Beam vs Truss- Which one will win?

PHYSICAL SCIENCES

GRADE 3

Background

- When I see bridges, why do they have different designs like triangles and squares. Why can't they be flat like a road?
- I know bridges can be strong if they have good structure.
- There are different types of bridges, like the beam, Truss, Suspension and Arch bridge. The strength of the bridge depends on its structure.
- Truss bridge is one of the strongest bridge structure.

Research Question

- When I see bridges, why do they have different designs like triangles and squares. Why can't they be flat like a road?

- What bridge is stronger: a beam bridge or a truss bridge? What structure makes a bridge stronger?

Hypothesis

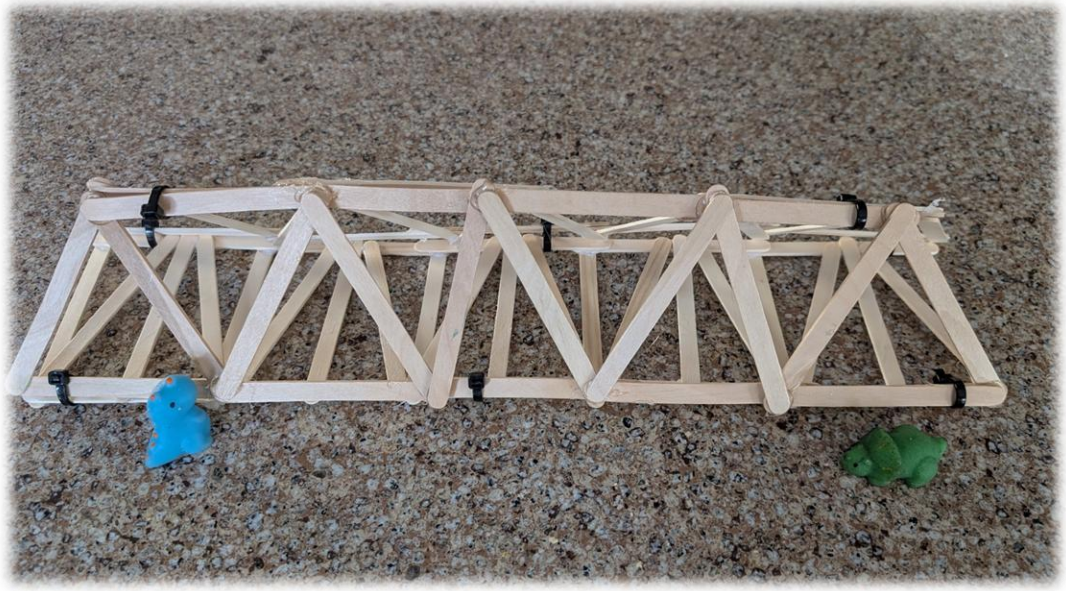
- I Think the Truss bridge will hold more weight then the beam bridge.

Materials

- Hot glue gun
- Glue sticks
- Popsicle sticks
- Zip tie
- A bungee cord with a hook
- A rope
- Weights; 2 lbs and 5 lbs
- A flat-topped bucket with a handle
- Measuring tape
- Weighing scale with a hook
- 2 boxes of same height

Experimental Set-up: Making a Truss Bridge

- Using glue sticks, and a hot glue gun, I glued popsicles together to make a flat surface.
- Then I made the walls of the bridge in a triangle shape
- I connected the triangle walls of the bridge with the flat bridge by tying zip ties to each corner of the triangle with the flat bridge and the top of the triangles together
- I measured the length of the Truss bridge which was 16 inches



16 inches

Experimental Set-up: Making a Beam bridge

- I glued 5 popsicles together horizontally and then added one popsicle across the top and one popsicle across the bottom to hold them together
- I made 4 flat structures 5 popsicle sticks long and then glued them together to make a beam bridge
- I measured the bridge to be 16 inches, the same length as the Truss bridge

16 in

Procedure

- Weave a rope through the middle of the bridges
- Weave a bungee cord through the rope
- Weigh the bucket using the weighing scale
- Then hang the bucket to the bungee hook
- I put two tables side-by-side with a small distance between the two tables
- Put the two boxes on the tables
- Place the ends of the bridge on the two tables, with the middle of the bridge having nothing under it
- Now start placing the weights on top of the bucket until one of them collapses

Data

Beam Bridge	
Total Weight Added	Did it break?
2 lbs	No
4.5 lbs	No
7 lbs	Yes

*__Limitation__: We could not fit any more weights after this weight because there was not enough space between the bucket and the hook

Truss Bridge	
Total Weight Added	Did it break?
2 lbs	No
4.5 lbs	No
7 lbs	No
9.5 lbs	No
12 lbs	No
14.5 lbs*	No

Results

- Truss Bridge: the Truss bridge held up to 14.5 lbs and it did not break
- Beam Bridge: the beam bridge held up to 7 lbs before it broke in the middle

Truss Bridge:
14.5 lbs

Beam Bridge:
7 lbs; just before it broke

Observations

- While adding weights to the Truss bridge, I saw that the Truss bridge held better; it did not bend that much or at all

- While adding weights to the beam bridge, I observed that the bridge started to bend in the middle and eventually it snapped because the weight was too heavy

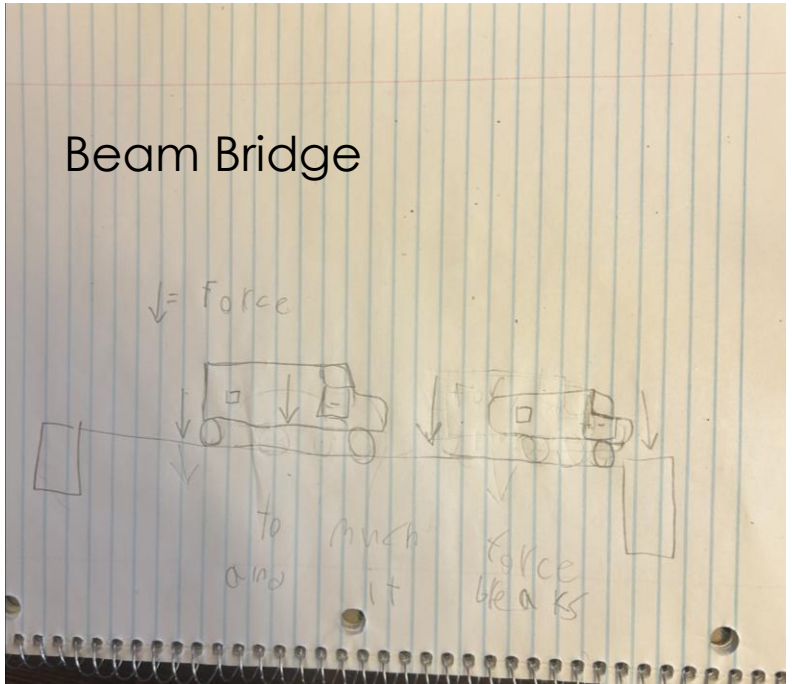
Conclusion

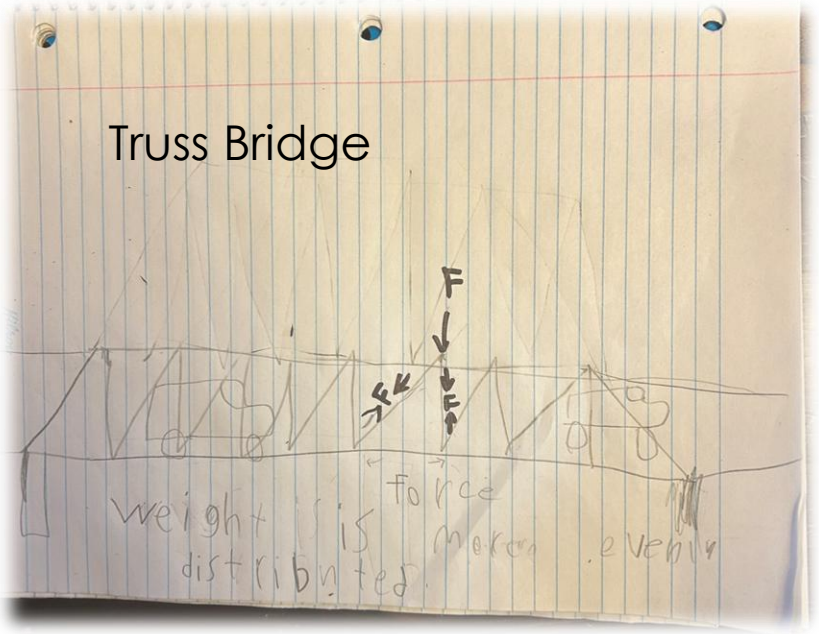
- The Truss bridge is the winner. I learned that the triangles on Truss bridge made it stronger.

- The Truss bridge's design held up better than the beam bridge because the triangles on the Truss bridge helped the surface of the bridge to keep straight and hold the load of the bridge. The triangle shape helps distribute the weight better. The triangle shape does not allow the forces to bend the sides of the bridge.

Conclusion

- The beam bridge breaks because there is nothing to support and distribute the weight so it bends.





Next Steps

- Next time, I would compare the Truss bridge with a different design of the bridge, like Suspension bridge or the Arch bridge.

References

- https://www.youtube.com/watch?v=oVOnRPefcno
- https://scienceandsteamteam.com/seven-different-types-of-bridges-and-why-we-build-them/