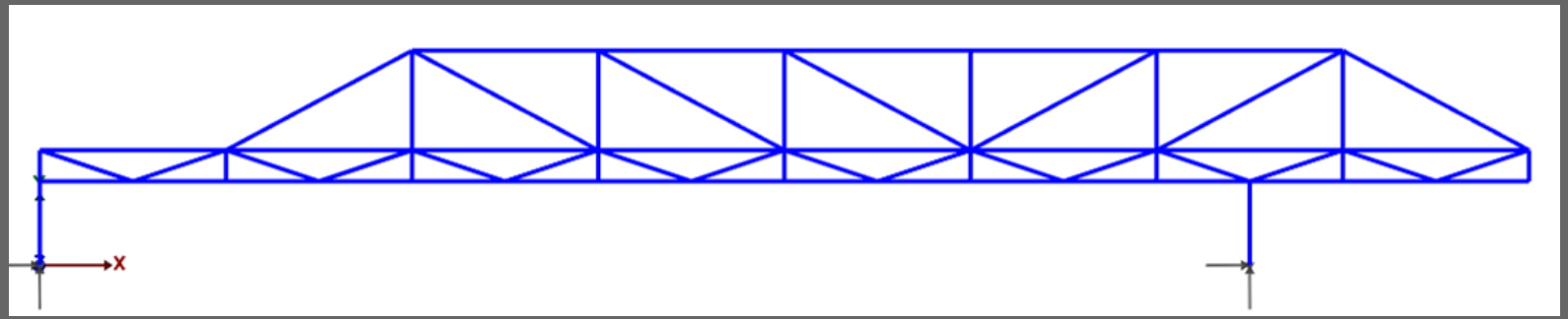
Cons

- Deflection

Design 2 - Beam With Over Truss



Design 2 - Beam With Over Truss



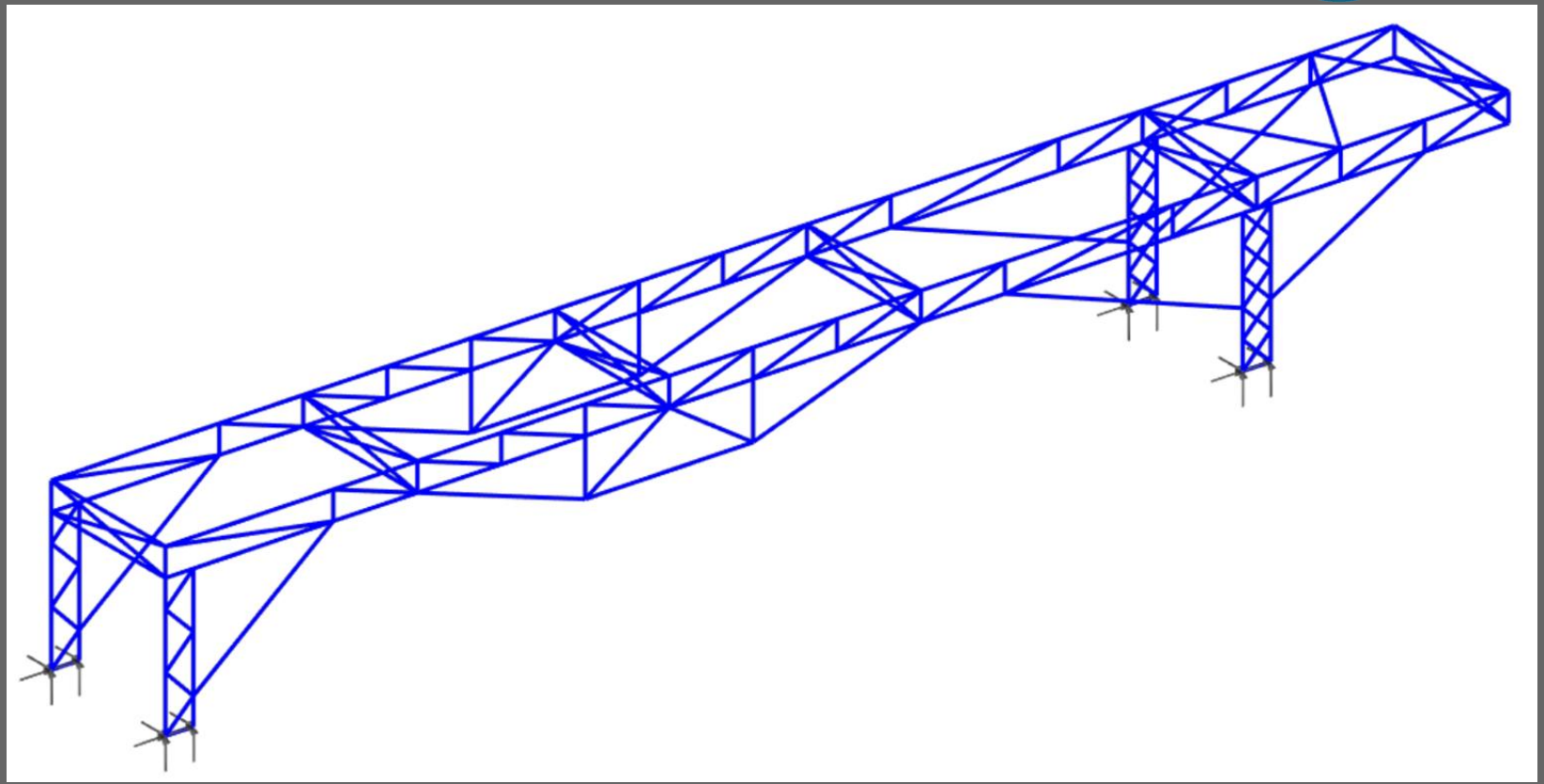
Pros

- Lightweight

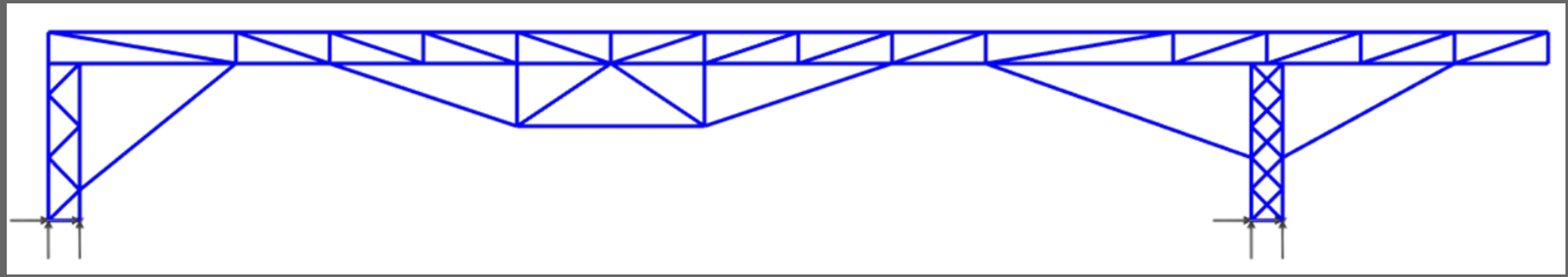
Cons

- Deflection
- Constructability

Design 3 - Pratt Truss Beam Bridge



Design 3 - Pratt Truss Beam Bridge



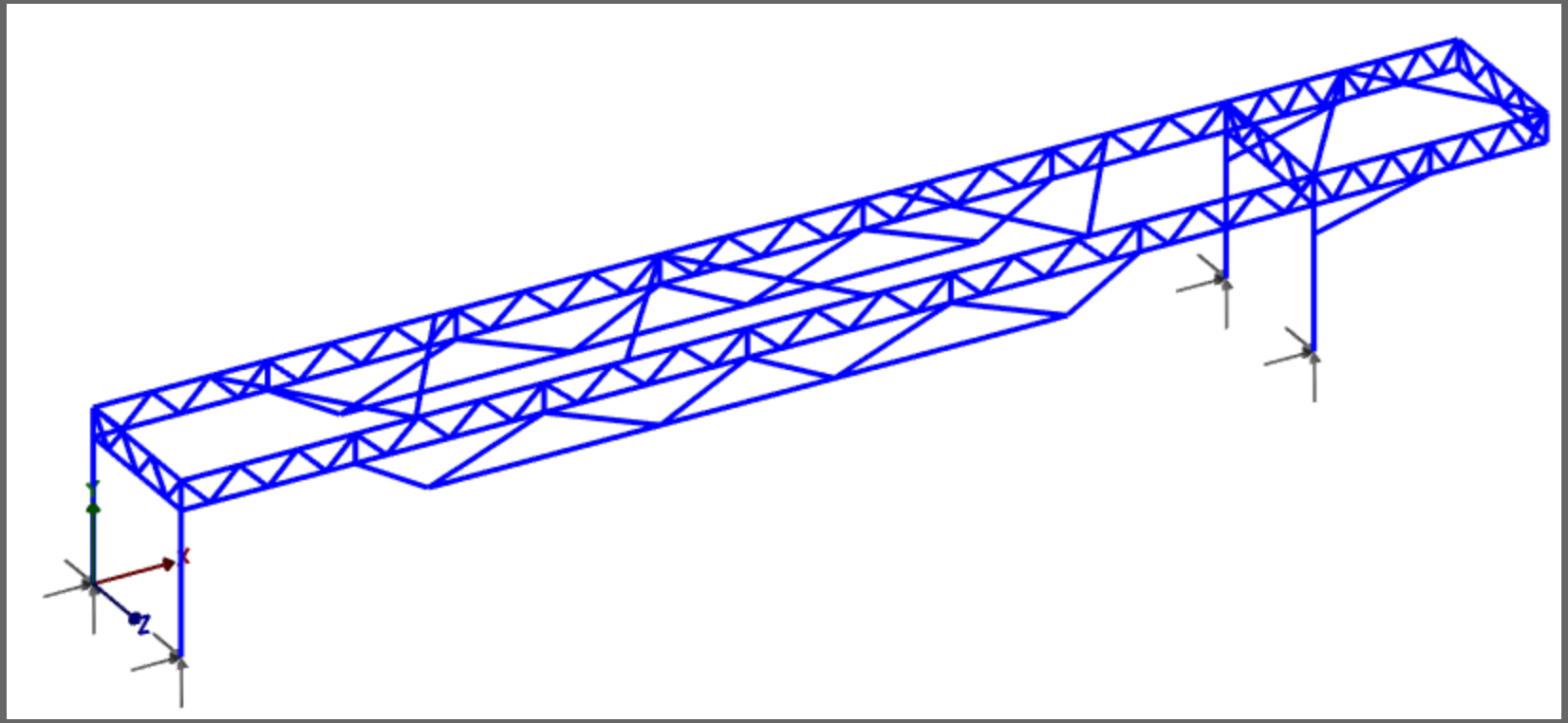
Pros

- Deflection
- Fabrication

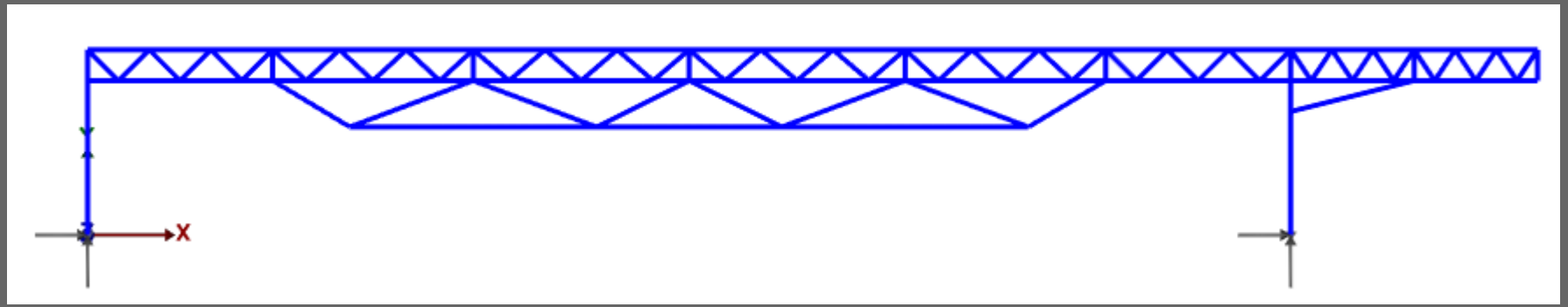
Cons

- Self Weight
- Constructability

Design 4 - Beam with Under Truss



Design 4 - Beam with Under Truss



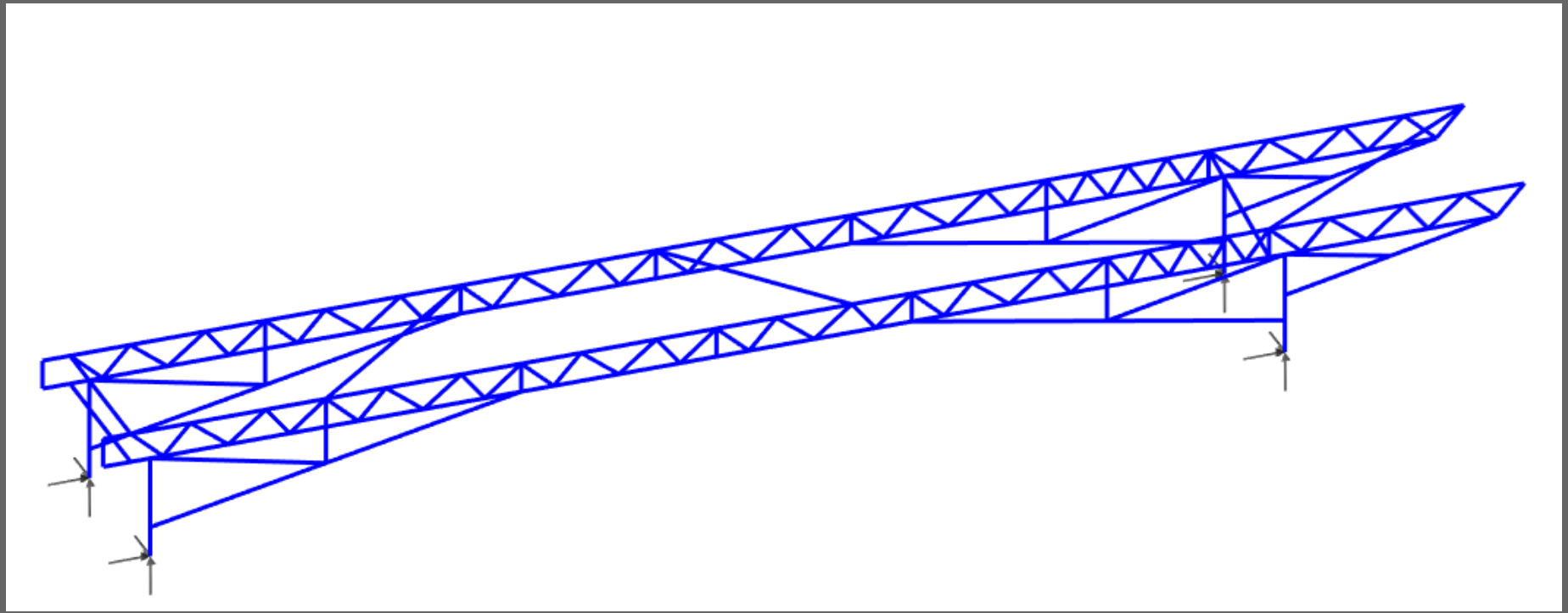
Pros

- Fabrication
- Deflection

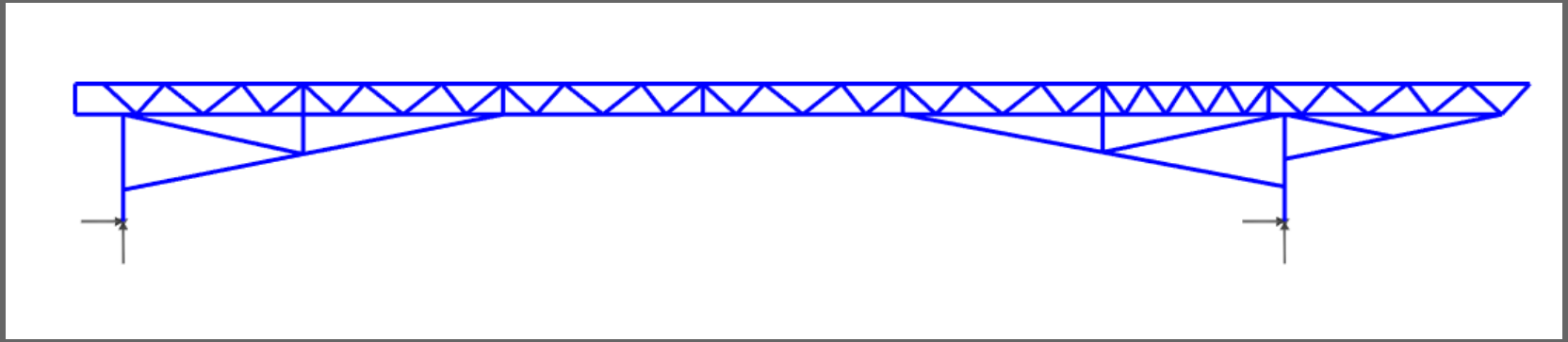
Cons

- Construction Time
- Self Weight

Design 5 - Beam Bridge With Truss Arch



Design 5 - Beam Bridge With Truss Arch



Pros

- Deflection
- Constructability

Cons

- Self Weight

Design Analysis Summary

Bridge Type	Max Deflection (in)	Weight (lbs)	Number of Connections	Number of Members
1: Beam with Howe Under Truss	1.40	262	57	42
2: Beam With Over Truss	1.68	283	88	54
3: Pratt Truss Beam Bridge	0.56	357	63	49
4: Beam with Under Truss	0.30	388	100	55
5: Truss Arch	0.07	415	60	45

Preliminary Decision Matrix

Criteria	Value	Design 1: Beam with Howe Under Truss	Design 2: Beam with Over Truss	Design 3: Pratt Truss Beam Bridge	Design 4: Beam with Under Truss	Design 5: Truss Arch
Constructability	5	5	2	4	1	4
Deflection	3	2	1	3	4	5
Weight	1	5	4	3	2	1
Total Score:		36	17	32	19	36

- The Alternative with the Highest Score is Optimal
- Tie Between Design 1 and Design 5
- Best Alternative Decided through Cost Equation

Cost Equation

Construction Economy Equation:

C_c = (Construction Time x Number of Builders x 160,000 x γ_{build}) + [(Total Time - Construction Time) x 350,000]

Structural Efficiency Equation:

C_s = [Measured Weight]$^{1.8}$ x 75 + (Total Weight - Measured Weight) x 4,375 + γ_{Lat}x Aggregate Deflection x 4,000,000 + Load Test Penalties

Cost Equation

Total

Deflection >3" penalty	Total Cost
$0.00	**$14,052,100.00**
$0.00	**$17,412,100.00**
$0.00	**$12,596,200.00**
$0.00	**$13,944,800.00**
$0.00	**$11,204,600.00**

Best Alternative

- Design 5

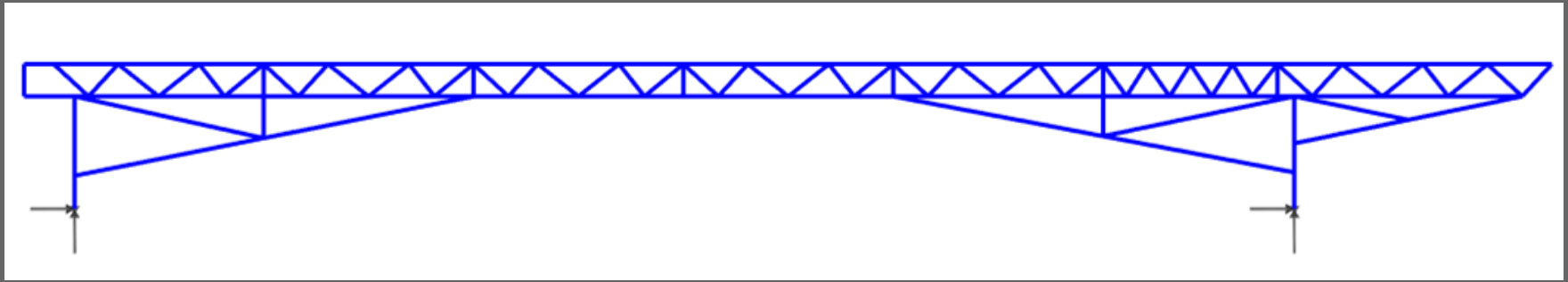
Construction

Design	Members	Connections	Construction Time (min)	Builders	Barges	Y build	Construction Economy Cost
1	42	57	9.300	1	3	0.8	$4,761,600.00
2	54	88	13.183	1	3	0.8	$6,749,900.00
3	49	63	10.558	1	3	0.8	$5,405,900.00
4	55	100	14.292	1	3	0.8	$7,317,400.00
5	45	60	9.875	1	3	0.8	$5,056,000.00

Structural

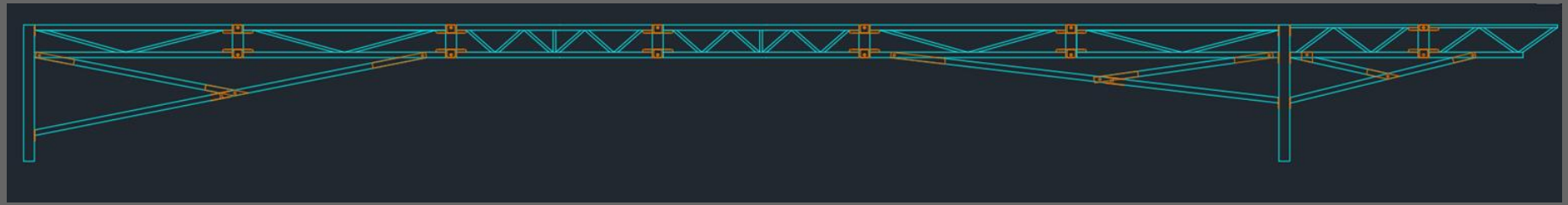
Design	Bridge Weight (lbs)	Lateral Sway (in)	Y lateral	Vertical Deflection (in)	Structural Efficiency Cost
1	262	0.5	1	1.4	$9,290,500.00
2	283	0.5	1	1.68	$10,662,200.00
3	357	0.5	1	0.56	$7,190,300.00
4	388	0.5	1	0.3	$6,627,400.00
5	415	0.5	1	0.07	$6,148,600.00

Final Design Selection



- Optimize Members
- Construction Method
- Consolidate Connections
- Lateral Bracing

Optimized Final Design

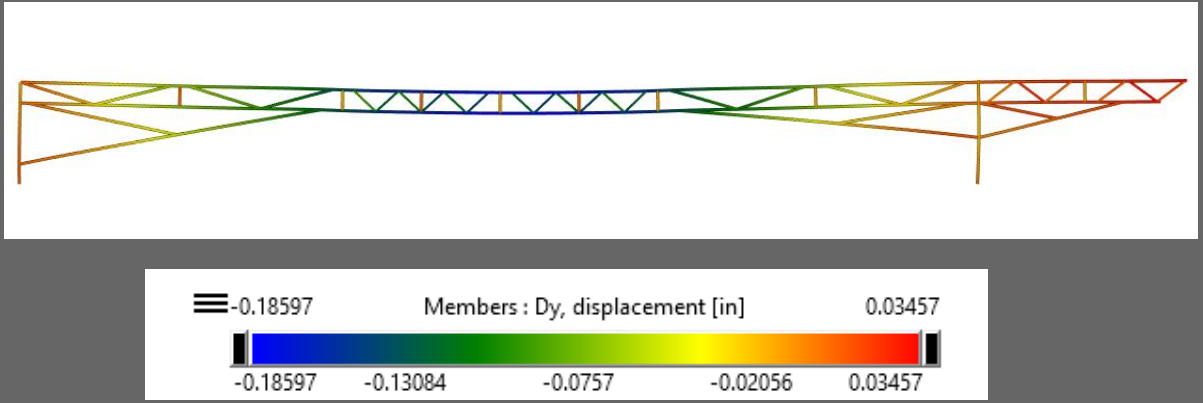


Design	Members	Connections	Construction Time (min)	Builders	Barges	Y build	Construction Economy Cost
Optimal	44	52	9.100	1	3	0.8	$4,659,200.00

Design	Bridge Weight (lbs)	Lateral Sway (in)	Y lateral	Vertical Deflection (in)	Structural Efficiency Cost
Optimal	294	0.5	1	0.56	$6,312,200.00

Deflection >3"	Total Cost
$0.00	**$10,971,400.00**

Deflections Cases



- Case 6 is controlling

Case	Deflection
Case 1	0.30”
Case 2	0.39”
Case 3	0.46”
Case 4	0.54”
Case 5	0.54”
Case 6	0.56”
Case 7	0.54”
Case 8	0.54”
Case 9	0.52”
Case 10	0.45”
Case 11	0.38”

Materials

Members

- 2” x 2” x ⅛”
- 1” x 1” x ⅛”
- ½” x ½” x 1/16”

Plates

- ⅛” & ¼” Thick

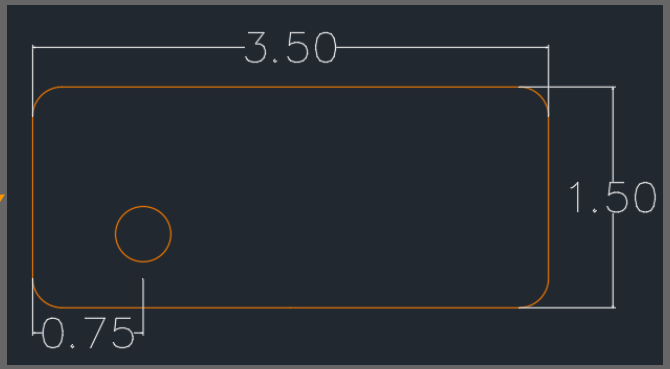
Bolts

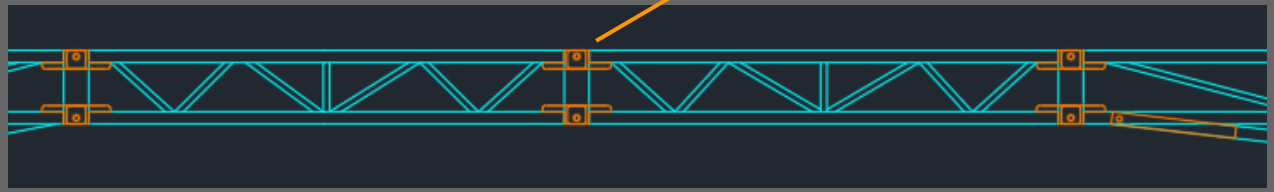
- ⅜” Diameter Grade 8
  - 3” Length
  - 1½” Length

Connections

Beam Member Connection

- Male/Female Connections
- Double shear
- Welded

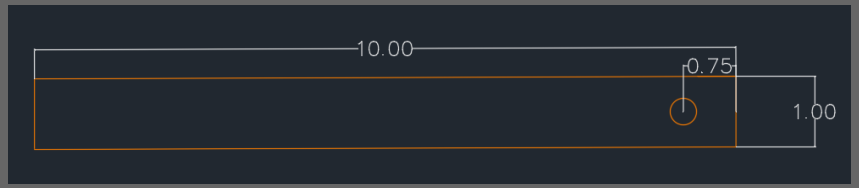


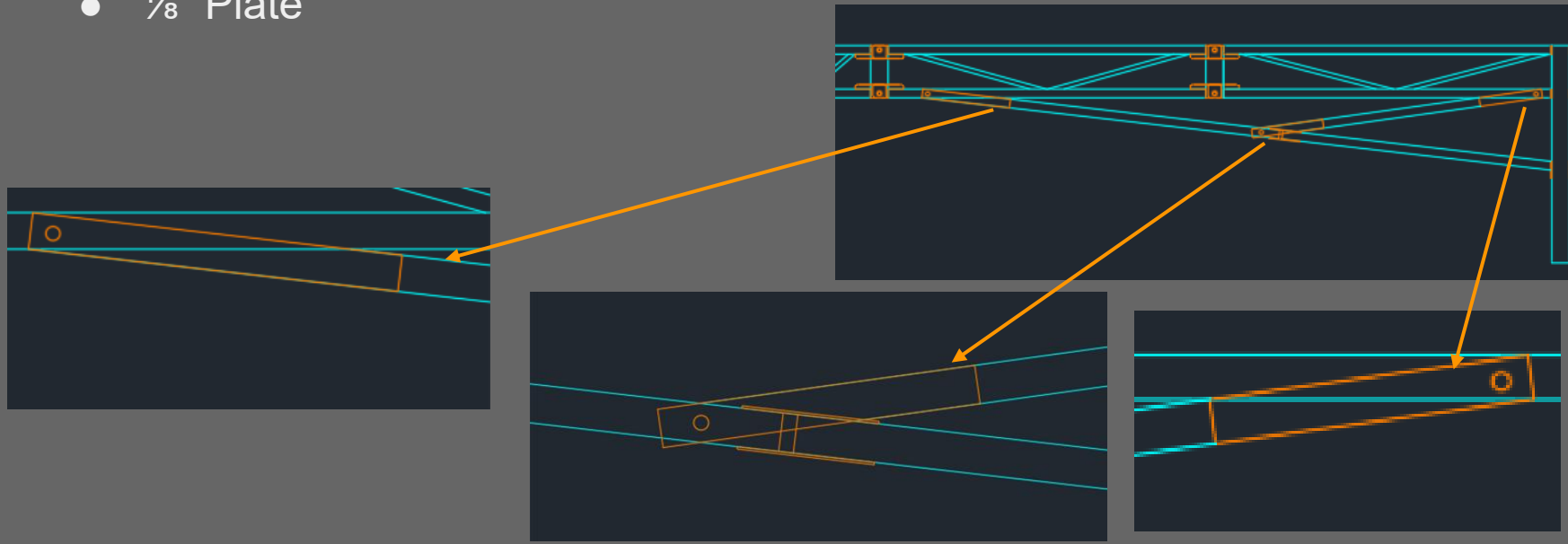


Connections

Under Truss Connection

- Single Shear
- ⅛” Plate

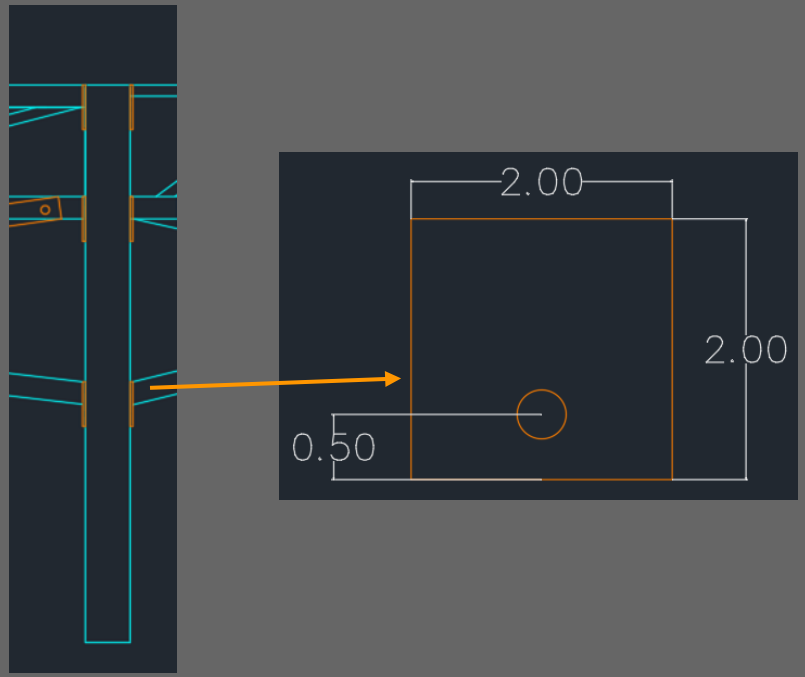




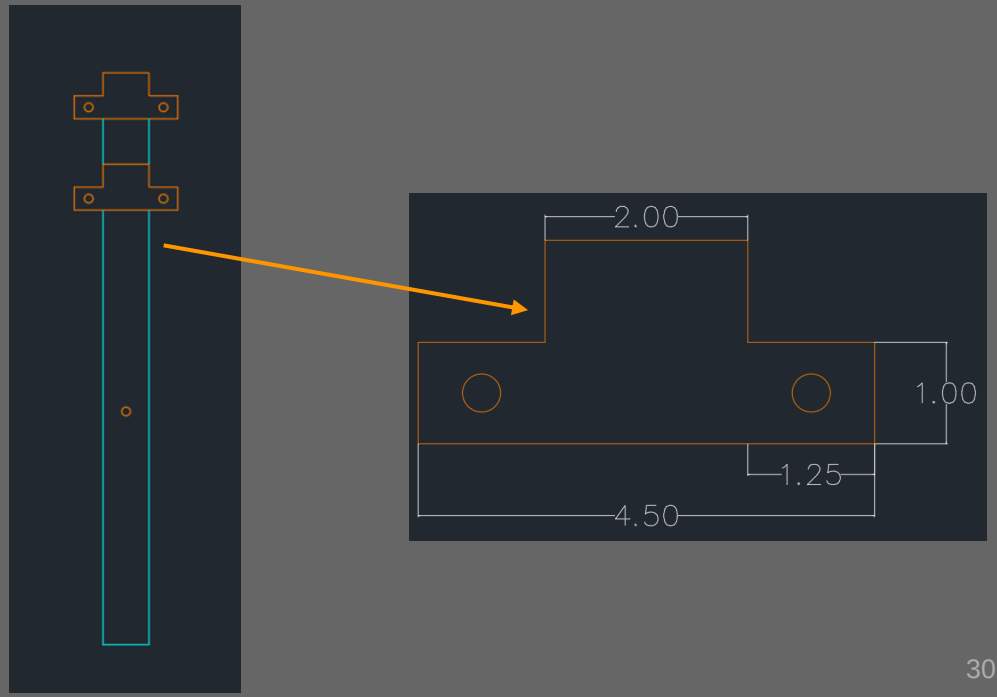
Connections

Pedestal Connection

Side View



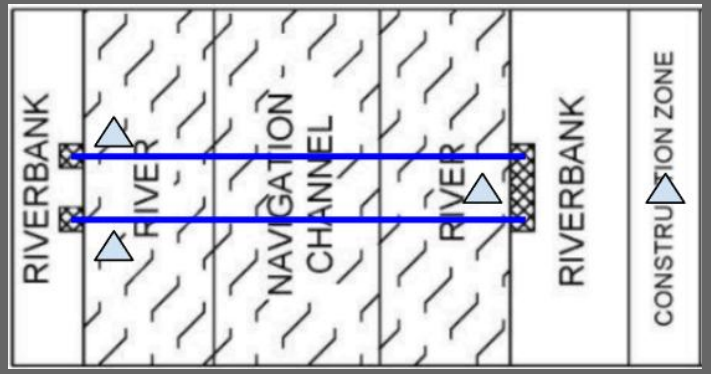
Cross Section View



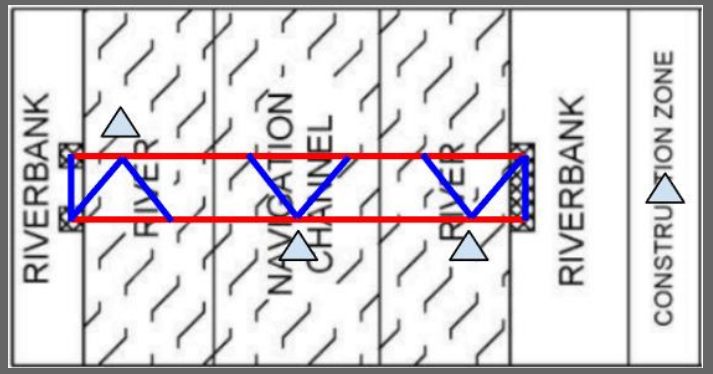
Method of Construction

Legend:
Blue = Under Construction
Red = Complete

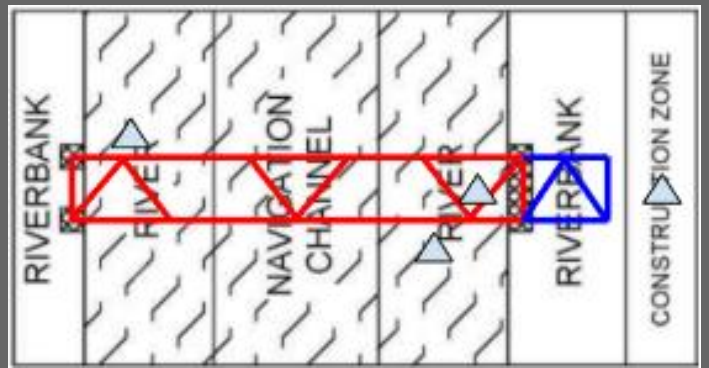
Step 1:



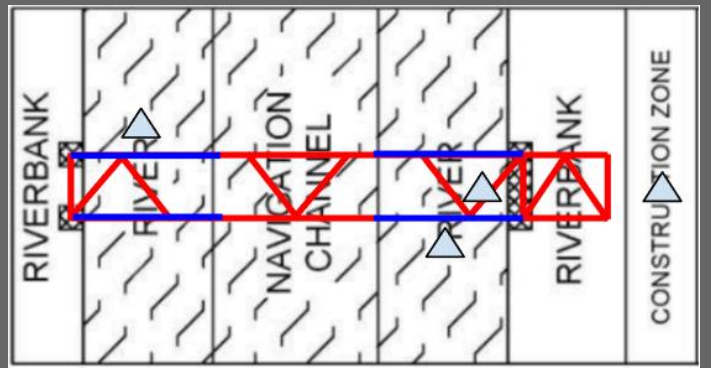
Step 2:



Step 3:



Step 4:



Engineer Services Hours

Task	Dr. Nabil Al-Omaishi Faculty Advisor Engineer V	Joseph Zanetti Lead Machinist Machinist	Steven Ioannidis Team Leader Engineer II	Joseph Ricciani Members Lead Engineer I	Hannah Shepkosky Connections Lead Engineer I	Max Dawson CAD Lead Engineer I	Phillip Sambucci Material Analysis/ Fabrication Lead Engineer I
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	1		10	10	10	10	10
Final Design Improvements	5	2	18	18	18	18	18
Member Designs	1	1	5	5	5	7	6
Connection Designs	5	1	12	12	16	12	15
CAD Drawings		1	6	6	6	8	6
Material Ordering			4	6	2	2	2
Competition Preperation			8	4	4	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**

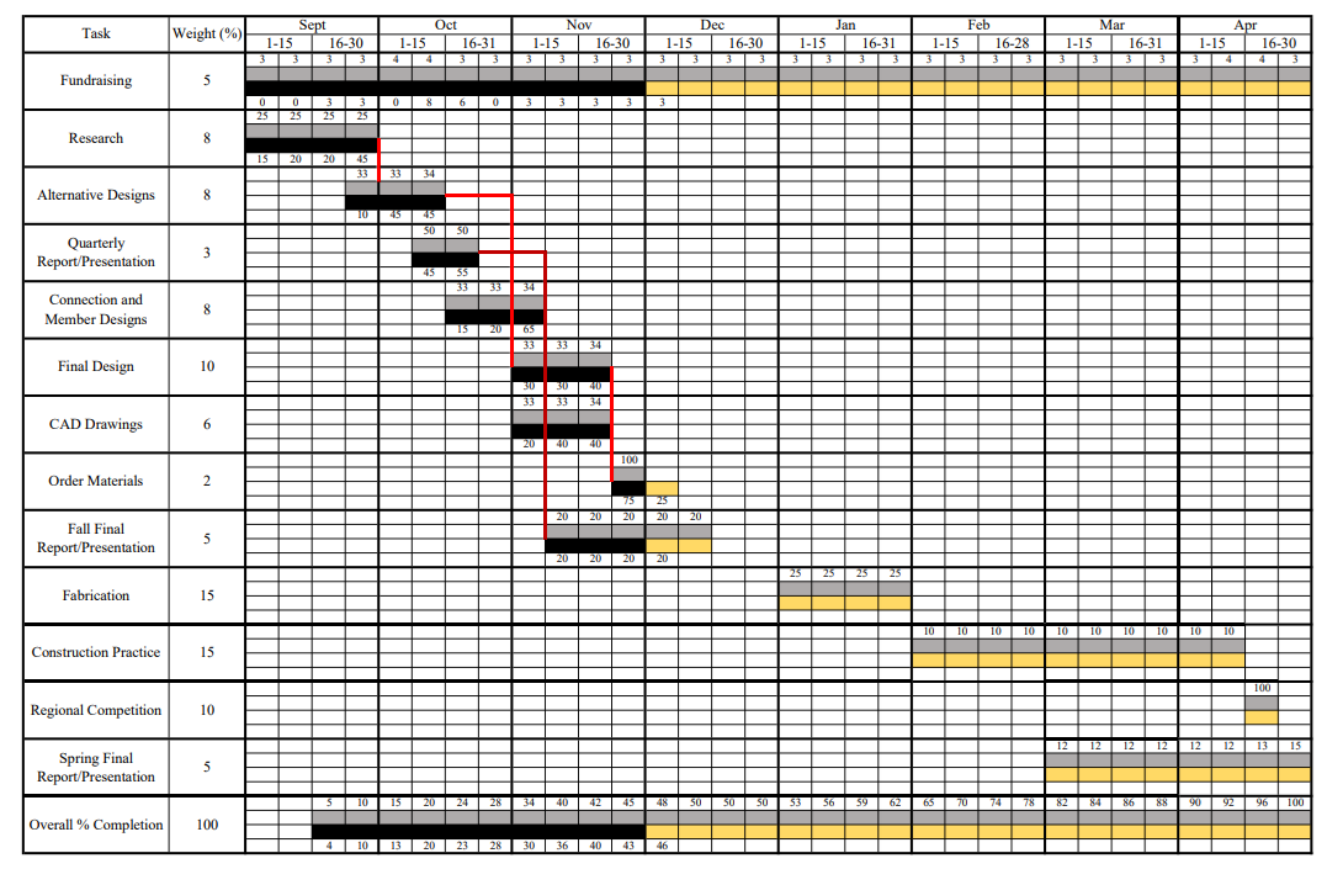
Engineering Services Cost

Team Member	Dr. Nabil Al-Omaishi	Joseph Zanetti	Steven Ioannidis	Joseph Ricciani	Hannah Shepkosky	Max Dawson	Phillip Sambucci
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	$110.00	$70.00	$40.00	$38.00	$38.00	$38.00	$38.00
Fall Total Hours	23	19	138	132	132	132	132
Salaries	$2,600.00	$1,400.00	$5,600.00	$5,100.00	$5,100.00	$5,100.00	$5,100.00
Winter Total Hours		30	50	50	50	50	50
Salaries	$0.00	$2,100.00	$2,000.00	$1,900.00	$1,900.00	$1,900.00	$1,900.00
Spring Total Hours	11	15	92	92	92	92	92
Salaries	$1,300.00	$1,100.00	$3,700.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00
Total Salaries	$3,900.00	$4,600.00	$11,300.00	$10,500.00	$10,500.00	$10,500.00	$10,500.00

Engineering Services Cost

Engineering Cost		
Fall Total		$30,000.00
Overhead Fee	150%	$45,000.00
Fixed Fee	10%	$7,500.00
Fall Total Engineering Cost		$82,500.00
Winter Total		$11,700.00
Overhead Fee	150%	$17,600.00
Fixed Fee	10%	$3,000.00
Winter Total Engineering Cost		$32,300.00
Spring Total		$20,100.00
Overhead Fee	150%	$30,200.00
Fixed Fee	10%	$5,100.00
Spring Total Engineering Cost		$55,400.00
Year Total Engineering Cost		**$170,200.00**

Estimated Schedule



Task	Weight (%)	Sept 1-15	Sept 16-30	Oct 1-15	Oct 16-31	Nov 1-15	Nov 16-30	Dec 1-15	Dec 16-30	Jan 1-15	Jan 16-31	Feb 1-15	Feb 16-28	Mar 1-15	Mar 16-31	Apr 1-15	Apr 16-30
Fundraising	5	3 3	3 3	4 4	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 4	4 3
		0 0	3 3	0 8	6 0	3 3	3 3	3									
Research	8	25 25	25 25														
		15 20	20 45														
Alternative Designs	8		33	33 34													
			10	45 45													
Quarterly Report/Presentation	3			50	50												
				45	55												
Connection and Member Designs	8				33 33	34											
					15 20	65											
Final Design	10					33 33 34											
						30 30 40											
CAD Drawings	6					33 33 34											
						20 40 40											
Order Materials	2						100										
							75	25									
Fall Final Report/Presentation	5					20 20 20		20 20									
						20 20 20		20									
Fabrication	15									25 25 25 25							
Construction Practice	15											10 10 10 10		10 10 10 10		10 10	
Regional Competition	10																100
Spring Final Report/Presentation	5													12 12 12 12		12 12	13 15
Overall % Completion	100		5 10	15 20	24 28	34 40	42 45	48 50	50 50	53 56	59 62	65 70	74 78	82 84	86 88	90 92	96 100
			4 10	13 20	23 28	30 36	40 43	46									

Regional Competition

- Hosted by TCNJ on the 18th of April

Acknowledgements

- Dr. Nabil Al-Omaishi PEng, PE
- Joe Zanetti
- Dr. Krstic PE
- Dr. Bechtel
- McKnight Steel & Tube Co.

Questions?