

Popsicle Stick Bridges!



Lesson:

This lesson will teach students how to engineer bridges by using Popsicle sticks to withstand weight, be sturdy, and with the least amount of resources possible. Students will work in 8 groups of 5 to design and build their own bridge. Bridges must have a span (length) of at least 14 inches and be able to hold 5 or more pounds. Students are encouraged to use the least amount of resources possible while building their bridges. Each bridge is scored on effectiveness, design, creativity, aesthetics, and each team will present their bridge to the class.

Synopsis:

This lesson explores the basic understandings of engineering concepts as well as challenge students to design and build their own versions of historical and contemporary bridges. This project has been used in the past as a way to develop innovative bridges and has impacted the design of many bridges we see today. As a team, students will be challenged to take initiative in proposing, designing, building, and evaluating their finished products to the class.

Objective Goals:

- ➡ Learn about structural engineering.
- ➡ Learn about creative design.
- ➡ Learn about project efficiency.
- ➡ Learn about teamwork and leadership.

Materials:

- Student resource page
- Student procedure page
- Student checklist and roles sheet
- Student bridge outline sheet
- Teacher evaluation sheet

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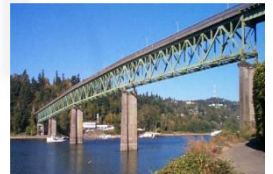
Student Resource Page:

There are six different types of bridges: Arch, Beam, Cable-stayed, Cantilever, Suspension, And Truss.

Arch: Arch bridges are arch-shaped. They have supports on each end and the center weight of the bridge is supported by both ends of abutments. (Arkadiko Bridge)



Beam: Beam bridges are horizontal and are supported at the end of each side. This type of bridge rests its weight on top of beams that push straight down on both ends of the bridge. (Brooklyn Bridge)



Cable-stayed: Closely resembling suspension bridges, cable-stayed bridges are supported by cables except they use fewer cables. The towers that hold the cables are much shorter than suspension bridges. (Tatara Bridge)



Cantilever: Cantilever bridges use horizontal beams that support only one end of the bridge. Most cantilevers use dual arm supports that extend from opposite sides meeting at the center. (Quebec Bridge)



Suspension: Suspension bridges held by cables. These cables are hung from towers that are attached to cofferdams. These blocks are entrenched deep into the floor or body of water. (Golden Gate Bridge)



Truss: Truss bridges have a solid deck and a frame of girders on the sides. Truss bridges can be designed in many different ways from adding many triangle frames together or by using a pyramid type frame. (Illinois Lacon River Bridge)



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Student Procedures:

As a student engineer, your goal is to build a sturdy popsicle stick bridge using the lowest amount of sticks possible. This project will require your group to pre-plan, create a design, build, and present your finished bridge to the class. Each bridge will be tested and scored on effectiveness, design, creativity, and aesthetics (how it looks).

Procedures:

1. Once you are put into your groups, take a look at the student resource page to collaborate on which type of bridge to build. You do not have to select the type of bridge given in the resource page. You can always create your own or build a combination style of different types of bridges.
 2. When your group has decided on what type of bridge to build, designate one person to be the team leader. This team leader will be your group representative. He or she will be keeping track of everyone's roles and making sure that the group is completing each task from the checklist.
 3. Once you have designated a team leader, refer to the checklist/roles sheet page to begin your project.
 4. Remember, you must try your best to use the least amount of resources possible while building a sturdy bridge able to hold 5 or more pounds. Bridges must be at least 14 inches in length.
 5. Have fun becoming engineers in creating your very own stylish and innovative bridge.
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How does scoring work?:

1. **Effectiveness:** On a scale of 1-5 how well does the bridge hold weight? Does it curve significantly with weight or does it stay straight?
2. **Design:** On a scale of 1-5 how well is the bridge designed? Does it require a large amount of resources in order to stay strong? Are there any unnecessary pillars, arches, curves, or cables?
3. **Creativity:** On a scale of 1-5 how creative is the bridge? Does it resemble bridges already built or is there innovation present? Is it simple or complex?
4. **Aesthetics:** On a scale of 1-5 how does the bridge look? Is it clean? Does it have too many loose ends or unnecessary amounts of glue or tape? Is it symmetrical?

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Student Checklist and Roles Sheet:

This is your checklist. Be sure to complete each task listed. The team leader is in-charge of making sure each task is completed.

Roles: Although each student will have a role, everyone is responsible in physically creating the bridge itself.

Team Leader (1) [Acts as group representative and keeps group on track]

Resource Manager (1) [Keeps count of all resources used {glue, tape, sticks, etc.}]

Design Manager (1) [In charge of drawing the outline and physical design of the bridge]

Main Builders (2) [Focus on staying as close to the bridge outline as possible and making the bridge look as symmetrical as possible]

Checklist:

- Designate** a team leader on the bridge outline page
- On** the bridge outline page, collaborate and assign each group member a role
- On** the bridge outline page, create an estimate of how many popsicle sticks you will need (a good starting number might be 120)
- Draw** an outline of your bridge using the "Bridge Outline Sheet"
- Begin** building the foundation pieces (the pillars, beams, or general foundation of the bridge)
- Begin** building the structural support pieces (cables, crossovers, arches, etc.)
- Combine** all structural and foundation pieces together
- On** the bridge outline page, make a list of all resources used (How many popsicle sticks used? How many inches of tape used? How much of 1 bottle or bottles of glue used?)
- On** the bridge outline page, decide on how to present your bridge to the class, who will discuss what? Also, don't forget to give your bridge a name! (example: "The 1000 Piece Bridge" or "Arch Nemesis")
- Make** sure everything is in organized and that your group is ready to present.

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Bridge Outline Page:

Draw an outline of the bridge your group intends to build. Be sure that you stay as close to this outline as possible when making your bridge. Also, write out neatly on the bottom what style/s you are using (See the Reference Page) and the name of the bridge. The name can be done later.

Name of Bridge: _____

Style/s Used: _____

Roles: Team Leader: _____ Resource Manager: _____

Design Manager: _____ Builders: _____

Estimated Resources: _____

Amount of Resources used: _____

Outline: Draw your bridge here!

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Teacher Evaluations Page:

This is the grading sheet. Everything is on a scale of 1 – 5. Write the name of each group's bridge for their evaluations.

Evaluation: Name of Bridge _____

Effectiveness

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
|---|---|---|---|---|

Design

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
|---|---|---|---|---|

Creativity

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
|---|---|---|---|---|

Aesthetics

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
|---|---|---|---|---|

Total points: _____ of 20

Comments:



Jason:

- Present introduction of project
 - Introduce bridge project
 - Tell kids the lesson goal
 - Tell kids what objectives are taught
 - Tell kids what type of materials will be used
 - Tell kids how to get separated into 8 groups of 5

Kingston:

- Introduce examples of bridges that can be built
 - Go through reference sheet
 - Explain requirements of bridge (hold up to 5 pounds and be at least 14 inches in length)

- Allow students for questions
- Begin project.