

Western Engineering Outreach

Carving Out the Landscape
Grades 3-5

Meet Today's ENG HERO!



Julie Shang – Professor with Western Engineering

Dr. Shang is a professor in the department of Civil Engineering at Western University. Dr. Shang completed her BSc in Physics at Beijing Science and Technology, her MEng in Civil Engineering at Carleton University, and her PhD in Civil Engineering at Western University. Her research focuses on Geotechnical and Geoenvironmental Engineering.

To learn more about Dr. Shang visit:

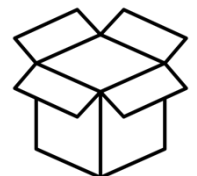
https://www.eng.uwo.ca/civil/faculty/shang_j/index.html

Learning Goal:

- Students will learn about the considerations and engineering that is used when planning where and how to build roads through the natural landscape.
- Curriculum Connections: Grade 3 - Strong and Stable Structures
- Cross-Curricular Connections to Social Studies: Grade 3 - Living and Working in Ontario; Grade 4 - Political and Physical Regions of Canada

Materials Needed:

- About 60cm x 60cm piece of cardboard (or similar dimensions)
- Coloured markers and/or paint
- Popsicle sticks
- Black construction paper



- Paper mache materials:
 - White glue
 - Water
 - Newspaper torn into strips
 - White paper torn into strips (final layer only)
 - Bowl to mix
 - Paint brush
- Cotton balls
- Assorted items to build landforms under the paper mache:
 - Straws
 - Popsicle sticks
 - Pipe cleaners
 - Newspaper
 - Paper cups
 - + any other items you have available around your house
- Paper
- Pencil
- Scissors
- Glue
- Tape



Engineering and Science Connections:

Today, you will be making a custom landscape and then using engineering concepts to design a road through your landscape.

We are all pretty accustomed to driving on roads. We use the road to get to school, to the grocery store, and many other places in our day-to-day lives. But do you know who built those roads and what considerations were taken into account when planning to build them? Engineers designed the layout of the roads and where to build them to connect our communities and allow us to safely travel from place to place.

The landscape is very different depending where you are on earth because of the different types of natural landforms that exist. What different kinds of landforms can you think of?

Some examples of landforms:

- Hills are a naturally raised mound of land and can be small or large.
- Mountains are very tall places on earth that rise steeply from the surface level, much larger than a hill.
- Plateaus are tall like mountains, but they have large, flat tops.

- Plains are large, flat area of land with hardly any trees.
- Valleys are low areas, usually between hills or mountains.
- Canyons are deep, narrow valleys with steep sides that usually have a stream or a river flowing through it.

What kind of landforms exist where you live?

How do engineers know where to build roads, tunnels, and bridges across these landforms?

Geologists and engineers work together to determine where to build roads, tunnels, and bridges. A geologist is an expert in geology, which is a type of science that studies the earth's physical structure and what it is made of. Geotechnical engineers study the earth's different rocks and soils. A geotechnical engineer would work with civil and transportation engineers to design roads, highways, and train tracks to provide safe ways to travel through the natural landscape. They determine the location, route, size, and what materials will be used. Together, geologists and engineers along with many others, will work to ensure the roads can be built safely.

Often engineers build a model of a transportation system before the real one is built. This helps them explain why a road or tunnel is in the right place.

In today's activity, you get to act like engineers and build a model of a landscape and then determine the best place to put a road through your model. Are you ready?

Video Recommendation: Building the perfect road! (Are We There Yet: Guide to Roads)

<https://www.youtube.com/watch?v=H5zMmvORYj4>

Activity:

Before beginning, think about the following questions:

- Which landforms do you want to incorporate into your model?
- What materials can you use to build these landforms in your model?

Building Your Landscape

Today you are building your own landscape. Your landscape should include at least one mountain, one river, a large body of water, and two hills. Feel free to include more landforms in your design! The body of water should take up approximately one quarter of the space on the cardboard (about 15cm x 15cm depending on the size of your cardboard base). The mountain base should be at least 10 cm in diameter. After you have built your landscape, you will design and build a road through your landscape.

CARVING OUT THE LANDSCAPE

1. First, brainstorm different materials you can use to create each of the landforms in the table below. The required landforms have been written into the table for you, but some blank space has been left for you to include more landforms of your choice. Once you have built the skeleton of each landform, you will be covering the entire surface of your landscape in paper mache to smooth it out. Then you will paint it, so at this stage you only need to think about what materials you will use to form the shapes of your landforms.

Landform	Material Ideas
Mountain (required)	e.g. crumpled newspaper, paper cups
River (required)	e.g. pipe cleaners, straws
Body of water (required)	
Hills (required)	

2. Next, design your plan for your landscape. Before building your landscape, draw out where each landform will be located on your cardboard base and the size of each. Once you have drawn your design on a piece of paper, it may be helpful to draw it directly onto your cardboard base. This will help when you start building.
3. Next, build the skeleton of your landscape. Using the materials you decided on in Step 1 above, shape the materials into the landforms and then tape or glue them onto your cardboard base.



4. Now it is time to paper mache your landscape. Be sure to put down newspaper or a plastic tablecloth where you are working to protect your desk or surface from getting dripped on - paper mache can be a little messy!

Tear newspaper into rectangular-ish strips. Mix together white glue and water in your bowl. The mixture should be roughly $\frac{1}{2}$ white glue and $\frac{1}{2}$ water, but you can adjust it by adding more glue if it seems too runny. Either dip a newspaper strip into the glue and water mixture or use a paintbrush to fully cover both sides of the newspaper strip in the glue and water mixture. You want the strip to be fully covered but you don't want excess dripping or clumping on your landscape. If you decide to dip the strips, run the newspaper piece between two fingers to remove any excess glue and water mixture. Then, place the strip over the landscape skeleton you have created.

Note, for tips about paper mache or for other ingredient options, you can refer to this link: https://www.dltk-kids.com/type/how_to_paper_mache.htm

5. Fully cover the landscape skeleton with paper mache overlapping the newspaper strips and running the strips in different directions. Allow your first layer to dry completely before starting the next layer.



6. Repeat the paper mache (Steps 4 and 5) for at least 3 or 4 layers. For the final layer, use torn white paper (if possible) to make it easier to paint your landscape.
7. While your paper mache is drying, draw a bird's eye view picture/map of your landscape.
8. Now it is time to act like a civil engineer and design your road to be built through your new landscape. The road must go from one corner of your model to the opposite corner. On the drawing of your landscape, draw where you plan to build your road. You may have to build a bridge if your road has to travel over water.
9. Next, paint your landform! Now that your paper mache has completely dried, paint your landforms.



10. Once the paint is dry, build your road onto your landscape. Use black construction paper cut into strips as your road and use popsicle sticks to build your bridges.



11. Now that you're done building your road into the landscape, show off your model!

What Did You Learn?



- What are some different types of landforms?
- Was it harder than you thought it would be to build a road through the landscape?
- Why do you think it is important for engineers to build models before the actual road is built?

Future Learning

- Now that you have built your landscape and the road through it, what would you do differently next time? What other landforms could you incorporate into your design? Could you incorporate other transportation systems into your design? For example, tunnels through mountains or a train track.
- You can visit this website if you would like more ideas for building your landscape:
<http://teachers.egfi-k12.org/road-warriors/>



Share your creations!

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Thanks for discovering with us!