

## **Shapes and Building Structures to Resist Earthquakes 2021 NHERI LHPOST REU**

### **Audience**

Elementary (3-5<sup>th</sup> grade)

### **Takeaways**

Students will learn about basic lateral systems, structure vibration (back-and-forth movement, wobble), and basic geometry, angles, etc.

### **Introduction/Motivation**

This activity offers students a better understanding of the structures that surround them, why buildings are designed a specific way, the geometrical shapes which provide stability to structure under shaking (\*standard gravitational loads and extreme natural hazard loads).

### **Learning Activities**

- Earthquake model simulation
  - Miniature “building” structure
- Spaghetti and marshmallow towers
  - Build spaghetti and marshmallow towers in groups
  - Simulate shaking
  - Add weight to see how much the structure can support
- General Timeline:
  - About 1 hour total (not including material gathering or prep time)
  - Provide basic, short overview/PowerPoint with pics (~15 minutes)
  - Gathering materials/assembling teams or pairs (~15 minutes)
  - Activity (~20/30 minutes)
  - Wrap-up (~5 minutes)

### **Objectives**

Students will . . .

- Examine pictures of buildings under construction
- Identify basic shapes (rectangle, square, triangle, lines, angles, etc.) of structural lateral systems or the building blocks of the structure (\*CC geometry 4<sup>th</sup>)

- Draw spaghetti tower building plan using shapes, lines, and angles you identified in the first activity
- Label shapes, lines, and angles of your plan
- Construct marshmallows and spaghetti towers with shapes and angles
- Shake table that the tower sits upon
- Observe what happens to each group's tower
- (\*With guidance) Understand how height and width affect structural response

### **Background and Vocabulary**

- Earthquake
- Vibration
- Truss
- Seismic forces
- Lateral Load
- Structure
- Tectonic plates
- Friction
- Waves
- Lateral systems

### **Assessment**

Students will meet the learning objectives when they create a basic truss shape for their structures and see how the different designs perform under lateral loading. These trusses will take the shape of triangles or X's.

### **Conclusion**

From this activity, students learned that triangular shapes are critical to support lateral loads. By building structures of different dimensions, they learned that short buildings with wide bases are less vulnerable to lateral loading failure.