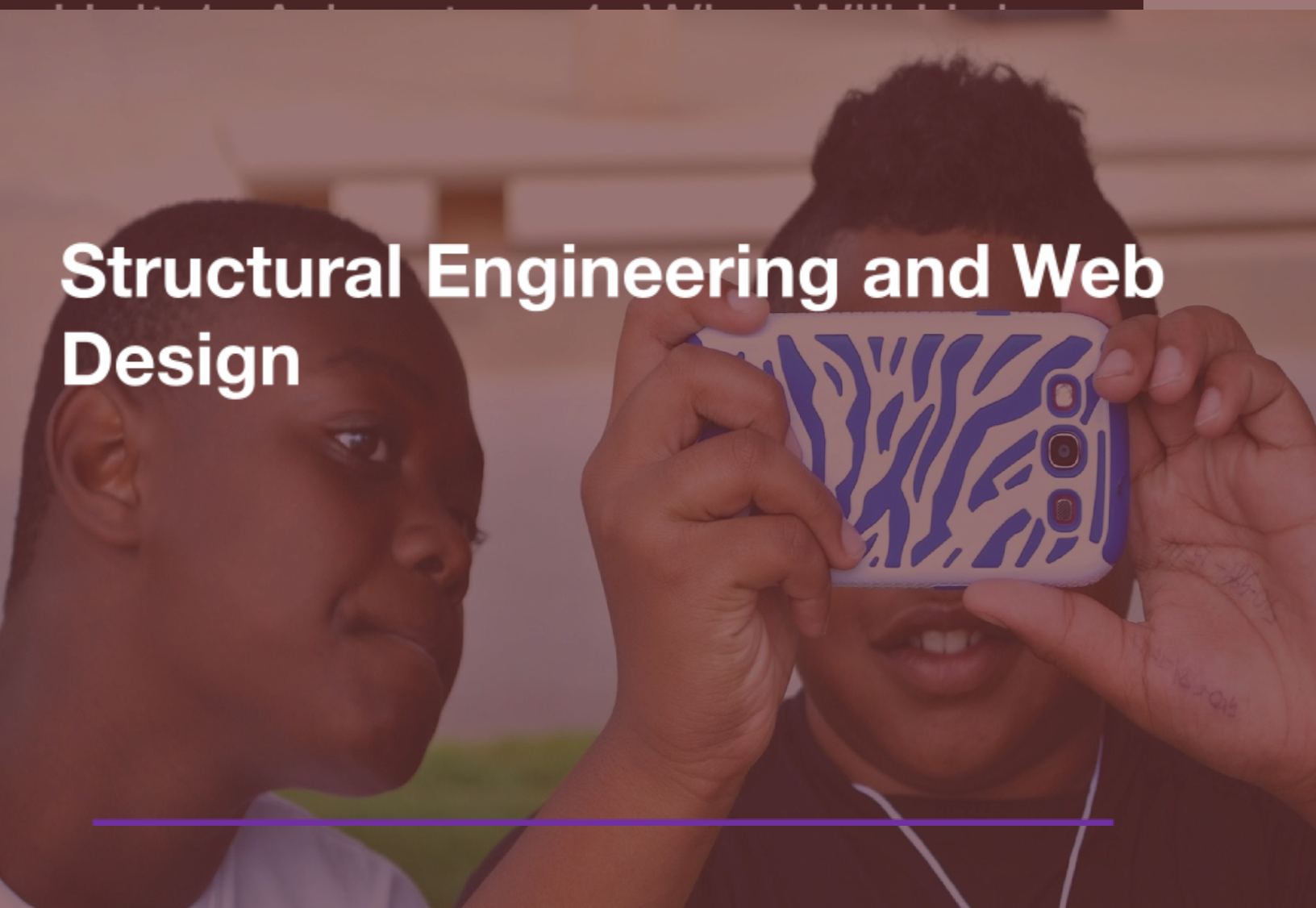
Student Handbook

Structural Engineering and Web Design



Module 4
Structural Integrity/ HTLM

Who Will help US? How Community Leaders Must Prepare The Community for an Earthquake Disaster

Agenda

Time	Task	Description	Needs
10 min	**Introduce The Problem**	**Discuss this problem with your students:** Scientists expect California to have a major earthquake sometime soon. To make sure our community is safe, we need two things: (1) We need to udnerstand how to make sure our homse are structurally secure. (2) We need to have emergency plans for water and food.	Have problem in the handout.
10 min	**How can we build for Strength**	**Directions:** Use the space below to write down your opinion. (1) How can we build apartments and housing than can survive an earthquake?	Have problem in the handout.
10 min	**Video: Structural Integrity**	https://www.khanacademy.org/partner-content/49ers-steam/ka-videos-topic/ka-videos-tutorial/v/truss-basics	Have problem in the handout. Have video available in slides.
15 min	**Video Questions**	**Directions:** Use the space below to answer questions about the video: (a) What is a Truss? (b) Why are buildings build with triangles? (c) How do trusses apply to the design of bridges	Have problem in the handout.
10 min	**Discussion**	The teacher will lead a discussion of Trusses and triangle strength	Have video available in slides.
DAY 2			
10 min	**Video Triangle Strength**	**Directions**: Students will watch the following video about Triangle strength: https://www.youtube.com/watch?v=mBHJtWbsiaA	Have problem in the handout. Have video available in slides.

5 min	**Structural Integrity Reading**	Students will read a short reading about structural integrity and answer questions	Have reading available.
10 min	**Structural Integrity Questions**	**Directions:** Use the space below to answer the following questions: (1) What is structural integrity? (2)	Have working space in in the handout.
20 min	**Design**	**Directions:** Use the space below to design a building structure where we can store our play equipment on campus.	Have working space in in the handout.
10 min	**How to Build Strong Community Structures**	**Directions:** Use the space below to write your thoughts about how we can use what we learned about structural integrity and triangles to build buildings that can survive earthquakes.	Have problem in the handout. Have video available in slides.
10 min	**Script Write**	**Directions:** You will record a PowToon video that explains how structural integrity works. Use the space below to write your scrip.	Have problem in the handout.
DAY 3			
25 min	**PowToon Video Recording**	We will use the next few minutes to make our Powtoon videos explaining structural integrity.	Have link on students CPUs to PowToon Have directions in handout
25 min	**Evaluating Community Structures**	We will take a quick trip through our neighborhood. As we walk around, we will examine the community structures. Do we see Trusses? How can we build stronger structures? Use the space below to write your notes.	Teacher needs to plan walking tour through the neighborhood to examine structures.
DAY 4			
15 min	**Community Recommendation**	**Directions:** We will write a letter to Mayer Scaff, explaining how we can use Trusses to prepare for earthquakes.	Have text available in the handout.
5 min	**Geoesic Dome Video**	https://www.youtube.com/watch?v=TqxarO-5igc	Have text available in the handout.
	Geodesic Dome	We will use the next few moments to build	Have lab instructions in

40 min	**Design**	our Geodesic Domes. https://www.instructables.com/id/How-to-Build-a-Geodesic-Dome/	the handout.
DAY 5			
60 min	**Webpage Building**	We will use the next few moments to build our new webpage explaining Geodesic domes and structural integrity.	Have materials in the handout.

The Problem

Discuss this problem with the class: Scientists expect California to have a major earthquake sometime soon. To make sure our community is safe, we need two things:

(1) We need to understand how to make sure our homes are structurally secure.

(2) We need to have emergency plans for water and food.

How Can We Build For Strength

Directions: Use the space below to write down your opinion.

(1) How can we build apartments and housing than can survive an earthquake?

Video: Structural Integrity

As you watch the videos on structural integrity and triangle strength write your notes here.

Structural Integrity Reading

Structural integrity is an engineering idea. It explains how a structure has the to support a weight or force without breaking. Engineers study how to build stronger structures by studying structures that are strong and other structures that have failed.

There are 3 basics factors in structural engineering that determine the structural integrity of the building. First, each structure is made of certain materials. Materials like wood and concrete are considered strong, but how would they perform in an earthquake. In California, the materials must be strong and flexible. Second, the design is important. The way you can put materials together will also make them stronger. Third, the way you connect materials with strong brackets and bindings add to the structural strength of a building.

To construct an item with structural integrity, an engineer must first consider a material's mechanical properties, such as toughness, weight, and flexibility. A very stiff material may resist bending, but unless it is sufficiently tough, it may have to be very large to support a load without breaking. On the other hand, a highly elastic material will bend under a load even if its high toughness prevents fracture.

Triangle Strength

Look around you. Triangles are everywhere! Any structure requiring a strong and rigid construction depends on triangles to achieve that goal. Even though they might not be obvious or even seen for that matter, triangles are at work wherever strength and rigidity are important.

The triangle is the only two-dimensional shape that if constructed of rigid members with hinged corners is absolutely fixed in shape up to the compressive and tensile limits of its members. A square, for example, can easily be broken or changed into a parallelogram.

All other shapes are similarly able to bend and break. This is not what you want. However, other shapes can be strong by connecting their angles through the use of triangles. The strengthening of a triangular to make other structures strong is call "gussets" or "tresses" and, although they may not extend the total length of the material, they effectively make the two connecting parts into a single strong structure. When enough internal triangles are connected in this way, the overall shape becomes

really strong. Triangle are the strongest shapes because the forces are shared equally making the structure extremely strong.

Structural Integrity Questions

Directions: Use the space below to answer the following questions:

(1) What is structural integrity?

(2) Why are triangles the best structure for building?

Designing a Strong Storage Shelter

Directions: Use the space below to write your thoughts about how we can use what we learned about structural integrity and triangles to build buildings that can survive earthquakes.

How to Build Strong Community Structures

Directions: Use the space below to write your thoughts about how we can use what we learned about structural integrity and triangles to build buildings that can survive earthquakes.

Script Writing

Directions: You will record a PowToon video that explains how structural integrity works. Use the space below to write your scrip.

PowToon Video Recording

We will use the next few minutes to make our Powtoon videos explaining structural integrity.

Evaluating Community Structures

Directions: We will take a quick trip through our neighborhood. As we walk around, we will examine the community structures. Do we see Trusses? How can we build stronger structures? Use the space below to write your notes.

Community Recommendation

Directions: We will write a letter to Mayer Scaff, explaining how we can use Trusses to prepare for earthquakes.

Geodesic Dome Video Notes

Directions: Use the space below to write your notes about what a Geodesic dome is and how it works.

Geodesic Dom Building Instruction

Step 1: Materials and Getting Started.

To make this, you're going to need a couple things.

-Newspaper, and lots of it (could be substituted for toothpicks for a smaller version)
-Staplers and extra staples (marshmellows for a smaller version)

Step 2: Getting Started

So we're going to take 3 pieces of newspaper stacked on top (make sure it's the bigger type of page, with the fold on the middle,) start at one corner and roll it to the far corner, forming a tube. Be sure to read the funnies once you get to them.

Step 3: Roll More Tubes

We're going to need 25 tubes. So git' rollin'.

Step 4: Making Individual Tubes Into a Series

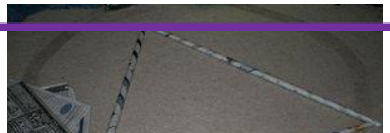
Now we need to make the frame that will eventually become the awesome structure

that is our dome.

Make a triangle.
Make an inverted triangle (with the point at the opposite side of the first)
Continue until you have 5 "upright" triangles and 5 "upside down" triangles (all connected, see image)
attach 1 tube to the end of the "ladder"

Now the tricky part, fold the "ladder" up so that the ends of the chain meet and staple (This is easiest with 2 people)

You should have 5 tubes left after this step. Now staple one tube to each of the tops of the "upright triangles" and staple in the center (looks like a 5 pointed star)



Webpage Building

Directions: We will use the moments to come to build our next webpage. On this page, we will build a webpage that explains the big ideas of structural integrity. Those ideas are Structural Integrity, Triangles, and Material Strength. Make sure use the your website explains these ideas and make sure your website embeds your PowToon video. Use the space below to begin changing your coding language.