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# ONTARIO SCIENCE CENTRE



Exhibit Inquiry

# Structures

An agency of the Government of Ontario

Grade SK - 3



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# Structures

Have students look for the following exhibits related to structures during their visit to the Ontario Science Centre:

## Structures at the Ontario Science Centre

Where to go:

Front entrance



What it's about:

The Ontario Science Centre building exemplifies many of the structural elements that students are taught in elementary school

What to say and do:

- Take your students outside. Ask the students to identify as many different aspects of structures as possible. (*The dome of the Omnimax theatre, columns supporting the roof of the front entrance hall, struts and ties of the windows, cylindrical shape of many of the structural parts.*)
- Ask what kind of loads each structure has to support. (*The roof has to be able to support many metres of snow; the large areas of windows have to withstand high winds without breaking while letting in as much light as possible.*)
- Go closer to the windows underneath the large Ontario Science Centre sign. Ask students if the structure that holds the window frames reminds them of something. (*It resembles an archer's bow. The thicker cylindrical part is similar to the bow and the thinner cables are similar to the bow string.*) Explain that separating the part that resists compression (the thicker cylinder) from the part that resists tension (the cables) enables lightweight but extremely strong structures. Other examples of structures that use the same principle of separating tension and compression are: suspension bridges, bicycle wheels, the rigging on sailboats, old TV antennas with rope support etc.

## Bone Structures

Where to go:

Human Body (Level 5)

*Why is a Bone Like a Bridge?*

*The Human Foot*



What it's about:

Bones are examples of natural structures. Students can compare the shapes and forces in bones to human-made structures like bridges.

What to say and do:

- Take a look at the *Why is a Bone Like a Bridge* exhibit. Is this a natural or human-made structure? Ask students to explain how the bone is like a bridge. (*Prompt by asking where the compression [push] and tension [pull] forces are. The bone has tiny struts inside, helping to make the structure stronger against compression forces.*)
- Ask the students to find a natural arch structure. (*The Human Foot*)

Where to go:

The Living Earth (Level 6)



## Natural Structures

What it's about:

This exhibit will help students appreciate the variety of natural structures in the environment and the different functions they can serve.

What to say and do:

- Ask the students to identify as many natural structures as possible. (Coral, the bat cave) What is the function of the structure? (Coral provides shelter for fish.) Why are these structures strong? (Shapes: cylinders, arches. Materials: rock, calcium). Can you tell what the function of the structure is just by its shape?

Where to go:

KidSpark (Level 4)

*Build an Arch*



*Multi-Materials Workshop*



## Be a Builder

What it's about:

The supplies in this area allow students to design, build, and test bridges and towers. They apply previous knowledge and acquire new understanding of how materials and shapes affect the strength and stability of structures.

What to say and do:

- Build an arch using the base and the blocks provided, and then carefully remove the base. What force is keeping the bridge from collapsing? (*Compression – the blocks are pressed against each other by gravity and the friction between the blocks prevent them from sliding out.*)
- Using the Multi-Materials table, build a skyscraper that will support the weight of your shoe without tipping or collapsing. Test, re-design and re-build it as necessary. What materials did you choose and why? Which part of the building is the widest? (*A wider base will make it more stable and stronger materials at the bottom will make it stronger.*) What kinds of shapes did you use in your design to make it stable and strong?
- If you were to create a life-size version of your building what would you change about the materials and design?
- What forces are acting on buildings in the real world? (*Gravity, people and objects, wind, snow on the roof etc.*)

# Structures

**Vocabulary**

<b>Arch</b>	A semicircular structure with abutments (columns) at each end; an arch bridge is always under compression.
<b>Bridge</b>	A structure built over any body of water, obstacle or depression to allow the passage of vehicles or pedestrians.
<b>Bulk (mass)</b>	The physical volume or bulk of a solid body.
<b>Column</b>	A rigid upright support consisting of a base and a shaft.
<b>Compression</b>	A force that acts to shorten the object it is acting on; to press together. A “push” force.
<b>Force</b>	A push or a pull by one body on another.
<b>Function</b>	The action for which a person or thing is particularly fitted.
<b>Keystone</b>	The central wedge-shaped stone of an arch.
<b>Layer</b>	A single thickness of material covering a surface.
<b>Load</b>	The overall force to which a structure is subjected in supporting a weight or mass or in resisting externally applied forces.
<b>Materials</b>	The substance or substances out of which a thing is or can be made.
<b>Shape</b>	The characteristic surface configuration of an object (e.g., square, circle and triangle are three common <i>shapes</i> found in structures).
<b>Stability</b>	The ability of an object (like a structure) to maintain its original upright position after disturbance by outside forces (wind, water, load).
<b>Strength</b>	The power to resist strain or stress; durability.
<b>Structure</b>	A supporting framework (a skeleton, a bridge or a building that sustains a load).
<b>Strut</b>	A bar or rod used to resist longitudinal compression.
<b>Support</b>	To bear the weight of or hold up (a load or mass).
<b>Tensegrity</b>	Describes a structure that retains its integrity under tension, by balancing the counteracting forces of compression and tension.
<b>Tension</b>	A force that acts to expand or lengthen the thing it is acting on. A “pull” force.
<b>Tie</b>	A beam, rod or chain holding two parts together; it withstands compression forces.
<b>Tower</b>	A structure that is exceptionally high in proportion to its width and length.

**Internet Links**

Exploratorium – Structures around the World: Activities for the Elementary Classroom  
[www.exploratorium.com/structures](http://www.exploratorium.com/structures)

Building Big  
[www.pbs.org/wgbh/buildingbig/index.html](http://www.pbs.org/wgbh/buildingbig/index.html)

**Books**

Johmann, CA and Rieth, EJ. *Bridges/Vermont*: Williamson Publishing, 1999.

**PLEASE NOTE:** Programs and exhibits are subject to change without notice.