Hands-On Lab Small groups 45 minutes

Bridging Alligator Alley

SEP Engaging in Argument from Evidence

Students design a section of a causeway to reduce the effects of habitat fragmentation by allowing water and organisms to pass under a roadway.

Safety Information

Remind students to be cautious when using scissors.

Setup

If there are not enough 100 g weights for each group, set up a testing station in one area of the classroom.

Strategies

- Point out the image of the land bridge in the lesson. Show an image of a causeway and ask students how it serves the same purpose for wetlands.
- Encourage the class to aim for a variety of designs that could be used in different locations rather than one "best" design.
- Remind students of the constraint to use just one sheet of paper for their causeway design.
- Encourage students to draw their ideas before they start building.
- Students should test their model to determine whether it supports 100 g in the center. More successful bridges will allow for greater water flow.
- If time allows, students should improve their model or design a new model based on what they learned from testing the first model.

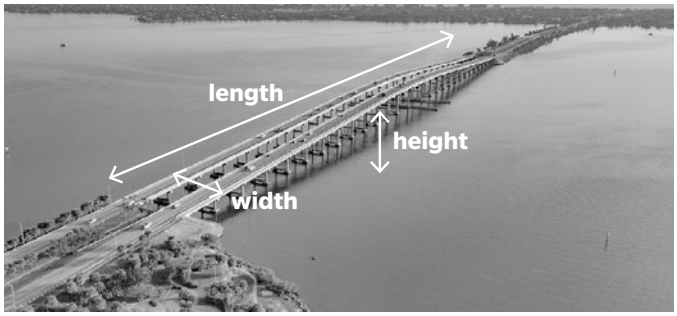
PDF Student Lab Worksheet available online

Name _____ Date _____

HANDS-ON LAB

Bridging Alligator Alley

The Everglades is home to many rare species of aquatic animals. To reduce habitat fragmentation, water crossings in this area can be built as causeways—elevated roads that allow water to pass underneath. Causeways also allow animals, plants, and nutrients to move throughout the wetlands.



A causeway in the Everglades reduces habitat fragmentation.

Procedure

STEP 1 Your task is to design a causeway that meets the following criteria and constraints. Discuss this problem with your team and sketch two or three ideas on a separate sheet of paper.

Criteria
Causeway is 4 cm wide and 20 cm long.
Underside of causeway is 2 cm above bottom of the wetland.
Causeway supports at least 100 grams in the middle.
Allows as much water as possible to flow underneath.

Constraints
Use only the materials listed or provided.
Final design made with one sheet of paper.
Top surface of causeway is flat.

MATERIALS

- glue, white (or glue stick)
- objects to use as a 100 g test weight (options include: coins, mass from a set, washers)
- paper, 3 sheets
- ruler, metric
- scissors
- tape
- markers (optional)

STEP 2 Use one sheet of paper to build a model of your causeway.

Analysis

STEP 3 Test how freely water can pass under the causeway. To do this, (1) measure the total length of the causeway (*L*). (2) Then, measure the width of all the supports (*S*) that block possible water flow. (3) Subtract the space blocked by supports from the total causeway length to get the length of the causeway that allows water flow (*W*). (4) Finally, divide the length that allows water flow (*W*) by the total causeway length (*L*) and multiply by 100 to find the percentage of potential water flow your design allows (*P*).

Total causeway length (L) = 20 cm

Total width of supports (S) = 12 cm

L - S = Length that allows water flow (W) = 8 cm

$\left(\frac{W}{L}\right)$ X 100 = Percentage of potential water flow (P) = 40%

STEP 4 Evaluate your solution based on the remaining design criteria and describe your findings. What changes would you like to make to improve your solution?

Sample answer: The supports of our causeway are too wide, which limits water flow under the causeway. To improve our solution, we will make the supports more narrow.

STEP 5 Revise your causeway design. Once you build and test your new model, repeat the measurements from Step 3 in order to compare your designs.

Sample answer: L = 20 cm; S = 8 cm; W = 12 cm; P = 60%

STEP 6 Use measurements you collected to explain which of your causeway designs is the best solution to this problem.

Sample answer: The revised causeway is a better solution. The supports are narrower which increases the length of the causeway that allows water flow by 4 cm. This results in a 20% increase in potential water flow.

STEP 7 Use evidence from your investigation to explain how causeways increase the stability of ecosystems. Why would a community decide to build a causeway rather than a roadway on a levee that fully blocks a waterway?

Sample answer: Causeways increase the stability of ecosystems by causing less habitat fragmentation, which helps minimize biodiversity loss. Building a roadway on a levee will fragment the water ecosystem and disrupt water flow and animal migration.

Self-Management Use the brainstorming step of the engineering design process as an opportunity to encourage students to respect and value one another's ideas and suggestions. During the brainstorming step, explicitly remind students to take turns making suggestions and recording ideas non-judgmentally.

Hands-On Lab Scoring Rubric

Points	Criteria
	Follows lab procedures carefully and fully
	Organizes data clearly
	Supports conclusions and explanations with valid and reliable evidence