

Project: Build a stick bridge

In this project you will build a stick bridge. The goal of your bridge is hold the most weight before collapsing.

Initial Test Phase

Before you get started, you must create your test sticks for testing.

You will test the breaking strength of the sticks over a span of about 11.5cm. The testing apparatus is a bucket in which weights will be placed. This activity can produce flying pieces of wood shards. Safety glasses must be worn during testing.

Test 1:

Your first test will be determine the breaking strength of a single stick.

One stick test: Record the breaking point of 1 stick in pounds:

Trial 1: _____

Trial 2: _____

Trial 3: _____

Average: _____

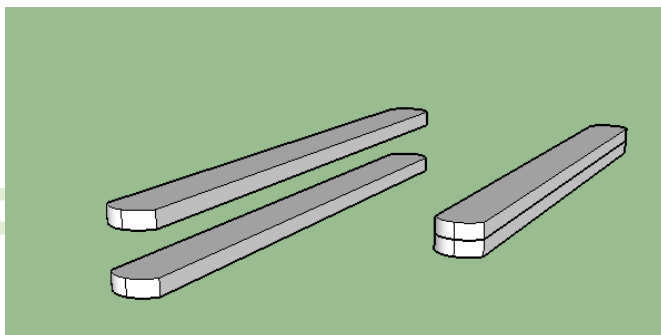
Based on the 1st test, estimate how much more weight the double stick structure will hold:

Estimate: _____

In the space below explain how you came with up with your estimate.

Test 2:

You will create a stronger structure by gluing two sticks together. You will need three sets of two sticks. Each person in your group needs to create a 2-stick structure. See the image below for an example.



Double Stick test: Record the breaking point of 2 sticks in pounds:

Trial 1: _____

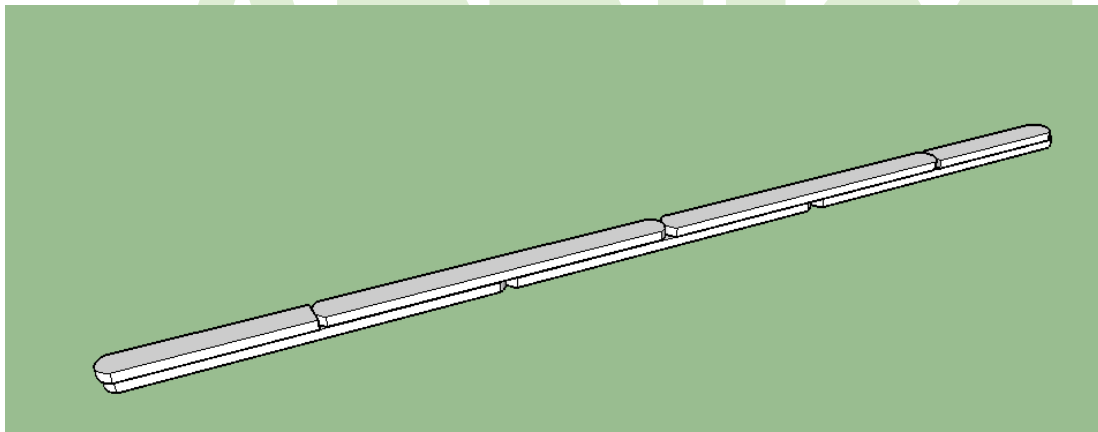
Trial 2: _____

Trial 3: _____

Average: _____

Test 3:

The next step is to build a structure that will span a 30cm span. Create an overlapping design. You will have **no more than 10 sticks**, to create 1 structure per group. See the image below for an example structure.



You will test this structure to see its breaking point.

Overlap-Design test: Record the breaking point of the overlapping structure in pounds:

Trial 1: _____

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Test 4:

The 4th step is to estimate the average weight of 1 popsicle stick, using 3 sets of 10 sticks, and 1 set of 30 sticks.

3 sets of 10 sticks weight test: Record the weight of each set of 10 sticks in grams:

Trial 1: 10 sticks = _____, so 1 stick = _____

Trial 2: 10 sticks = _____, so 1 stick = _____

Trial 3: 10 sticks = _____, so 1 stick = _____

Average: 10 sticks = _____, so 1 stick = _____

1 set of 30 sticks weight test: Record the weight of 1 set of 30 sticks in grams:

Trial 4: 30 sticks = _____, so 1 stick = _____

Does Trial 4 "1 stick" weight equal (or very closely equal) the "1 stick" average from Trials 1-3?

Yes _____ No _____

Why or why not?

Design Phase

Next step: Design your individual bridge.

Your bridge must span 30 cm. (The space between the supports equals 30 cm.)

What length should your bridge be to span the required distance?

Bridge Length Estimate: _____

Your bridge will be limited to 150g, including the glue. What is the maximum number of sticks that you can use? (Hint: Weigh 3 sets of 10 sticks, and calculate an average weight for a single stick. Then calculate the number of sticks, remembering to allow for the weight of glue.)

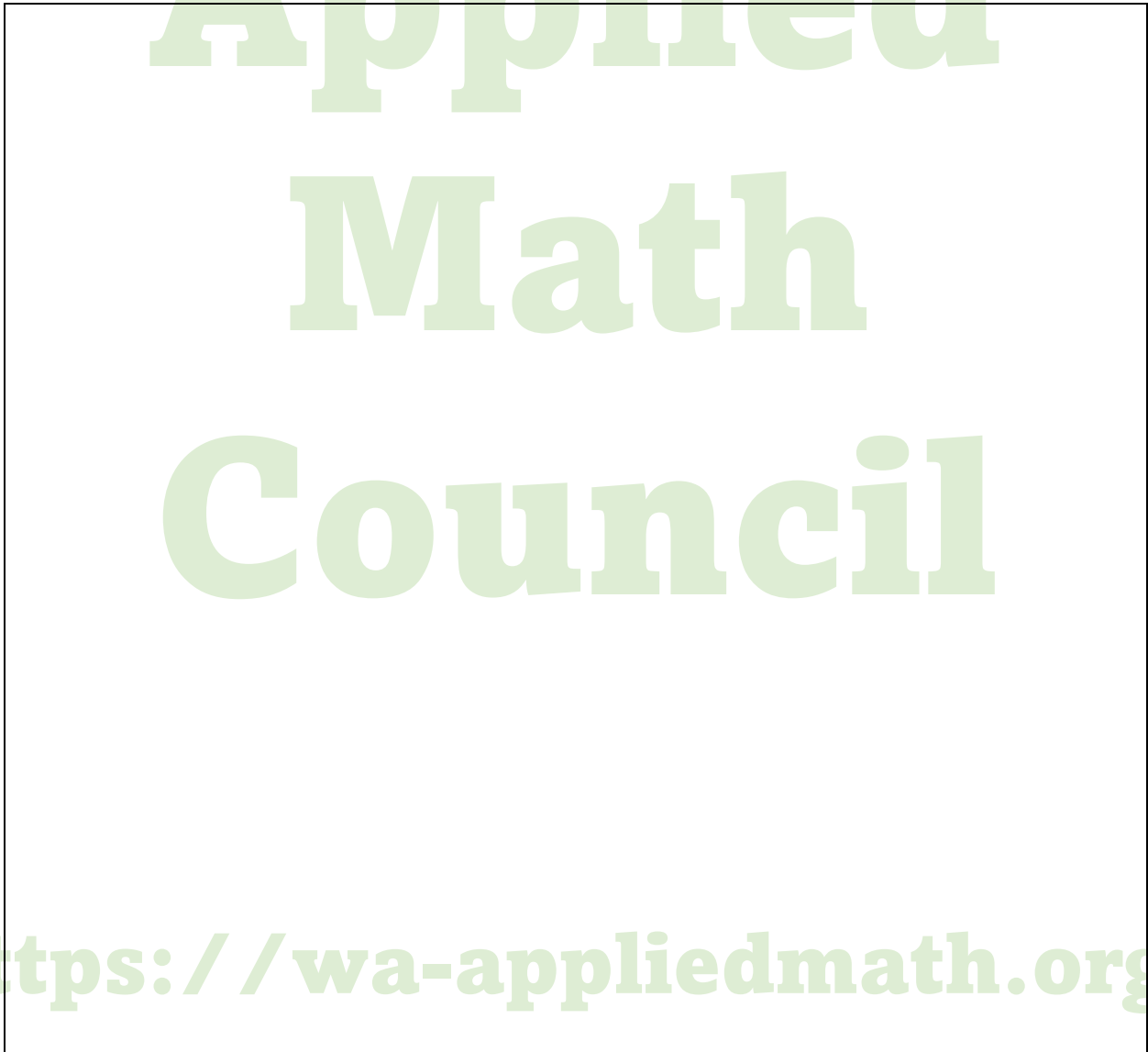
Estimate of maximum number of sticks: _____

Draw a design for your bridge. What patterns might be the strongest? How can you include aesthetics into your design? Include how many sticks you anticipate using.

The bridge must have a smooth continuous driving deck that spans the entire length of the bridge. The deck must be unobstructed and at least 9cm wide.

The weight test will be a suspended weight, not a weight applied to the top of the bridge (i.e. the weight test will NOT be a crushing weight test). The load will be applied to the deck of the bridge by means of a rope that will hold the weight below the bridge. An opening of at least 40mm by 10 mm should be left at or near the middle of the deck to allow for the rope.

You may use your own design or find one on the internet.

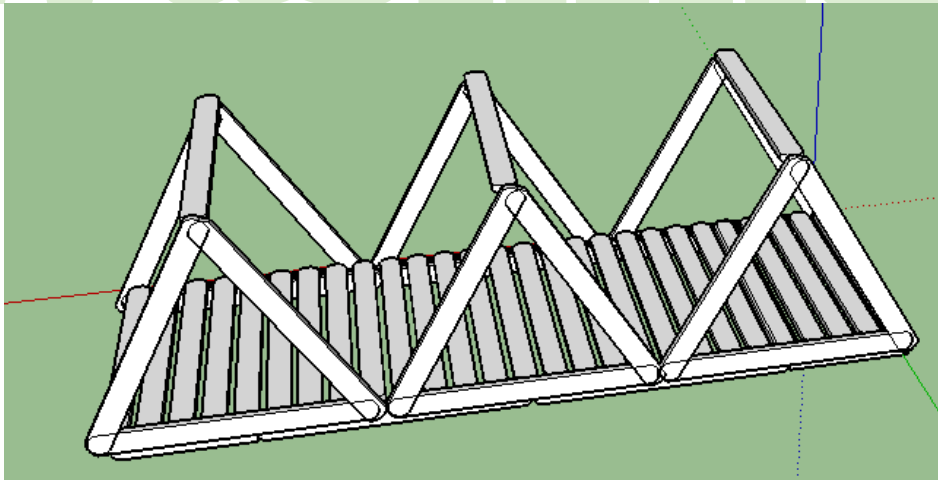


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Build Phase

Next step: Build the bridge.

Your bridge will be limited to 150g, including the glue. The image shown below provides one possible design.



Test Phase

Next step: Test the bridge. Remember to include the weight of the bucket/rope/hooks in the total weight held by the bridge. Subtract the weight that caused the bridge to fail to arrive at the final successful weight held. Record this weight value below.

Bridge weight held before failure: _____

Reflection Phase

Answer the following questions on a separate sheet of paper.

- 1) Did you succeed in creating a bridge that held the required weight for a full minute? If not, why did it fail?
- 2) Did you decide to revise your original design while in the construction phase? Why?
- 3) How many popsicle sticks did you end up using? Did this number differ from your plan? If so, what changed?
- 4) What was the average aesthetic score for your bridge? How did this compare to the rest of the class? What design elements of other bridges did you like the best?
- 5) Do you think that engineers have to adapt their original plans during the construction of systems or products? Why might they?
- 6) If you had to do it all over again, how would your planned design change? Why?
- 7) What designs or methods did you see other teams try that you thought worked well?
- 8) Do you think you would have been able to complete this project easier if you were working on a team of 2-4 students together? Explain...
- 9) What sort of trade-offs do you think engineers make between functionality, safety, and aesthetics when building a real bridge?

Math Council

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