# Steel Bridge Team

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CENE 476
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# 1.0 Project Understanding

## 1.1 Project Purpose

- Client: Mark Lamer
- Student Steel Bridge Competition (SSBC) held by AISC and ASCE at UNLV
- Intermountain Southwest Region
- Goal to construct a 1:10 scale model of a wildlife crossing bridge

## 1.2 Project Background

- Competition Details
- Scoring
  - Aesthetics
  - Construction Speed
  - Lightness
  - Stiffness
  - Construction Economy
  - Structural Efficiency
  - Overall Performance

# 1.0 Project Understanding

## 1.3 Technical Considerations

- Located along I-90 in Washington
- Cantilever Bridge
- Using RISA to design bridge
- Load calculations
- Material testing

## 1.4 Potential Challenges

- Designing a Cantilever Bridge
- Designing loading
- Determining the ideal material that meets the requirements
- Select final design

# 1.0 Project Understanding

## 1.5 Stakeholders

- Northern Arizona University
- Client: Mark Lamer
- American Institute of Steel Construction
- American Society of Civil Engineers


Figure 1: ASCE Logo [6]


Figure 2: AISC Logo [1]


Figure 3: NAU Logo [5]

# 2.0 Scope of Services

Task 1: Competition Due Diligence

Task 2: Impact Analysis

Task 3: Conduct Material Research


Figure 4: SSBC Logo [1]

# 2.0 Scope of Services

Task 4: Research Potential Bridge Designs

- Task 4.1: Cantilever Design
- Task 4.2: Member Design

Task 5: Conduct Connections Design Research

- Task 5.1: Material Specifications
- Task 5.2: Connection Schematics

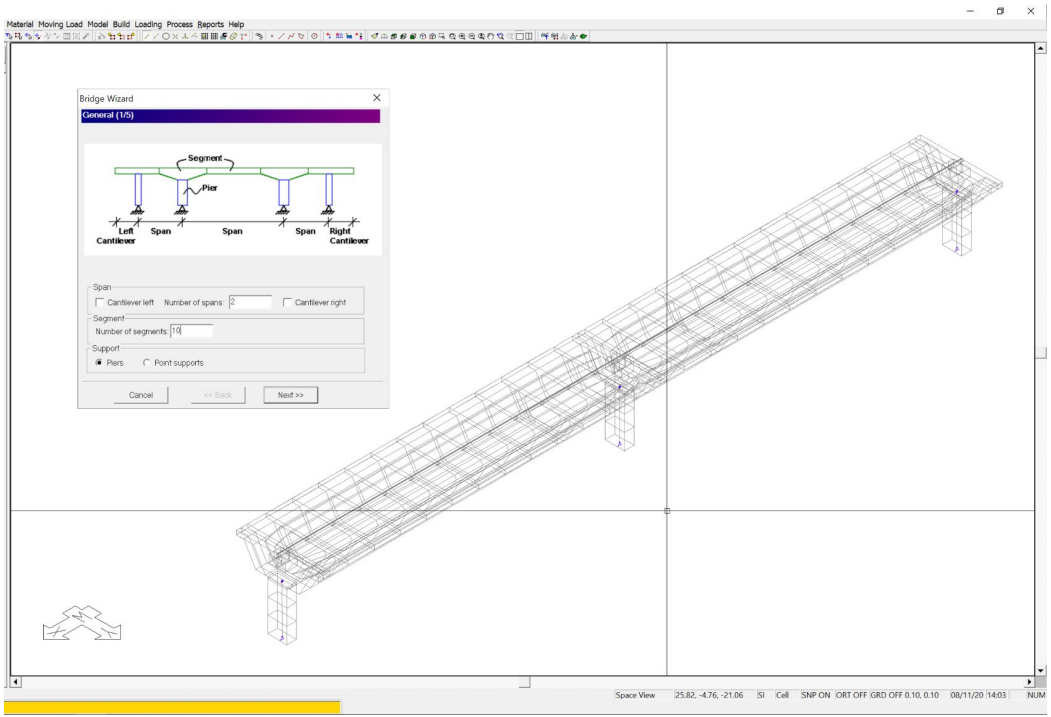



Figure 5: Risa Modelling Example [2]

# 2.0 Scope of Services

Task 6: Conduct Modelling and Analysis o
Design

- Task 6.1: Loading Calculations
- Task 6.2: Calculate Stress and Strain

Values

- Task 6.3: Log Data of Tensile Tests

Task 7: Shop Drawings

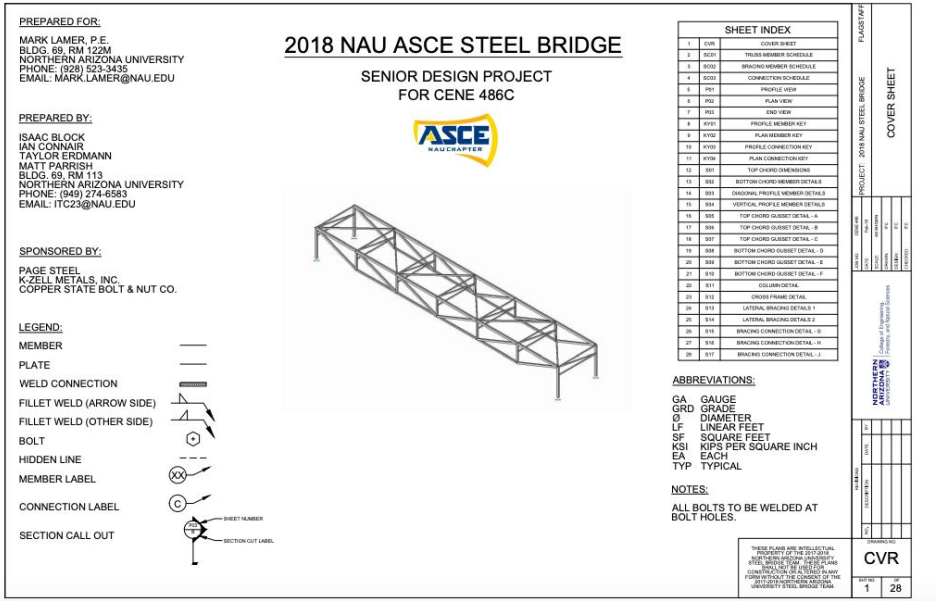



Figure 6: Shop Drawings Example [4]

# 2.0 Scope of Services

Task 8: Coordinate Assembly: Member Fabrication

Task 9: Coordinate Assembly: Connection Fabrication

Task 10: Team Assembly: Modifications and Member Connection

Task 11: Team Assembly: Construction Practice

Task 12:  Regional Competition

# 2.0 Scope of Services

Task 13: Project Deliverables

- Task 13.1: 30 Percent Deliverable
- Task 13.2: 60 Percent Deliverable
- Task 13.3: 90 Percent Deliverable
- Task 13.4: Final Report
- Task 13.5: Plans
- Task 13.6: Product
- Task 13.7: Presentation

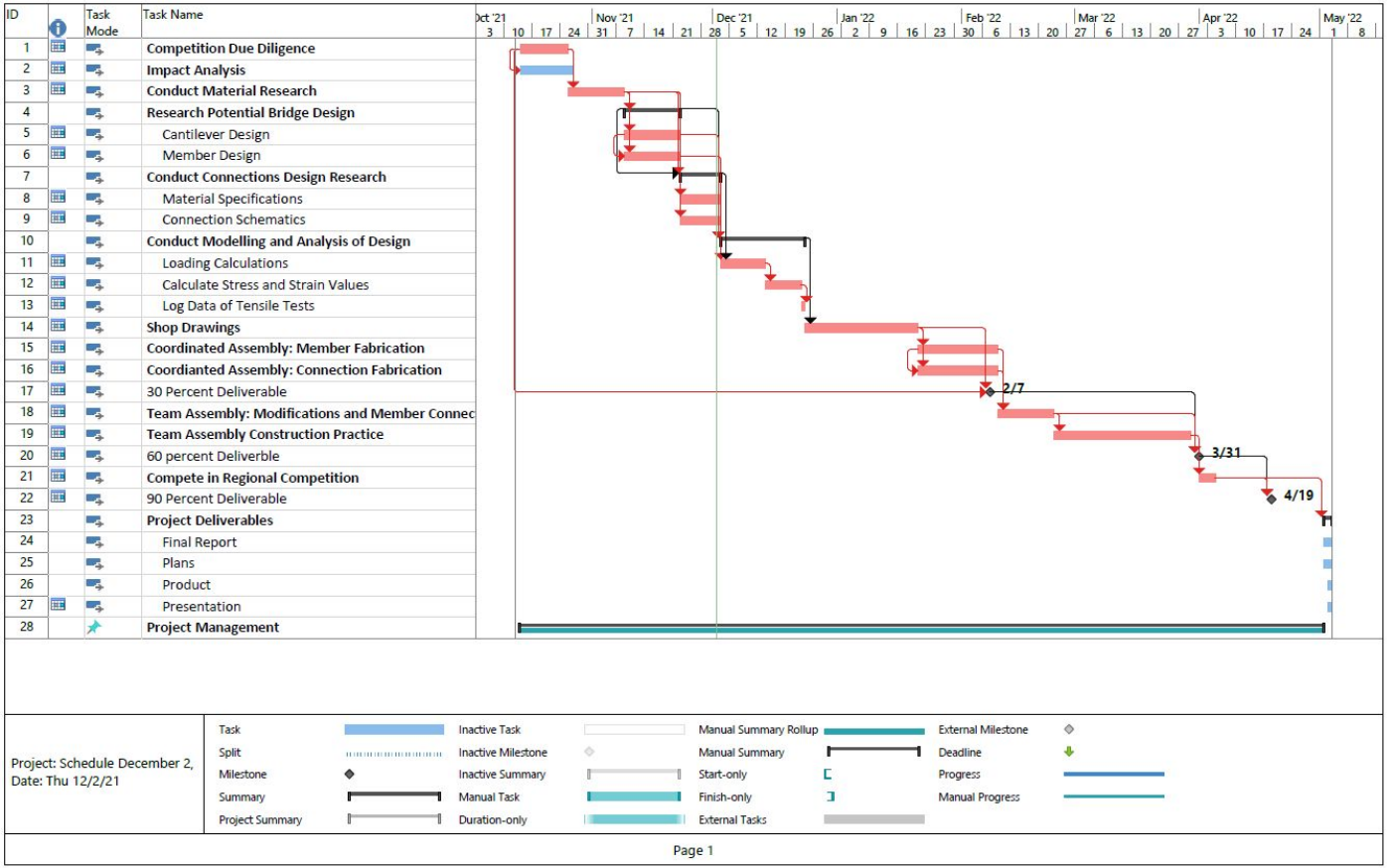
Task 14: Project Management

- Task 14.1: Schedule Management
- Task 14.2: Resource Management
- Task 14.3: Meetings
- Task 14.4: Coordination with Fabricators
- Task 14.5: Coordination with Mentees

# Exclusions

- Providing exact coordinates of the bridge within the hypothetical location area
- Application of a green surface to the top of the bridge
- Full scale construction of the bridge

# 3.0 Schedule


ID
Task Mode
Task Name
1 Competition Due Diligence
2 Impact Analysis
3 Conduct Material Research
4 Research Potential Bridge Design
5 Cantilever Design
6 Member Design
7 Conduct Connections Design Research
8 Material Specifications
9 Connection Schematics
10 Conduct Modelling and Analysis of Design
11 Loading Calculations
12 Calculate Stress and Strain Values
13 Log Data of Tensile Tests
14 Shop Drawings
15 Coordinated Assembly: Member Fabrication
16 Coordianted Assembly: Connection Fabrication
17 30 Percent Deliverable
18 Team Assembly: Modifications and Member Connec
19 Team Assembly Construction Practice
20 60 percent Deliverble
21 Compete in Regional Competition
22 90 Percent Deliverable
23 Project Deliverables
24 Final Report
25 Plans
26 Product
27 Presentation
28 Project Management
Oct '21
Nov '21
Dec '21
Jan '22
Feb '22
Mar '22
Apr '22
May '22
2/7
3/31
4/19
Project: Schedule December 2,
Date: Thu 12/2/21
Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress
Page 1

# 4.0 Staffing Plans

| Task | Personnel | | | | | | SUM |
|---|---|---|---|---|---|---|---|
| | SENG | PENG | EIT | INT | DRF | ADM | |
| Task 1: Competition Due Diligence | 2 | 2 | 4 | 4 | 0 | 4 | 16 |
| Task 2: Impact Analysis | 1 | 1 | 3 | 3 | 0 | 4 | 12 |
| Task 3: Conduct Material Research | 0 | 3 | 8 | 6 | 0 | 8 | 25 |
| Task 4: Research Potential Bridge Designs | 0 | 4 | 10 | 10 | 0 | 10 | 34 |
| Task 4.1: Cantilever Design | 0 | 2 | 5 | 5 | 0 | 5 | 17 |
| Task 4.2: Member Design | 0 | 2 | 5 | 5 | 0 | 5 | 17 |
| Task 5: Conduct Connections Design Research | 8 | 10 | 15 | 15 | 0 | 0 | 48 |
| Task 5.1: Material Specifications | 4 | 5 | 10 | 10 | 0 | 0 | 29 |
| Task 5.2: Connection Schematics | 4 | 5 | 5 | 5 | 0 | 0 | 19 |
| Task 6: Conduct Modelling and Analysis of Design | 12 | 36 | 18 | 15 | 0 | 0 | 81 |
| Task 6.1: Loading Calculations | 4 | 12 | 6 | 5 | 0 | 0 | 27 |
| Task 6.2: Calculate Stress and Strain Values | 4 | 12 | 6 | 5 | 0 | 0 | 27 |
| Task 6.3: Log Data of Tensile Tests | 4 | 12 | 6 | 5 | 0 | 0 | 27 |
| Task 7: Shop Drawings | 4 | 2 | 0 | 0 | 35 | 0 | 41 |
| Task 8: Coordinated Assembly: Member Fabrication | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 9: Coordinated Assembly: Connection Fabrication | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 10: Team Assembly: Modifications and Member Connection | 5 | 10 | 50 | 20 | 0 | 0 | 85 |
| Task 11: Team Assembly: Construction Practice | 5 | 10 | 50 | 20 | 0 | 0 | 85 |
| Task 12: Compete in Regional Competition | 0 | 84 | 84 | 84 | 0 | 0 | 252 |
| Task 13: Project Deliverables | 7 | 19 | 70 | 21 | 0 | 14 | 131 |
| Task 13.4: Final Report | 1 | 5 | 10 | 3 | 0 | 2 | 21 |
| Task 13.5: Plans | 1 | 2 | 10 | 3 | 0 | 2 | 18 |
| Task 13.6: Product | 1 | 2 | 5 | 3 | 0 | 2 | 13 |
| Task 13.7: Presentation | 1 | 1 | 10 | 3 | 0 | 2 | 17 |
| Task 14: Project Management | 16 | 20 | 4 | 4 | 0 | 16 | 60 |
| Task 14.1: Coordination of Teammates and Duties | 10 | 14 | 1 | 1 | 0 | 4 | 30 |
| Task 14.2: Steel Donation Contact | 2 | 2 | 1 | 1 | 0 | 4 | 10 |
| Task 14.3 Fabricator Contact | 2 | 2 | 1 | 1 | 0 | 4 | 10 |
| Task 14.4 Mentors Contact | 2 | 2 | 1 | 1 | 0 | 4 | 10 |
| Total | 60 | 201 | 316 | 202 | 35 | 56 | **870** |

# 5.0 Cost of Engineering Services

| Cost of Engineering Services | | | | | |
|---|---|---|---|---|---|
| 1.0 Personnel | Classification | Hours | Rate, $/hour | | Cost |
| | SENG | 60 | 170 | | $10,200.00 |
| | PENG | 201 | 150 | | $30,150.00 |
| | EIT | 316 | 50 | | $15,800.00 |
| | INT | 202 | 30 | | $6,060.00 |
| | DRF | 35 | 55 | | $1,925.00 |
| | ADM | 56 | 50 | | $2,800.00 |
| | Personnel Total | 870 | | | $66,935.00 |
| 2.0 Materials | Steel members, connections and hardware | | | | $1,800.00 |
| 3.0 Equipment | Tools required for construction and assembly | | | | $450.00 |
| 4.0 Subcontract | Labor | 120 hours | $60 | | $7,200.00 |
| 5.0 Travel | Van Rental | 4 days | $65/day | | $260.00 |
| | Mileage | 500 miles | $0.36/mile | | $175.00 |
| | Per Diem | 5 days | $64/person/day | 4 people | $1,200.00 |
| | Lodging | 4 nights | $118/room/night | 2 rooms | $944.00 |
| Total | | | | | **$145,899.00** |

Figure 7: Costs [7,8]

# References


[1] L. Kruth, J. Lanning, and C. Quadrato, “Student Steel Bridge Competition.” ASCE, 07-Sep-2021.

[2] "ADAPT-ABI", *RISA*, 2021. [Online]. Available: https://risa.com/products/adapt-abi. [Accessed: 02- Dec-2021].

[3]"Google Maps", *Google.com*, 2021. [Online]. Available: https://www.google.com/maps/place/University+of+Nevada,+Las+Vegas/@36.10749,-115.1456394,17z/data=!3m1!4b1!4m5!3m4!1s0x80c8c501997ee05f:0xe38117c11c6f42c6!8m2!3d36.1074857!4d-115.1434507. [Accessed: 22- Nov- 2021].

[4]"2017-2018 NAU Steel Bridge", *Ceias.nau.edu*, 2021. [Online]. Available: https://ceias.nau.edu/capstone/projects/CENE/2018/ASCESteelBridge/. [Accessed: 22- Nov- 2021].

[5]"Northern Arizona University | Online, Bachelor’s, Graduate | NAU", *Northern Arizona University*, 2021. [Online]. Available: https://nau.edu/. [Accessed: 22- Nov- 2021].

[6] “File:ASCE logo.svg,” Wikimedia Commons. [Online]. Available: https://commons.wikimedia.org/wiki/File:ASCE_logo.svg. [Accessed: 02-Dec-2021].

[7]"Vehicle Rental | University Transit Services", *University Transit Services*, 2021. [Online]. Available: https://in.nau.edu/university-transit-services/fleet-services/vehicle-rental/. [Accessed: 02- Dec- 2021].

[8]*Defensetravel.dod.mil*, 2021. [Online]. Available: https://www.defensetravel.dod.mil/Docs/perdiem/browse/Allowances/Per_Diem_Rates/Text_Only/Continental-US/2022/conus2022.pdf. [Accessed: 02- Dec- 2021].

# Questions?