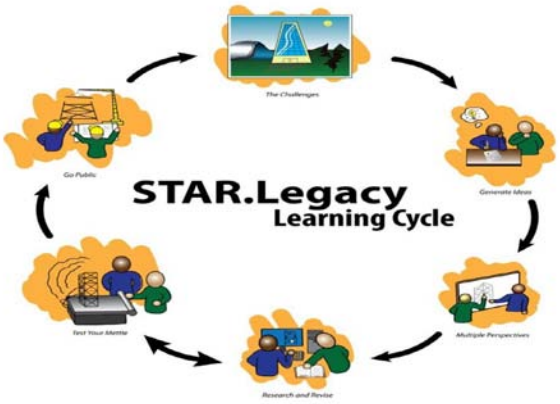
Gender: _____ **Year & Major: _____**

Welcome…
The following challenge explores various issues and opportunities related to designing resilient structures to earthquake activity. You will be following a learning cycle designed to support your inquiry process into the challenge and follow through learning activities designed to support your understanding of governing scientific principles and engineering skills associated with designing buildings.



Please follow the direction in each section and respond to the best of your ability. Input your responses in this document and save your work.

The Challenge

Challenge: A new restaurant is being built in Northridge California. The proposed one story structure has an estimated mass of 1000 tons (106 kg), a natural frequency of 5 Hz, and a damping ratio of 0.05.
Your engineering team needs to identify various alternatives and explain the pros and cons of various solutions for making this building earthquake resistant.

Generating Ideas/Thoughts

Write out your initial thoughts about each of these questions. This is an exercise to help you think about some of the big ideas you need to explore in a challenge like this on.

1. What questions do you need to ask either the client or earthquake engineer to improve the quality of your investigation?

2. What methods do you suggest for designing the structure to be earthquake resistant?

3. What methods do you suggest for designing the structure to be earthquake resistant?

4. How will you know if your design is effective?

Multiple Perspectives

We asked several specialists about how to approach this situation. We found several existing solutions that might help you expand on your initial thoughts.
Review these links to see how others might approach this problem and what they considered:

Hold the ctlr key and click on the image to launch a video

Please provide your thoughts about how these perspectives are similar and different from what you generated previously.

Research and Revise

Activity 1: One of the techniques used by engineers to minimize the effects of earthquakes is Linear Base Isolation (read more about base isolation by clicking on the link).
A modeling tool called Linear Base Isolation can be used to test how different isolation systems will affect this building's performance (After launching the tool you can learn more about Linear base Isolation here).

You are given three commercially available base isolators with natural frequencies of

Sway Right 1000 -- 0.1Hz
Smooth Ride Pro – 0.5 Hz
Shaker Stopper -- 1.0 Hz

Using the Linear Base Isolation model, calculate the maximum displacement of the structure when each of these base isolators is used.

Which isolator will you recommend using for the structure?

Why is your choice the best option?

Test Your Mettle

Activity 2: In this activity we will see how the damping ratio of base isolators relates to the maximum displacement of the structure.

In the tool vary the damping ratio of the isolators from 0.1 to 0.7

What is the relationship between damping ratio and displacement?

What value of damping ratio works best for this type of structure? Why?