GRADE LEVEL: ELEMENTARY

Everyday Engineering: STEM@Home

Activity: Slender Tower Challenge

INTRODUCE THIS:

As cities grow, sometimes the best way to do this is by growing upward, not outward. Imagine that there is an old building in an urban environment that you want to replace with a new, taller, skyscraper. The original building already has neighboring structures all around it, so you must design something that fits in the original footprint (area taken up by the building's base). Your new building needs to be taller, but it can't be wider.

WATCH THIS:

The Shanghai Tower, one of the tallest buildings in the world, shelters 16,000 people in a single city block. To see details of the building watch Dream Big – "Holding Sway: Wind Engineering," https://youtu.be/nxnrtqd9Duc.

MATERIALS:

- Scissors
- 10 sheets of paper (if possible, reuse scrap paper instead of new paper)
- Tape
- Ruler

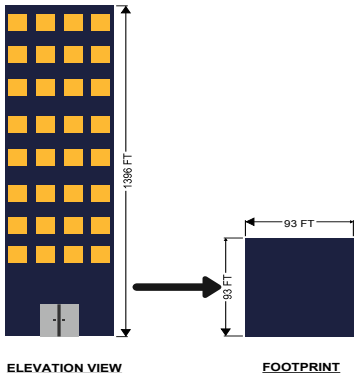
DO THIS

Using no more than 10 sheets of paper, design and build a tower at least 3 feet tall.

Once you are successful, build a taller tower, or one with a smaller footprint. Is there a way for you to more securely attach your taller tower to the ground? Does making the base of the building heavier help?

TALK ABOUT THIS

For a structural engineer, *footprint* means the area taken up by a building's base. Imagine that your body is a structure. Is it easier for you to balance on one foot or two? When both of your feet are on the ground you have a bigger base which help to distribute your weight over a larger area and helps with stability.



Making buildings taller means that you can fit more people in a small footprint. But very slender towers have their own set of challenges.

To an engineer, a building is considered "slender" if it has a width-to-height ratio of at least 1:10 or 1:12. In the illustration above, 432 Park Avenue has a slenderness ratio of 1:15 because it is 93 feet wide and 1,396 feet tall. For a non-square base, use the largest dimension of your base for your width.

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WANT MORE CHALLENGE?

Calculate the width-to-height ratio of your tower. Can you build a more slender version?

Test your tower in the wind (a fan) or by shaking the surface it is constructed on (to model natural disasters like earthquakes). What happened?

Would the tower perform better if it were made of a different material? Try plastic bricks, paper tubes, etc.

WANT TO GO FURTHER?

This activity and over 65 others were developed in support of the award-winning documentary *Dream Big: Engineering Our World*. This version has been adapted to showcase how to do it at home.

For more in-depth coverage download the Slender Tower Challenge from the *Dream Big: Engineering Our World* website: http://discovere.org/dreambig/activities. There you will find discussion questions for younger as well as older children, relevant vocabulary, and more.

Dream Big: Engineering Our World is available on Netflix and Vimeo.

The free library of over 65 activities and webisodes can be found at www.discovere.org/dreambig.

You can find Everyday Engineering: STEM@Home activities, videos, and other links at www.asce.org/pre-college_outreach. The YouTube playlist of supporting videos can be found at https://www.youtube.com/playlist?list=PLA61bxD8Jg-0V3ExN9sHkUYIrdKqSgfXJ.

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