

Truss Bridge Project

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Abstract:

Our team used the Engineering Design Process to create a truss bridge, by sketching, assembling and CAD, and 3D printing members and pins. While designing the bridge, we considered several constraints such as weight and size, and were successfully able to create a truss bridge that held load.

Objectives:

- Use force was to design and construct a bridge within certain size and weight constraints.
- Bridge must be 3D printed and tested to determine the maximum load it can withstand before failure.

Methods:

Throughout this project, the engineering design process was used to determine which truss design would work best.

- Ideas were designed in SolidWorks.
- We used the Ender-6 3-D printer to make the members, pins, and supports.
- Tested the assembled bridge using the AMT Truss Tester. We tested the bridge to failure and evaluated the weaknesses in our design. We used this data to remodel our bridge after each test and repeat the process.

Design Evolution:

Our first design consisted of circular pins and rounded members. The setbacks for this design were the strength of the pins, weight and how the 3D printer works with our design. Fig. 2.



Fig. 2. Design 1

Design two implemented square pins and members and reduced weight. This was done to solve the 3D printing issues that came with cylindrical pins. This was still overweight but held significantly more at 270 lbs. Fig. 3.



Fig. 3. Design 2

Design three had new design for load supports and cross members. This bridge was within all the restrictions. The setback of this design was the new load support was very weak. Fig. 4.

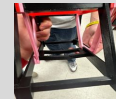


Fig. 4. Design 3

Our final design solved the issue of the weak load bearing cross beam by bringing back elements from design 2 Fig. 3. This increased the load our bridge was able to take because it solved the weak point. This design held 253 lbs and had a load to weight ratio of 1.98. Fig 5.



Fig. 5. Design 4

Introduction:

A truss bridge is a type of bridge structure that consists of two force members, connected at joints. These types of structures distribute loads and weight evenly. The amount of force in each member can be determined using the method of joints and allows for us to determine how much load our bridge can hold.

Results:

Final dimensions: 9.25" L x 4.00" W x 4.375" H
Final load: 103 lb
Final weight: 132.6 grams
Final ratio: 0.78

Table 1. Force held by each design

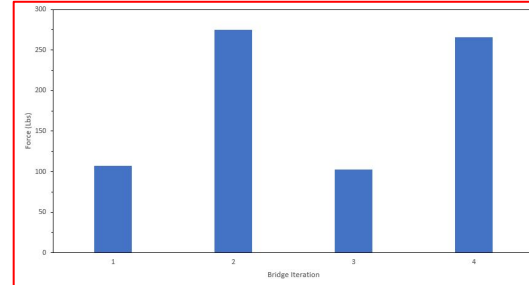


Table 2. Force in each member

Member	Force (Lbs)
1	113
2	113
3	113
4	113
5	94.11
6	-47.01
7	-47.01

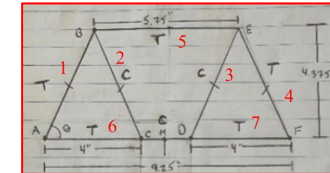


Fig. 1. Representation of final truss bridge with labeled members.

Conclusion/ Future Work:

- Our warren truss bridge design allowed us to apply a large force to the structure.
- Our bridge held 103 lbs and our point of failure was within our load support rather than our members.
- In the future, we learned that is vital to test as much as possible to ensure the best results.
- Our final design fixed the issue with the load support while still maintaining the weight limitations. This design held 253 lbs.