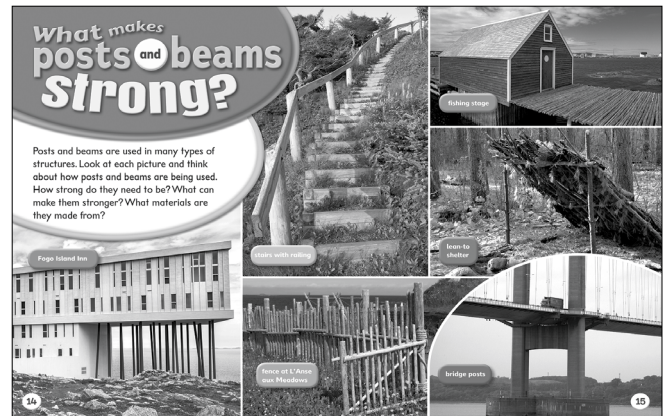
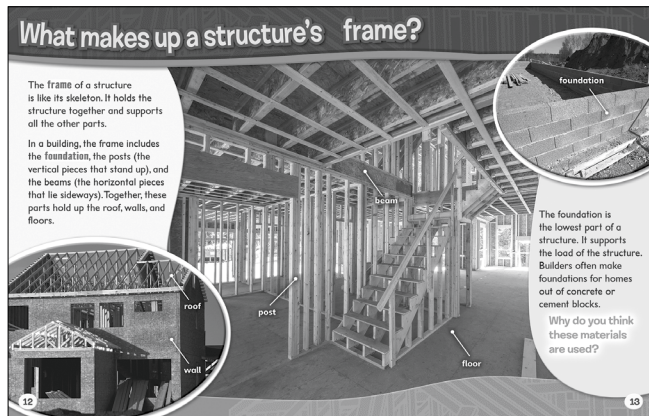


What Makes Posts and Beams Strong?



Focus: Students investigate how posts and beams help support a structure and how these elements can be made stronger and more stable.

Specific Curriculum Outcomes

Students will be expected to:

- 20.0 investigate and describe ways different shapes and forms help provide strength and stability [GCO 1/3]
- 21.0 follow a simple procedure [GCO 2]
- 22.0 identify and suggest explanations for patterns and discrepancies in objects and events [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- describe some ways that posts and beams can be used together
- investigate ways to make posts and beams stronger and more stable
- record their observations in a results table

NOTES:

Attitude Outcome Statements

Encourage students to:

- consider their observations and their own ideas when drawing a conclusion [GCO 4]

Cross-Curricular Connections

Math

It is expected that students will:

- collect first-hand data and organize using charts to answer questions [3SP1]

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]

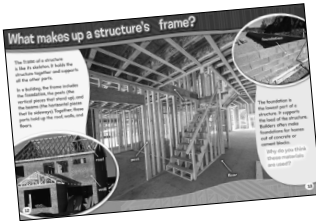
Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine pages 12–15 • BLM <i>Results Table 2</i> Literacy Place: • <i>Building a Skyscraper</i> (Guided Reading, Level N)	• 3 sheets of construction paper • markers and crayons • small containers of modelling clay (1 per pair of students) • cylindrical wooden craft sticks (such as dowelling), all of equal diameter (4 per pair of students) • small, open milk containers (1 per pair of students) • marbles (20 per pair of students) • straws of equal diameter but of two different lengths (4 of each length per pair of students) • digital cameras (optional) • students' Science Journals • pre-cut pieces of string (1 per pair of students) • scissors (1 per pair of students) • small, open milk containers with two pre-punched holes on opposite sides, near the top • flat wooden craft (1 per pair of students) • straws of two different lengths (1 of each length per pair of students) • students' Science Folders • computers or tablets with Internet access • bottles of white glue (1 per group) • several craft sticks (an equal number per group)	• Use a single-hole punch to create holes in several small, open milk containers (1 per pair of students). Punch both holes near the top, on opposite sides of the container. • Cut several pieces of string (1 per pair of students), at varying lengths.	• beam • foundation • frame • post

Science Background

- A post is a main vertical support in a structure, while a beam is a main horizontal support.
- The strength and stability of posts and beams depends partly on their length (the shorter a post or beam, the stronger and more stable it is) and on the material used (rigid material is stronger and more stable than a flexible material). The width or thickness of posts and beams also determines their degree of strength and stability. The wider the surface area at the top of a post, the more weight it can support. The thicker the beam, the better it can resist bending.
- Posts that will be subjected to horizontal forces should be stabilized by a wide base and supports that join the post to the base. This will prevent the post from leaning.
- The heavier the load to be carried by a beam, the more posts there should be to support the beam. This will prevent the beam from bending.

ACTIVATE



Definitions

Have students look at pages 12–13 in their Student Magazine and read the text. Then have the class create definitions for “frame” and “foundation.” (A “frame” holds a structure together. A “foundation” is the lowest part of a structure that can support weight.) Discuss with students why concrete and cement blocks are appropriate materials for building foundations for homes. As a class, create two new entries for the “Structures Visual Dictionary” and then review the entries for “beam” and “post.” Add the terms “frame” and “foundation” to the Word Wall.

CONNECT



Posts and Beams

Have students examine pages 14–15 in their Student Magazine and discuss the various set-ups of posts and beams shown. Ask:

- How are the set-ups similar? How are they different?
- What materials are they made from?

Ask students to consider what size the posts and beams should be in a structure. Tell students that they are going to test the size and strength of some posts and beams by following two procedures.

Procedure 1: Posts

Distribute BLM *Results Table 2* to each pair of students and have them use it to record their findings.

Results Table 2

Name: _____

1. Complete the table. The number of trials that you will be doing.

2. Set up the structure you are going to test. Measure the length of the post.

3. In column 2, write the material used to make the post. For example, wood, plastic, etc.

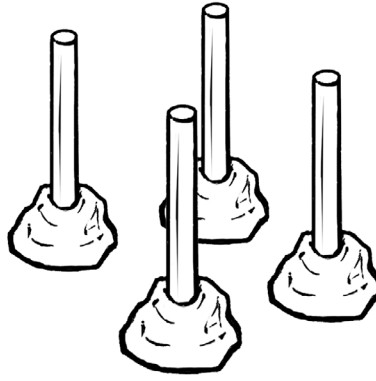
4. After you test each type of post, write the number of times you tested it.

5. At the bottom of each page, write in conclusion. Tell which type of post you like in the structure and why you like it.

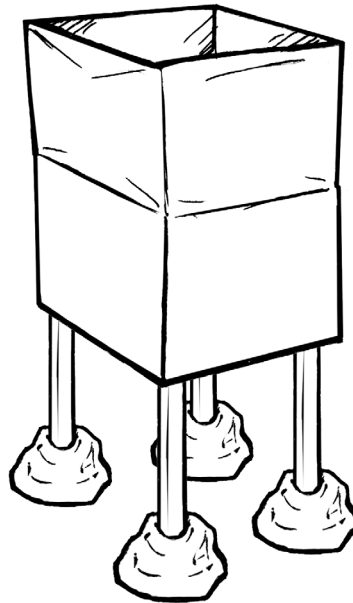
Post Number	Length of Post	Material of Post	Number of Trials
1.			
2.			
3.			

Conclusion: _____

1. Partners lay down four lumps of modelling clay in a square formation. They then stand a short cylindrical craft stick (such as dowelling) in each lump to create a vertical post. The four sticks should all be the same thickness and length.



2. Students gently set a small, open milk container on top of the four posts.



3. Partners take turns adding one marble at a time to the milk container until the container and/or posts collapse. Partners should note how many marbles were successfully supported.
4. Students set up the structure again, this time using straws of approximately the same length and diameter of the craft sticks and the same lumps of clay as bases. Partners then repeat step 3, again noting the number of marbles that were successfully supported. At this point, partners should suggest explanations for the differing results.
5. The structure is set up a third time, using long straws. Partners again repeat step 3 and note the number of marbles supported.
6. Partners evaluate which posts provided more stability and strength, and suggest reasons why.

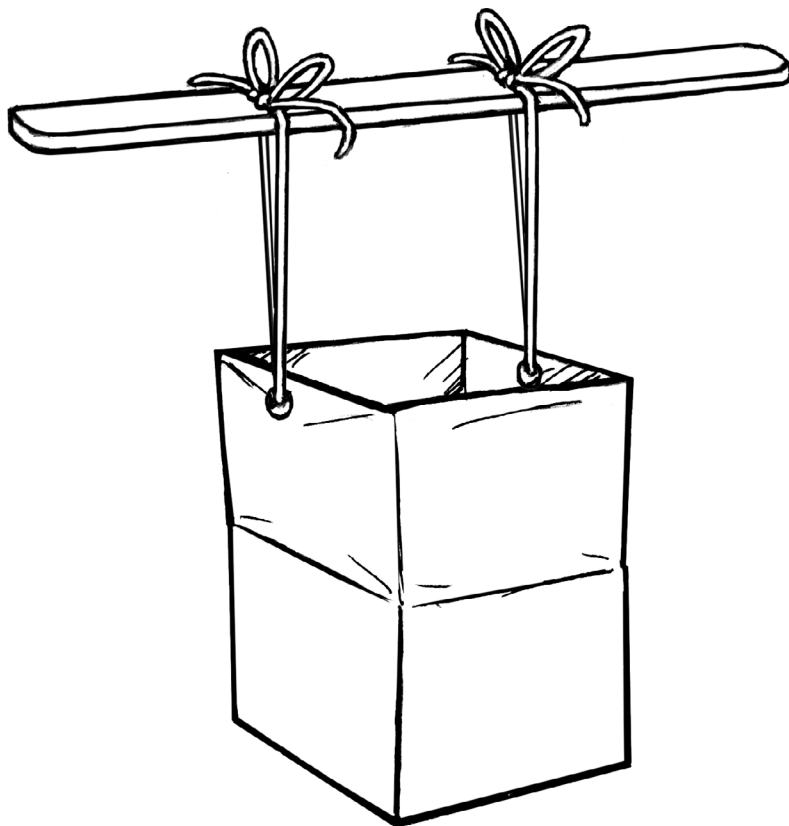
Create a class table showing the number of marbles that were supported in each case and discuss any discrepancies as a whole group.



Procedure 2: Beams

Ask each pair of students to choose a method of recording their findings, either digitally or in their Science Journals.

1. Provide each pair with a piece of string. Partners fold their piece of string in half and cut it in the middle, creating two shorter strings of equal length. They thread each string through a pre-punched hole in the top of a small, open milk container.
2. They then tie the strings around a flat wooden craft stick. One partner holds the stick horizontally so that the container hangs underneath.



3. Partners take turns adding one marble at a time to the milk container until the container is full or the “beam” breaks. Partners should note how many marbles were successfully supported.
4. Students set up the structure again, this time using a straw of approximately the same length as the craft stick. Partners then repeat step 3, again noting the number of marbles that were successfully supported. They should also suggest explanations for the differing results.
5. The structure is set up a third time, using a longer straw. Partners again repeat step 3 and note the number of marbles supported.
6. Partners evaluate which beam provided the most stability and strength, and suggest reasons why.

Create a class table showing the number of marbles that were supported in each case and discuss any discrepancies as a whole group.

CONSOLIDATE



Group Discussion

Bring students together and hold a whole-class discussion about the two procedures. Discuss the conclusions that students wrote on their BLMs. Discussion should elicit the following concepts, which should be recorded on chart paper and copied into students' Science Journals:

The strength and stability of posts and beams depends on

- their length—the shorter a post or beam, the stronger and more stable it is
- the material used—a rigid thicker material is stronger and more stable than a flexible material



Encourage students to discuss discrepancies between partners' findings and why these might have occurred. Record any questions on the I Wonder Wall. Have students store their completed BLMs in their Science Folders.



Literacy Place Connection:

Building a Skyscraper (Guided Reading, Level N) incorporates illustrations, photos, and text to explain the process of building a new office tower. Share the text and discuss with students the importance of a strong foundation and frame in supporting a building such as a skyscraper.

EXPLORE MORE

Comparing Structures

Students could look at models or photos of Innu tents to identify the posts, beams, and other means of support. Students could also compare post and beam construction of western houses with traditional Indigenous shelters such as the Innu tent, Inuit snow house, and Mi'kmaq wigwam. They could discuss how the structures are similar to and different from the western styles. Students can suggest why such structures came to be built in the different environments.

Loads Lab

Students can try the Loads Lab at the Website
<http://www.pbs.org/wgbh/buildingbig/lab/loads.html>.

Groups or partners can then build small structures using white glue and a set number of craft sticks. Challenge students to build structures that can support the weight of a book.

Results Table 2

Name: _____

1. Column 1 shows the number of each test you will be doing.
2. For each test, measure the posts you will be using. Write the length in column 2 (the length should be the same for all four posts).
3. In column 3, write the material used to make the posts (for example, wood, plastic, and so on).
4. After you test each type of post, write the number of marbles you added in column 4.
5. At the bottom of the page, write a conclusion. Tell which type of post you think is the strongest and why you think so.

Test Number	Length of Posts	Material Used to Make Posts	Number of Marbles Added Before Collapse
1.			
2.			
3.			

Conclusion: _____