Steel Bridge Team

Figure 1: 2017-2018 Steel Bridge [2]

Project Proposal

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December 7th, 2018

CENE 476C

Project Background

- American Institute of Steel Construction (AISC) Student Steel Bridge Competition
  - Conference Host: Cal Poly San Luis Obispo
  - April 4th– 6th 2019
- Objective: design and build

  a 1:10 scale bridge
- Client: Mark Lamer
- Past Results
  - 2017: 9th Overall
  - 2018: 8th Overall

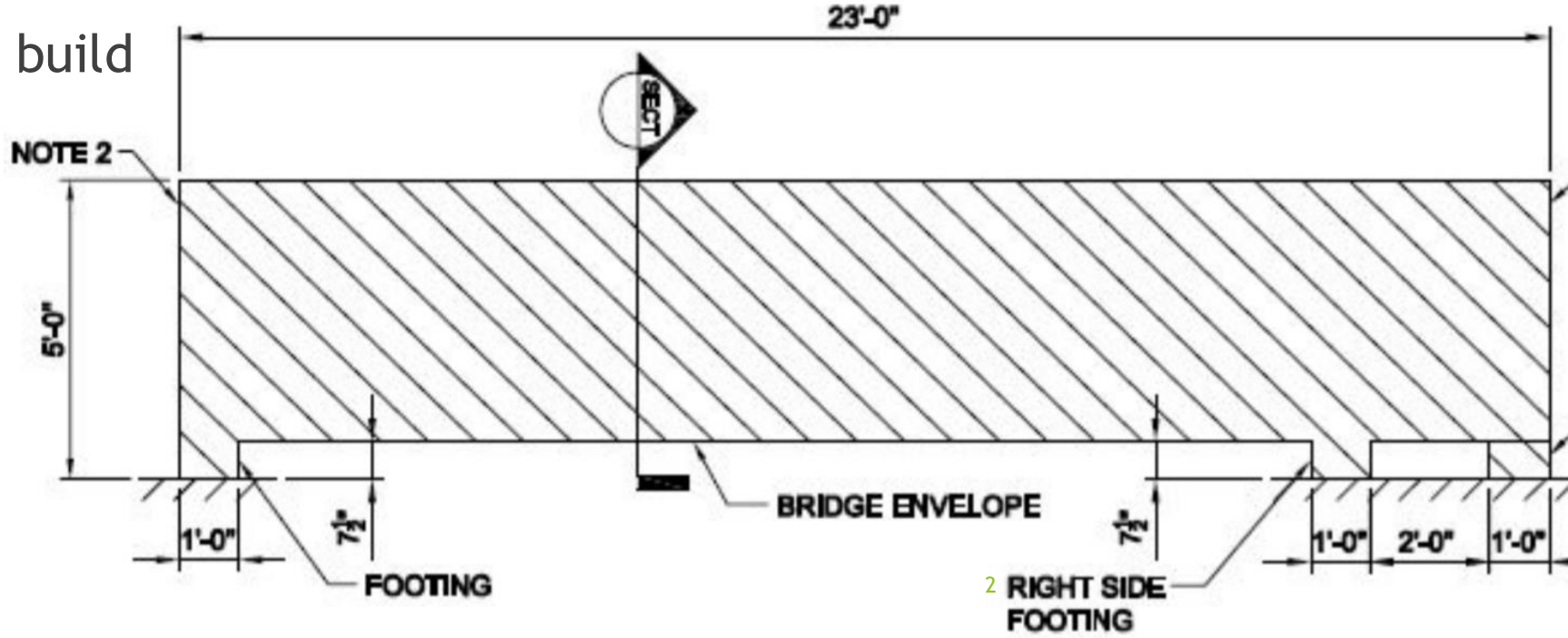

Figure 2: Bridge Envelope Right Side Elevation [1]

Project Background

- Categories of Competition
  - Aesthetics
  - Construction Economy
    - Construction Speed
  - Structural Efficiency
    - Lightness
    - Stiffness
  - Overall Performance

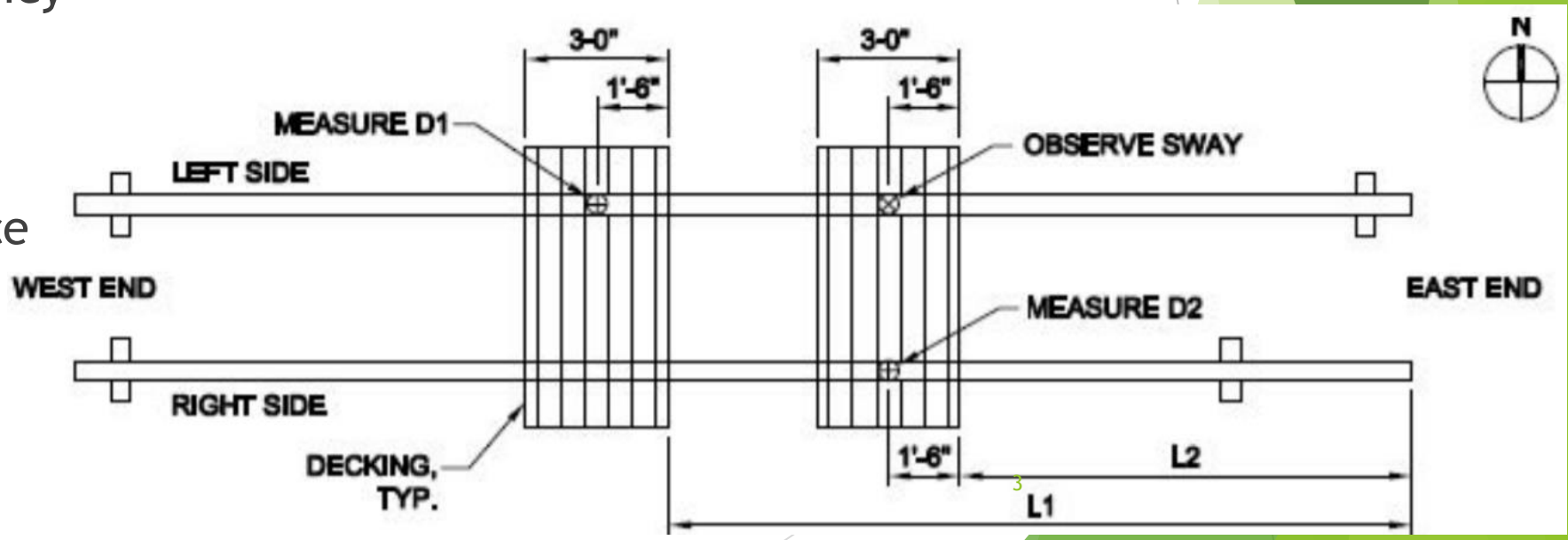

Figure 3: Plan view of loading on bridge [1]

Task 1: Project Research

- 1.1 Overview of 2019 SSBC Rules and Guidelines
- 1.2 Research Types of Steel Bridges
- 1.3 Review Steel Design Code Manual

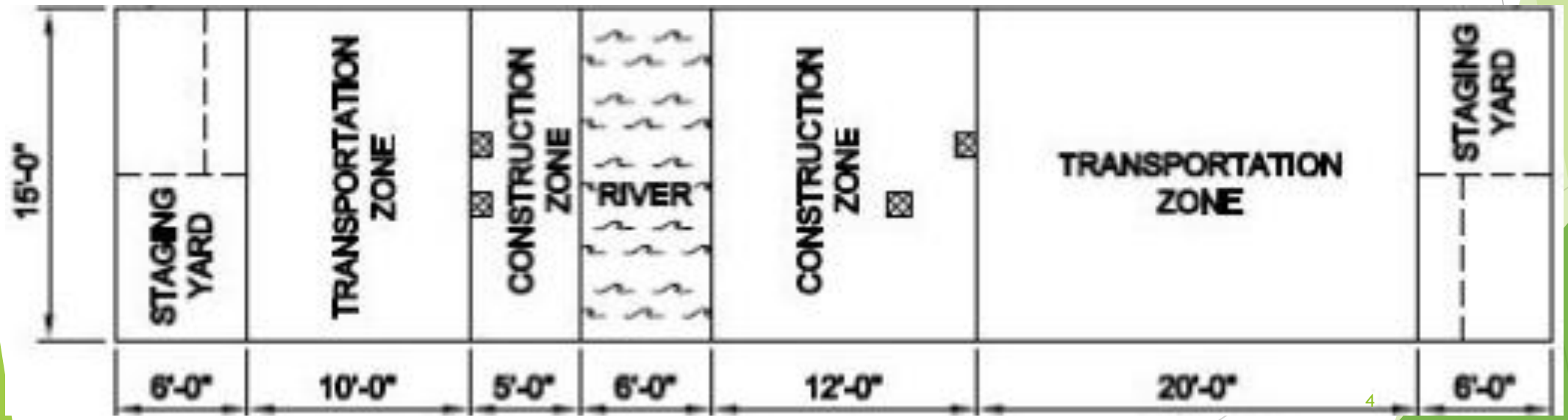

Figure 4: Construction Site Plan for Competition [1]

Task 2: Resourcing

- 2.1 Sponsor Outreach
- 2.2 Fundraising

Figure 7: Page Steel

Figure 6: MUHS Welding

Figure 5: K-Zell Metals

Figure 8: Copper State Nuts & Bolts

Task 3: Structural Analysis

- 3.1 Vertical Deflection Design
- 3.2 Lateral Deflection Design
- 3.3 Lateral Torsional Buckling and Overturning Design
- 3.4 Design Fittings/Connections
- 3.5 Final Bridge Design

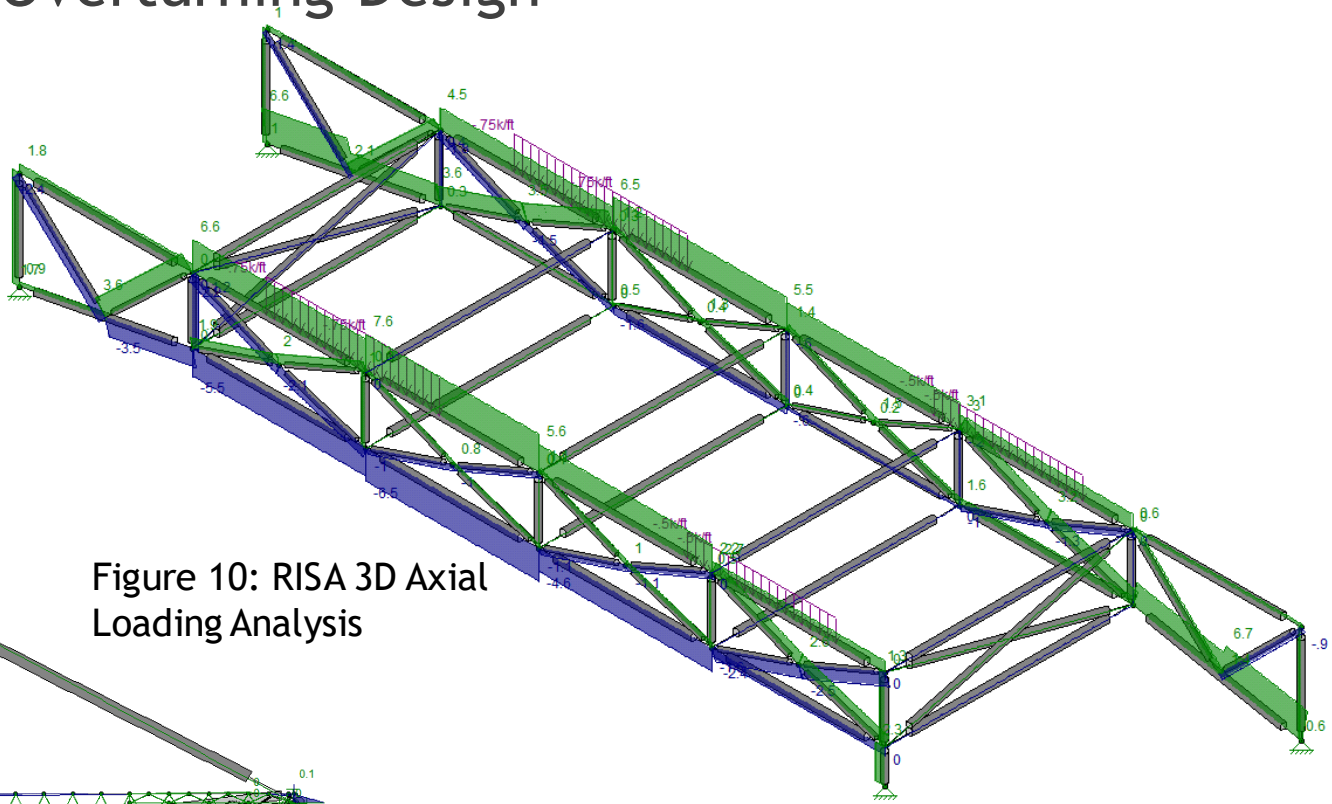

Figure 10: RISA 3D Axial Loading Analysis

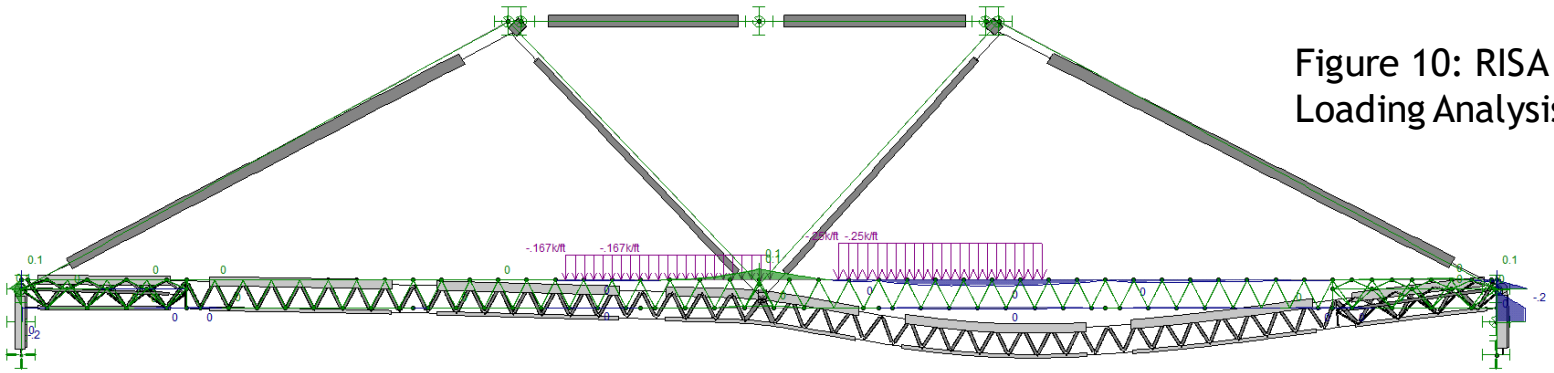

Figure 9: RISA 2D Moment & Deflection Analysis

Figure 11: Member Welding [2]

Task 4: Fabrication

- 4.1 Produce Construction Drawings
- 4.2 Steel Preparation
- 4.3 Welding
- 4.4 Finish Fabrication
- 4.5 Finishing

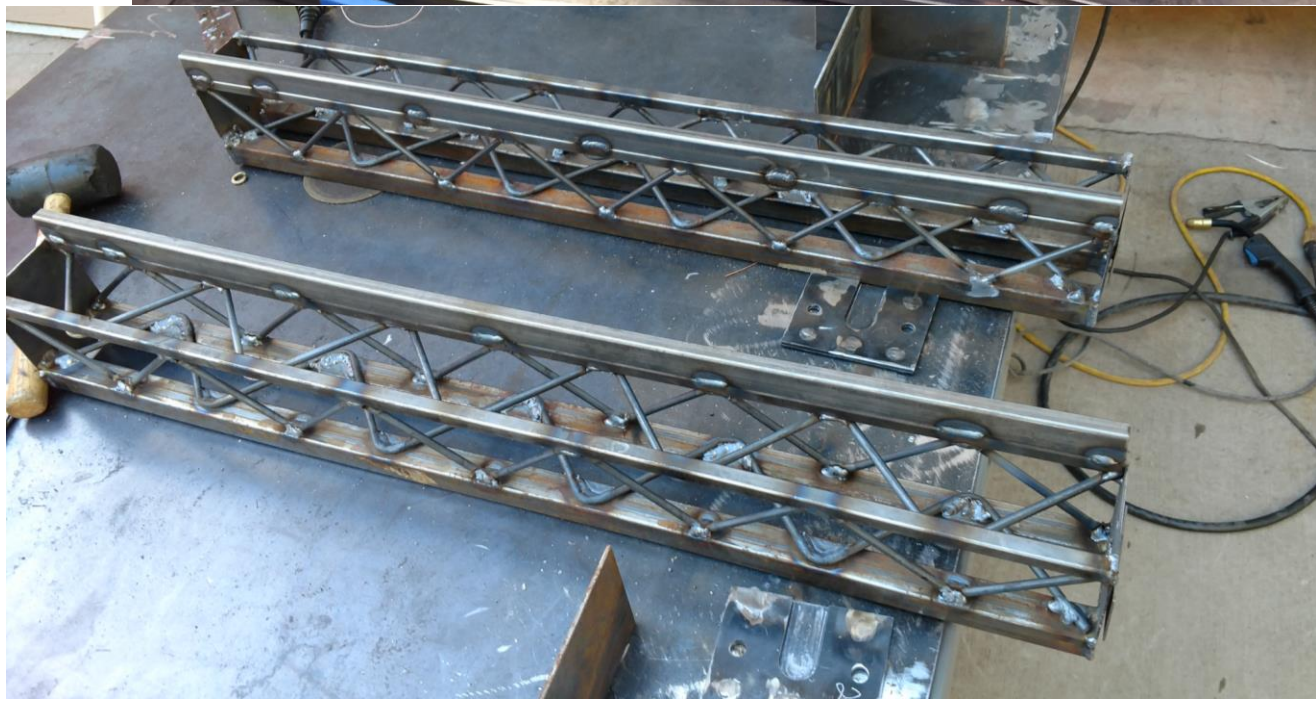

Figure 12: Welded Mini-Trusses [3]

Task 5: Construction Practice

- 5.1 Practice Assembly
- 5.2 Optimize Construction Time

Figure 13: Bridge Construction over river [2]

Figure 14: Bridge Construction [2]

Task 6: Project Deliverables

- 6.1 Project Impacts
- 6.2 Website
- 6.3 30% Design Report
- 6.4 60% Design Report
- 6.5 Final Design Report
- 6.8 Undergraduate Research Symposium Presentation

Task 7: Project Management

- 7.1 Coordination
  - 7.1.1 Travel
  - 7.1.2 Competition
  - 7.1.3 Donations & Sponsors
- 7.2 Budget Management
- 7.3 Meetings

Figure 15: Bridge Team at 2017 Conference[3]

ID	Task Name	Duration
1	**Task 1: Project Research**	
5	**Task 2: Resourcing**	
8	**Task 3: Structural Analysis**	
9	3.1 Vertical Deflection Design	40 days
10	3.2 Lateral Deflection Design	40 days
11	3.3 Lateral Torsional Buckling and Overturning Design	40 days
12	3.4 Design Fittings/Connections	40 days
13	3.6 Final Design	20 days
14	**Task 4: Fabrication**	
15	4.1 Produce Construction Drawings	6 days
16	4.2 Steel Preparation	24 days
17	4.3 Welding	14 days
18	4.4 Finish Fabrication	7 days
19	4.5 Finishing	5 days
20	**Task 5: Construction Practice**	
21	5.1 Practice Assembling	13 days
22	5.2 Optimize Construction Time	13 days
23	**Task 6: Project Deliverables**	
31	**Task 7: Project Management**	

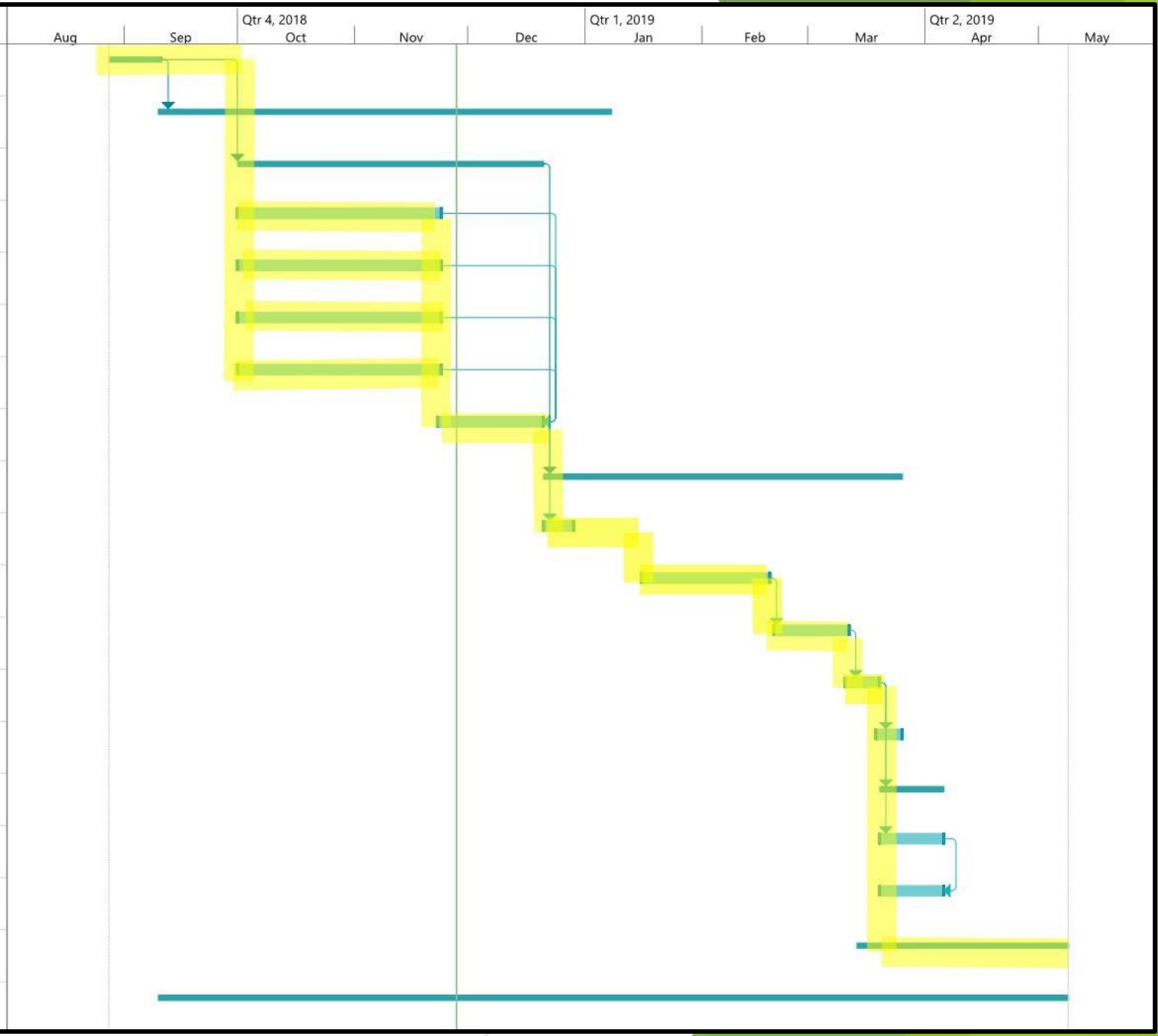

Figure 16: Project Schedule

Project Staffing & Cost of Services

Table 1 : Project Hours by Task and Cost of each task

Task Name	Number of Hours & Total Task Cost						
	Senior Engineer	Engineer	E.I.T	Drafter	Admin	Total Hours	Total Task Cost
Task 1: Project Research	6	12	18	6	8	50	$ 3,820
Task 2: Resourcing	12	8	12	12	16	60	$ 4,408
Task 3: Structural Analysis	30	60	75	77	30	272	$ 19,790
3.1 Design For Vertical Deflection	6	12	15	8	6	47	$ 3,662
3.2 Design For Lateral Deflection	6	12	15	8	6	47	$ 3,662
3.3 Design For Lateral Torsional Buckling and Overturning	6	12	15	8	6	47	$ 3,662
3.4 Design Fittings/Connections	6	12	15	8	6	47	$ 3,662
3.6 Final Design	6	12	15	45	6	84	$ 5,142
Task 4: Fabrication	6	12	30	32	4	84	$ 5,428
4.1 Produce Construction Drawings	2	6	8	32	0	48	$ 2,734
4.2 Steel Preparation	0	0	8	0	0	8	$ 464
4.3 Welding *	0	0	0	0	0	0	$ -
4.4 Finish Fabrication	2	4	6	0	0	12	$ 1,108
4.5 Finishing	2	2	8	0	4	16	$ 1,122
Task 5: Construction Practice	3	16	16	4	0	39	$ 3,378
Task 6: Project Deliverables	13	16	30	17	25	101	$ 7,010
Task 7: Project Management	58	56	60	46	13	233	$ 20,876
Hours Total:							**839**
Cost Total:							**$ 64,710**

Table 2 : Staffing Billable Rates

Personnel	Abbreviations	Billing Rate ($/hr)
Senior Engineer	Sr.Eng	**150**
Engineer	Eng	**115**
Engineer in Training	E.I.T.	**58**
Drafter	Drf	**40**
Administration	Admin	**32**

Total Cost of Project

Table 3: Total Engineering Service Cost Breakdown

Item	Description	Cost per Unit ($/unit)	Units	# of Units	Anticipated Cost
Engineering Services	Senior Engineer	150	hr	128	$ 19,200
	Engineer	115	hr	180	$ 20,700
	E.I.T	58	hr	241	$ 13,978
	Drafter	40	hr	194	$ 7,760
	Admin	32	hr	96	$ 3,072
Material	Nuts & Bolts	0.1	bolt/nut	200	$ 20
	Steel	0.50	lb	400	$ 200
Travel	Van Rental	60	per day	8	$ 480
	Mileage	0.54	miles	1232	$ 665
	Lodging	40	room/person/night	12	$ 480
Subcontracted Services	Welding	60	hr	30	$ 1,800
	Plate Cutting	35	cut	25	$ 875
Total Project Cost:					**$ 69,230**

References

[1] AISC, Student Steel Bridge Competition 2019 Rules, 2019.

[2] 2017-2018 NAU Steel Bridge Team

[3] 2016-2017 NAU Steel Bridge Team

[4] https://www.payscale.com/research/US/Job=Computer_Aided_Design_(CAD)_Drafter/Hourly_Rate

[5] https://www.asce.org/uploadedFiles/Membership_and_Communities/salary-survey-asce-asme-2013.pdf

[6] https://www.irs.gov/newsroom/2016-standard-mileage-rates-for-business-medical-and-moving- announced

[7] https://www.payscale.com/research/US/Job=Office_Administrator/Hourly_Rate