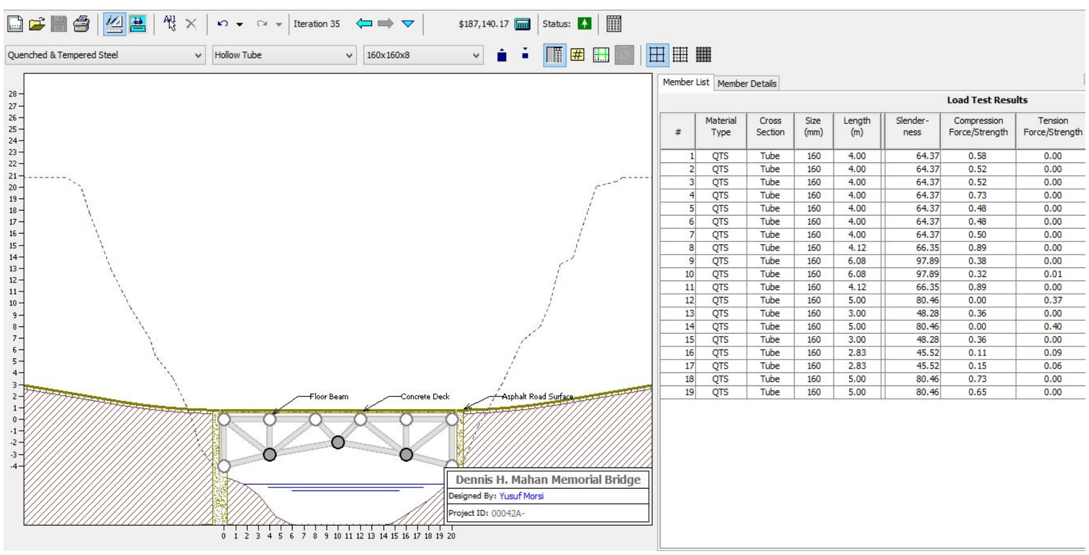
Eastwood Ravine



#	Material Type	Cross Section	Size (mm)	Length (m)	Slender-ness	Compression Force/Strength	Tension Force/Strength
1	QTS	Tube	160	4.00	64.37	0.58	0.00
2	QTS	Tube	160	4.00	64.37	0.52	0.00
3	QTS	Tube	160	4.00	64.37	0.52	0.00
4	QTS	Tube	160	4.00	64.37	0.73	0.00
5	QTS	Tube	160	4.00	64.37	0.48	0.00
6	QTS	Tube	160	4.00	64.37	0.48	0.00
7	QTS	Tube	160	4.00	64.37	0.50	0.00
8	QTS	Tube	160	4.12	66.35	0.89	0.00
9	QTS	Tube	160	6.08	97.89	0.38	0.00
10	QTS	Tube	160	6.08	97.89	0.32	0.01
11	QTS	Tube	160	4.12	66.35	0.89	0.00
12	QTS	Tube	160	5.00	80.46	0.00	0.37
13	QTS	Tube	160	3.00	48.28	0.36	0.00
14	QTS	Tube	160	5.00	80.46	0.00	0.40
15	QTS	Tube	160	3.00	48.28	0.36	0.00
16	QTS	Tube	160	2.83	45.52	0.11	0.09
17	QTS	Tube	160	2.83	45.52	0.15	0.06
18	QTS	Tube	160	5.00	80.46	0.73	0.00
19	QTS	Tube	160	5.00	80.46	0.65	0.00

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Design Brief

I will be constructing a structurally stable bridge called Eastwood Ravine. However, it will have a budget of $190,000. I will need to cut down on things that may make the bridge better, but at the same time are not necessary. I will also need to focus the money that I spend on the things that keep the bridge up and running.

This bridge's deck needs to be 10 feet wide so it can accomodate two lanes of traffic. I will also need to construct Eastwood ravine using a deck thickness of 15 centimeters if high-strength concrete, and 23 centimeters thick if medium-strength concrete. The highest my bridge can go is 24 meters above the water, and there is no restriction on how low I can build it. The maximum amount of joints that each main truss can have is 50, and each can have up to 120 members.

Research Summaries

Through West Point Bridge Design Software, I taught myself which materials that are good for building bridges are most affordable. However, I needed a little assistance to do so, which caused me to use TeachEngineering.com. I also had a little assistance with lowering my bridge under $190,000, so i asked a classmate, Sami Rida, to help me out.

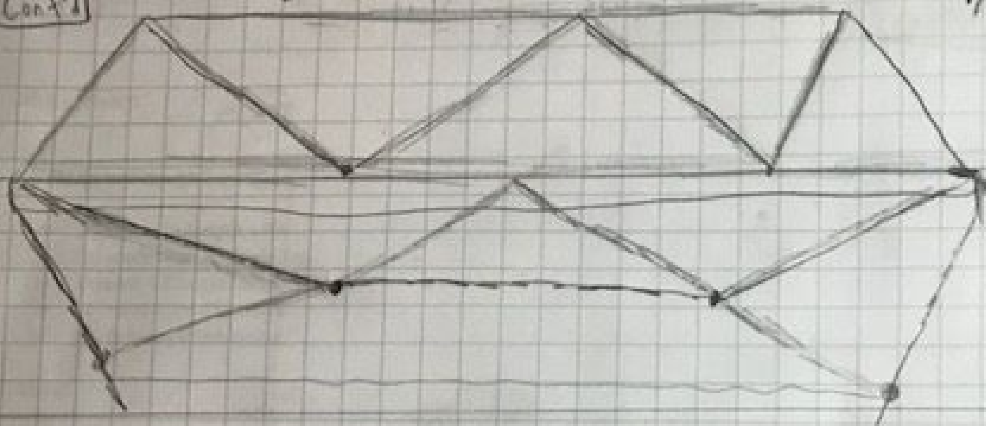
West Point Building Project
Cont'd

Sketches

Brainstorming Sketches

1/8/18

1



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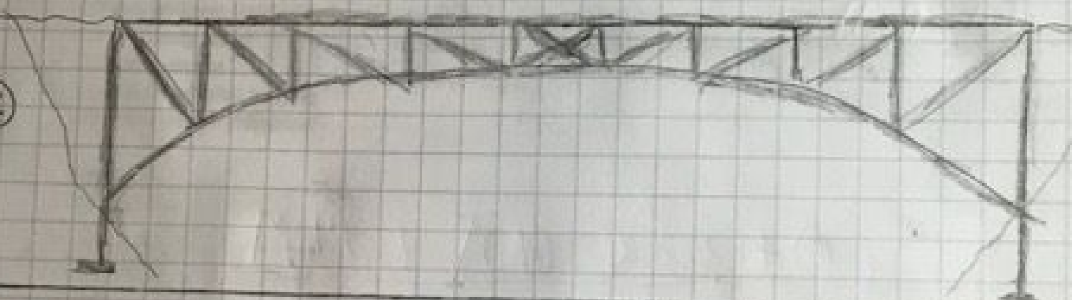

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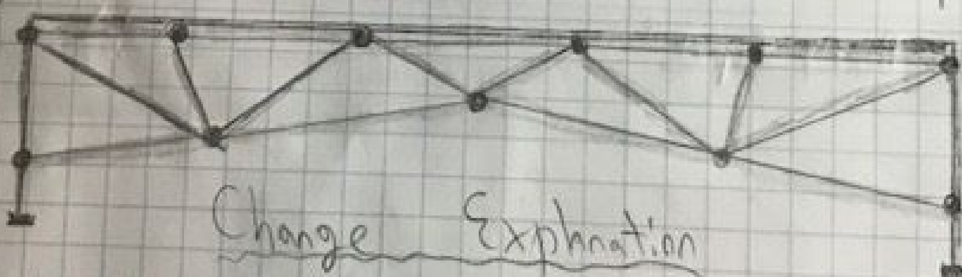
Modification CAD's & Explanation

3



Change Exphnation

Throughout this experience & a projet, my bridge, Eastwood
Ravine, has gone through many different designs. My first bridge was
the quite expensive, yet the most creative. My second design was
structurally stable, but wouldn't ended up as the most expensive. This caused me
to seek help from an online website and a classmate, who both
helped me realize how to make a structurally stable bridge costing
less than $190,000.

Member Properties Report

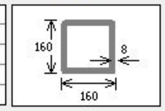
Material Properties:

Material	Quenched & Tempered Steel
Yield Stress (Fy)	485000 kN per sq. meter
Modulus of Elasticity (E)	2.00E+08 kN per sq. meter
Mass Density	7850 kg per cubic meter

Dimensions:

Cross-Section Type	Hollow Tube
Cross-Section Size	160x160x8
Area	0.0049 sq. meters
Moment of Inertia	1.88E-05 meters^4
Member Length	--

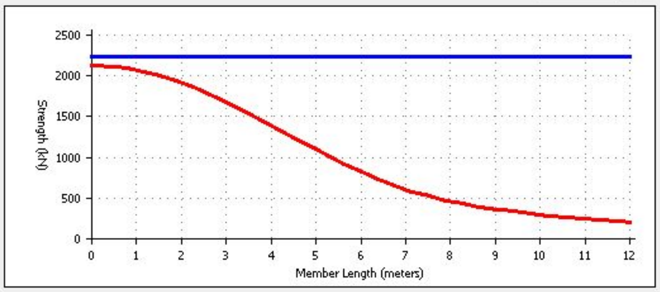
Section (mm):



Cost:

Unit Cost	$295.91 per meter
Member Cost	--

Strength vs. Length: Graph all tabs Member:



Load Test Report

#	Material Type	Cross Section	Size (mm)	Length (m)	Compression Force	Compression Strength	Compression Status	Tension Force	Tension Strength	Tension Status
1	QTS	Tube	160	4.00	807.43	1390.76	OK	0.00	2241.09	OK
2	QTS	Tube	160	4.00	717.01	1390.76	OK	0.00	2241.09	OK
3	QTS	Tube	160	4.00	717.01	1390.76	OK	0.00	2241.09	OK
4	QTS	Tube	160	4.00	1016.23	1390.76	OK	0.00	2241.09	OK
5	QTS	Tube	160	4.00	670.56	1390.76	OK	0.00	2241.09	OK
6	QTS	Tube	160	4.00	670.56	1390.76	OK	0.00	2241.09	OK
7	QTS	Tube	160	4.00	700.08	1390.76	OK	0.00	2241.09	OK
8	QTS	Tube	160	4.12	1209.07	1354.47	OK	0.00	2241.09	OK
9	QTS	Tube	160	6.08	303.56	793.57	OK	0.00	2241.09	OK
10	QTS	Tube	160	6.08	252.24	793.57	OK	24.90	2241.09	OK
11	QTS	Tube	160	4.12	1209.07	1354.47	OK	0.00	2241.09	OK
12	QTS	Tube	160	5.00	0.00	1096.25	OK	838.19	2241.09	OK
13	QTS	Tube	160	3.00	607.28	1673.53	OK	0.00	2241.09	OK
14	QTS	Tube	160	5.00	0.00	1096.25	OK	896.26	2241.09	OK
15	QTS	Tube	160	3.00	607.28	1673.53	OK	0.00	2241.09	OK
16	QTS	Tube	160	2.83	183.75	1718.37	OK	199.65	2241.09	OK
17	QTS	Tube	160	2.83	258.54	1718.37	OK	125.47	2241.09	OK
18	QTS	Tube	160	5.00	797.47	1096.25	OK	0.00	2241.09	OK
19	QTS	Tube	160	5.00	709.33	1096.25	OK	0.00	2241.09	OK

Cost Calculations

Type of Cost	Item	Cost Calculation	Cost
Material Cost (M)	Quenched & Tempered Steel Hollow Tube	(3057.2 kg) x ($7.75 per kg) x (2 Trusses) =	$47,386.77
Connection Cost (C)		(11 Joints) x (500.0 per joint) x (2 Trusses) =	$11,000.00
Product Cost (P)	19 - 160x160x8 mm Quenched & Tempered Steel Tube	($1,000.00 per Product) =	$1,000.00
Site Cost (S)	Deck Cost	(5 4-meter panels) x ($5,150.00 per panel) =	$25,750.00
	Excavation Cost	(85,000 cubic meters) x ($1.00 per cubic meter) =	$85,000.00
	Abutment Cost	(2 arch abutments) x ($8,501.70 per abutment) =	$17,003.40
	Pier Cost	No pier =	$0.00
	Cable Anchorage Cost	No anchorages =	$0.00
Total Cost	**M + C + P + S**	**$47,386.77 + $11,000.00 + $1,000.00 + $127,753.40 =**	**$187,140.17**

Final Justification

In this project, I used hollow tubes instead of solid bars since they served the same function. I found that this was the same case for the metal, as I used quenched and tempered steel. I also decided to place three joint tools, so I would be able to use less members, helping me stay under my budget.

References

Goode, J, S (2006, August 13). Lesson: Strength of Materials. Retrieved from https://www.teachengineering.org/lessons/view/cub_brid_lesson04

Rida, S (2018, January 12). Personal.