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## Challenges

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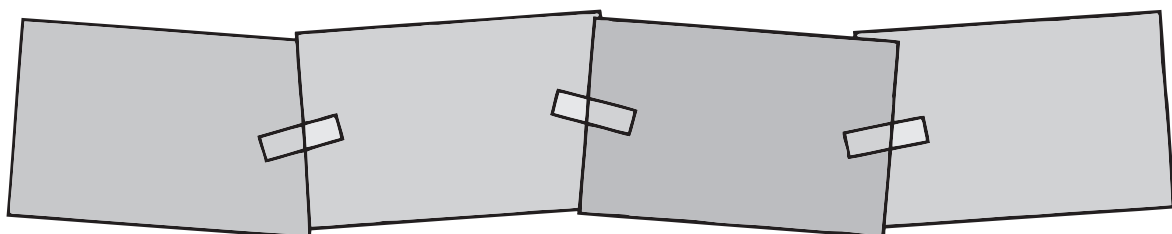
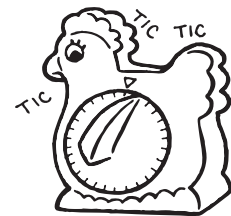
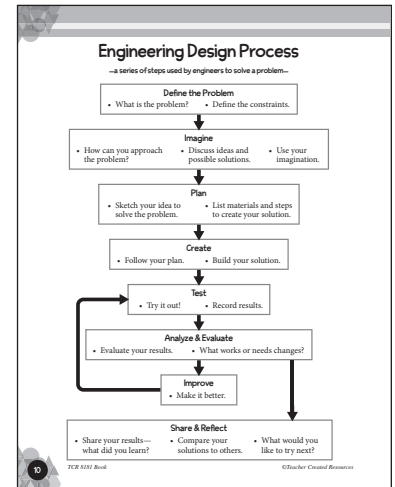
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# Chicken Bridges

## Main Challenge

### Create • Test • Improve

1. Tell students that they will now build bridges to help their chickens get across the road.
2. Display the *Engineering Design Process* (page 10, enlarged if possible) and review it with students. Point out that they have already done the *Define the Problem*, *Imagine*, and *Plan* parts of the process. Go over the *Create*, *Test*, *Analyze and Evaluate*, and *Improve* steps.
3. Ask students how they will test their bridges. (*Put the chicken in the middle of their bridge and see if it falls.*) Emphasize to students that they can keep changing or adjusting their bridges and making them better until the building time ends. Give them access to additional materials if they need them.
4. Have each team claim a small section of the “road” that you have set up in the classroom over which to build their bridge. They should keep their bridge plans with them to refer to as they build.
5. Call each team up to gather the materials on their list.
6. Tell students how long they have for building. Call, “Ready, set, build!” Set a timer if appropriate.
7. As students are working, circulate to observe and encourage students to improve their designs. Ask them to check their bridge to make sure it has or does all the things on the list. If it doesn’t, ask them to make changes to improve it. Resist the urge to make suggestions or to “fix” things for students.
8. If they are really stuck or frustrated, ask leading questions to help them think about how they can improve their bridges, such as, “*It looks like your bridge is sagging in the middle. What could you add or change to make it stronger there?*”



# Chicken Bridges

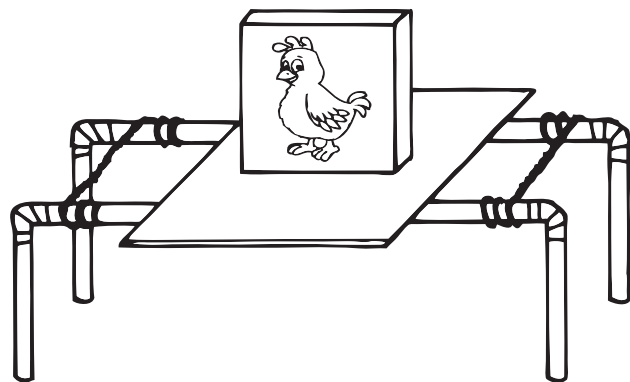
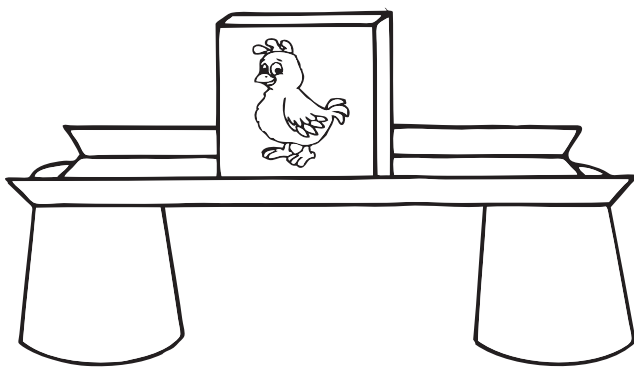
## Main Challenge *(cont.)*

### Analyze & Evaluate

1. Have each team show their bridge to the group or class and explain how they built it.
2. Display the list created earlier, and ask each team to state or show how their bridge meets the requirements.
3. Ask each team to explain any changes or improvements that they made when they were testing. *Note:* This is a good opportunity to take notes for assessment.
4. Ask students to look up and down the road at all the different bridges. Have them describe some of the similarities and differences they observe among the bridges.

### Extensions

- Have students draw and write or dictate stories about why the chicken wanted to go across the road.
- Tape the chickens to small, empty milk cartons or other containers, and have students add pennies or washers for weight. They can test to see how many pennies or washers their bridge will hold.
- Repeat this challenge using fewer materials—for example: only craft sticks, paper cups, and tape, or with a wider span, or have students build bridges between tables or chairs.



Name \_\_\_\_\_

Date \_\_\_\_\_

# Plan a Bridge

## Record

1. Draw a diagram of your idea for your bridge.



2. Label the materials on your diagram.
3. List the materials that you will need to build your idea. Be sure to write how many of each item you need.

|       |       |       |
|-------|-------|-------|
| _____ | _____ | _____ |
| _____ | _____ | _____ |

## Reflect

4. What changes did you make to your bridge?

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5. What was the hardest part of building your bridge?

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6. What part was the most fun?

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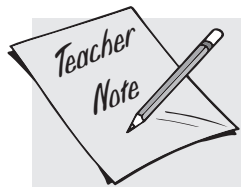
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# Slip and Slide

## Mini Challenge

### Part 1

1. Show students one of the ramps you have set up. Place a plastic bottle cap at the top, and let it slide down.
2. Tell students that they will choose a toy and put it into a bottle cap. The bottle cap will be like a sled for the toy to slide in. They can make a “seatbelt” for their toy to keep it in the bottle cap by putting tape across it.
3. Tell students that they will place different materials on the ramps and will send their toy in a bottle cap down to see which materials give the toy a fast ride.
4. Show students how to place a new material on the slide and how to hold it to the top of the slide with their fingers. Then, place the toy just below where the material is held and let it go or give it a little push. Ask:
  - Do you think the toy went faster this time?
5. Group students in pairs. Give each pair of students a copy of *Slide Materials*. Go over the chart, holding up an example of each material in order to show them what it looks like. You can ask some students to feel each material and to describe to the class what it feels like—*rough, smooth, slippery, scratchy*, etc.
6. To scaffold, run the first test and show students how to mark an **X** in the appropriate column.



**The data in this test is subjective—students are only giving their opinion on whether the toy went “fast.” If you want to standardize the data, you can give each team a stopwatch to time the tests, but you may need longer ramps as students may not be able to push the stopwatch fast enough when testing on a one-foot ramp.**

7. Be sure students understand how to retest the materials that they marked *Yes*, how to choose the fastest one, and how to record it onto the bottom of their recording sheets.

# Slip and Slide

## Mini Challenge (cont.)

### Part 2

- Let each team choose a toy and a bottle cap. They may need a little help taping the toy into the bottle cap.
- Distribute a set of materials to each team, and have them run their tests.
- Have students record their results onto their recording sheets.
- Circulate to observe and ask questions for formative assessment, such as, “Do you think that this material is causing a lot of friction? Why do you think so?”
- Once all teams have recorded their results, bring the class or group back together.
- Give each team a sticky note and have them write their names on it.
- Write the name of each material across the bottom of a whiteboard or chart paper.
- Form a graph by having each team put their sticky note above the material they found gave the fastest ride, stacking the sticky notes vertically to create a column.
- Review the graph with the class, and ask the following question:
  - What can you tell by looking at this graph?
  - Which material or materials did most teams say gave their toy the fastest ride?
  - Were there any materials that no one thought gave the fastest ride?
- Have students turn to their partner and have them discuss which material they want to use to make a slide for their toy.

