



*Drexel-SDP GK-12 ACTIVITY*

## Activity: Paper Tower Competition

**Subject Area(s)** Problem solving

**Associated Unit** Landforms, module 1

**Associated Lesson** None

**Activity Title** Activity: Paper Tower Competition

**Grade Level** 6 (3-7)

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**Activity Dependency** None

**Time Required** 30 minutes

**Group Size** 3

**Expendable Cost per Group** \$0



### Image 1

**ADA Description:** Picture shows the leaning tower of Pisa

**Caption:** The leaning tower of Pisa

**Image file name:** 14\_19\_53-the-leaning-tower-of-pisa-tuscany-italy\_web.jpg

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### Summary

In this activity, students will be given 3 sheets of newspaper, a construction paper base, and unlimited amounts of tape to construct the highest and strongest structure they can. The teacher will turn on a fan to mimic wind, and students will see how well their structures stand up to shear (wind) force. Towers will be evaluated for height and durability.

## **Engineering Connection**

Did you ever wonder how all the roads, schools, hospitals and bridges in our cities came into being? Were they always there? No! People, specifically engineers made it happen. Without engineers, there would be no cities. In this activity, we will conduct a little competition to explore some of the tradeoffs engineers face in design and construction of their buildings, specifically, the tradeoffs between height and durability.

## **Keywords**

Civil engineer, competition, engineer, paper tower

## **Educational Standards (PA)**

- Science: Technological Devices – Instruments 3.7.B, Physical Science, Chemistry and Physics – Astronomy 3.4.D
- Math: Measurement and Estimation 2.3, Geometry 2.

## **Pre-Requisite Knowledge**

Familiarity with the concepts of mass, motion and inertia

## **Learning Objectives**

After this activity, students should be able to:

- **Describe the tradeoffs between height and durability**
- **Describe what a civil engineer does**
- **Fabricate a durable and tall from paper tower newspapers and tape**

## **Materials List**

Each team needs:

- 3 sheets newspaper
- base (a sheet of construction paper)
- tape – 3 ft. (or as much as teacher wishes to allow).

## **Introduction / Motivation**

How do we create tall and durable structures for our cities? (e.g. explore the tasks and challenges civil engineers encounter) What are some of the tradeoffs that an engineer would encounter when designing these buildings to make them impressively tall but fail-safe to all wind conditions?

## Vocabulary / Definitions

Word	Definition
Durable	Serviceable for a long time; "durable denim jeans"
Civil engineer	An engineer who plans, designs and supervises construction of public structures.
Wind force	Force of the wind on a structure, object, etc

## Procedure

### Before the Activity

- Distribute the materials

Discuss the different types of engineers involved in construction.

Environmental Engineering: What does an environmental engineer do? Ever wonder where the water goes that you flush down the toilet? There are plans to dredge (deepen) the Delaware River for commercial boating so that the local area can generate more money. Ever wonder what stirring up the river bed does to the fish that live in that river?

Soil has useful value for absorbing rainwater runoff, much of which is then absorbed by tree and plant roots. So... if the ground is paved over with concrete, Where is there for the water to go?

Environmental engineers are responsible for studying these issues -- the relationship of civilization and our necessary infrastructure to the earth -- sometimes this relationship is in conflict!

Electrical Engineering: How many different ways can you think of to generate power? (coal, water (hydroelectric), nuclear, wind, solar). Electrical engineers do design small electronics, but on a larger scale (a landforms scale), electrical engineers help to design power generating systems. Electrical engineers study how to convert energy in one form (flowing water, moving air, solar radiation, nuclear fission) into another form of energy -- electric current!

Geophysical Engineer: What do you think will happen when New Orleans rebuilds the levees to keep the seawater out of the city? Geophysical Engineers study the settlement of buildings, stability of slopes and fills, and probable effects of landslides and earthquakes to support construction and civil engineering projects. When the levees are rebuilt, a geophysical engineer will help to measure how well the earth strata will be able to support the new foundations.

Geophysical engineers often work closely with civil engineers to help make improvements to the structures designed by the civil engineers -- for example, earth studies to measure how well the civil engineer's dam will hold up against time.

Geophysical Engineers conduct theoretical and experimental studies in mining exploration and mine evaluation. How many of you have heard of mine subsidence? It happens when the groundwater weakens the earth layers that sit on top of mines. The ground above may eventually

cave in and cause lots of damage and heartache to the people who live above it. Geophysical engineers help to determine the likelihood of mine subsidence.

Geophysicists study the earth's structure in the exploration for oil and gas deposits. Geophysical engineers are working around world to discover new sources of oil.

Civil Engineering: Ever consider how your school was actually built? How your home was built? An architect designs the building, then a civil engineer helps with the actual construction. Civil engineers choose appropriate building materials and then how to use them. Civil engineers design bridges, buildings, tunnels, highways, dams, just about any large-scale structure you can imagine requires civil engineers.

What are some issues you think a civil engineer would have to consider when choosing a building material? (load-bearing (weight), shear forces (wind), permeability (water), erosion (water, wind)).

### **Procedure:**

Step 1: Each team of 3 students (civil engineers) gets 3 sheets of newspaper, an unlimited amount of tape, and one sheet of construction paper for a base.

Step 2: Teams have 15 minutes to construct a paper tower as high and durable to shear force as possible.

Step 3: After 15 minutes, a fan will be turned on to test the structures durability to windy conditions. If the tower sways, it is durable. If it falls, it is not durable.

Step 4: The towers are evaluated for their height and durability and winners chosen.

Step 5: Open a discussion with the students and inquire about the engineering design changes they would make for the next competition. What materials would they wish for?

### **Safety Issues**

- Supervise students for proper use of materials

### **Troubleshooting Tips**

Advise the students to explore different methods to strength the newspaper, e.g. via reinforcement with tape, via folding, via buttresses, via rolling, or via crumpling.

### **Investigating Questions**

Question 1: What challenges did you encounter building your tower?

Question 2: Are there other building materials you think would be preferable for height and durability? What would help your building be water resistant?

Question 3: What would you do differently next time?

**Assessment**

Observe the students during the competition. You may use the following rubric to evaluate their participation.

Students will be evaluated on a scale from 0 to 4 on:

_____	_____	_____	_____
Teamwork	Task Completion	Height	Durability

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