**5) BRIDGE LAB**

**Purpose:** The intent of this lab is to test how various structures in the context of a bridge may affect structural integrity.

**Materials:** white printer paper

 Five paper clips (per bridge)

 Ruler

 Two books or blocks for the bridge to connect

 Scissors

 A few dollars worth of pennies

**Procedure:**

1. Set up the two books or blocks parallel to each other with an 8 inch gap between them
	1. Use a ruler to measure out the exact distance
2. Within each group, decide on a design a build a bridge out of 2 pieces of white printer paper and 5 paper clips
	1. Make sure to think back to videos and models of bridges you have seen before
3. Construct the imagined bridge
4. Test the strength of the bridge by laying pennies in a line down the middle of the bridge
5. Continue doing so until failure
6. Diagnose the weak link of the bridge and seek to reinforce the weaknesses for further revisions
7. Provide a final version of the bridge for competition with the rest of the class

**Data:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Carrying capacity of the prototype** | **Carrying capacity of the first revision** | **Carrying capacity of the second revision** | **Carrying capacity of the final design** |
| **Group 1** |  |  |  |  |
| **Group 2** |  |  |  |  |
| **Group 3** |  |  |  |  |
| **Group 4**  |  |  |  |  |
| **Group 5** |  |  |  |  |
| **Group 6** |  |  |  |  |
| **Group 7** |  |  |  |  |

**Observations:**

**(Make 10 qualitative assessments of your bridge or the bridges of classmates)**

1.
2.
3.
4.
5.
6.
7.
8.
9.

**Questions:**

**During the Lab:**

1. Discuss the the various types of bridges, what popular bridge types can you draw inspiration from?
2. Think about what part of the bridge you foresee to fail and try to address those in your first build.

**Post Lab Questions:**

1. What were the points of failure on your bridge?
2. What were the most commons points of failure on the bridges of your classmates?
3. What methods were employed to remedy these issues?
4. What designs were very strong?
5. What designs should engineers utilize for a full sized bridge?
6. Is there a difference in the load your bridge can hold if you put the load in the center of the bridge compared to spreading it out along the bridge? Make a prediction and test it.

**TEACHER KEY**

[**http://npass2.edc.org/sites/npass2.edc.org/files/Paper%20Bridges%20Sample.pdf**](http://npass2.edc.org/sites/npass2.edc.org/files/Paper%20Bridges%20Sample.pdf)

**Preparing Ahead**

1. Teach a lesson on bridges before this lab.
2. Think about interesting bridges in the area, perhaps arrange a field trip.
3. Gather plenty of materials for the lab, a ream of paper and a few pounds of pennies.
4. Go through the lab ahead of time, formulate plans for bridges to demonstrate to the children. Notice what structures are strong and which are not.

**Leading the Activity**

* Let the children work at their own creative pace with little oversight.
* Introduce excitement by putting the entire lab under time constraints, perhaps with the help of a stopwatch
* Jump between the groups and try to stimulate their thinking, ask questions like:
	+ Why did you place the paperclip there?
	+ What function might it serve?
	+ What is the weakest part of your bridge?
* Keep the class on pace to build their multiple trials and their final bridge
* All the while drop physics keywords in hopes of them truly understanding the concepts

**Post Lab**

* Perhaps demonstrate an example of a bridge you though up yourself and demonstrate why certain structures improved the structural integrity of the bridge
* Make sure to recycle all the used up paper!