Building for Earthquakes
Earthquake Tower Challenge
100 points

Your team has been hired as the structural engineers in charge of designing a new art building, upwards of 5 stories. There are many building codes you must follow; floors being level, able to hold weight. The building will be located near an earthquake fault; therefore your building must be able to withstand ***both*** small and large earthquakes. Since the building will be used for art classes, you may be as creative as you like with the shape and design of the building (it does not need to be box shaped).

Possible materials to use (please get approval on other materials you might want:

- 1 cardboard base (approximately 25 cm by 25 cm)
- Straws/wooden skewers/spaghetti (you need to keep a count of how many used)
- Items to attach corners; small marshmallows/gum drops/tape/hot glue
- Other; items your team thinks of approved by teacher
- Straight Pins (no more than 20)

Your building must meet the following requirements:

- The building must fit on the base. Attach your building to the base using pins, paper clips, glue, whatever you can use.
- Your building must be between 36 cm and 50 cm in height.
- Each story of your building should be between 8 and 12 cm.
- Each story must support the weight of at least 200 grams without collapsing.
- A construction drawing with measurements and analysis must be submitted before earthquake testing.
- To survive an earthquake test, the building must not collapse for 10 seconds after the earthquake begins. The weights must stay on the building. You have 1 minute to repair any damage to your building before the next earthquake test.

Hints and tips:

- **PLAN CAREFULLY!** Additional supplies will not be provided.
- Remember these words of wisdom: "Measure twice. Cut once."
- Use the concepts of tension and compression. If an element is in tension and not compression, you can use string instead of straws.
- Try building without pins first then add pins where connections need reinforcement.
- Make sure that your foundation is very strong.
- Remember to design a way to secure the weights so that they don't fall off **AND** so you can add additional weights to the top story.

Grading:

25 points	Building stands by itself, fits on the base, is secured to the base, is 36 - 50 cm tall, and the stories of the building are 8 – 12 cm tall.
10 points	Building supports 200 g on the first story.
10 points	Building supports 200 g on the top story.
10 points	A clear and detailed construction sketch was completed. Materials used should be easily distinguished. All important design features and all critical measurements should be labeled on the sketch.
20 points	A structural analysis of your building was completed. The following questions should be answered clearly and completely: • During construction, how did you test the strength and stability of your structure? • During construction, what strategies did you use to strengthen the weaker areas? Why? • What are the strongest parts of your building? Why? • What are the weakest parts of your building? Why? • Where did you use string in your structure? Why? • Where did you use pins in your structure? Why? • If you had 5 more straws, where would you add them? Why?
5 points	Building remains standing with 200 g on the top story after a mild earthquake.
5 points	Building remains standing with 200 g on the top story after a major earthquake.
5 points	Building remains standing with 200 g on the top story and 200 g on the first story after a major earthquake.
5 points	Building remains standing with 400 g on the top story and 200 g on the first story after a major earthquake.
5 points	Building remains standing with 400 g on the top story and 400 g on the first story after a major earthquake.

Bonus:

The building in each class that can hold the most weight and remain standing after a major earthquake will be awarded 20 bonus points.

Deadline:

** The last day for earthquake **testing** is Thursday, February 18th. **
Competition Day; Friday, February 19th.

If you test your building before the final deadline, you may start over from scratch with new materials to try to win the bonus points. However, you will ***not*** be able to make up points that you lost with your first building. Therefore, do your best with your first building, but if you earthquake test your building before the deadline, then you will have a second chance to win the bonus points.