

## 8. Bridge Challenge

### Classroom Activity:

Design and build a frame structure that can support a load. Identify the parts of the structure that are under tension and those under compression. The lightest and stiffest bridge that supports a brick wins

### Grade(s): 5 and 7

**Strand(s):** Understanding Structures and Mechanisms (Grades 5 and 7)

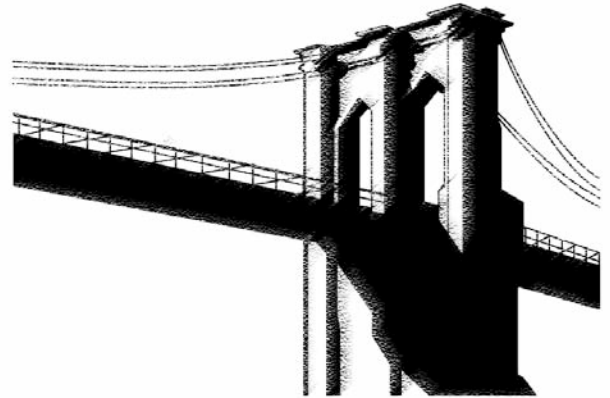
This task addresses the following grade 5 overall expectations:

- investigate forces that act on structures and mechanisms;
- identify forces that act on and within structures and mechanisms, and describe the effects of these forces on structures and mechanisms.

and the following grade 5 specific expectations:

- follow established safety procedures for working with tools and materials;
- use scientific inquiry/research skills to investigate how structures are built to withstand forces;
- use technological problem-solving skills to design, build, and test a frame structure that will withstand the application of an external force or a mechanical system that performs a specific function;
- use appropriate science and technology vocabulary, including tension, compression, torque, system, and load, in oral and written communication;
- use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes;
- identify internal forces acting on a structure, and describe their effects on the structure;
- identify external forces acting on a structure and describe their effects on the structure, using diagrams.

This task addresses the following grade 7 overall expectations:



- design and construct a variety of structures, and investigate the relationship between the design and function of these structures and the forces that act on them;
  - demonstrate an understanding of the relationship between structural forms and the forces that act on and within them.
- and the following grade 7 specific expectations:
- follow established safety procedures for using tools and handling materials;
  - design, construct, and use physical models to investigate the effects of various forces on structures;
  - investigate the factors that determine the ability of a structure to support a load;
  - use technological problem-solving skills to determine the most efficient way for a structure to support a given load;
  - use appropriate science and technology vocabulary, including truss, beam, ergonomics, shear, and torsion, in oral and written communication;
  - use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes;
  - describe ways in which the centre of gravity of a structure affects the structure's stability;
  - identify the magnitude, direction, point of application, and plane of application of the forces applied to a structure;

## 8. Bridge Challenge (continued)

- distinguish between external forces and internal forces (tension, compression, shear, and torsion) acting on a structure;
- identify and describe factors that can cause a structure to fail.

### Assessment categories:

- Knowledge and Understanding
- Thinking and Investigation
- Communication

**Type of Activity:** Classroom (small group work)

Preparation: 240 minutes Time needed to complete the task: varies

### Materials/Resources for teachers:

More information on the bridge challenge is available from the EIR program office at (416) 481-7070

Bridge Watching by Edmund Jupp

<http://www.media.uwe.ac.uk/~masoud/projects/bridges/ext/contents.html>

Newton's Apple- Bridges

<http://www.ericir.syr.edu/projects/newton/12/lessons/bridges.html>

Building Structures

<http://www.campus.bt.com>

bricks

Materials/Resources for students:

uncooked pasta (spaghetti, lasagna, cannelloni)

straws

string

cardboard

glue

### Activity Description:

The bridge challenge is preceded by classroom sessions designed to introduce the basic principles of bridges and the properties of materials. The sessions should cover:

- Introduction to structures (artificial and natural)
- Loads and other forces on structure
- Classification of structural members - beams, struts, ties
- Strength of materials
- Introduction to bridges - superstructure and substructure three types: beam, arch, suspension bridge physics

Divide the students into groups to build a bridge that would cover a span of 25 cm and support a brick weighing 2kg at least 10 cm above the base of the support structure for at least ten minutes.

### Tips:

- Hand out bridge building material only after discussing theory.
- Older students can measure the performance of a structure by comparing its mass with the mass of the load it supports.