How Much Load Can It Hold?

v2.0

Foundational Fluencies: Is It Strong? | Teacher Lesson Plan

Overview:

In this lesson, students will explore what it means for something to be strong and the relationship between weight, strength, load, and reinforcement.

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Key Concepts & NGSS Alignment:

- Manipulate ROK Blocks to build increasingly complicated structures
- Explore a specific problem engineers often face (how to make things stronger)
- Understand that pushes on objects can have different strengths and that bigger pushes cause bigger changes in the object
- Match 3-dimensional objects to 2-dimensional pictures
- Test constructions for strength; Try to improve strength by using different designs
- Recognize symmetry

Scientific/Engineering Practice - Developing and using models
Crosscutting Concept - Structure and function

Lesson Introduction:

Instructor: "One of the most common problems engineers solve is how to make things stronger. Adding reinforcements that can help distribute the weight or load is one way engineers make things strong."

Core Learning Activity:

1. Give each team of two students a How Much Load Can It Hold Construction Mat and the correct assortment of engineering materials listed above.

Activity Time:

30 Minutes

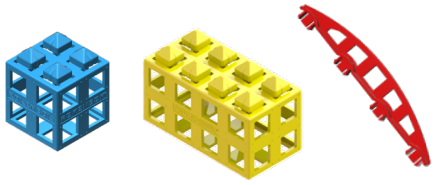
Kid Spark Mobile STEM Lab:

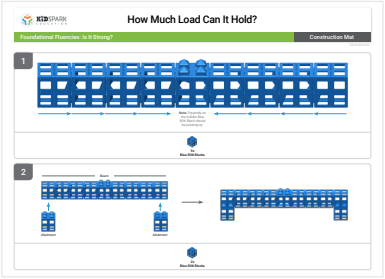
ROK Blocks

Materials Per Team:

Group students in teams of 2.

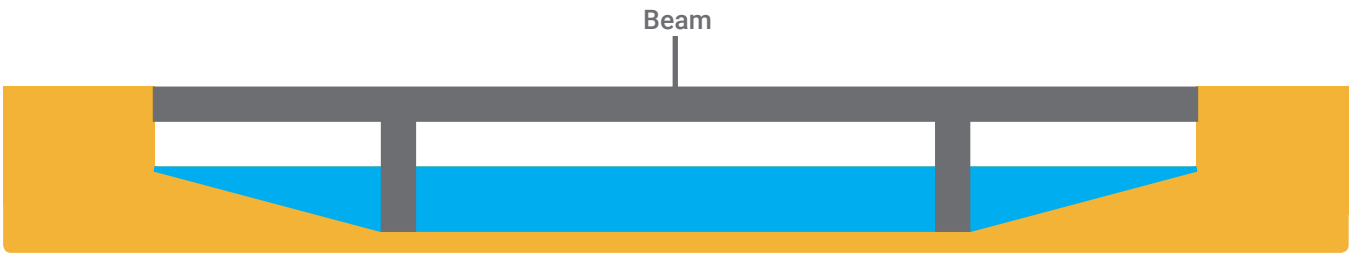
- 14 Blue ROK Blocks
- 2 Yellow ROK Blocks
- 2 Girders
- 1 Construction Mat



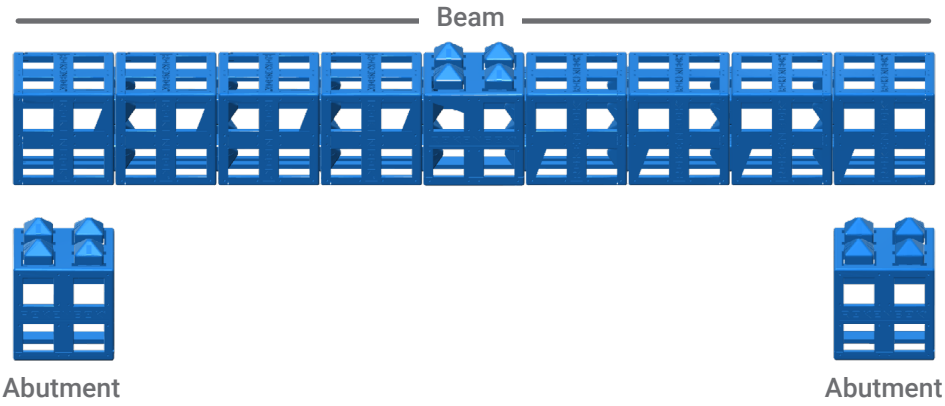


2. Start by engaging the students in a discussion about bridges. Ask students to raise their hands if they have traveled over a bridge lately. If there are bridges in the local neighborhood, ask if any of the children live near them, or cross them frequently. Ask them what bridges do and why we need them.

Instructor: "Today we're going to build bridges. We're going to build the most common type of bridge. It's called a beam bridge." Draw a simple beam bridge on the whiteboard/chalkboard or paper (see image below). ***Instructor: "The long part in the middle is called a beam."***



3. Instruct students to follow the step-by-step instructions on the How Much Can it Hold Construction Mat to assemble a bridge. Go ahead and build a bridge for yourself that can be used for instruction. As students are building their bridges, point out how the beam of the bridge is supported by two "abutments".

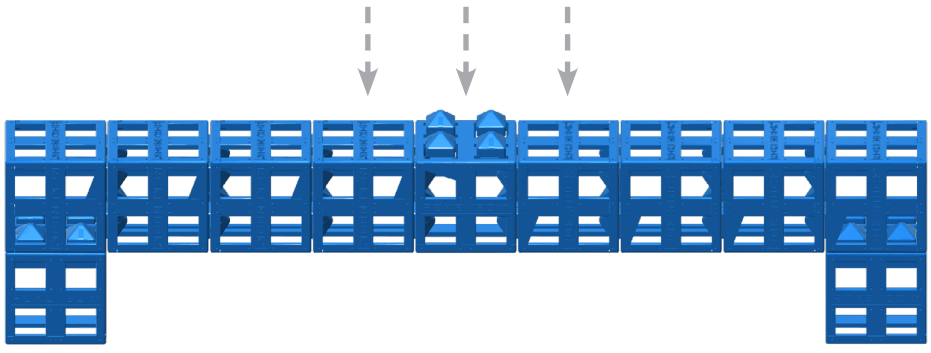


4. As students finish building their bridges, ask the following prompt questions:

    a. Are both sides of the bridge symmetrical?
    b. Is the bridge long and thin, or short and wide?
    c. What do you notice about the middle of the bridge?

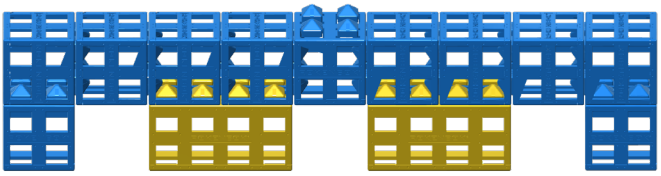
5. ***Instructor: "Let's test our bridges to see how strong they are. Put your bridge on the table. "Testing" means we're trying out the bridge to see if it works. Think about this question: What do you predict will happen if you walked on the bridge? (It would break.) What do you predict would happen if you were to put pressure on it?"***

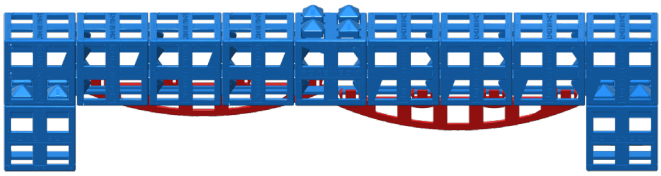
6. After making their predictions, have students put their bridges on their desks or on the floor and put pressure on them. Make sure every student has the chance to put pressure on their bridge and break it. Feeling their own body's force against the bridge can help them understand the relationship between load and strength.



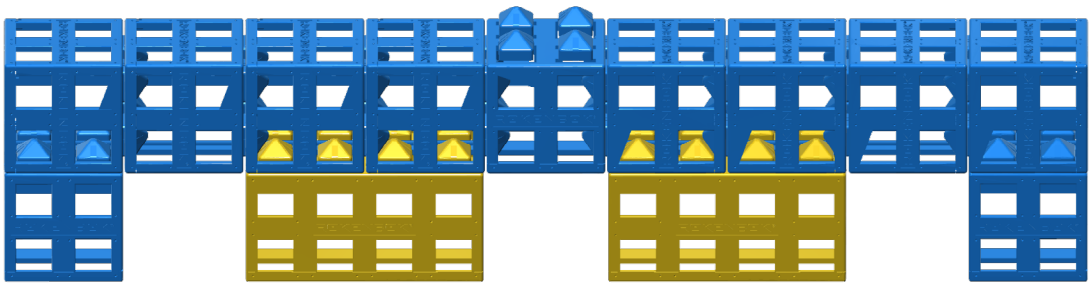
7. ***Instructor: "When we put pressure on the bridges, we're putting our "weight" on them. Weight on a bridge is called a "load." When have you heard the word "load" before? (A load of laundry, picking up a load of garden soil, etc.) Our bridges are not strong enough for us to put pressure on them. How could we make them stronger?" (Make the beam shorter, use supports, braces.)***

8. Provide students with the remaining Yellow and Blue ROK Blocks, and Girders. Let them experiment with different ways to make their bridge stronger. (See examples below) ***Note: girders may be too difficult for some students to snap into openings. Demonstrate how to easily connect girders by snapping one end of the girder into an opening, and then pressing down on the remaining tabs to snap into place.***





9. After students have tested various configurations to add strength to their bridges, add 2 Yellow ROK Blocks to the bottom of your bridge (see image below). ***Instructor: "I reinforced my bridge by connecting 2 Yellow ROK Blocks underneath it. The word "reinforce" means to strengthen something. We can reinforce our creations by adding materials in certain places. Some places are better than others for reinforcement. I put the Yellow ROK Blocks towards the middle of the bridge where it is often very weak. Next time we work with ROK Blocks we will build something designed to move heavy things."***



Learning Extensions:

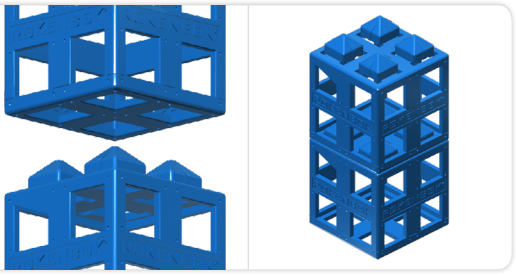
1. Have students work in groups to test their bridges to see which are the strongest. They can put pressure on the bridges or put heavy objects, such as books on the bridges to see which designs can bear the heaviest loads.

Building Basics

The following tips will be helpful when using Kid Spark engineering materials.

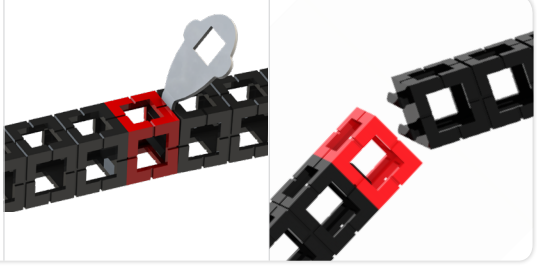
Connecting/Separating ROK Blocks:

ROK Blocks use a friction-fit, pyramid and opening system to connect. Simply press pyramids into openings to connect. To separate blocks, pull apart.



Connecting/Disconnect Smaller Engineering Materials:

Smaller engineering materials use a tab and opening system to connect. Angle one tab into the opening, and then snap into place. To disconnect, insert key into the engineered slot and twist.

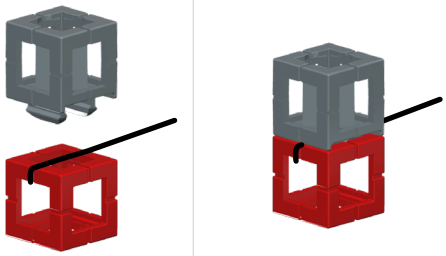


Snapping Across Openings:

Materials can be snapped directly into openings or across openings to provide structural support to a design. This will also allow certain designs to function correctly.

Attaching String:

In some instances, string may be needed in a design. Lay string across the opening and snap any component with tabs or pyramids into that opening. Be sure that the tabs are perpendicular to the string to create a tight fit.



Measuring:

The outside dimensions of a basic connector block are 2 cm on each edge. This means the length, depth, and height are each 2 cm. To determine the size of a project or build in centimeters, simply count the number of openings and multiply by two. Repeat this process for length, depth, and height.