2.1.9 Truss Design

Principles of Engineering
Block 3

December 9, 2015

Reid Harrison

Jacqi Kelly, Abhi Gohli

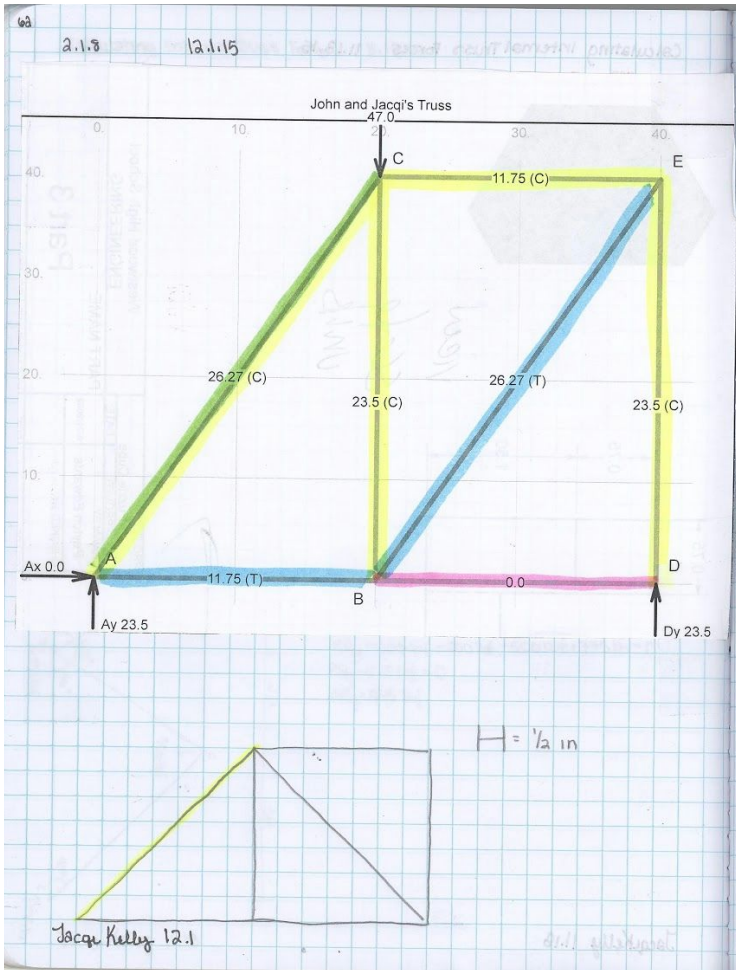
Design Problem:

There are several goals we are aiming for in this project. We are to build a truss capable of holding as much weight as possible, to analyze and observe its performance, to interpret the results, and to work effectively in a team to accomplish a common goal.

Our truss must be able to be evaluated for quality (total force) and efficiency (E = F/W). Furthermore our truss must meet the following constraints and criteria. It must be made only of balsa wood, glue, and paper, span more than 7 inches, and be less than 4 ⅝ inches tall.

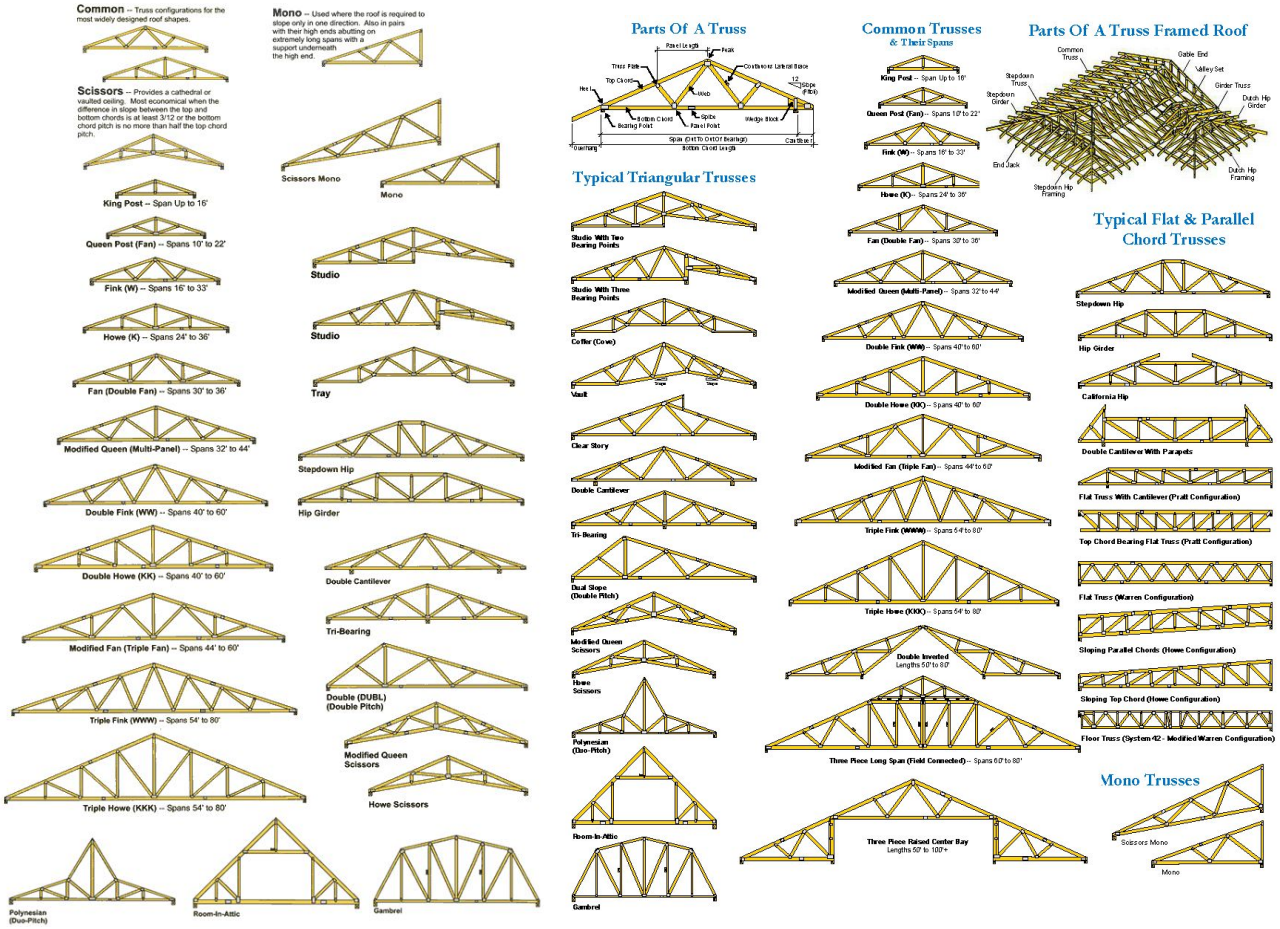
Test Truss:

The test truss held 47lbs before breaking close to the center of member AC. It had an efficiency 573170.7%. Below is a picture of the test truss.



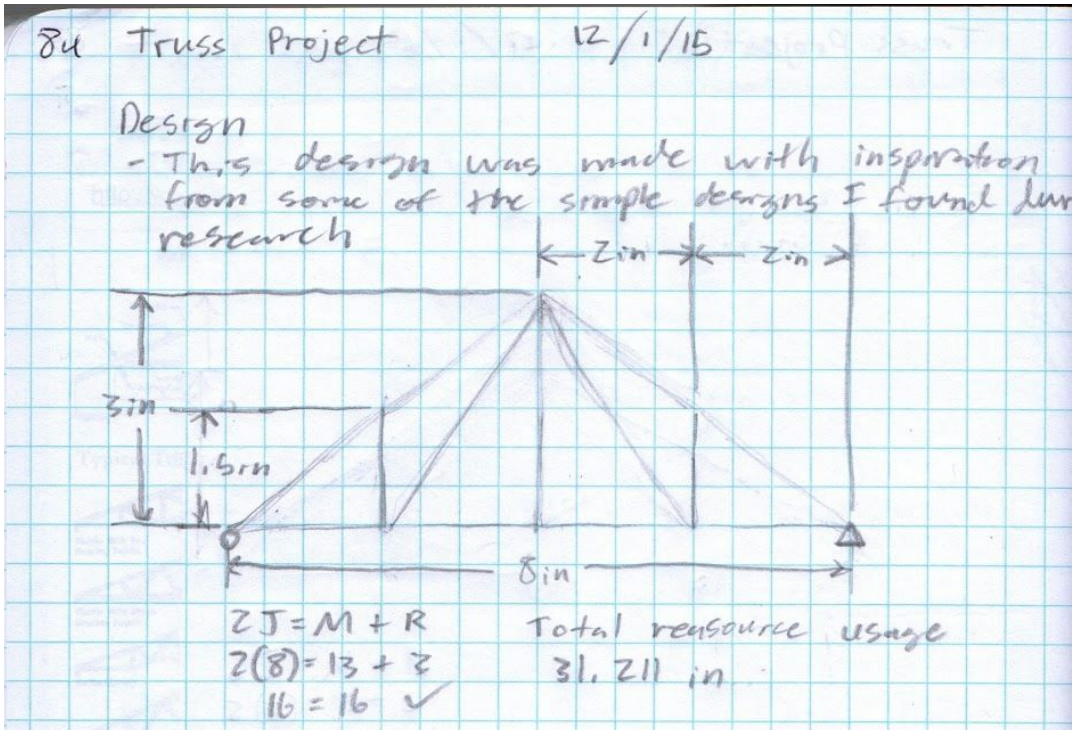
Research Results:

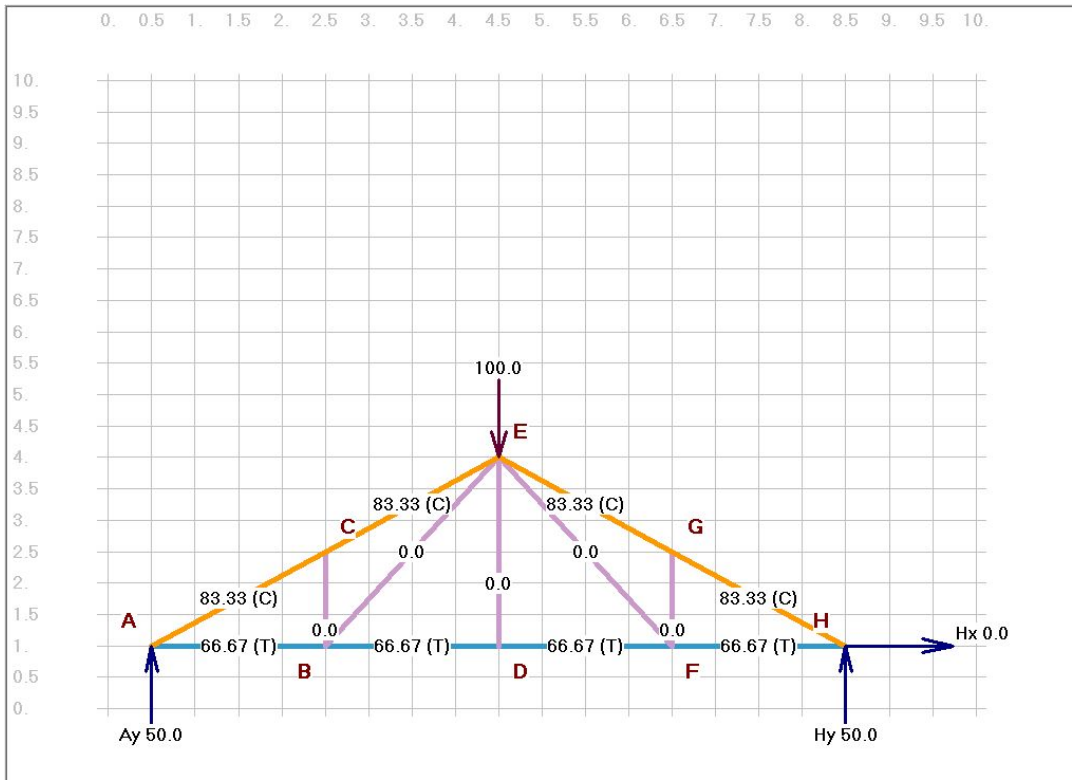
I found two pictures with a large quantity of various types and styles of truss. I then looked through all of the designs and picked out a design that looked strong but simple as my inspiration for my proposed design. Below are the images I used as a reference when making my own design.



Design Idea:

Below you can see several images of my proposed design idea. The design uses a total length of 31.211 in of balsa wood.

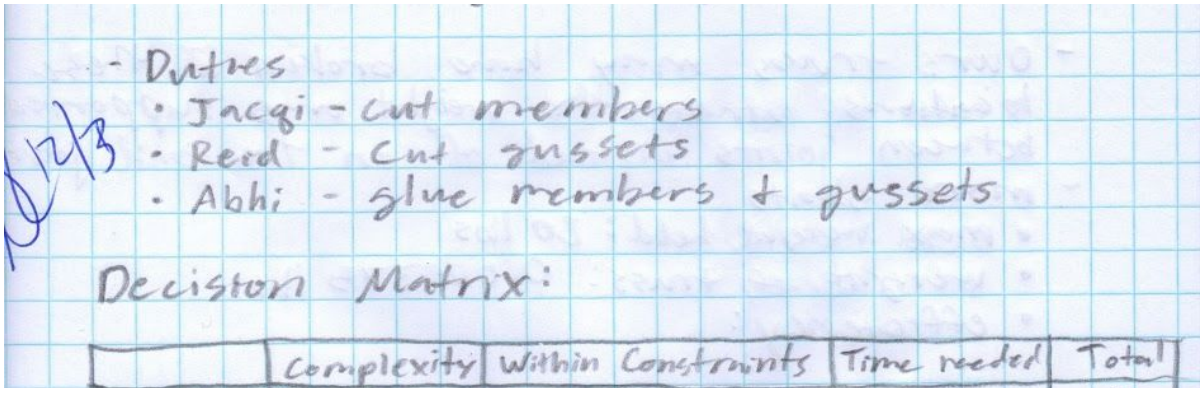




Decision Process:

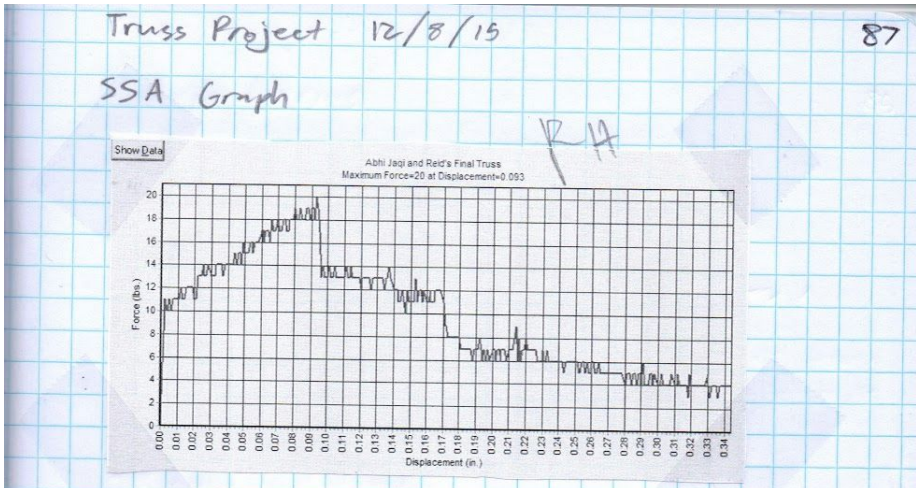
- **Jacqi's Idea:** Jacqi's idea followed all constraints, and was fairly simple, but due to the complexity of some of the angles we would have had to build we ruled out the design deeming to be a little more time consuming than other designs.
- **Abhi's Idea:** Abhi's idea did follow all constraints, but we ruled it out due to it having a high complexity and high build time.
- **Reid's Idea:** My idea was finally chosen as the final design as it was deemed the least time consuming and most easily built of all three designs.

Below you can see the decision matrix that we used in our selection process. Lower numbers are better. While higher number are worse. The final design is no different from my proposed design. (Please reference design idea to see sketches of our final design).



Official Test:

Our truss was able to hold a maximum of 20 lbs before one of the members gave out. Our truss broke twice. The first break was along member FH close to joint H. The second break was along the same member but on the other side close to joint F. Compared to the test truss' performance, our truss' performance was dismal. The efficiency of our truss was 213333.33% which is low compared to the test truss' efficiency of 573170.7%. Our truss also held 27lbs less than the test. The pictures below show the breaks in our truss after testing as well the corresponding SSA graph.



Teamwork Evaluation:

Abhi Gohil:

Abhi has met all of our group's expectations. He worked efficiently and respectfully with other group members, and he fulfilled his specific role to our group as our gluer. He glued all of the members and gussets together.

Jacqi Kelly:

Jacqi has met all of our group's expectations. She worked efficiently and respectfully with other group members. She fulfilled her role as our group's designated member cutter. She crafted all members with a high attention to detail and quality. She also did clean up work on some of the rougher points on our truss.

Self-Evaluation:

I think I have successfully followed all of our group norms and I too have fulfilled my assigned job. I cut our group's gussets for our truss.

Reflection:

1. I think that our truss failed at the point it did because our truss was not bearing the weight at the most optimal location. I believe that it broke in the given location because the weight of the downward force was being channeled to the ends of the truss which were not supported by anything. The truss instead was supported a little further in towards it's center which put immense strain on these parts.
2. I would definitely be much more precise with the placement of the ends of my truss. I might also consider saving materials to double up some of the members, or I might try a new design all together.

Bibliography:

Timplex. "Timplex." *Timplex*. N.p., n.d. Web. 09 Dec. 2015. <http://www.timplex.com/trusses.html>.

Trout Creek Truss Inc. "Trout Creek Truss." *Engineered Roof Trusses from*. N.p., 2007. Web. 09 Dec. 2015. <http://www.troutcreektruss.com/Products/Engineered-Roof-Trusses.php>.