Learn by Doing: Engineering Activity

Engineering for Coastal Resilience

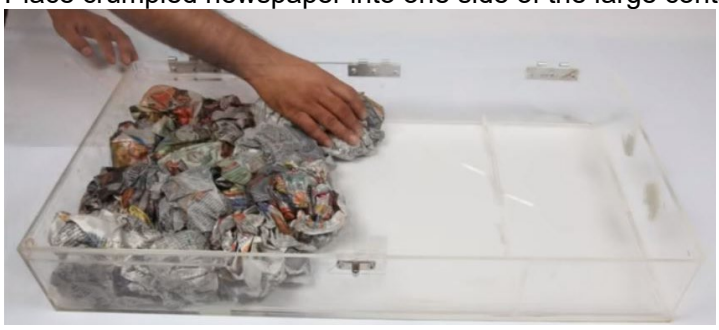
You will build a waterfront property, learn how wave action impacts the site, and design ways to mitigate property damage and improve the site's resilience!

Required Materials:

- Large container (a 21" x 13" x 3" aluminum chafing/roasting pan works well)
- Newspaper
- Sand
- Cardboard or paper to make a house
- Water bottle (full of water)
- Playdough or clay
- Balsa wood or heavy cardboard
- Stones
- Popsicle sticks
- Pipe cleaners
- Fake grass/plants (like those used in aquariums)

Setup: Build your Property

1. Place crumpled newspaper into one side of the large container.



2. Spread sand on top of the newspaper so that it is in an even layer and completely covers the paper.

3. Place cardboard house on the beach. Then, pour water into the other end of the container.

4. Now your beachfront property is set up!

Test Wave Action Impacts and Mitigate Them

Trial 1: No Mitigation

1. Using the water bottle, practice making waves wash up on your beach. ***Pay attention*** to how the water affects the beach. What happens?
2. Using the shovel, bring sand back out of the water to even out your sand and reset your beach.

Trial 2: First Attempt at Mitigation

1. Using any of the building materials you were given, set up a way to protect your house and property from the oncoming waves. See the PowerPoint and the cost estimation information on the following page for some common solutions.
2. Using the water bottle, start making waves in the water that wash over your beach.
3. ***Ask yourself:*** How did your protection stand up to the water? What can you do to improve?

Trial 3: Second Attempt at Mitigation

1. Reset your beach using the shovel to bring sand back up to the beach.
2. Using what you learned in the last trial, set up a new or improved method of protection for your house.
3. Using the water bottle, make waves in the water that wash over your beach.
4. ***Ask yourself:*** How did your new method of protection change the outcome?

Trial 4: Low-Cost Solution

Now that you've had a chance to see how different methods protect your house, it's time to try to protect the house and beach at a lower cost.

1. Reset your beach.
2. Using the price list on the following page, try to protect your house with a low-cost solution.
3. ***Ask yourself:*** What was your total cost? See the cost estimation information on the following page to calculate the cost.
4. Using the water bottle, make waves in the water that wash over your beach.
5. ***Ask yourself:*** How did this compare to Trial 2? What did you need to sacrifice for the lower cost?

Trial 5: Green Solution

Now that you've tried a low-cost solution, it's time to come up with a green solution!

1. Reset your beach.
2. Using only the options that are designated "green" on the cost estimating sheet on the following page, set up a method of protection for your house.
3. Using the water bottle, make waves in the water that wash over your beach.
4. ***Ask yourself:*** How did this compare to the other trials?

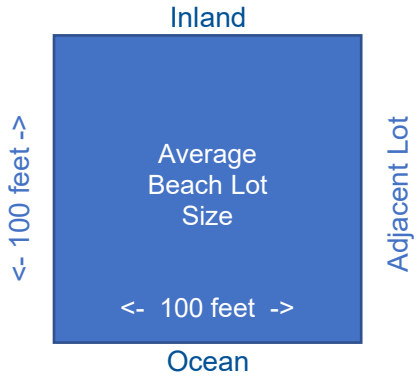
Wrap Up

Now that you've completed these trials, ***discuss with your team***:

1. What method worked the best?
2. Why was it important to look at green and low-cost solutions?

Cost Estimation Information

The cost associated with your mitigation solution(s) is determined based on the length/quantity of materials used. For reference, the average size of a beach lot is shown below:



For this activity, consider ***one inch in your model equal to 10 feet in real life***. So, if you build a natural sand berm (as described below) that is three inches long, you would calculate cost as follows:

3 inches x 10 feet = 30 feet
30 feet x $75 per linear foot = $2,250

Resilience Strategy	Cost	Type of solution
A natural sand berm *Build using playdough with sand on top*	$75 per linear foot	Green
Coastal Vegetation *Build using fake grass*	$50 per linear foot	Green
A sea wall *Build using balsa wood*	$250 per linear foot	Grey
A breakwater/stone revetment *Build using stones*	$100 per linear foot	Grey
Raise the house out of the flood plain *Build using popsicle sticks & pipe cleaners*	$50,000 per home	Grey

Cleanup

1. Move all protection and houses out of the large container.
2. Throw away used materials in the trash bags placed at each table.
3. ***Do not move the large container*** containing your beach! Once you have all the other material out of the container, call over an adult activity leaders to help you dispose of the water.
4. Gather together all unused materials to be collected.

Notes:

Visit http://www.nitscheng.com/about-us/educational-offerings/introduce-a-girl-to-engineering-day for additional resources and similar event information!