

# Earthquake-Resistant Building

Objectives:

- Students will explore how different variables (weight, shape, height, material) can affect a structure's ability to withstand shaking
- Students will experience a process of engineering design

## Earthquake-Resistant Building Engineering Project

The site at Discovery School has an excellent guide for this project, including instructions on how to build a simple shake table.

<http://school.discovery.com/lessonplans/programs/earthquakeproof/>

Some suggestions for doing this project are:

- a. Build more than one shake table (4 for a class of 20 is probably adequate)
- b. Check the websites listed – some are no longer in use; you may wish to substitute others. For example. “tremor tech” at <http://tlc.discovery.com/convergence/quakes/articles/tremortech.html>
- c. Instead of starting with research, give the students a small introduction. Ask them to research the following:
  - Distribution of weight
  - Variation in shape
  - Variation in height
  - Variation in foundation material
- d. Each group will test all four variables. Set up four stations. Students rotate through to see the effects of each variables.
- e. After progressing through these four variables, discuss the results with the class.
- f. There are 5 discussion questions. They are extensive questions – we recommend doing #1 and then one of the other 4 questions.
- g. Give the students the challenge to design their own building. They should make their structure out of recycled and/or reusable materials.
- h. On the earthquake-proof building competition itself, we suggest using Velcro to fasten their structure to the shake table.
- i. Keep the shake tables out so they can continue to test and refine their designs.

Use the algorithm  $Q = f \times h$  (where  $f$ =frequency of shake table vibration and  $h$ =height of the structure) to determine which group wins the competition. (The largest “Q value” wins!) The frequency can be easily quantified using a metronome (free metronome programs are available on the internet, or borrow one). Frequency is the number of complete back and forth vibrations per second.