



**Science Unit: Structures**

**Lesson 5: Building Bridges – Part 2**

School year: 2008/2009

Developed for: Britannia Elementary School, Vancouver School District

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Grade level: Presented to grades 3 and 4; appropriate for grades 3 – 7 with age appropriate modifications.

Duration of lesson: 1 hour and 15 minutes

**Objectives**

1. Test the strength of beam, truss, simple suspension and suspension bridges.
2. Learn about different forces (tension, compression & torsion).
3. Relate those forces to the strength of bridges.

**Background Information**

This is the fifth in a six-part series of lessons on “Structures.”

**Vocabulary**

<u>Word:</u>	Brief definition.
Span	the distance across the bridge
Gravity	down pull of the earth
Load	the weight supported by a structure (e.g., it could be a car driving on a bridge)
Dead load	an unchanging force (e.g., the structure's own weight)
Live load	a changing force (e.g., traffic or the wind)
Compression	when a load presses together (or “squishes”) a structure
Tension	when a load stretches a structure
Torsion	when a load makes one part of a structure slide past another part (e.g., twisting)

**Materials**

- cardboard
- string
- weights
- tape
- plasticine
- Popsicle sticks
- glue

**In the Classroom**

**Introductory Discussion**

1. Review what the class has covered over the past four weeks.



## SCIENTIST IN RESIDENCE PROGRAM

- We've learned about structures and fasteners, and we've built towers and bridges.
  - Over the past week, you have continued to work on your bridges – what have you learned?
2. Short description of other items to discuss or review.
- Forces:
    1. Tension: the force of pulling. Have the students link the fingers of their right hand with the fingers in their left hand and pull in opposite directions. Ask them if they can feel the force of the pulling – that's tension!
    2. Compression: the force of pushing. Have the students link the fingers of their right hand with the fingers in their left hand and push in opposite directions. Ask them if they can feel the force of the pushing – that's compression!
    3. Torsion: the force of twisting. Have the students link the fingers of their right hand with the fingers in their left hand and pull in opposite directions. Ask them if they can feel the force of the pulling – that's torsion!
  - Forces in a truss – have kid stand with legs apart (forming a triangle) and use one leg as a brace to stop from falling over when being pushed. That is like the forces that are applied to the triangle structure in a truss.
3. Briefly describe science experiment/activity.
- Today, we are going to test some bridges that the students have built<sup>1</sup>.
4. Making predictions (a.k.a., hypotheses), conducting experiments to test hypotheses and recording observations are important parts of science. Today we will be predicting how much weight the bridges will hold, conducting an experiment to test those hypotheses and recording our observations on a worksheet.

### Science Activities

Activity Title: Testing Bridges

Purpose of Activity: To test the strength of bridges and to be able to explain why different types of bridges are stronger than other types.

Prediction or Hypothesis: Based on what you know about the different types of bridges, make a prediction about how much weight each bridge type will hold. Record your predictions on the worksheet.

Methods and Instructions:

Brief description of how students will work in groups or pairs.

1. Students will make predictions about how much weight they think each bridge will hold.
2. The bridges will be tested by weights, one by one, on each bridge until they break.
3. Students will record how much weight it took to make each bridge break.
4. Students will try to explain why each bridge broke the way they did, talking about the forces acting on the bridge.

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<sup>1</sup> Note: You may not want to test the bridges that the students built, as the bridges will be broken during testing and this might upset the kids who have worked very hard on their bridges. Beth built some bridges specifically for testing.



**Closure Discussion**

1. What did you learn about building bridges?
2. What things did you do to make your bridge strong? What other things can you try to make your bridge strong?

# Bridge Testing Worksheet

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Beam Bridge

Prediction:

I think the beam bridge will hold \_\_\_\_\_ grams

Results:

The beam bridge held \_\_\_\_\_ grams

## Truss Bridge

Prediction:

I think the truss bridge will hold \_\_\_\_\_ grams

Results:

The truss bridge held \_\_\_\_\_ grams

## Simple Suspension Bridge

Prediction:

I think the simple suspension bridge will hold \_\_\_\_\_ grams

Results:

The simple suspension bridge held \_\_\_\_\_ grams

## Suspension Bridge

Prediction:

I think the suspension bridge will hold \_\_\_\_\_ grams

Results:

The beam suspension held \_\_\_\_\_ grams