Musical Plates

Name_____ Class_____ Date_____

Enrichment Lesson 4: Engineering Application: What Can I Build On?

U R G E N T U P D A T E !

A CORPORATION IS STILL WILLING TO DONATE LAND TO YOUR TOWN TO BUILD A COMPUTER- TECHNOLOGY BUILDING!!!!

Land has been donated to your town to build a computer-technology building, although the land itself is susceptible to earthquakes. The goal for your team is to improve the architect's building design to make it sturdy enough to withstand a possible earthquakes. Only particular materials are available and you will be challenged to be as economical as possible. Therefore, while designing the building your team must consider the materials available, the cost, the substrate that the building will be built upon, and the fact that the building will be in an earthquake zone. The group will be responsible for agreeing on a design, drawing the design to scale, listing materials and cost, and writing a proposal selling the team design idea to the architect on the project. Good luck!

Develop a testing method:

1. Place plastic tub containing the substrate on a clean, flat table surface with mock building standing inside.

2. Align the house so that it is as level as possible.

3. Using a light-weight object, such as a pair of scissors or a ruler, and an easy swing tap the side of the plastic tub for 20 seconds (a slight tremor).

4. Check the house to see how level it is. Measure the distance it is off-level with a small ruler. If the building tips over, note that the structure is "thoroughly unstable".

Engineer a better design strategy

1. Give each student a Design Log to complete during testing.

2. Each design team should select a person to generate all the earthquakes. This will help standardize the earthquakes or make them as similar as possible. This person should perform the same steps as were demonstrated and measure the distance the building was off-level. Try it two or three times to develop some consistency.

3. As a team brainstorm some ideas to improve the building's ability to stay level. See the materials list at the end to determine what choices you have.

Remember you cannot:

- alter the architect's building design
- use any of the volume inside the building
- attach anything to the sides of the plastic tub

However you may attach things to the building.

4. Next choose the best idea, build and test that idea out. Write down the results of your test in the Design Log. Also, calculate a **Percent change** for your design:

   Percent change = [Original X New]/Original X 100

   Original = amount off-level without any modifications
   New = amount off-level with new modifications

   If your answer is positive, then you have successfully improved the design. Congratulations! Now can you do better?
   If your answer is zero, then you have made no change in the building's ability to withstand an earthquake. Try again.
   If your answer is negative, then you have made the building worse than the original design. Try again!

   Finally, consider the additional cost of the building due to these suggested changes.

5. Reiterate the group's design ideas. In other words, attempt to improve your design for the next trial. Can you improve the structure's ability to withstand a 20 second tremor? Can you make your design modification more economical? Can your design modifications withstand a 60 second tremor?

Materials	**Price/Unit**
Aluminum Foil(3"x5")	*10 cents/Sheet*
Popsicle sticks	*$1.00 /each*
Toothpick	*25 cents each*
Rubber band	*30 cents each*
Tape	*5 cent/cm*
Index card	*45 cents each*
Other (TBD by teacher)	

Final Project:

Prepare an engineering report that reflects your work and illustrates your team's most economical and viable idea for improving the original building's ability to withstand liquefaction during an earthquake. Remember, the group will be responsible for drawing the design to scale, listing materials and cost, and writing a proposal selling the team design idea to the architect on the project.