

Lesson Plan

Assessment	AOL, Unit Project Rubric
Cross-curricular	

Big Ideas

- Structures and mechanisms throughout our environment have forces that act on and within them.
- We can measure forces in order to determine how they affect structures and mechanisms. This information can be used to guide the design of new structures and mechanisms.

Learning Goals

- To bring together all the information learned in the unit to conclude the project.
- To better understand how earthquake forces act on structures and how humans manage those forces.

Specific Expectations:

- 1.1** analyse the effects of forces from natural phenomena (e.g. earthquakes) on the natural and built environment
- 2.3** use scientific inquiry/research skills to investigate how structures are built to withstand forces
- 2.5** use appropriate science and technology vocabulary, including tension, compression, torque, system, and load, in oral and written communication
- 2.6** use a variety of forms communicate with different audiences and for a variety of purposes
- 3.1** identify internal forces acting on a structure, and describe their effects on the structure
- 3.2** identify external forces acting on a structure and describe their effects on the structure, using diagrams
- 3.4** describe forces resulting from natural phenomena that can have severe consequences for structures in the environment, and identify structural features that help overcome some of these forces

Description:

This is the fifth lesson in a five-lesson unit on the forces of earthquakes. In this last lesson the focus is on consolidating what we've learned by completing the unit project.

Materials/Resources:

Links to various videos. See in Consolidation section.

Safety Notes

Introduction

Wrap up discussion

- Over the last few days we have learned about forces of earthquakes on structures. What did we learn?
- Do you think it's important to protect buildings from earthquakes?
 - It may depend on where you live. Not every part of the world is prone to earthquakes. As we learned it depends on where continental plates collide or slide past each other.

Videos of real earthquake structural testing

Students will be interested in seeing how engineers do very similar experiments to what they did. We have also included a video showing Japanese skyscrapers swaying in an earthquake. This is in contrast with the videos we watched when we started to unit where buildings collapsed. We have now learned how we can design buildings to resist even extremely strong earthquakes.

- We did experiments to see what type of structural design resists earthquakes the best.
- Such experiments are also done by engineers. Sometimes on a really huge scale. Let's watch a few videos!

Action

Finish Unit Project

Today we want to make sure that everything is finished, and that we do a recap of earthquake resisting systems employed in building construction. The final task is meant to allow the students to be creative and have fun drawing something. By incorporating what they've learned into this task they will really show if they understand how the forces of earthquakes act on structures and how we mitigate the effects of those forces.

- If you haven't finished any sections from previous days yet, work on that first. In particular finish your pages on designs we can add to buildings to resist earthquakes.
- Today we would like you to make a sketch of three systems that help reduce earthquake impact. They are:
 - Isolation bearings
 - Damper pendulum (the technical term is a tuned damper pendulum)
 - Cross-bracing
- Next describe briefly how each one works to reduce the impact of the forces of an earthquake.
- Finally – draw a structure from your imagination. A great tower, a bridge, a hut, whatever you want to! But your structure has to be earthquake proof. Therefore, clearly show or describe in writing, what systems you've included to achieve this.
- You can use the worksheet.

Consolidation/Extension

Earthquake testing videos

- World's largest earthquake test: <https://www.youtube.com/watch?v=hSwjkG3nv1c>
- Shake table crash testing: <https://www.youtube.com/watch?v=kzVvd4Dk6sw>
- Taipei 101 damper moving: <https://www.youtube.com/watch?v=NYSgd1XSZXC>
- Short video of an isolation bearing testing:
<https://www.youtube.com/watch?v=JM3uGyPwVP4>
- Japanese sky scrapers swaying in earthquake: <https://www.youtube.com/watch?v=g0cz-oDfUg0>
 - French safe - <https://www.youtube.com/watch?v=QTEW4xmzprM>