SLINGER HIGH SCHOOL

Introduction to Engineering

Technical Report

My Bridge Design

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Submitted by:

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Introduction

I was given the task to make a bridge out of a certain amount of balsa wood, and make it hold as much sand as possible. I then began to research how a bridge works, and different types of bridges. I learned about suspension bridges, beam bridges, and arched bridges. I took all the research and made my bridge. My bridge ended up weighing 14 grams, and it held 5200 grams. This gives it a 371:1 ratio.

Suspension Bridge

Beam Bridge

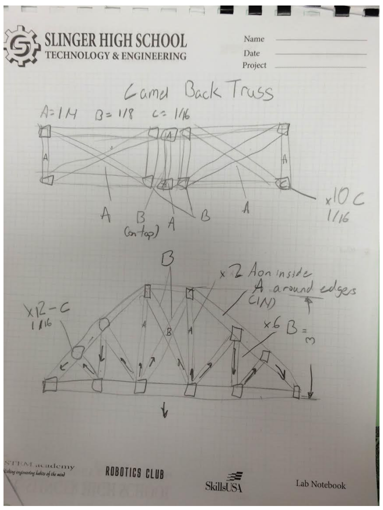
Arched Bridge

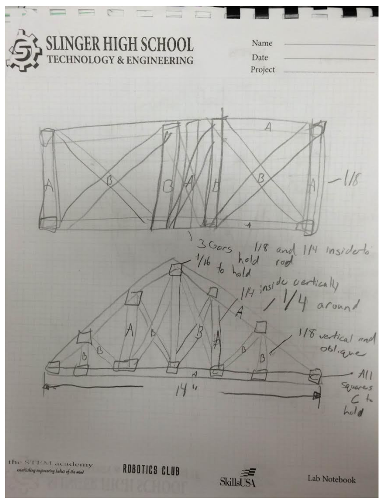
Goal

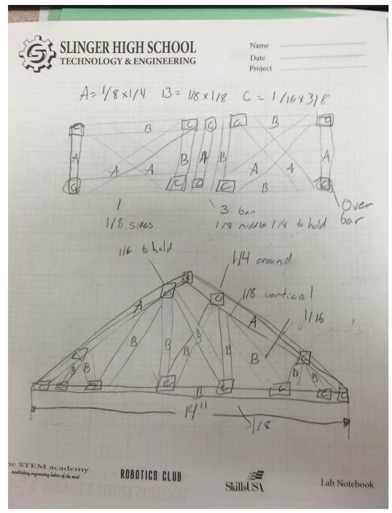
My goal with my design was to make the lightest bridge possible, while making it strong enough to hold a ratio of 600:1. To achieve this goal I decided to make as many triangles as possible, because triangles make the design a lot stronger, and helps transfer the weight to the outside of the bridge, rather than keeping it in the center.

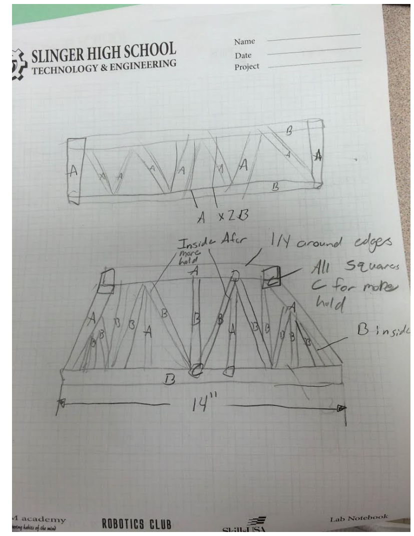
<u>**Procedure**</u>

The first thing I did was research bridge terms and find out what makes a bridge strong. After this I made several different designs, I made several different designs.

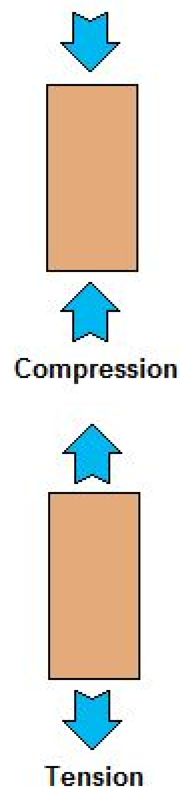


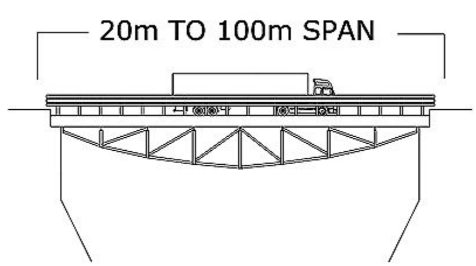


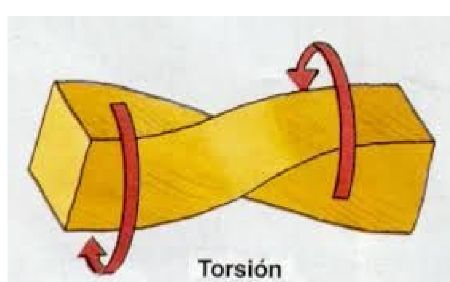




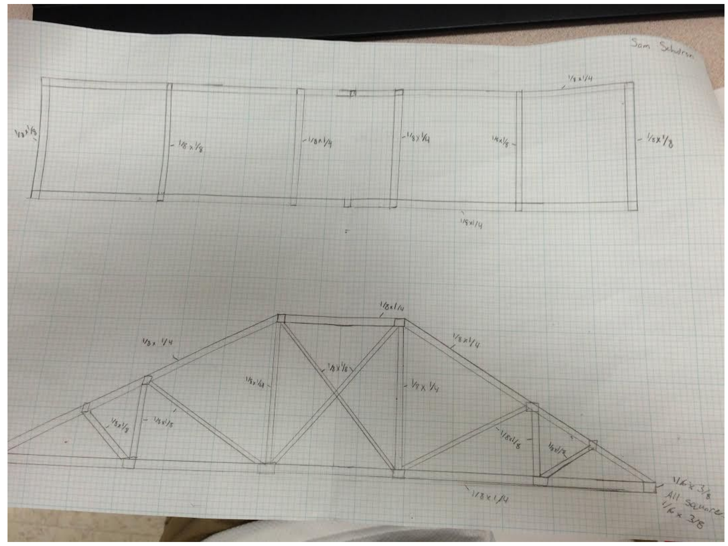
After making these designs I chose which one would be best to hold the bridge up. The biggest things I had to keep in mind were compression, tension, and torsion. Tension is the force lengthening the object it is acting on, while compression is the act that shortens the object it is acting on. Torsion is the twisting motion on the material. I had to span 14 feet, and make the deck at least 3 feet wide.

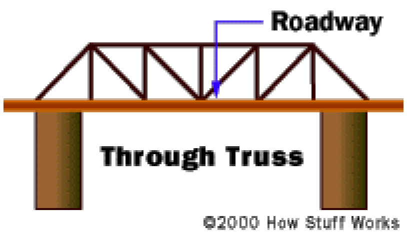


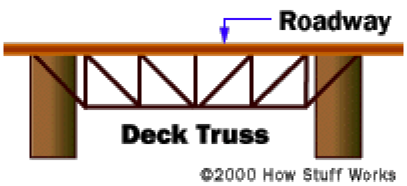


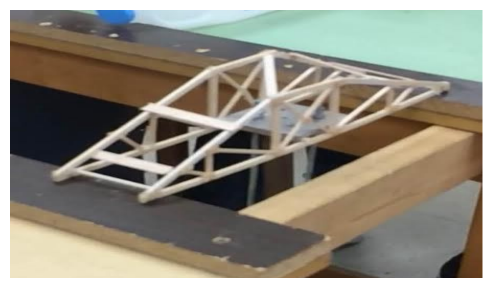


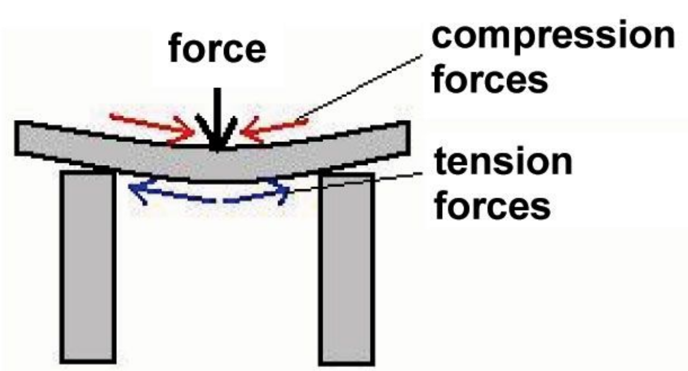
Keeping all this stuff in mind I chose the first drawing. I then drew an 11x17 sketch, and put more detail on this one. I then received my supplies and began to build. This bridge's design is a through truss, meaning it's beams and support is on top of the deck. The other type of bridge design is a deck truss, which has its support underneath the deck. Building the bridge I built the sides first and then placed then on the deck, and then connected them on the top. The finished bridge is shown on the right. The force would be placed directly in the middle of the bridge, so the bridge had to transfer the weight from the middle to the outer points. The force is the downward pressure put on the bridge, in this case brought to the bridge by the bucket and sand. In my design, I made sure that all the weight possible was transferred to the ends.



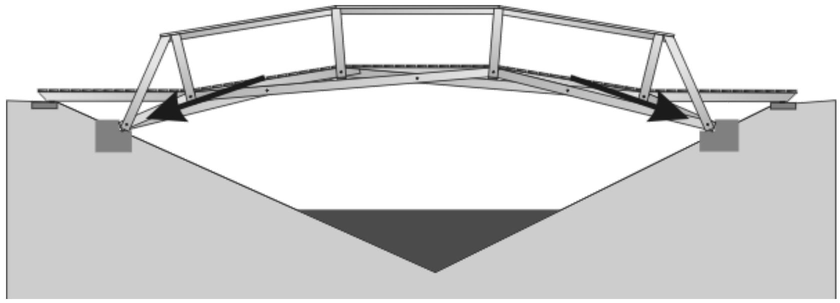




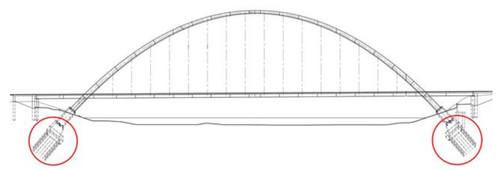


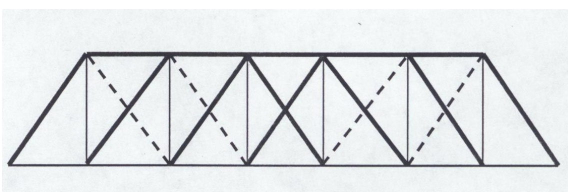


Since the footing of my bridge were both the left and right ends, my bridge was designed to send all weight to those points. The footing is the point the foundation rests on. I designed the bridge with the verticals and the diagonals transferring the weight out to the thrust. Verticals are the vertical chords on a bridge,

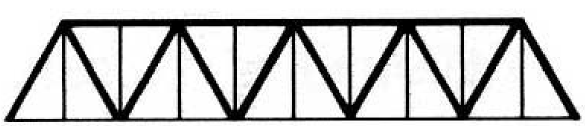


while the diagonals ones are the ones that are turned at an angle. The thrust is the point of the bridge where it connects to land, and it is where all the weight is distributed to.





The chords are the parts of the bridge that hold the bridge up. My chords were on top of the bridge,



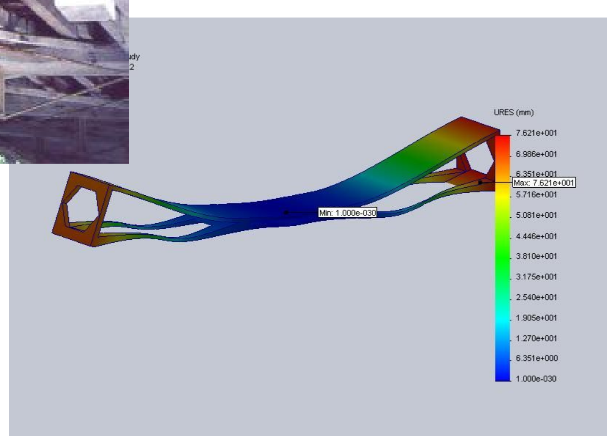
which makes it a through truss as explained before.Taking in all this information I decided to give myself the go ahead on this design, and started creating my bridge.

There are a lot of things I could not put on the bridge, due to the place the bridge would eventually be placed, and the amount of material given. Some things that would make the bridge even stronger than it already was would be abutments and piers. Abutments are a structure on the end built to withstand the lateral pressure of the bridge, while piers are solid structures support designed to withstand vertical pressure.

Pier

Abutment

I did, however, put floor beams, the beams underneath the bridge to help give it more support, to add structural support to the bridge. I had to think about where the displacement would be, as it was impossible to test my bridge, so I could add strength to those places on the bridge. Displacement is the movement of the joints where force is applied.



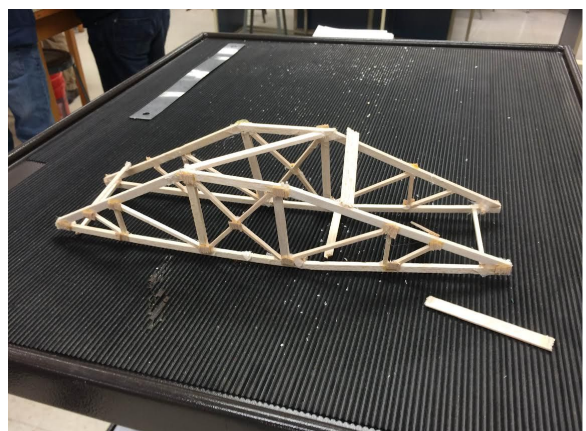
Displacement table

Cost

Materials	Cost Per Inch	Inches used	Cost
1/8''x1/4''	$0.811	84	$6.8124
1/8" x 1/8"	$.0689	48	$3.3072
1/16" x 3/8"	$.0883	18	$1.5894
		Total Cost:	$11.709

Conclusion

When I weighed my bridge it ended up weighing 14 grams. When I tested my bridge, it ended up being able to hold 5200 grams of sand. My bridge got a ratio of 371:1. This was a little lower than I expected but after surveying the leftovers of the bridge, I found out the flaws with my build design. I found that the top portion of the bridge was weak, despite my effort to make a strong hold on top. The bridge cracked due to the torsion, or twisting motion, applied to the top portion of the bridge. There was also a cracked portion on the deck of the bridge, due to the force applied to the top, and a weak spot in the wood. Overall I learned a lot about what I could have done better, but I was proud of my efforts.



Part Number	Item Name	Length	Price Per Inch	Final Price
#1	1/8’’x1/4’’	14’’	$0.0811	
#2	1/8’’x1/4’’	36’’	$0.0811	
#3	1/8’’x1/4’’	17’’	$0.0811	
#4	1/8” x 1/8”	36’’	$.0689	
#5	1/8” x 1/8”	‘12’’	$.0689	
#6	1/16” x 3/8”	9’’	$.0883	**FINAL**
#7	1/16” x 3/8”	9’’	$.0883	$11.709