Steel Bridge Competition Team Project Proposal CENE 476C December 6, 2019

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Introduction

Purpose Design and build a 1:10 scale steel bridge

<u>Client</u> Mark Lamer

<u>Case Study Location</u> Katy Trail State Park, Missouri; over the Missouri River

Background

The AISC 2020 Steel Bridge
 Competition Rules describe
 a Case Study at Katy Trail
 State Park.

Project Background

Categories of Competition

- Aesthetics
- Construction Economy
- Structural Efficiency
- Overall Performance

Past Teams Performance

- 2019 Disqualified
- 2018 8th Overall
- 2017 9th Overall

<u>Task 1:</u> <u>Research</u>



Student Steel Bridge Competition



[1]

1.1 Analysis methods

1.2 RISA

1.3 Bridge Types

1.4 Connections

1.5 Materials

Task 2: Analysis

2.1 Bridge Type

- Truss
- ✤ Beam
- **2.2 Material Analysis**
 - Cold- vs. Hot- rolled, metal composition

2.3 Connection Design

- Assess different types and their deflection
 - **2.4 Member Analysis**
- Dimension, weight, and strength

Task 3: Shop Drawings

Shop Drawings

Create plan set in AutoCAD
Send to K-Zell Metals and Mingus Welding



Figure 1: Elevation View from Shop Drawing from 2018 Steel Bridge Team [2]

Task 4: Fabrication Management



4.2 Mingus Welding





[2]

<u>Task 5: Final</u> <u>Product</u> <u>Improvements</u>

Ensuring that the product:

- Is ready to be competitive at competition
- ✤ Is cohesive and constructible

Can include:

Redesigning Connections
 Pre Welding Plates
 Drilling holes for bolts
 Redesign Bracing

Task 6: Competition Preparation

6.1 Construction Practice

6.2 Poster and Display



Figure 2: 2018 NAU Steel Bridge Team during competition constructing [2]

Task 7: AISC Competition

Where: Cal State Fullerton

When: April 1 and 2, 2020

Competition includes:

- Display
- Construction

Testing

<u>Task 8: Project</u> <u>Management</u>

8.1 Schedule

8.2 Sponsor Communication

- ≻ K-Zell Metals
- ➤ Mingus Welding Team
- ≻ Page Steel

Co.

➤ Copper State Bolt and Nut



8.3 Meetings

8.4 Deliverables

- 30%, 60%, 90% Design Report and drawings
- Final presentation and Final Design Report
- Competing at AISC
- ✤ Website

8.5 Fundraising



Task 9: Impacts

Exclusions

- * Social
- * Economical
- * Environmental

Geotechnical work
Surveying
Traffic planning
Designing footings

Fask Name	Duration	Start	Finish	18	25 Se	o'19	15 22 2	Oct '19 9 6 13	N 3 20 27	Nov '19 3 10 17	24 1	:'19 8 15 1	Jan '2	0 5 12 19	Feb '20	16 23	/ar'20 1 8 15	22 29	r '20 5 12
Task 1: Research	5 days	Wed 8/28/19	Tue 9/3/19		-														
1.1 Analysis Methods	5 days	Wed 8/28/19	Tue 9/3/19		-		L L												
1.2 RISA 3D	3 days	Thu 8/29/19	Mon 9/2/19		-									Note:	Deadline		*		
1.3 Bridge Types	3 days	Thu 8/29/19	Mon 9/2/19			_									Critical				
1.4 Connections	3 days	Thu 8/29/19	Mon 9/2/19				-												
1.5 Materials	3 days	Fri 8/30/19	Tue 9/3/19				+												
Task 2: Design and Analysis	70 days	Tue 9/3/19	Mon 12/9/19	9	ľ	-						-1							
2.1 Bridge Type	5 days	Tue 9/3/19	Mon 9/9/19		1	·													
2.2 Member Analysis	50 days	Tue 9/10/19	Mon 11/18/1	1		-						<u> </u>							
2.3 Connection Design	60 days	Tue 9/17/19	Mon 12/9/19	9		H						-							
2.4 Material Analysis	45 days	Tue 9/24/19	Mon 11/25/1	1			×												
3.1 Shop Drawings	15 days	Tue 11/26/19	Sun 12/15/19	9															
Task 4: Fabrication Management	36 days	Mon 12/16/1	Mon 2/3/20									_							
4.1 K-Zell	5 days	Mon 12/16/1	Fri 12/20/19									*							
4.2 Mingus Welding	5 days	Tue 1/28/20	Mon 2/3/20																
5.1 Final Product Improvement	4 days	Tue 3/10/20	Fri 3/13/20														* -		
Task 6: Competition Preparation	11 days	Mon 3/16/20	Mon 3/30/20	c													-	-	
6.1 Construction Practice	11 days	Mon 3/16/20	Mon 3/30/20														—		
6.2 Poster and Display	2 days	Mon 3/16/20	Tue 3/17/20														*		
Task 7: AISC Competition	4 days	Tue 3/31/20	Fri 4/3/20															1	
Task 8: Project Management	170 days	Wed 8/28/19	Tue 4/21/20		-												- 1 - 1		
8.1 Schedule	169 days	Wed 8/28/19	Mon 4/20/20																
8.2 Sponsor Communication	127 days	Mon 9/2/19	Tue 2/25/20	_															
8.3 Meetings	145 days	Sun 9/8/19	Sun 3/29/20								-	-							
8.4 Deliverables	111 days	Tue 11/19/19	Tue 4/21/20							-								-	
8.5 Fundraising	154 days	Wed 8/28/19	Mon 3/30/20																
Task 9: Impacts	1 day	Thu 3/26/20	Thu 3/26/20															1	

- 1. Task 1.3 Bridge Type Research
- 2. Task 2.1 Bridge Type Analysis
- 3. Task 2.2 Member Analysis
- 4. Task 2.3 Connection Design
- 5. Task 2.4 Material Analysis
- 6. Task 3.1 Shop Drawings
- 7. Task 4.1 K-Zell Metals
- 8. Task 4.2 Mingus Welding
- 9. Task 5 Final Product Improvement
- 10.Task 6 Competition Preparation
- 11.Task 7 AISC Competition

Critical Path

Project Staffing

Table 1: Project Staffing Table

Tack		ŀ	ersonnel			Sum							
1 dSK	SENG	ENG	EIT	Lab	AA	Sum							
Task 1: Research	8	16	90	8	0	122	Task 5: Final Product Improveme	2	4	24	16	0	46
1.1 Analysis Methods	1	2	16	0	0	19	5.1 Final Product Improvement	2	4	24	16	0	46
1.2 RISA 3D	2	4	12	0	0	18	Task 6: Competition Preparation	3	6	24	2	9	44
1.3 Bridge Types	2	4	24	4	0	34	6.1 Competition Preparation	2	4	20	2	6	34
1.4 Connections	1.5	3	14	4	0	22.5	6.2 Poster and Display	1	2	4	0	3	10
1.5 Materials	1.5	3	24	0	0	28.5	Task 7: AISC Competition	6	12	24	2	2	46
Task 2: Design and Analysis	20	41	102	32	0	195	Task 8: Project Management	35	88	216	38	112	489
2.1 Bridge Type	2	6	14	0	0	22	8.1 Schedule Management	6	3	4	0	6	19
2.2 Member Analysis	8	18	38	0	0	64	8.2 Sponsor Communication	4	6	5	0	6	21
2.3 Connection Design	8	12	32	12	0	64	8.2 Mostings	12	62	140	20	70	214
2.4 Material Analysis	2	5	18	20	0	45		12	02	140	30	70	314
Task 3: Shop Drawings	4	4	40	4	2	54	8.4 30% Deliverables	2	3	12	2	3	22
3.1 Shop Drawings	4	4	40	4	2	54	8.5 60% Deliverables	2	4	12	2	3	23
Task 4: Fabrication Management	4	8	62	40	8	122	8.6 90% Deliverables	3	6	16	1	6	32
4.1 K-Zell	1	2	6	0	4	13	8.7 Final Deliverables	4	2	13	1	6	26
4.2 Member Cutting	2	4	32	24	0	62	8.8 Fundraising	2	2	14	2	12	32
4.3 Mingus Welding	1	2	24	16	4	47	Personnel Hours	82	179	582	142	133	1118

Total Cost of Project

Table 2: Total Projected Cost

	Classification	Units	Rate	Cost	
Personnel	SENG	82	\$200	\$16,400.00	
	ENG	179	\$137	\$24,523.00	
	EIT	582	\$72	\$41,904.00	
	LAB	142	\$90	\$12,780.00	
	AA	133	\$67	\$8,911.00	
	Total Personnel	1118		\$104,518.00	
Travel		5 nights and 2 rooms	\$220/room	\$2,200	
	Competition	Vehicle Rental for 6 days	\$60/day	\$360	
		900 mi	\$.58/mi	\$522	
	Fabrication Management	450 mi	\$.58/mi	\$261	
Supplies	Materials			\$2,000	
	Tools			\$500	
Subcontracting	Mingus Welding			\$100	
Total	Total Cost			\$110,461.00	

<u>References</u>

[1] AISC website, AISC Steel Bridge Competition. 2019

[2] NAU, 2018 Steel Bridge Competition Team Website. 2018