Science Explorers Winter 2014
Engineering Unit: Bridge building (3 weeks)

Goals: (1) Learn a little bit about engineering structures, (2) design and build a bridge, (3) test bridges.

Day 1:

Supplies:
oversized craft sticks for test structures, 12/student
glue- 1 bottle/group.
binder clips to help with keeping structure together when drying
worksheet/student
pencil/student
example mini bridges
hot air guns/blue dryers
testing device composed of strap, carabiner buckets, sand

minute 0-10: Show pictures of bridges. Ask the students

- Why do we build bridges?
- What makes a good bridge (strength, length)?

Break into pairs.

minute 10-20: Discuss what makes a bridge strong.

- The material: Have students each hold a popsicle stick. Have the try to bend it the easy way (bend the skinny part)- maybe they can break it. Have them try to break it by bending it the hard way. If you want you can introduce the idea of an i-beam.
- The joints: Ask them what would happen if they attached two pieces. Where do they think the bridge might break?
- Have them brainstorm other things they see on bridges. (triangles, trusses, suspension cables) Why might bridges have them?

minute 20-40: Bridge models

- Instead of building big bridges, we will first try small prototype bridges out of 12 sticks. It should just be the bridge side (i.e., not all three parts). It should span 1 ft. If it must span 1 ft- how long must it really be? (greater than 1 foot)
- Have them draw a sketch of what they would like to try.
- Build it! Use hair dryers etc. to help dry the bridge quickly. Don't use too much glue or it won't dry!

minute 40-60:

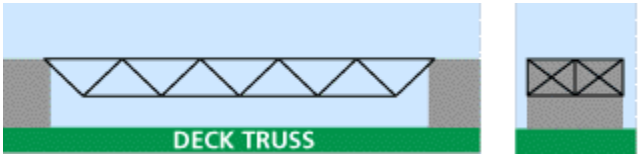
- protoype Bridge testing with bucket, strap, and sand.

Homework (or if time in class): Worksheet for bridge design.
Requirements

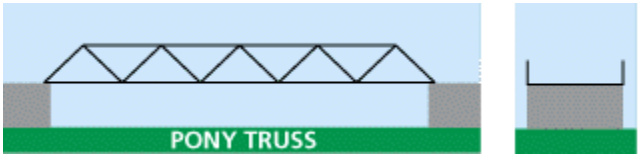
1) span 2 ft
2) a tennis ball can roll over it.

Example prototypes: (http://pghbridges.com/basics.htm)
Simple beam bridge (i.e. no trusses)

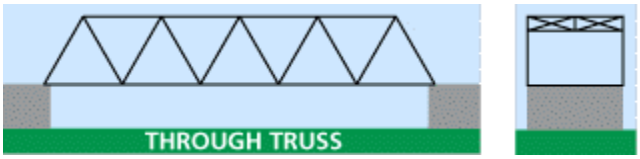
Deck truss: traffic rides on top.



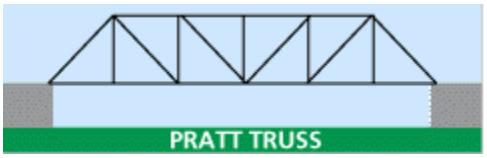
Pony truss: traffic rides on the bottom and top is not connected.

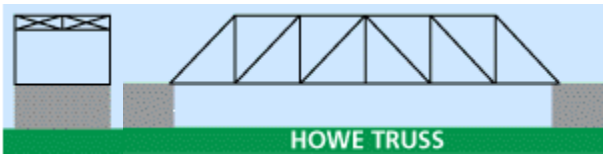


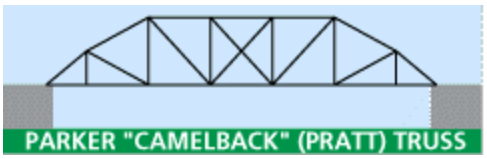
Through truss: traffic rides on bottom and both top and bottom is connected

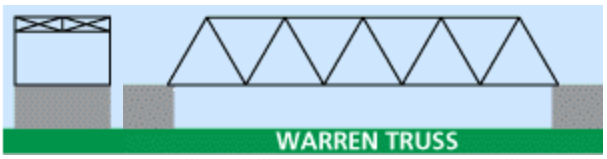


Other types: Arch bridge (hard, but people do it with sticks), Suspension bridge (outside our scope),
Different types of trusses:









Day 2: Large bridge building
Requirements
1) span 2 ft

2) a tennis ball can roll over it.

Materials:

1) Worksheet/pencil
2) Glue (1/group)
3) Binder clips
4) 75 popsicles

- Test Sunny/Nick's bridge (10 minutes)
- Spend some time discussing bridge design with the worksheet. Students are working in teams of 2 with a tutor. It will make sense to do some high level planning- will there be sides? will there be a top? how will they all be attached? before dividing the labor.
- Make the bridges!

Day 3: Finish bridges!