

STRAWMENDOUS

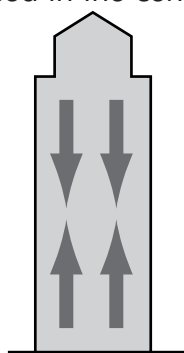
Background Information for Activity Leaders

Overview

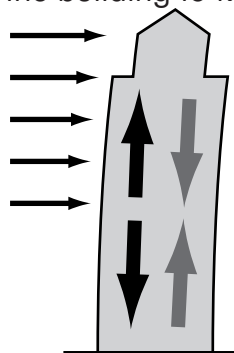
Children will investigate how to use simple building materials to make a skyscraper. Both successful and unsuccessful models allow children to experience the engineering design process. There are many versions, but the basic steps are: 1) define the problem; 2) brainstorm ideas; 3) draw a plan; 4) test design; 5) improve design; and 6) test again.

Key Concepts

- **Skyscrapers** are very tall buildings, usually 150 meters or higher. Civilizations have always been fascinated with tall buildings, starting with early towers, followed by cathedrals, and finally today's tall buildings.
- During the Industrial Revolution, in the 1880's civil engineers began to experiment with iron and steel, two new building materials. It wasn't until this time that the word 'skyscraper' came into being.
- The 10-story Home Insurance Building in Chicago, built in 1885, was the first building entirely supported by a steel frame in the United States. It is considered the first skyscraper in the United States.
- The main obstacle in building upward is the downward pull due to gravity. To make a tower that is multiple levels you need the levels at the bottom to support the weight of the levels above.
- Skyscrapers are so tall that they are often subjected to high-speed winds. Steel columns must be used in the center or outside perimeter of the building to keep it stiff.



The weight of the skyscraper and the forces from the solid ground are balanced. The skyscraper does not sway.



When the wind blows, the columns on the windy side stretch apart, and the columns on the other side squeeze together.

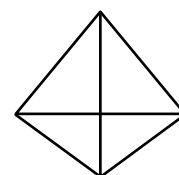
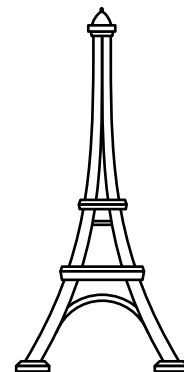
- Detailed plans of buildings are called **blueprints**.
- **Resources** are the people, time and money needed to construct a building. Resources are limited and must be used wisely.

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Background Information for Activity Leaders

What to Expect

- Younger children will need plenty of time to discover for themselves that a two-dimensional model will not stand on its own. Usually, the first attempt at overcoming the two-dimensional design is to attach a straw “leg” to the structure, so that it stands much like a picture frame on a desk.
- Placing a cube over a cube with no structural support will cause the straws to buckle and bend. This is a good example of why structural supports such as I-beams and crossbracing are important design concepts.
- Most children will make models that resemble the Eiffel Tower. This occurs because as the building gets taller they find it simpler to balance the weight of the upper levels by tapering off at the top and forming a peak.
- Children may discover that a tetrahedron (three triangular sides with a triangular base) is very strong.



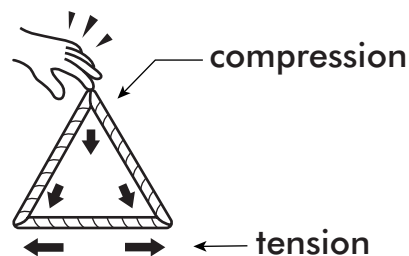
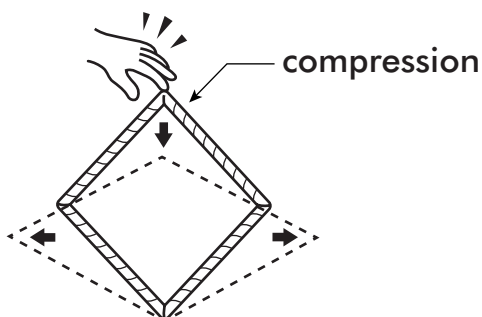
Common Misconceptions

- *Children may think, “Two-dimensional structures can stand on their own.”*

As children begin to build their initial structure, they will try to make a two-dimensional design that cannot stand on its own. The idea that they will need a three-dimensional structure develops after having had the opportunity to try a few unsuccessful models and learn from their mistakes.

- *Children may think, “Cubic shapes are more stable than triangular shapes.”*

Straws placed into triangles are more stable shapes than straws arranged into squares. When compression force (the pressure felt by an underlying object) is applied to the joints, a triangle changes shape less than a square. Tension pulls back in the opposite direction.



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Data Collection Sheet

Name: _____

Date: _____

WONDER: What will your building look like? Draw your blueprint below.

building height: _____

RECORD: What changes did you make to your original design to make you skyscraper sturdy?

Draw your final building.

CONCLUDE: What did you learn about designing skyscrapers?

Set Up the Expedition

Materials:

For the activity leader:

- (20) large blocks

For each group:

- **Strawmendous** Learning Cards
- (30) unwrapped drinking straws
- (1) ruler or meter stick
- (10) pieces of 5 cm masking tape
- crayons

For each child:

- (1) **Strawmendous** Data Collection Sheet
- drawing paper

Prepare the demonstration:

1. Place the blocks where all the children can see them.

Prepare the exploration:

1. Cut ten 5 cm portions of tape per group.
2. Place ten pieces of tape halfway on the edge of the table for each group.
3. Place 30 drinking straws on the table for each group.

Note:

Limiting the amount of materials helps children understand that resources are limited and must be used wisely. This requirement may be eliminated for younger children.

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Activity Leader's Guide

Group Size: 2 children

Time: 30 minutes

Engage

- 1** Gather the children together. Ask children to come forward one by one to place one block on top of another. When the tower falls, encourage children to talk about why it fell.

Ask:

"How do builders make tall buildings?" Allow the children time to come up with some ideas.

- 2** **Ask:**

"Very tall buildings are called skyscrapers. What factors are important to consider when you design a skyscraper?" Encourage children to talk about building materials and techniques such as I-beams and cross-bracing.

- 3** **Explain:**

"Resources are the materials you have available to accomplish your task. It's a big challenge to make the best use of your resources. Builders must conserve resources when they build skyscrapers. Today you are builders and you must use only what you have on the table. You will get no additional resources to build your structure."

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Activity Leader's Guide

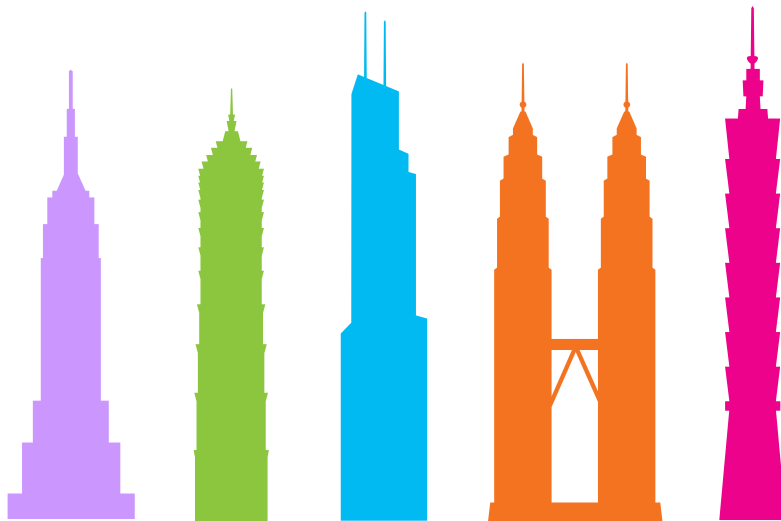
Explore

- 4 Divide the children into pairs. Distribute the Data Collection Sheets and the Learning Cards.

Say:

“Follow the directions on the Learning Card to discover some of the challenges in making a skyscraper.”

- 5 Allow children enough time to complete the WONDER, EXPLORE, RECORD, and EXPAND sections of their Learning Card.



Conclude

- 6 Gather the children together and ask the following questions:

“What were some of the challenges of building a skyscraper?” Allow children to discuss their experiences.

“What happened as your building got taller?” As buildings become taller, the weight of the materials above the ground floor increases. The added weight can make a building unstable.

“What happened as the weight of the top of the building increased?” As the weight increases, the levels that do not have adequate support bend and sway.

Expand

- 7 If time permits, the children to follow the EXPAND instructions on their Learning Card.

- 8 Help the children discover that tall buildings can be found in their neighborhood, town or city. Children can research on the internet or in the library using keywords like tall building, skyscraper and your city's name.

- 9 **Say:**
“Congratulations! You have earned your ‘Ask Me About Design and Construction’ stamp. You are ready to tell people about design and construction.”

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Expedition Learning Card



Can you build a skyscraper?




skyscraper blueprint resources

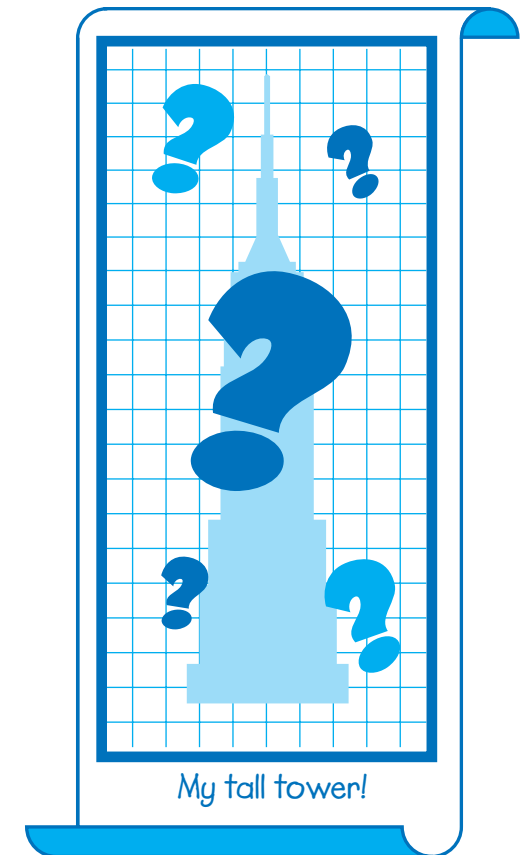


Explore how to build a skyscraper using your own design.

1 WONDER Using only your available materials, how tall can you build a skyscraper? What will it look like?

 Draw your plan on your Data Collection Sheet. Detailed plans of buildings are called blueprints.


2 EXPLORE Build a skyscraper using only the supplies you have been given. Make sure that the building can stand upright on its own. Make changes as needed to make your skyscraper sturdy.



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Expedition Learning Card

3 RECORD

 Record on your blueprints how tall your skyscraper is. Record the changes that you made to your design to make your skyscraper sturdy.

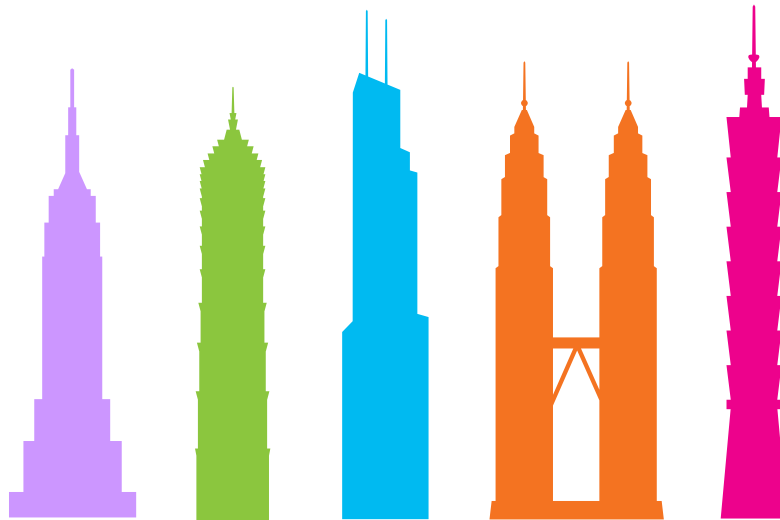
4 CONCLUDE

 What did you discover about making skyscrapers?

5 EXPAND

 Discover what tall buildings can be found in your neighborhood, town or city.

 Draw a picture of the building on a sheet of paper. Find out everything you can about who built it and what it is used for.



Discovery

Why did we do that?

- Different kinds of building techniques and materials can be used to make structures tall.
- Tall buildings are called skyscrapers.
- A tall building must bear a lot of weight so it does not tip over and fall.

Congratulations!

You have earned your "Ask Me About Design and Construction" stamp! Now you are ready to tell people about design and construction!

