The Sellwood Bridge Project

Activity Book
2013-2014

The Sellwood Bridge Project
Goes to School!
K-12 Lessons & Activity Sheets

Programs developed and delivered by Lois D. Cohen Associates

The New Sellwood Bridge
Open to the Public in 2015!
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Introduction

As part of Multnomah County’s outreach efforts for the Sellwood Bridge Project, Lois D. Cohen Associates (LDC) has developed and implemented a School-Based Outreach Program. The program engages students in the project by:

- **Enriching the curriculum with hands-on learning:** Leading in-class projects and field-based activities to help students apply what they are already learning in math, science and civics to an exciting, real-world project in their community.

- **Exposing students to a variety of career paths:** Increasing students’ understanding of career possibilities by introducing them to technical experts from the Sellwood Bridge Project Team ranging from engineers and environmental consultants to contractors and communications professionals. We also point out to young girls the range of technical careers open to them that they may not have previously considered.

- **Exploring all aspects of bridge building:** Inviting students to explore the environmental, economic, civic and social considerations and impacts of the bridge, and to design solutions that meet standards and address all users’ needs.

The School-based Outreach Program has created a sense of connection to the Sellwood Bridge Project among the students with whom we have worked. Students have expressed excitement about the new bridge and are looking forward to the completion of the project and using the new structure, with its wide pedestrian and bike-paths. Furthermore, the program has engaged our young citizens in one of the largest public infrastructure investments currently taking place in our region. Encouraging students to learn about public projects in their communities has expanded their understanding of civic processes and has opened their eyes to a wide diversity of career paths available to them. This experience has also introduced our younger citizens to the community at large and helped them see themselves as part of a community that extends past their neighborhood boundaries.

This Activity Book and Curriculum Guide is a resource for K-12 teachers and those leading after-school and/or summer or other educational programs. Here, you will find materials and complete lesson plans that are directly relevant to the new Sellwood Bridge. Many of these lessons could be easily adapted for other major bridge projects as well.
Project Description

The Sellwood Bridge Project involves replacing the 87-year-old (built in 1925) Willamette River crossing with a new, seismically-sound structure that offers upgraded facilities for all users, including wider vehicular travel lanes, bicycle lanes, wider sidewalks, lighting, and pedestrian seating areas. Additionally, the bridge is being built to accommodate potential streetcar construction in the future.

The project team is using an innovative detour solution while the new bridge is being constructed. The existing bridge has been moved to the north, approximately 50 feet, and utilized as the detour bridge while the new bridge is being constructed. The team placed temporary piers (supports) adjacent to the current bridge location and slid the existing bridge (truss and deck) onto the temporary supports.

Bridge Users

Due to the lack of other river crossings in the southern Metro region, and its close proximity to the Multnomah/Clackamas County line, the Sellwood Bridge serves a diverse group of users. The bridge is a primary East-West connection for residents and businesses in west Portland/Washington County and those in Sellwood, Milwaukie, and Clackamas County.

Many bridge users are commuters who live in Clackamas County. In fact, 83 percent of Sellwood Bridge trips begin or end outside Portland city limits. Prior to the reduction of weight limits in 2004, the bridge was an important secondary freight route, especially for local deliveries. Weight limits prevent many delivery trucks and TriMet buses from using the bridge, forcing out-of-direction travel that adds to congestion on other routes and increases costs to businesses and consumers.
Did You Know?

**Facts:**
The Sellwood Bridge was built in 1925. The steel continuous truss is one of the only known 4-span continuous truss bridges in the country.

**How much traffic can it carry?**
Today it serves about 31,000 vehicles per day. It is the first Willamette bridge in Portland that was constructed without any trolley tracks. However, the new bridge is being built to accommodate future streetcar tracks!

**How long did it take to build the bridge?**
It took one year to build the old bridge (January-December 1925). It will take four years to build the new bridge.

**What materials were used?**
Steel and concrete.

**Key differences between the old and new bridges:**

<table>
<thead>
<tr>
<th>Old Bridge</th>
<th>New Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truss</td>
<td>Arch</td>
</tr>
<tr>
<td>Narrow vehicular lanes</td>
<td>Wider travel lanes</td>
</tr>
<tr>
<td>One narrow sidewalk, no bike lane</td>
<td>Wide sidewalks and bike lanes on both sides</td>
</tr>
<tr>
<td>Structure damaged by landslide</td>
<td>Landslide mitigation to prevent damage</td>
</tr>
<tr>
<td>No streetcar tracks</td>
<td>Built to accommodate future streetcar tracks</td>
</tr>
<tr>
<td>Buildings underneath</td>
<td>No buildings underneath</td>
</tr>
</tbody>
</table>
Detour Bridge

How will we travel across the river while the new bridge is being built?

Instead of building the new bridge in two phases, Multnomah County used the “Shoofly” method to move the old bridge approximately 50 feet north of its original location. Until the new bridge is ready for traffic, the old bridge is serving as a detour bridge.

First, temporary piers were built to the north of the existing bridge piers and then the entire steel deck truss was slid onto the temporary piers using hydraulic jacks. Temporary approach spans were installed prior to the truss move at the east and west ends of the bridge to link the bridge to SE Tacoma Street and Hwy 43.

Using the old bridge as a detour bridge offers several advantages over building the new bridge in stages:

- The temporary detour structure is as strong as, if not stronger, than the old bridge.
- The new bridge will be built in one single phase.
- Cost savings are estimated at $5 to $10 million.
- It saves up to a year in construction time.
- This approach has the safety benefit of separating construction workers from vehicles crossing the bridge.
- Fewer temporary work bridges are required, resulting in less impacts to the river ecosystem.
Architectural Rendering of the New Sellwood Bridge

Opening to the Public Fall 2015

LOCATION OF BENTS* AND SPANS FOR NEW SELLWOOD BRIDGE

*Bent = A set of columns or other structure that supports one end of a bridge span.

Total bridge length = 1970'-0"
What Would You Do if You Owned the Sellwood Bridge?

After nearly 90 years of public service, the old Sellwood Bridge could have had a new owner and a new home. The bridge has been designated a historic resource which required it to be made available for historic reuse before it is removed to make way for the new Sellwood Bridge. Multnomah County was inviting proposals to buy the bridge until September 12, 2014.

No one stepped up to make an offer on the bridge, perhaps because any prospective buyer would have needed to:

- Move the bridge safely with their own resources
- Cover the steel structure to contain lead paint
- Re-use it in a way that preserves the historic resource
- Have a place to put it
- Prove they can pay to move it safely

Since no buyer was found, the bridge will be demolished in 2015, when the new bridge is in place. The steel, concrete, and even the lead paint will be turned over to the contractor in charge of building the new Sellwood Bridge—Slayden/Sundt. The contractor will sell the bulk of the steel and concrete to a recycling company.

A few pieces, such as the plaque that commemorates the original bridge’s 1925 completion, will be saved. These items will join a host of bridge artifacts already on display in the Multnomah County bridge office. Plaques will be placed on the new bridge to honor the old structure that once stood in its place.
Lesson Plans
**Amazing Newspaper Bridges**

*Summary:* Students will learn about the importance of bridge planning and design and will be provided with an opportunity to creatively construct their own bridge to serve the needs of the citizens who use it. With the Willamette River running through the classroom, small teams of students will work together to plan and then build models of a new Sellwood bridge using just newspaper and tape.

*Objectives:* At the completion of this activity, students should be able to:
- Construct a newspaper bridge
- Explain what it looks like to cooperate with others on planning and implementing an idea

*Materials:*
- Stacks of newspapers
- Masking tape
- Blue fabric, chalk, or other representation of a river on the floor
- Photos of amazing bridges
- Optional student handouts: (Design your Own Bridge, Bridge Matching, Family Chat & Build)

*Instructions:*
- Show students pictures of amazing bridges and talk about creative designs for bridges.
- Present students with a challenge: to design and build a model bridge over a pretend river just using newspaper and tape.
- Divide students into groups of 3 or 4, and give each student some newspaper and tape to experiment with individually, emphasizing that there are ways to make newspaper stronger (folding it, rolling it, etc).
- Each group should agree on a bridge design
- Next, they cooperate to build their bridge
- Students should name their bridge
- Teams take turns presenting their bridge to the class, explaining the features and their design/construction process.

*Grade Level:* 1-3

*Subject Areas:* Architecture, Planning, Engineering

*Duration:* Prep Time: 10 minutes to set-up river. Activity Time: (warm up: 10 minutes, activity: 30-35 minutes, debrief 10 minutes)

*Setting:* Classroom with floor area to build newspaper bridges

*Skills:* Critical Thinking, Planning, Collaboration, Design

**Match-a-Bridge Answers:**
1-Drawbridge, 2-Suspension Bridge, 3-Beam, 4-Arch
Pictures of Amazing Bridges Around the World

Nanpu Bridge (Shanghai, China)  Gateshead Millennium Bridge, England

Millau Viaduct, France

Roll-Up Bridge, England
Design your Own Bridge

If you could build an amazing bridge, what would it be like? Draw your bridge here.
Match A Bridge!

Connect the bridges to the description

1. Portland’s Burnside Bridge

Arch Bridge
A bridge that has a rainbow structure

2. Portland’s St. Johns Bridge

Drawbridge
This bridge allows for boats to go underneath when open

3. Portland’s Morrison Bridge

Suspension Bridge
This bridge looks like it has triangles in it

4. Portland’s Fremont Bridge

Beam Bridge
This bridge can look long and flat
**Family Chat & Build**

Here are some questions to talk about with your family:

1. How many Portland bridges have we crossed together?

2. If we could design a fun bridge what would it look like?

3. What are some different ways bridges are used?

4. Can you build a bridge at home with any of these:
   - paper
   - sticks
   - blocks
   - books
   - Play Doh or clay
   - cardboard
   - popsicle sticks
   - blankets
   - furniture
   - string

Try building different types of bridges and test out how much weight they can hold by putting toy cars, stuffed animals, or other things on them.

Happy Bridge Building!
Beam Bridge and Suspension Bridge Challenge

Summary:
Students will construct a simple beam bridge, testing the load it can withstand, converting it into a suspension bridge, and testing its load again. Each pair of students will receive an illustrated handout to guide them through the step-by-step instructions.

Objective: At the completion of this activity, students should be able to:
- Construct a model beam and suspension bridge
- Explain the forces at play in suspension bridges

Materials: Each small group (of 2 or 3 students will need:
- 7 drinking straws—not flexible
- 1 paperclip
- A strip of masking tape
- A small Dixie cup
- One cup of pennies, marbles, or other dense weights

Note: Students will be introduced to the vocabulary words tension and compression, and asked to identify forces acting on the loaded suspension bridge. Which parts of the bridge are under compression? Which parts are under tension?

Grade Level: 3-5
Subject Areas: Earth Science, Life Science, Math
Durations: Prep Time: 10 minutes
Activity Time: (intro: 10 minutes, activity: 30 -45 minutes, debrief: 10 minutes)
Setting: Classroom
Skills: Analyze, Apply, Construct, Plan
Vocabulary: Tension, Compression, Beam Bridge, Suspension Bridge
Teacher Instructions
Suspension Bridge Building Challenge (30 minutes)

Note: Activity adapted from www.OPB.org

Introduce the challenge and explain to students that they will be building a beam bridge, testing it, converting it into a suspension bridge, and testing it again. (Explain these types of bridges if students are not familiar with them). Give each student the illustrated handout to guide them through the instructions, step-by-step.

- Students will **build the towers** to support the bridge, tape the towers to the edges of two desks or chairs of the same height, and then build the bridge deck. They will have a simple beam bridge.

- Each pair will **test the load** by hanging a small paper cup from a paper clip, and hanging the clip on the bridge deck. Students will **record** how many pennies the paper cup can hold before the bridge fails.

- Students will then **convert the beam bridge into a suspension bridge** using floss and tape. Next, they will test the load again, and discuss and record their results.

- Any groups that finish early can attempt to tweak their suspension bridge so that it spans a gap twice as wide, but still supports the same amount of weight.

- When students are done, explain the terms compression (being pushed or squeezed) and tension (being pulled or stretched).

- Invite students to **create human bridges** that experience tension and compression. To discover tension, two students grasp each other’s forearms and then students lean back. Their arms should stretch out between them. They are under tension. To discover compression, pairs of partners put their hands together, and slowly step backward. Their arms are under tension.

<table>
<thead>
<tr>
<th>Tension</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How to Build a Model Suspension Bridge

Student Instructions

Step 1. Cut two short pieces of straw, each 3 centimeters long. To make a tower, tape two long straws on either side of a short piece of straw, as shown. Tape the long straws together at the top, too. Repeat this to make 2 of these towers:

Step 2. Tape one tower to the edge of a chair as shown below. Tape the second tower to a second chair that’s the same height. Position the chairs so the towers are 17 centimeters apart.

Step 3. Put another straw between the towers so its ends rest on the short middle pieces. This is the bridge deck. Now you have a beam bridge.

Step 4. Make a load tester. Unbend a large paper clip into a V-shape. Poke the ends of the paper clip into the holes on the sides of your cup. Use another paper clip to hang the load tester on the bridge deck.

Step 5. Make a hypothesis: How many pennies do you think your cup will hold before your bridge breaks? Write your guess here: _____________
How to Build a Model Suspension Bridge

Student Instructions 2

Step 6. Test your load! Put pennies in the cup until your bridge fails. How many pennies did your bridge hold?

Step 7. Turn your beam bridge into a suspension bridge. Take away the old bent straw and tie the center of your floss around the middle of a new straw. Place the straw between the towers. Pass each end of the floss over a tower and down the other side:

Step 8. Anchor your bridge. Tie or tightly wrap or each end of floss around a paper clip. Slide the clips out until the floss pulls tight. Tape the paper clips firmly to the desk.

Step 9. Hypothesis #2. How many pennies do you think your new bridge will support?

Step 10. Test it again. Add the pennies. How many did it hold?
Modeling Erosion around Bridges

Summary: This activity gives students hands-on experience modeling the forces of erosion that impact bridges. Students will create a model river and bridge, and will experiment with erosion caused by wind, water, and construction activity.

Objective:

After the activity, students should be able to:

• Describe how bridges and bridge construction can increase erosion and sedimentation.
• Describe how wind and water erosion can affect bridges.
• Optional: Identify at least two erosion mitigation measures that are being used on or around the Sellwood Bridge.

Materials: (materials on right for optional element)

- Drinking straws
- Squirt bottles
- Shallow bins
- Bag(s) of sand
- Panty hose
- Legos/blocks
- Water
- Straws
- Rocks
- Gravel
- Braided yarn or rope
- Sod
- Plastic wrap
- Netting
- Black fabric
- 8 paperclips
- Popsicle sticks

Note: Divide students into groups of 4 to 6. In a large, shallow bin (such as the plastic rectangular bin above), each group will create a simple model of a river with riverbanks and a bridge. The model will allow students to experiment with the erosion impacts caused by bridge construction and with the effects of erosion on the bridge itself. Discuss erosion control before passing out student instructions for modeling erosion around bridges.
Erosion Control Instructions for Teachers

**Set up:** Each group should have the student instructions sheet (next page), a shallow bin with sand that’s thicker along the sides, a pail of water, 2 squirt bottles, 1 toy construction vehicle, 6 straws, Legos or blocks to make a bridge, and your erosion control material (which will be different for each group – see below). Help students create their river by pouring most of the water carefully down the middle of the bin to make a river.

**Blow and squirt:** Before all the sand is all wet, have students model wind erosion by blowing sand around with their straws, and then model water erosion by squirting on the sand and dribbling water on the sand like rain. Discuss what’s happening. Review the term “erosion” (when wind or water wears away at the soil or rock and moves it from one place to another).

**Bridge construction zone:** Model erosion created by bridge construction by letting students take turns driving the toy construction vehicle around the river bank (photo D). Have them “drill” holes in the riverbed with their fingers to make a spot for the piers and bents. Have them set their bridge in the ground and pile sand around the bents and piers to help support it. One pier should be in the water. Have students squirt more water from an “upstream” side around the piers. Discuss any observed erosion or scour: (underwater soil erosion - often around piers). Does soil under the pier erode more on the upstream or downstream side? Would strong squirting around a pier destabilize the bridge?

**Optional- Erosion control methods:** Each group will be modeling one of 5 different erosion control methods. Each group will therefore receive a different erosion control material and a description of their method and how to install it. In their small groups, have a student read the description aloud (see the following pages), and install their erosion control method together. They should then test it out, by squirting water from uphill down the river. Have your students rate their method on a scale of 1 to 10 for how well it controls erosion, and write your rating on the handout provided. The different methods will include:

1. a strip of pantyhose and popsicle sticks to construct a silt fence
2. a small pile of gravel to use as riprap
3. lengths of braided yarn or rope to model straw wattles
4. small pieces of sod to model seeding and vegetation
5. some plastic wrap to model plastic sheeting

**Review:** Print out a Bridge Erosion Bingo sheet for each student. Students walk around amongst their peers, asking each other the questions on the Bingo sheet. A student who answers a classmate’s question writes his or her initials in the box of their friend’s Bingo sheet. The first person to fill in their sheet shouts, “Bingo!”
Erosion Control Student Instructions

1. **Create a river.** Pour most of your water down the middle of the bin with sand piled on the sides like riverbanks.

2. **Blow.** Use your straws to create wind erosion by blowing on dry sand. What happens when you blow on wet sand?

3. **Squirt.** Create water erosion by squirting water on the sand with the water bottles and dribbling water on the sand like rain.

4. **Construction zone!** To start bridge construction work, take turns driving your construction vehicle around the river bank. Drill holes in the riverbed with your fingers for the bridge piers and bents. What is happening to the sand and water?

5. **Build your bridge!** Set your bridge in the ground and fill in sand around the bents and piers to support it.

6. **Create more erosion.** Squirt more water from “upstream” around the piers. Do you see erosion or scour? What might the river current do to the soil around the bridge over 100 years? What might happen in a flood, with deeper, faster-moving water?

7. **Prevent erosion around your bridge!** If your teacher gave you some extra materials, flip to the next page to learn about the erosion control method your group will use, then install it and test it. When you’re done, walk around to see and learn about the other groups’ models.
Erosion Control Methods

GROUP 1 HANDOUT

Silt Fences

Background:
A silt fence is used to control erosion and sedimentation on construction sites. It protects the water quality of nearby rivers and lakes by preventing loose soil from running into the water. Silt fences are made from a piece of fabric stretched between wooden or metal stakes. Silt fences are common because of their low cost and simple design.

To install:
Stretch the black fabric from one popsicle stick to the other. Clip a short end of the fabric onto the long edge of the popsicle stick with two or three clips. Clip the other short end of fabric to the long edge of another popsicle stick with more clips. Decide where to put your fence to control runoff. Stretch the fabric along the area, and bury the ends of the two sticks in the sand. Add a few more popsicle sticks on the downhill side of the fabric to support your fence. Anchor the bottom edge of the fabric by pushing it into the sand along its length, and then test it out.

Discussion:
How well do you think your silt fence controls erosion?
What are the pros and cons of your method?
Why would someone choose to use a silt fence for controlling erosion?
What would you have to do to keep your silt fence working well over time?

Group Supplies: fabric, popsicle sticks, 8 paperclips or small binder clips
Erosion Control Methods

GROUP 2 HANDOUT

Riprap

**Background:**
A wall or pile made of rocks or concrete rubble thrown together in a jumble to protect shorelines, riverbanks, bridges, or other structures from erosion caused by the water. Riprap can be made from different kinds of rocks, or from chunks of concrete rubble recycled after demolishing a building. An erosion filter fabric is often used underneath the riprap to further protect the soil.

**To install:**
Decide where to put your riprap to protect the bridge and land. When using it on the riverbank, first cut and lay down a strip of erosion fabric (the black fabric) on top of the sand to hold the sand down. Spread the riprap evenly on top of the fabric. You may want to pile it around the bridge piers and bents (the supports on the land) too. Test it out by splashing waves around the shore.

**Discussion:**
How well do you think your riprap controls erosion?
What are the pros and cons of your method?
Would riprap be effective at protecting the land and river against erosion caused by heavy rains?

**Supplies:** stones, black cloth, scissors
Erosion Control Methods

GROUP 3 HANDOUT

Straw Wattles

**Background:**

On slopes that are being eroded away, we need to slow down the surface water. Straw wattles can help. A straw wattle on a construction site protects water quality in nearby rivers or lakes from erosion. It is made of straw fibers rolled into tubes. During rainstorms, the rolls slow down the water running down the hill. Water passes through the wattle while trapping the soil and sediment on the uphill side.

**To install:**

Straw wattles are usually installed in rows. Put them parallel to the river’s edge, below the active construction. Before installing, dig a long, shallow trench in the sand for the bottom of your wattle to sit. Place your wattles in the trench and stake them in with toothpicks. Test it out by squirting water down the hill.

**Discussion:**

How well do you think your straw wattles control erosion?

What are the pros and cons of your method?

What would happen if the surface water from rainfall flowed under the wattle instead of over it? How could you prevent this?

**Supplies:** wattles, toothpicks
GROUP 4 HANDOUT

Seeding and Sod

Background:
The best erosion control comes from nature. Plant roots hold soil in place and slow down running water. Their leaves slow the force of the wind, also preventing soil erosion. While almost any plant can help control erosion, plants with deep roots are best. There are two ways to grow plants on construction sites: 1) seeding, and 2) sod.

Seeding is just planting seed, watering, and waiting for plants to grow. One common way to do this is called hydro-seeding, where a slush of seed and planting mix is sprayed on the ground, as shown.

Sod is grass that comes with part of the soil under it, held together by the roots.

To install sod:
Decide where you want your sod to prevent soil erosion. Wet the surface of your soil, and smooth it out as much as possible. Next, lay the sod in strips.

Discussion:
How well do you think your sod will control erosion?
What are the pros and cons of seeding and sod?
If you were going to choose a kind of seed to plant at a construction site near a river, what qualities would you look for in a plant?

Materials: sod (or just dig up a shallow patch of grass with a few inches of soil)
Erosion Control Methods

GROUP 5 HANDOUT

Erosion-control blankets

Background:
On slopes that are being eroded away, we need to slow down the surface water. Erosion-control blankets can help. They are made of many different materials—some natural (like straw or coconut) and some man-made, like plastic. The material usually has lots of ridges to slow down the water.

To install:
First, dig a trench parallel to the river’s edge, along the highest part of the slope where the top of your blanket will be. Put the top edge of the blanket in this trench and pile some sand on this edge. Anchor it with some toothpicks. Spread it out and anchor it with more toothpicks below. Test it out by squirting water on the blanket.

Discussion:
How well do you think your erosion-control blanket will control erosion?

What are the pros and cons of your method?

What would happen if the surface water from rainfall flowed under the blanket instead of over it? How could you prevent this?

Materials: fabric for blanket and toothpicks
BINGO!! Modeling Erosion around Bridges

Find classmates to answer each question and write his or her initials in the box. Fill it up and shout “Bingo!”

<table>
<thead>
<tr>
<th>What is Scour?</th>
<th>True or false: A landslide tore down the old Sellwood Bridge</th>
<th>What is a straw wattle?</th>
<th>True or false: Erosion can damage and destroy bridges.</th>
</tr>
</thead>
<tbody>
<tr>
<td>True or false: The new Sellwood Bridge will be an arch bridge.</td>
<td>What is runoff?</td>
<td>True or false: Building a major bridge is easy.</td>
<td>True or false: Sedimentation makes the river muddy and hurts the fish.</td>
</tr>
<tr>
<td>Which would you rather ride your bike on: the old or new Sellwood Bridge?</td>
<td>True or false: A superstructure is the building where Superman lives.</td>
<td>True or false: It will take about 6 months to finish building the Sellwood Bridge.</td>
<td>Which has or could have streetcar tracks: the old bridge or new bridge?</td>
</tr>
<tr>
<td>What is a pier?</td>
<td>True or false: Many different erosion control methods are being used on the new bridge.</td>
<td>How do plants help prevent erosion?</td>
<td>True or false: An erosion control blanket is a blanket worn to protect you from wind erosion during storms.</td>
</tr>
</tbody>
</table>
## Erosion BINGO!! Answer Key

<table>
<thead>
<tr>
<th>Scour: The removal of sand or sediment from bridge piers by moving water</th>
<th>F: There was a landslide on the side of the bridge, but it did not tear the bridge down.</th>
<th>Straw wattles: Long rolls of straw wrapped in netting, used to hold soil and prevent erosion</th>
<th>True.</th>
</tr>
</thead>
<tbody>
<tr>
<td>True. The deck will be supported by three arches.</td>
<td>Runoff: When water (like rainwater) drains down along the surface of the ground, rather than sinking in.</td>
<td>False! Building a large bridge is very complicated, and often takes several years</td>
<td>True.</td>
</tr>
<tr>
<td>The new bridge! The old bridge does not have a bike lane and the sidewalk is narrow.</td>
<td>False: A superstructure is the part of the bridge that supports the deck.</td>
<td>False. The new bridge will open in Fall 2015</td>
<td>The new bridge is built to accommodate a street-car.</td>
</tr>
<tr>
<td>Pier: The vertical structures that support a bridge roadway.</td>
<td>True.</td>
<td>Their roots hold the soil in place and their leaves can protect the soil from wind and water erosion.</td>
<td>False. It is a fabric “blanket” laid on the ground to prevent soil from washing away.</td>
</tr>
</tbody>
</table>
Mock County Commission Role Play Meeting

**Summary:**

Students representing multiple interest groups will participate in a mock county commission meeting to explore options and decide on the lane configuration of the new Sellwood Bridge (number, types, and arrangement of lanes).

**Objectives:**

At the end of the activity, students should be able to:

- Demonstrate understanding of the complexity of public decision-making processes and the legitimate concerns of multiple interest groups
- Negotiate, collaborate, and problem-solve by coming to an agreement on the proposed bridge configuration with members of different interest groups.

**Note:**

Prior to the lesson, have students complete a reading with background information on the bridge replacement, and review a list of lane design guidelines (provided in subsequent pages).

Students should be divided into interest groups. Our students were divided into these 5 groups:

1. Multnomah County Commissioners (with teacher or one student acting as Chair)
2. Sellwood-Moreland Improvement League
3. Oregon Trucking Alliance
4. The Bicycle Transportation Alliance
5. Automobile Commuters

During the first session, each group should spend some time researching the background of their group online, discussing its priorities, and identifying and drawing a proposed lane design for the bridge, with the guidance of the attached worksheet.

**Grade Level:**
8-12

**Subject Areas:**
Social Studies, Civics, Planning

**Durations:**
Prep Time: 45 minutes  
Activity: 2 hour-long class sessions

**Setting:**
Classroom

**Skills:**
Critical Thinking, Oral Presentation, Analyze, Evaluate, Debate, Plan

Students working together to draft a lane design; Commissioner McKeel reviewing activity.
Mock County Commission Activity
Session 1 Teacher Guide

These activities are meant to prepare students for the mock county commission meeting.

Materials: Print and provide the following:
- Student Preparation handout
- Interest Group handout
- Commissioner's handout
- A large sheet of blank paper for each group

Project Introduction: Provide students with the preparation handout that includes the descriptions of groups, and allow them time to read the handout individually or aloud. Discuss/answer any questions they have. Divide students into the following 5 interest groups, preferably with the same approximate number of students in each group:

- Multnomah County Commissioners
- Sellwood-Moreland Improvement League, SMILE (A neighborhood association)
- Oregon Trucking Association
- Bicycle Transportation Alliance
- Automobile Commuters

Group Research: If time and technology allow, invite each group of students to spend some time researching their interest group online (perhaps 10 minutes). Students should take notes about what they learn.

In their interest groups, students work through their Interest Group worksheets (pages 1 and 2). The group of Commissioners uses the Commissioners' handout, and the other groups use the general "interest group handout." They should work through their questions, discussing their group's priorities, identifying and drawing a proposed lane design (first on the worksheet, then on the large paper), which they will present at the meeting.

The Commissioners group does not need to draw a bridge design. You can show the attached example so they know what a "lane design" drawing might look like, but emphasize that they should not copy these designs - they are just examples. Students should make sure their design does not exceed the maximum width of 75'.

Presentation preparation: Allow students some time to prepare for a short (about 5-10 minutes), informal presentation that they will deliver on the day of the mock meeting. These presentations should allow about half of the time for explaining their priorities and concerns, and half the time for explaining their lane design. The Commissioners' group should be prepared to make a short presentation on their priorities, and to help facilitate the meeting. Collect the draft drawings and remind students to bring their completed handouts on the day of the mock meeting.
Mock County Commission Activity  
Session 2 Teacher Guide

1. **Introduce** and briefly explain the mock meeting, while students are sitting with their interest groups.

2. Student acting as County Commission Chair should **call the meeting to order**, explaining that the commissioners are requesting recommendations for the lane configuration of the bridge (# of traffic lanes, # of bike lanes, # sidewalks, width and arrangement of lanes).

3. Chair invites other student County Commissioners to stand and **introduce the meeting**, and share their priorities and goals.

4. Distribute the **County Commission Meeting notes** handout to each student so they can take notes during their classmates’ presentations.

5. Representatives of each **interest group stand, one by one, to explain their position**, and describe the draft lane design proposals that they created during session 1. Commissioners may ask questions of each group following their presentations.

6. Students now get divided into **four new groups**, with members of diverse interest groups now working together. Each new group needs to collaborate to come up with a new lane design that represents a compromise, taking into account the various positions of its stakeholders and the best elements from the previous designs. Each group will have a worksheet to guide them through this process.

7. One or two students from each group then **present the final collaborative design proposals** to the commissioners. The county chair will summarize the proposed designs and call for a vote from all students on their preferred lane design.

8. **Students vote**, the Commissioners thank them for their proposals, and the Commissioner adjourns the meeting.

**Debrief:**

Lead an open debrief, asking students about observations, challenges they experienced during this process, the complexity of representing the public interest, what they learned, or other questions you have for them.
A new Sellwood bridge is being built, and there is debate over the proposed capacity of the bridge and the number of lanes it should have. In this activity, you will have the opportunity to role play as representatives from County government and various interest groups as you work to reach a decisions on this important matter.

BACKGROUND
The Sellwood Bridge is the busiest two-lane bridge in Oregon, providing the only crossing for a 12-mile stretch of the Willamette River, between Portland and Oregon City. The current 87-year-old bridge has been in a state of disrepair; several years ago, cracks were found in the concrete girders that support the bridge. The cracks were repaired, and the weight limit for trucks crossing the bridge was reduced from 32 tons to 10 tons, which forced many businesses to send their trucks out of the way to other congested bridges. The current bridge also lacks adequate pedestrian and bicycling facilities.

Bridge users include residents of Sellwood-Moreland and surrounding neighborhoods, as well as people who live or work outside Multnomah County. A new bridge is currently being designed, and there was much debate over the capacity of the bridge.

The two primary recommendations were for a 64-foot wide two-lane bridge, and for a 75-foot wide four-lane bridge. A four-lane bridge may benefit some businesses and the freight industry, and many commuters argue that a wider bridge would improve traffic congestion. Opponents preferred a narrower two-lane option, fearing that a wider bridge would damage the character and safety of the neighborhood.

ACTIVITY
You have been invited to an important town meeting to discuss options for the bridge. You will be divided into various interest groups, and will meet with other members of your group to discuss your positions and come up with a negotiating strategy. You will then come together with the other groups to discuss this topic and to make a final recommendation to the Sellwood Bridge decision-makers on whether the bridge should be two lanes, four lanes, or some other number of lanes.
Group Preparation Handout - Interest Groups

Cut on dotted lines and distribute to students in each group.

Your group: Officials from Multnomah County - County officials are committed to providing a newer, safer bridge that meets the needs of residents, pedestrians, cyclists, businesses and commuters. The county views the bridge as a long-term investment and hopes to create a bridge that will meet the needs of the future – in terms of livability, maintenance, environmental protection, and cost, among other things.

Your group: Sellwood Westmoreland Business Alliance - Representing a diverse group of businesses, the Business Alliance works to ensure that their neighborhood businesses thrive. The alliance includes retail stores, restaurants, service businesses, antiques, grocery, real estate, travel and recreation businesses, and more. While some member businesses would benefit from a wider bridge (convenience stores and gas stations, for example), many Alliance members are interested in preserving the character of their neighborhood as a charming and thriving shopping destination.

Your group: Sellwood-Moreland Improvement League (SMILE) - SMILE is a neighborhood association of Sellwood-Moreland residents that includes families with young children, elderly residents, professionals who commute by car, and many others. The group is committed to promoting livability and safety in their neighborhood. They recently organized a march across the bridge, which several hundred people participated in, to “prevent their quiet community from turning into a highway.”

Your group: Oregon Trucking Association - The OTA advocates for the interests and concerns of the trucking industry in Oregon. Trucks are a vital part of our economy, providing jobs and delivering the goods and services we need every day. Safety is a priority for the OTA, and the group generally opposes regulations that interfere with the efficiency of trucking freight around the state.

Your group: Bicycle Transportation Alliance - The BTA works to improve conditions for bicycling throughout Oregon. They work to shape healthy, sustainable communities where people can meet their daily transportation needs on a bike.
Student Handout - Sample Lane Designs

Sellwood Bridge—Activity Book & Curriculum Guide
Student Interest Group Worksheet

Stakeholder Group: _________________________

Objective: Explain your group’s position on the new Sellwood Bridge’s lane configuration and present a corresponding proposed lane design.

Priorities
Read the list of considerations below and circle the priorities for your group. Use the blank lines to the right to list your priorities in order of importance.

Priority list in order of importance:
1. _________________________________
2. _________________________________
3. _________________________________
4. _________________________________
5. _________________________________
6. _________________________________
7. _________________________________
8. _________________________________

Traffic flow
Cost of construction
Cost of maintenance
Safety
Air pollution and/or noise pollution
Visual appeal (from the land, water, or bridge)
Pedestrian/cyclist accommodations
Speed limit (high or low?)
Impact on landscape
Accessibility to local businesses
Convenience as a thoroughfare (bypassing local businesses)
Long-term sustainability of materials
Mass transit accessibility
Other considerations not listed:
____________________________________
____________________________________
____________________________________
____________________________________
____________________________________
____________________________________
Student Interest Group Worksheet 2

1. **Position Statement** - Based on your list of priorities, write a position statement that explains which considerations are most important to your group and *why*.

2. **Proposed Lane Design** – Explain how your group would like the new bridge’s lanes to be configured and how this configuration satisfies your position statement.

3. **Rough Sketch** - Use the space below for a rough sketch of the lanes. Then create a final version of this sketch on a large sheet of paper to present at the mock commission meeting.

4. **Our presenter(s) at the County Commission meeting will be:**
During the presentations, please record the priorities and concerns for each group and any questions you may have for them.

**County Commissioners**

*Priorities/Main Concerns:*

**Sellwood-Moreland Improvement League (SMILE)**

*Priorities/Main Concerns:*

**Oregon Trucking Association**

*Priorities/Main Concerns:*

**Bicycle Transportation Alliance**

*Priorities/Main Concerns:*

**Automobile Commuters**

*Priorities/Main Concerns:*
**Time to Collaborate!**

What are some common priorities or concerns among the different interest groups?

How can you address these shared priorities in a revised lane design for the bridge?

Which priorities/concerns would not be addressed by this lane configuration?

Who will present your new design at the meeting (please choose someone who has not yet presented):

Use the space below for a rough sketch of your revised collaborative design:
Active Youth Citizenship

Steps YOU can take

As a young person, you can have a say in many of the decisions that will affect your life and your community. Here are some ways that young people like you can get informed and get involved in public decisions.

**In your own school:**
- Participate in classroom and school-wide decisions
- Pursue school leadership roles
- Strike up a conversation with your friends about an issue that is important to you

**In your community:**
- Participate in or organize community service projects
- Attend public hearings and other public meetings of interest
- Advertise your cause with wristbands, t-shirts, buttons, etc.
- Participate in Multnomah Youth Commission (MYC), the official youth policy body for Multnomah County and the City of Portland. This group of young people, ages 13-21, provides a voice for youth in the County & City's work.

**In your country:**
- Get involved in a campaign for an environmental or social issue that you care about, or for an elected official who you like.
- Share your views with government officials by writing letters, making phone calls, and speaking at public hearings.
Careers in Planning, Design, and Construction

Summary:
Students will be divided into small groups and presented with various careers involved in bridge building, design, or construction. Student groups will familiarize themselves with various careers while placing them into four broad categories: Bridge Design, Construction, Government, and Environmental/river.

Objective:
At the end of the activity, students should be able to:
- Explain why a large public project like a bridge requires many people with different expertise working together
- Describe 5-10 careers involved in bridge planning and construction

Instructions:
Ask students what careers they think are involved in bridge design and construction, and what they think the people in those jobs do. Divide students into small groups, give them a set of Career Descriptions, and have them read over these. Next, on their activity sheet, students match each career to one of the four broad categories.

Invite each student to identify one of the careers that was interesting to them, or that they might like to try someday. Encourage students to learn more about that career, and if possible, allow time for students to research that career online.
## Career Descriptions – Jobs in Bridge Design & Construction

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpenter</td>
<td>Carpenters build or remodel almost every kind of structure, including houses, business buildings, bridges, churches, factories and highways. They read blueprints (the architect's plans), and they work with many kinds of tools to build structures.</td>
</tr>
<tr>
<td>Cement Mason</td>
<td>Cement masons prepare and repair concrete, including pouring and finishing floors, steps, curbs, sidewalks, and streets.</td>
</tr>
<tr>
<td>Construction Lineman</td>
<td>Construction electrical line workers set up electric lines for homes, businesses, schools, farms, and organizations. They assemble and set up steel towers, wood poles, and cables, and trim trees.</td>
</tr>
<tr>
<td>Sign Fabricator</td>
<td>Sign fabricators craft signs by hand from a variety of materials including metal, plastic and glass. They use tools like computerized cutting machines, and cranes to install and repair the signs.</td>
</tr>
<tr>
<td>Laborer</td>
<td>Laborers help with a lot of different jobs, like clearing timber and brush, removing demolished materials from a job site, installing pipe, handling materials for other trades workers or using explosives to demolish buildings. Laborers are needed on all types of construction projects such as highways, bridges, tunnels, and large buildings, and must be good at working with their hands and using power tools.</td>
</tr>
<tr>
<td>Operating Engineer</td>
<td>Operating Engineers operate construction equipment like heavy-duty trucks, cranes, bulldozers, pavers, rollers, excavators and many other kinds of equipment used in constructing buildings, dams, airports and highways.</td>
</tr>
<tr>
<td>Role</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Painter</td>
<td>Painters apply paints and prepare surfaces for painting. Preparation is the most important part of painting. Traffic control painters paint striping on roads.</td>
</tr>
<tr>
<td>Plumber</td>
<td>Plumbers assemble, install and repair pipes, fittings, and fixtures of heating, water and drainage systems, like sinks, toilets, bathtubs, water heaters, dishwashers and water. Plumbers need to carefully follow the specifications and plumbing codes.</td>
</tr>
<tr>
<td>Architect</td>
<td>An architect plans and designs projects, creating the plans (blueprints) that the contractor uses to build the project.</td>
</tr>
<tr>
<td>Landscape architect</td>
<td>A landscape architect plans and designs outdoor spaces, landscapes and gardens.</td>
</tr>
<tr>
<td>Project Manager</td>
<td>A project manager is usually responsible for planning, carrying out and closing projects in a way that would satisfy the client. They often manage teams, set the project objectives, and manage the cost, schedule and quality of the work.</td>
</tr>
<tr>
<td>Sheet Metal Worker</td>
<td>Sheet metal workers use many different tools to cut, form, attach and install metal fittings together to create things like metal roofing, duct work for heating and cooling systems, or stainless steel work areas for restaurants, kitchens and hospitals, for example.</td>
</tr>
<tr>
<td>Superintendent</td>
<td>A construction superintendent runs the day-to-day operations on a construction site and controls the short-term schedule. The superintendent also makes sure the work is high quality, and coordinates the subcontractors, who are hired to help with smaller aspects of the project.</td>
</tr>
</tbody>
</table>
Careers in Planning, Designing and Building Bridges
Student Activity Sheet

Which Career Matches Which Category? Write the number of the Category next to the Career that it matches. Example: 2 Roadway Paving

**CAREER CATEGORIES:**

1. Bridge Design
2. Construction
3. Government
4. Environmental/River

_____ Demolition  
_____ Biologists  
_____ Project Managers  
_____ Electricians  
_____ Landscape Architects  
_____ Community Relations  
_____ Steel Fabricators  
_____ Concrete Workers  
_____ Federal Highway Officials  
_____ Excavators  
_____ Elected Officials  
_____ Utility Coordinators  
_____ Roadway Pavers  
_____ Financial Experts  

_____ Underwater Divers  
_____ Lighting Designers  
_____ Accountants  
_____ Surveyors  
_____ Lawyer  
_____ Engineers  
_____ Traffic Controllers  
_____ Landscapers  
_____ Crane Operators  
_____ Demolition Experts  
_____ Carpenters  
_____ Hydrologist  
_____ Pipe Fitters  
_____ County Commissioners
# Careers in Planning, Designing and Building Bridges

## Answer Sheet

Which Career Matches Which Category?
Write the number of the Category next to the Career that it matches. Example: 2__Roadway Paving

### CAREER CATEGORIES:

1. Bridge Design
2. Construction
3. Government
4. Environmental/River

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<th>Category</th>
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<tr>
<td>2 Demolition</td>
<td>1</td>
</tr>
<tr>
<td>4 Biologists</td>
<td></td>
</tr>
<tr>
<td>1,2 Project Managers</td>
<td>2</td>
</tr>
<tr>
<td>2 Electricians</td>
<td></td>
</tr>
<tr>
<td>4 Landscape Architects</td>
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</tr>
<tr>
<td>4 Hydrologist</td>
<td></td>
</tr>
</tbody>
</table>
Sellwood Bridge Budgeting and Building Challenge

Summary:
Students will be challenged to build a bridge based on a specific scenario. Students will visit the Sellwood Bridge Store and work within a budget to plan and build a bridge that will support the strength of a toy car.

Objective:
Students will practice their budgeting and mathematic skills while also having a hands-on opportunity to build a bridge. Students will learn the importance of keeping a project on budget, use limited resources to serve the needs of the project, and also practice their design and engineering skills.

Materials:
- Lego blocks
- Popsicle sticks
- Wooden blocks
- String
- Pipe cleaners
- Masking tape
- Cardboard strips
- Glue (free)
- Play currency

Note:
You can choose which materials to use. These were the materials that we used in our Sellwood Bridge Store.
Budgeting and Building Challenge Instructions

Problem:
A car needs to travel from one side of a canyon to another. The canyon is 45 cm wide.

Task:
You and your team need to make a bridge over which the car can travel.

Rules:

- Each group will work together to solve the problems. Your first task is to think of a name for your construction company.

- Next, you need to plan how you will build a bridge that is strong enough to hold a car and long enough to span 45 cm.

- Take a look at the materials list and count how much money you have. Decide how you will use your money to build your bridge. There are no refunds, and you’re not allowed to spend more than you have.

- You must work as a team, plan ahead, decide what to buy, and collaborate to solve any problems that arise.

- After you plan your bridge design, go to the materials store and purchase your materials, then start building your bridge!
**Sellwood Bridge Building Supply Store**

- **LEGO BLOCKS** 5 blocks for $10
- **POPSICLE STICKS** 10 sticks for $5
- **PIPE CLEANERS** 5 cleaners for $5
- **WOODEN BLOCKS** 5 blocks for $10
- **MASKING TAPE** 6 inches for $1
- **CARDBOARD STRIPS** 1 strip for $5
- **STRING** 6 inches for $1

**BUDGET:** Your group has $50 to spend on bridge materials.
Budgeting and Building Challenge
Bridge Planning Sheet

What is the name of your construction company?
____________________________________

What type of bridge do you want to build?
____________________________________

Sketch an example of how you want your bridge to look:

Which materials do you think will be the strongest?
____________________________________

How will you spend your money?

<table>
<thead>
<tr>
<th>Materials</th>
<th>Cost</th>
</tr>
</thead>
</table>
**Glossary**

**Arch Bridge** – A bridge in which the main supporting elements are arches (rainbow-shaped curves). These bridges transfer the weight to the supports on either side.

**Beam Bridge** – The simplest kind of bridge, like a log across a stream. A beam bridge is a horizontal structure that rests on two vertical supports.

**Bent** - The supports for the bridge that stand upright on the land and hold up the bridge.

**Budget** – An amount of money that can be spent. A budget is based on a plan for how the money will be spent.

**Citizenship** – Being a member of a community, and responsibly supporting that community.

**Civic Engagement** – Actions that we take by ourselves or together to make our community better. Examples of civic engagement include asking questions and presenting our positions to our leaders when they are deciding what is good for our community.

**Downstream** - Towards the lower part of a river, closer to the ocean.

**Drawbridge** – A moveable bridge, in which a section of the bridge can be lifted up, moved down, or to the side, to let boats pass under.

**Compression** – The act of being squeezed or pushed; a force that all bridges have to handle.

**Erosion** - When wind or water wear away at the soil or rock and moves it from one place to another.

**Infrastructure** - The basic structures that are needed for a country, region, or organization to function properly. Roads and bridges are an important part of infrastructure.

**Pedestrian** – A person who travels on foot - a walker or runner. Pedestrians also include people in wheelchairs, strollers, or people who are travelling using little wheels, such as roller skates, skateboards, and scooters.
**Pier** - The supports for the bridge that stand upright in the water and hold up the bridge

**Public Works** - Infrastructure projects that are paid for by taxpayers and built by the government. These projects typically create opportunities in the community for people to work, get around, and to be healthy and safe.

**Run-off** - Water from rain or snow that flows over the ground into streams and rivers

**Scour** - Underwater soil erosion that happens around the base of bridges. Bridge scour can weaken the bridge.

**Sedimentation** - When sediment, or gravel accumulates, often as a result of erosion. When this happens in water, it can clog streams, damage water quality and habitat for animals.

**Silt fence** - A filter-like fabric that is stretched between fence stakes along a slope, like the edge of a river. The fabric stops the movement of soil (or silt), and is often used on construction sites to protect water quality and minimize soil erosion.

**Stakeholder** - A person who is involved in or who is affected by a certain action, such as the creation of a bridge or other public project

**Substructure** - The bottom parts, or foundation of a bridge, including any columns or piers that are under the deck

**Superstructure** - The parts of a bridge that lie on top of the substructure (including the deck where the people cross)

**Suspension Bridge** - A bridge that has its roadway suspended from two or more cables passing over towers and securely anchored into the ground

**Sustainability** - The ability to continue a behavior or system forever. Sustainability includes environmental health, economic security, and social well-being.

**Tension** - The act of being pulled or stretched; a force that all bridges have to handle

**Upstream** - Towards the higher part of a river that is closer to the mountains or hills