

Challenge 3: How do we create an engineering model?

Get Prepared

Challenge Goal: Learn about the concept of an engineering model and then build a scale model of their community

Time Needed: Four 45-minute sessions (as needed to complete the 3D models)

What You Will Need:

Printouts

- **Activity Sheet C: 3D City**
- **Letter to the Editor Template (optional)**

Materials

- Samsung tablets
- construction paper
- pencils and markers
- glue gun
- craft materials (yarn, pipe cleaners, glitter, etc.)
- grid paper
- cardboard
- rulers
- scissors
- glue or tape
- Popsicle sticks and toothpicks

Connect With the Community (optional):

After kids have completed Unit 1, and the Engineering in Our Community worksheet, they will have identified important needs in their community. Now you can give them a chance to have their voices heard! Wrap up the unit by helping them write letters to the editor of their local newspaper about their community's needs. After they've researched the address of their favorite local newspaper, download the **Letter to the Editor Template** to help them figure out what to say.

Note: Kids may use the activity sheet printouts or they may follow along on their tablets at: www.scholastic.com/sparks3.



SESSION 1

Spark Exploration: STEM Careers 10 mins.

1. Share this fun fact before having kids use the tablets to open the **STEM Career Flip Book**. *Did you know 20 percent of all jobs in the U.S. are in STEM fields? That's about 26 million jobs!**

Goal Selection:

2. Introduce the food scientist and the wildlife biologist from the science section in the **Flip Book**. Ask kids to reflect on what they think food scientists and wildlife biologists do. Ask them to reflect on what goals people in these careers would set. Ask them to reflect on what is important about the work these scientists do. Provide background and some fun insights with the following information:
 - Food scientists make it possible for the world's population to buy different foods at a low cost. They also invent new

foods. Food scientists invented freeze-dried ice cream, which flew in space with the Apollo 7 space mission in 1968.

- At the age of 26, wildlife biologist Jane Goodall was accepted into the lives of wild chimpanzees in what is now Tanzania. Through detailed observation and a slow buildup of trust, she was able to observe behaviors that had never been seen before. They held tight family bonds, had a chain of command, and not only were they able to use tools, but they were seen making them.

After the discussion, explain that you will continue to discuss careers from the **STEM Career Flip Book** on future days.

*National Math + Science Initiative



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Challenge 3: How do we create an engineering model? (continued)

Setting the Strategy: Engineering in the Community 10 mins.

Show kids an image of an architectural model on your tablet, using the following link: <http://architecturalmodels.tumblr.com/>. Then ask:

- **What is a model?** (A 3D representation, usually done on a small scale, of an object or structure.)
- **Why do you think models are important to engineers?** (They help them show others how an engineering project will look, and function in the communities where the projects will be built. A model is also a visual representation of the strategies an engineer implements to achieve goals.)

- **What do engineers have to consider before building a model?** (How large the real-life structure will be and how the real-life structure compares to the size of the model; in determining the size of the model, engineers will consider the area of the space where the real-life structure will be built, the scale they will use to build the model, the structures and terrain that will surround the structure, the building materials that will be used to build the structure, as well as the goals the structure will need to achieve.)

Use the Tablets! 25 mins.

1. Have kids break off into their design teams. Hand out **Activity Sheet C: 3D City**. Kids will now get the chance to build a 3D model of their community.
2. Explain that they will start by determining the area of their model. Ask teams to use their tablets to view their neighborhoods on **Google Maps**. They should select an area that's no more than two blocks by two blocks. Have them write down the street names that will border their models on the activity sheet.
3. Finally, teams will sketch in the buildings, parks, and other structures that will make up their models on the activity sheet. Remind them they can use both **Google Maps** and **Google Earth** to get an idea of what they should include.
4. Now that they have mapped out their models, have teams use the activity sheet to consider the scale of their models' structures. If they need computing help, have them use the **Calculator app** on the tablet.
5. When this planning session is complete, make sure to hold on to the teams' sketches and scale charts. They'll need them for the next session.

Wrap-up and Reflection Activity:

6. Have students consider what they want their models to show overall. Are they showing large buildings, highways, or residences? Have they included community spaces, such as a park? Why did they choose the specific segment for their model?



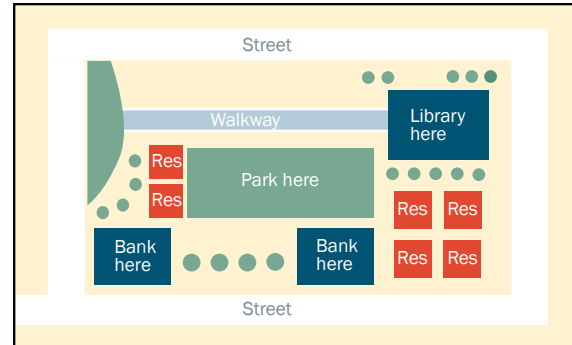
Challenge 3: What is innovative engineering? (continued)

SESSION 2

Shifting Gears: STEM Challenge! 45 mins.

To Get Started: Remind kids that they discussed engineering models in the previous session. Ask students to name a few reasons why models are so important to engineers.

1. Now that kids have used the first session to plan out their models, they are ready to build! Pass out large pieces of cardboard for kids to use as the bases for their models. Allow teams to decide how large they would like their models to be. Then circulate among the teams as they cut the cardboard to their desired foundation size.
2. Instruct kids to draw in the streets, buildings, and other structures they will include in their models. This will be a flat plan where they will place all the structures and elements that will be included in their model. A good way to describe this would be to liken the foundation to a place mat with shapes and designations as to where a plate, fork, or cup would go. Please refer to the illustration to the right for a visual example of a foundation.



3. After kids complete this task, they can start making their model structures as described in sessions 3 and 4. If not, they should have sufficient time to cut the foundation and draw in the model elements by the end of session 2.

Wrap-up and Reflection:

4. Ask kids to think about why laying out a foundation prior to building a model is so important. Guide kids to think about spaces and structure sizing.

SESSIONS 3 and 4

Shifting Gears: STEM Challenge! 45 min. Sessions

To Get Started: Remind kids that they started building their models in the previous session. Ask them to discuss any challenges they came across during this process.

1. During the final sessions of this activity, kids will build the buildings, trees, and other structures that will make up their models. Explain that this project will require them to think creatively about how to make the structures in their models. Explain that they can use popsicle sticks and toothpicks to build the structure of houses and other buildings. They can then cover the popsicle sticks with construction paper to serve as walls and roofs. As kids work, evaluate whether they are on track and provide feedback on the construction of their models. Remind them to use all the materials they have access to and to use their creativity. Answer any questions teams may have if they become stuck and encourage them to reflect and revise their models as needed.

Wrap-up and Reflection:

2. Depending on how quickly kids finished session 2, they may only need one session (session 3) to complete their models. If you find your kids need an additional day to put the finishing touches on their models, provide them with more time to wrap up so that they will have models they can be proud of.

TEAM NAME: _____

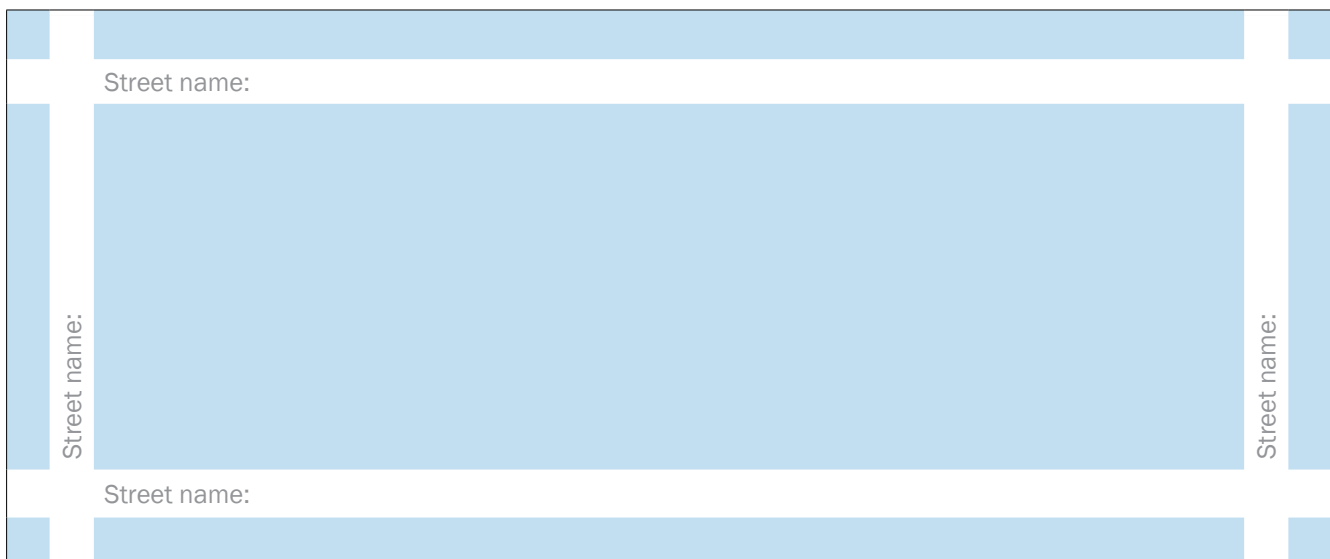
3D City

Maps are very useful, but the view they show of the world can fall, well, flat. Engineers draw their ideas, then build 3D models of their sketches. This allows them to see what their designs will look like in real life.

You've mapped out your community, so why not bring that 2D world off the paper? Follow the step-by-step instructions below to build a 3D model of your community.

Session 1: Planning the Model

Step 1: Choose Your Area: Choose whether you'd like to build a whole block or just the front of one block.



Step 2: Map Out Your Model: Use the space above to draw in the streets, building lots, parks, and other features you will include on your model.

Step 3: Consider the Scale: You want structures in your community to be proportional to those in real life. Decide the appropriate size of the houses, trees, and other structures in your community. Select dimensions for those items and write them in the chart below.

	Height	Length	Width
Houses			
Trees			
Other Structures			

Session 2: Drafting the Model

Create Your Foundation: Cut a piece of cardboard to the size you'd like to have for your model. Then use your model sketch as a guide to draw in the streets, buildings, and other structures you will include in your model.

Session 3: Building the Model

Build the Block: To build your community, cut pieces of cardboard and tape or glue them together to shape buildings' walls and roofs. Think about structures like bridges or water towers. How can you build your community out of the materials at hand? Add finishing touches to make your 3D model more realistic. For example, show grass or parks by coloring these areas green or by covering them with a piece of green construction paper.