Building Bridges – Unit 5 Project

**Student Objectives**

- To discuss the technical and social implications of the design and construction of bridges
- To define vocabulary associated with the construction of bridges: span, stress, tension, torsion, compression, truss, girder, and abutment
- To identify and describe various types of bridges in order to determine the strengths and weaknesses of each
- To design a bridge with aesthetic appeal that must span at least 14 inches and hold a 20 lb. weight for a full minute
- To use intuitive and imaginative thought and the ability to evaluate ideas, processes, and experiences while designing and constructing a bridge structure

**Types of Bridges**

**Arch**

A type of bridge in which its weight is carried outward along the curve to supports at each end (called abutments).

**Beam**

A simple type of bridge composed of horizontal beams supported by vertical posts.
Cable-stayed
A bridge in which the roadway deck is suspended from cables anchored to one or more towers.

Cantilever
A projecting structure supported only at one end, much like a shelf bracket or a diving board.

Suspension
A bridge in which the roadway is hung from strong cables that pass over two towers.

Truss
A rigid frame composed of short, straight pieces joined to form a series of triangles or other stable shapes.

Various truss designs ☰

Note that all of these diagrams depict through trusses. Many of these configurations are also used in deck trusses and pony trusses as well.
## Materials

Bridge Project Packet
200 Popsicle sticks
Carpenter’s glue

## Procedure

1. Based on the definitions and pictures of each of the 6 main types of bridges, brainstorm strengths and weaknesses of each bridge. Use these benefits and limitations to help you and your group to decide what type of bridge to design.

2. Design and draw a bridge with your group. Your constructed bridge must be at least 14 inches long and it must hold a 20-lb. weight for a full minute. Technically, the bridge must be longer than 14 inches because it will be lifted at least one foot above the floor in order to perform the weight-bearing test.
   **In addition to meeting the structural and weight requirements, the bridge will also be judged on aesthetic appeal.**
   **Think about what patterns and shapes might be the strongest.**

3. Construct your bridge. It is recommended that you be frugal and use the least amount of Popsicle sticks possible to reach your goal. (You get 200!)

4. Each bridge will be judged by the class in terms of its aesthetic value. Each student will cast a vote about the look of each bridge on a scale of 1-5.
   *1: Not at all appealing; sloppy execution
   *2: Not appealing
   *3: Neutral/Average
   *4: Somewhat appealing
   *5: Very appealing
   The number is averaged to generate a score for each bridge. Remember that your vote is not based on how well the bridge might hold weight, but on the visual presentation of the bridge.

5. Each bridge will undergo a weight-bearing test – it must hold a 20-lb. weight for a full minute.
Compare the 6 main types of bridges below in order to help you decide which type of bridge your group will design.

<table>
<thead>
<tr>
<th>Bridge Type</th>
<th>Weaknesses</th>
<th>Strengths</th>
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<tbody>
<tr>
<td>Arch</td>
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<td>Beam</td>
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<tr>
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<td>Suspension</td>
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<tr>
<td>Truss</td>
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Design your bridge in the space below. (Feel free to rotate your paper!)
*How many Popsicle sticks do you think you will need?
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 needing for your structure? Did this number differ from your design? If so, what changed?

4. Do you think that engineers have to adapt their original plans during the construction of systems or products? Why might they?

5. What design elements of other bridges did you like the best?

6. What is the longest bridge in this area? Why was it built? What factors determined the materials used to design and build it? Did the builders face any special challenges?