

2017-2018 Northern Arizona University Steel Bridge Project Proposal

CENE 476

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Project Understanding

For Competition in the 2018 National Student Steel Bridge Competition (NSSBC)

- Design of 1:10 scale bridge
- 18' in length, 5' tall
- Including only steel members

Design with Respect to Judging Criteria

- Display
- Construction speed
- Lightness
- Stiffness
- Construction economy
- Structural efficiency

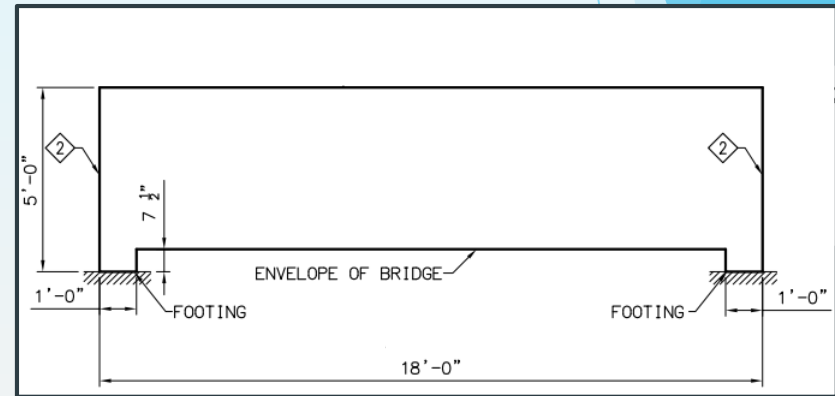


Figure 1: Bridge Envelope [1]

Project Understanding

Recognized Stakeholders

- Mark Lamer (*Client*)
- Thomas Nelson (*Technical Advisor*)
- Burgeon County Transportation Commission (*Beneficiary*)
- American Society of Civil Engineers (*Competition Host*)
- American Institute of Steel Construction (*Competition Host*)
- Northern Arizona University

Challenges

- Condensed Scheduling
- Fabrication Requirements



ASCE Logo [2]



AISC Logo [3]

Scope of Services

Task 1: Research

- Steel design and construction
- Fabrication methods
- Construction methods

Task 2: Fundraising

Task 3: Analysis (Members and Connections)

- RISA 3D structural modeling software
- AISC Specification for Structural Steel Buildings [4]
- Hand calculations

Task 4: Fabrication

- Shop drawings
- Member preparation
- Welding

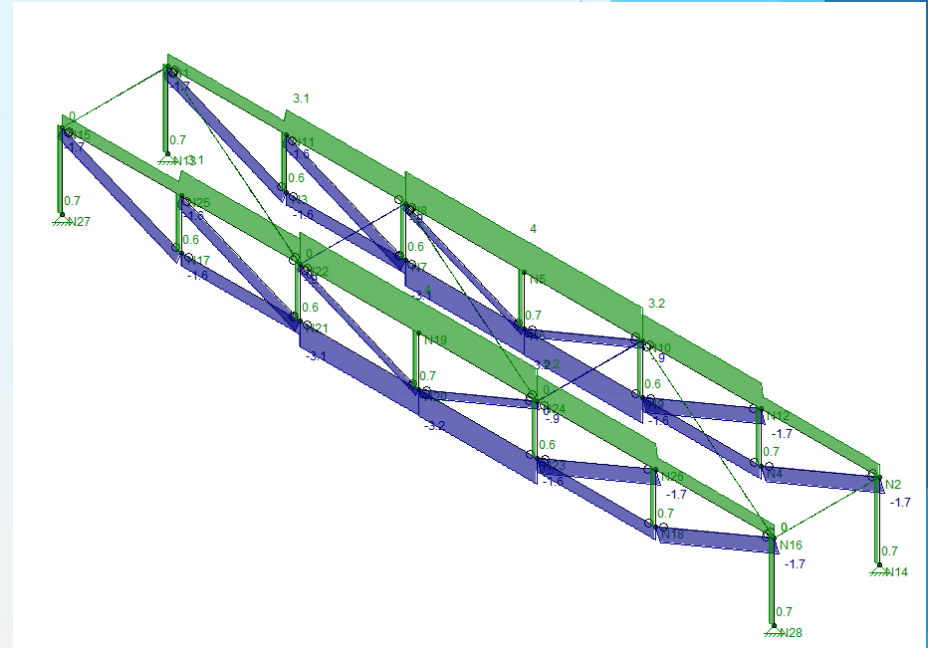


Figure 2: Example of RISA 3D Analysis Displaying Axial Forces

Scope of Services

Task 5: Construction Practice

Task 6: ASCE Pacific Southwest
Conference (PSWC) 2018 Competition

Task 7: Displaying Results

- Design Report
- Website
- NAU Undergraduate Research and Design Symposium (UGRADS)

Task 8: Project Management

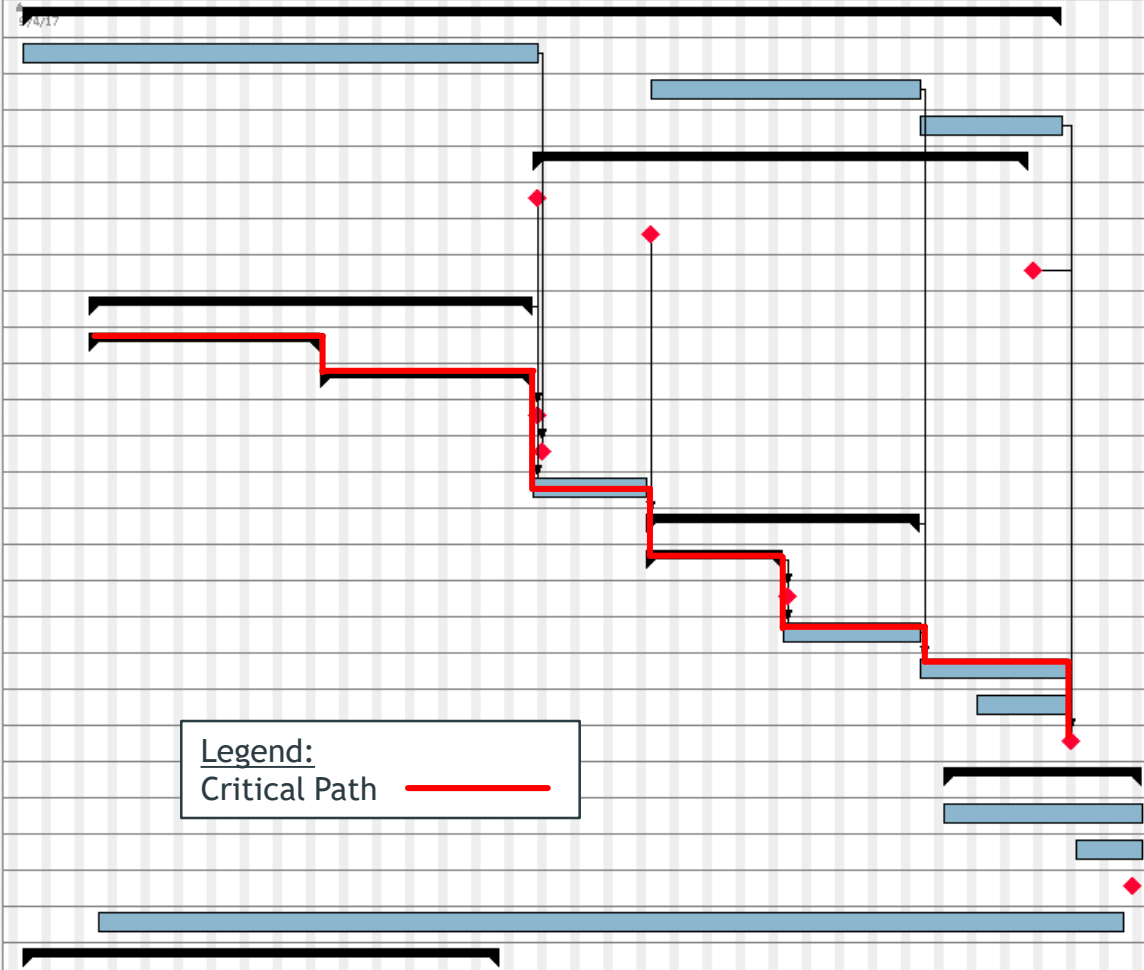


Figure 3: Loading of the 2016-2017 NAU Steel Bridge Team's Bridge at PSWC 2017 [5]



Project Schedule

• Task 1: Research	9/5/17	4/12/18
• Steel Design	9/5/17	12/22/17
• Steel Fabrication	1/16/18	3/13/18
• Construction Methods	3/14/18	4/12/18
• Task 2: Fundraising	12/22/17	4/5/18
• \$500 Raised Total	12/22/17	12/22/17
• \$1000 Raised Total	1/15/18	1/15/18
• \$2000 Raised Total	4/6/18	4/6/18
• Task 3: Analysis	9/19/17	12/21/17
⊕ Preliminary Analysis	9/19/17	11/6/17
⊕ Final Design	11/7/17	12/21/17
• Place Steel Order	12/22/17	12/22/17
• First Draft of Shop Drawings	12/23/17	12/23/17
• Winter Break	12/22/17	1/14/18
• Task 4: Fabrication	1/15/18	3/13/18
⊕ Preparation	1/15/18	2/12/18
• Welding	2/13/18	2/13/18
• Finish Fabrication	2/13/18	3/13/18
• Task 5: Construction Practice	3/14/18	4/13/18
• Competition Poster Preparation	3/26/18	4/13/18
• Task 6: Competition	4/14/18	4/14/18
• Task 7: Displaying Results	3/19/18	4/29/18
• Project Design Report	3/19/18	4/29/18
• Project Website	4/16/18	4/29/18
• NAU UGRADS Presentation	4/27/18	4/27/18
• Task 8: Project Management	9/21/17	4/25/18
• Course Deliverables	9/5/17	12/14/17



Project Staffing

Table 1: Staff Member Billing Rates

Staff Member	Abbreviation	Rate* (\$/hr)
Principle Engineer	PRE	175
Project Engineer	PJE	135
Project Manager	PM	150
Engineer in Training	EIT	75
Intern	INT	45
Administration	ADM	60
Drafter	DRF	60

*Billing rates consider base pay, office overhead, software license fees, employee benefits, and desired profit.

Cost of Engineering Services

Table 2: Anticipated Labor Hours and Cost

Task	Number of Hours Anticipated							Task Total Hours	Task Total Cost (\$)
	PRE (1)	PJE (1)	PM (1)	EIT (4)	INT (4)	ADM (1)	DRF (2)		
1: Research	1		2	10	20			33	\$2,125
2: Fundraising			2	2	4			8	\$630
3: Analysis	6	6	6	160				178	\$14,760
4: Fabrication	3	7.5	6	100	40			156.5	\$11,738
5: Construction Practice	1	10	2	30	20			63	\$4,975
6: Competition	3			28	38			69	\$4,335
7: Displaying Results	3			51	2		7.5	63.5	\$4,890
8: Project Management	8		11	64	64	2	8	157	\$11,330
Staff Total	25	23.5	29	445	188	2	15.5	Total Hours:	728
Staff Total Cost (\$)	\$4,375	\$3,173	\$4,350	\$33,375	\$8,460	\$120	\$930	Total Cost:	\$54,800

Project Cost Summary

Table 3: Anticipated Project Cost Summary

Item	Cost per Unit (\$/unit)	Units	# Units	Cost
Total Personnel Cost	-	-	-	\$54,800
Steel	2	lineal feet	250	\$500
Material Testing	100	hours	5	\$500
Welding	70	hours	8	\$560
Van Rental	80	day	4	\$320
Lodging	30	room/person/night	12	\$360
Total				\$57,000

Summary

Total Time For Completion: August 28th, 2017 - April 12th, 2018

Total Labor Cost: \$54,800

Total Service Cost: \$2,180.00

- Steel
- Van Rental
- Lodging
- Material Testing

Total Project Cost: \$57,000



**Figure 2: 2017-2018 Steel Bridge Team
(Taken By Ally Marnocha)**

References

- [1] Student Steel Bridge Competition 2018 Rules, 1st ed., ASCE / AISC, 2017.
- [2] Available: https://library.ucf.edu/wp-content/uploads/sites/5/2015/12/ASCE-LOGO_0.jpg
- [3] Available: https://www.aisc.org/globalassets/aisc/images/logos/aisc_logo-180.png
- [4] “Specification for Structural Steel Buildings,” American Institute of Steel Construction, 2017
- [5] S. Ballard, S. Hopper, R. Morofsky, M. Stevens. (2017, Nov. 30). *Northern Arizona University 2016-2017 Steel Bridge Capstone Team* [Online]. Available: <https://www.cefns.nau.edu/capstone/projects/CENE/2017/SteelBridge/index.html>