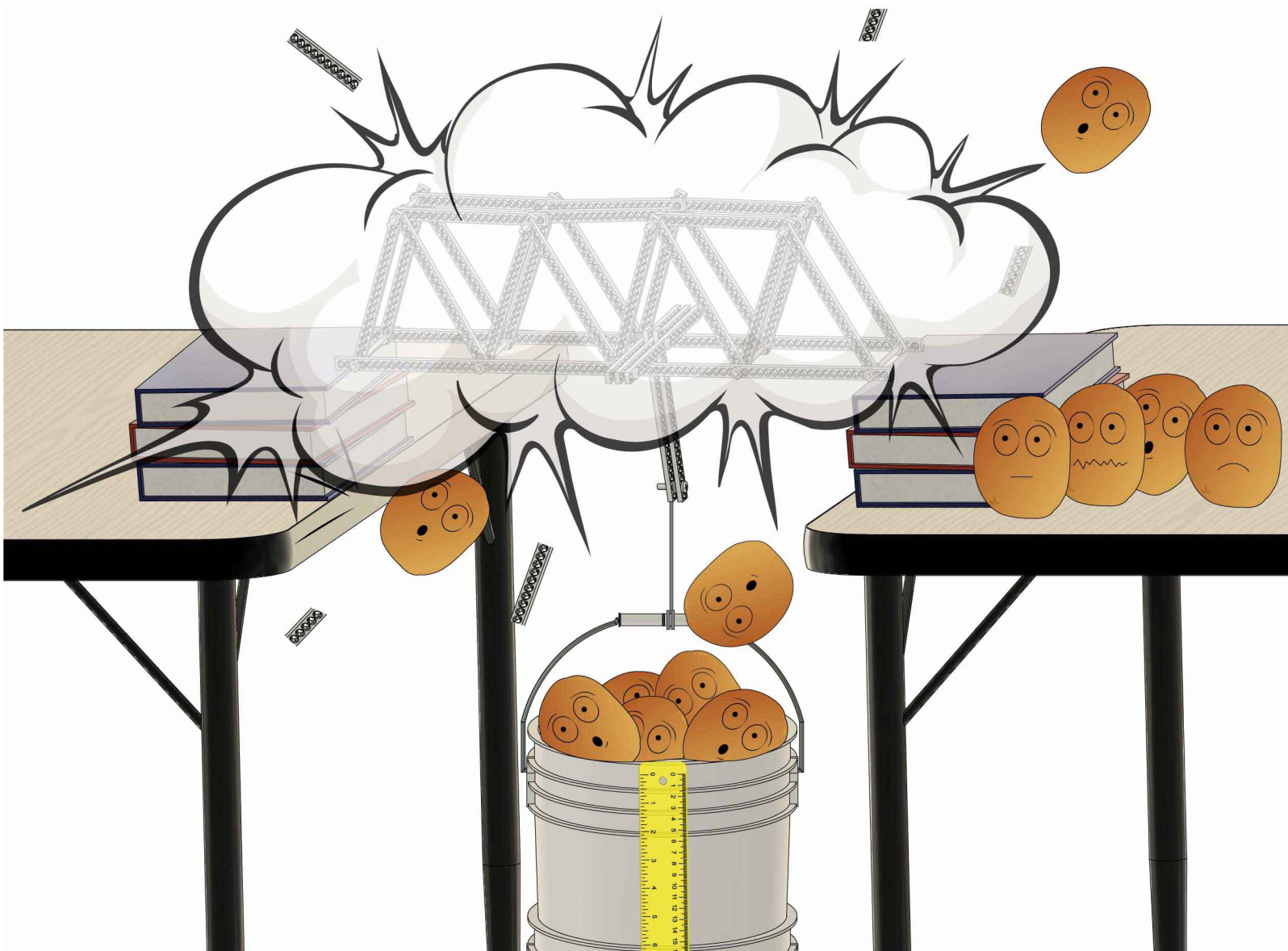


TESTING GUIDE

BREAKING BRIDGES



Get set up to test your bridge! You can test destructively or non-destructively.



WARNING:
CHOKING HAZARD -
Not for children under 3 yrs. Small parts.

Adult supervision required. Not a toy.
Educational product.

Warning: To avoid danger of suffocation, keep enclosed bags away from babies and children.
Do not use in cribs, beds, carriages, or playpens.

Visit teachergeek.com/bridges for more documents and info.

TESTING GUIDE

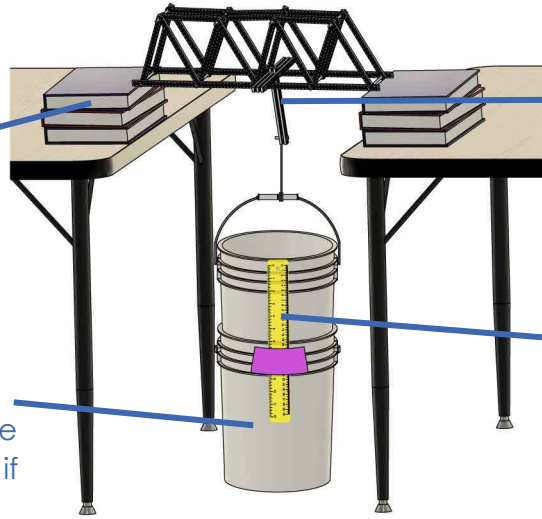
BREAKING BRIDGES

Test bridges with everyday supplies...

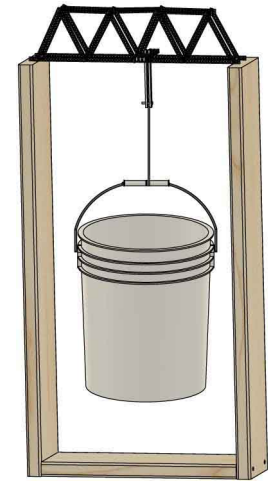


...Or build a wooden station!

Use tables and books as abutments to support your bridge.



Build a hook to attach weights to your bridge.



(Optional) Nested buckets prevent spilling weights and give a softer landing if a bridge fails.

(Optional) Use a ruler to measure bridge deflection.

TESTING SUPPLIES

TeacherGeek Parts

NAME	QTY	PICTURE
17ga. Wire 46cm (18in.)	1	
#10 Lock Nut SKU 1821-26	2	
Short Screws 25mm (1 in.) #10 SKU 1821-22	2	
Long Screws 38mm (1 1/2 in.) #10 SKU 1821-23	1	
Half Strips 15cm (6 in.) SKU 1821-31	5	

Other Supplies

- **2 Buckets** (5 or 7 gal.)
- **30+ lb. of Weights** (potatoes, water bottles, etc.)
- **Tables & Books**
OR
2x8 (12ft.) & **Screws** (3in.)
- **Tape**
- **Safety Glasses**
- **Scale** (optional)
- **Ruler** (optional)

Need to hold more weight?



Get extra-large 7-gallon buckets at teachergeek.com

Half strips can be made by cutting a full 30cm (12in.) strip in half.

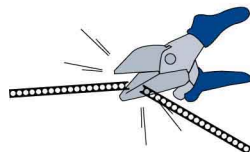
TeacherGeek Tools



Phillips Screwdriver



Pliers



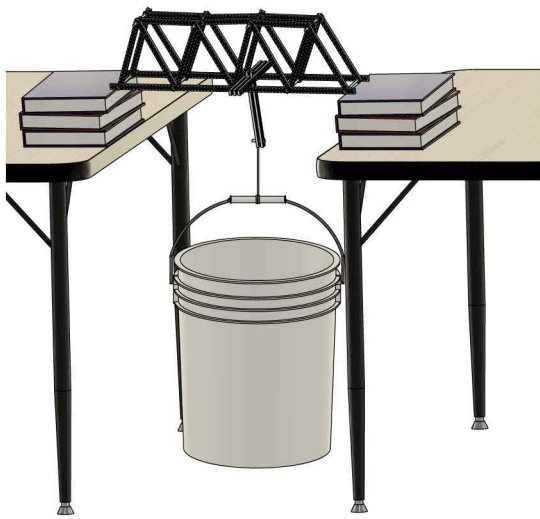
Multi-Cutter
(for making half strips)

BUILD YOUR ABUTMENTS

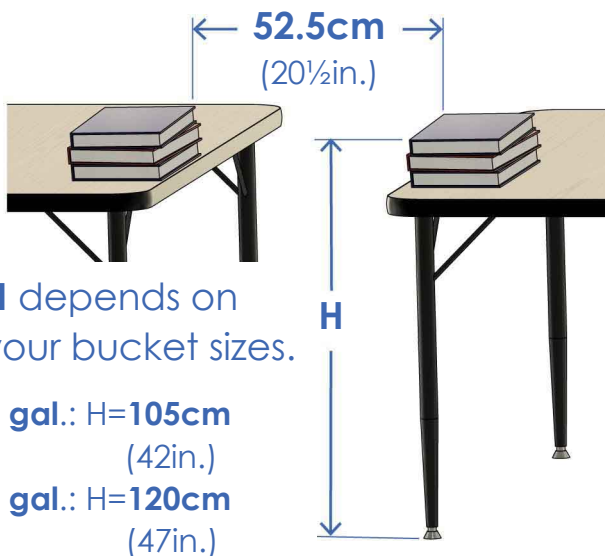
Build abutments to support bridges during testing. You can make "Table Abutments" with common supplies or "Wooden Abutments" with lumber and deck screws (not provided).

WHAT ABUTMENTS WILL YOU CHOOSE?

TABLE ABUTMENTS

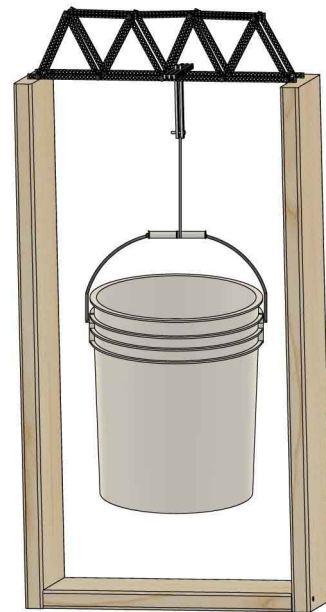


Arrange tables and books using the measurements below.



OR

WOODEN ABUTMENTS

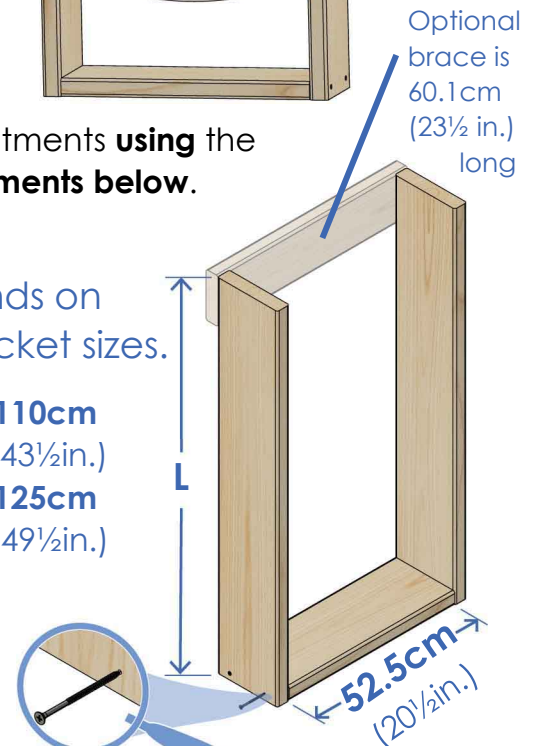


Build abutments using the measurements below.

L depends on your bucket sizes.

5 gal.: L=110cm
(43½ in.)

7 gal.: L=125cm
(49½ in.)



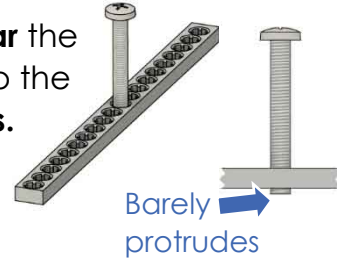
Your abutments are done!

BUILD YOUR WEIGHT HANGER

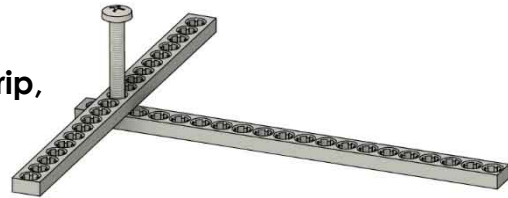
It's time to build a weight hanger! To test your bridge, you will hang this from your bridge and load it with weights.



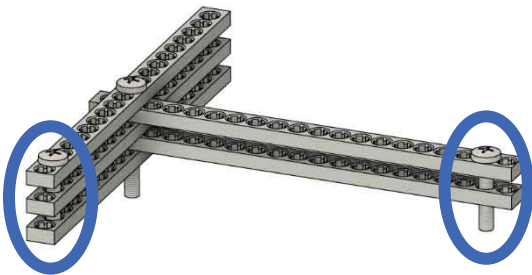
1 Drive a long screw near the middle of a half strip so the screw barely protrudes.



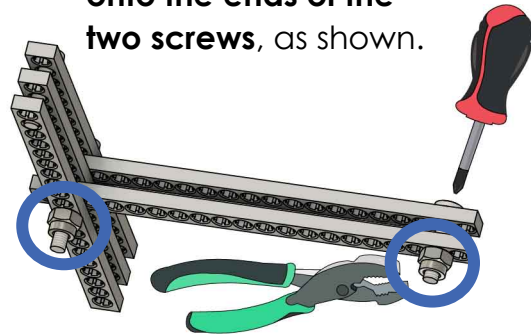
2 Screw on a second half strip, as shown.



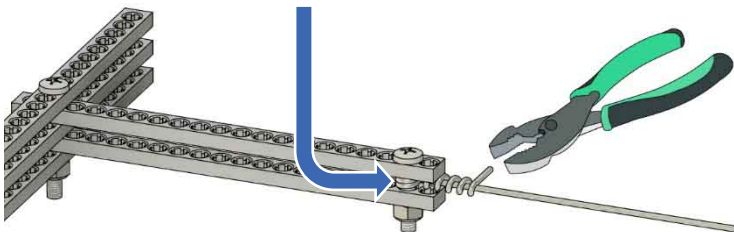
3 Screw on three more half strips, then add two short screws.



4 Twist two lock nuts onto the ends of the two screws, as shown.



5 Twist 17 ga. wire twice around the screw using pliers.

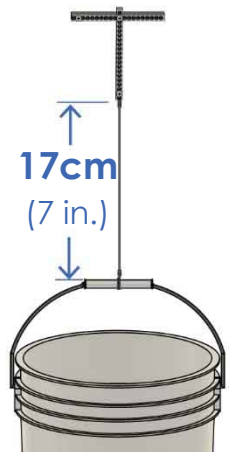


6 Then twist the wire around itself.

7 Attach the hook to the bucket so there is 17cm (7in.) of wire between them.

A Twist the wire twice around the handle.

B Then twist the wire around itself.

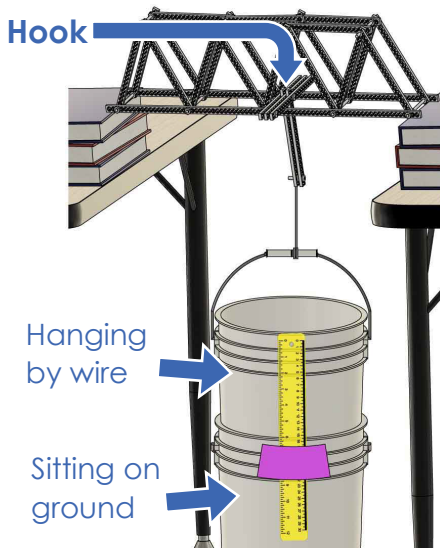


Your weight hanger is ready for testing!
Read on to make it even better.

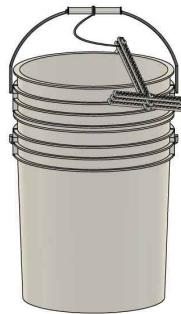
NON-DESTRUCTIVE TESTING

Non-destructive testing is a great tool to find weaknesses in bridge design. By measuring deflection, you can evaluate bridges without breaking them (that comes next).

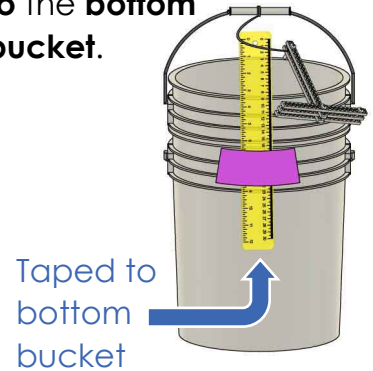
- 10** Set a bridge on the abutments, then add the hook near the middle of the bridge.



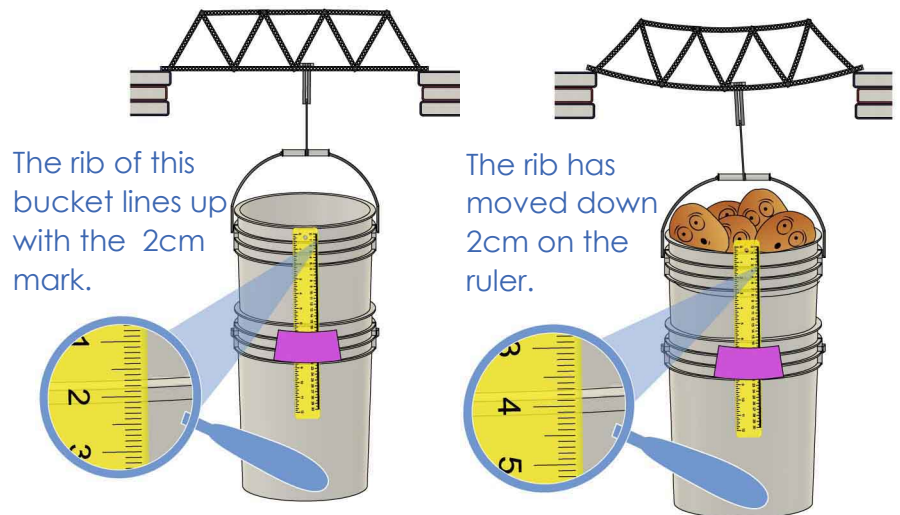
- 8** Put the bucket from Step 7 into another bucket.



- 9** Tape a ruler to the bottom bucket.



- 11** Add weight to the bucket until the upper bucket moves down 2cm on the ruler.



Weights

What's in your bucket?

As you test, you need to add weights to your bucket, and you need to have a way to measure the total weight. Here are some ideas for weights.

Potatoes or Water Bottles

We like potatoes because they are cheap and fun. Water bottles are cheaper, yet. Use a scale or count them to measure weight.

Water or Sand

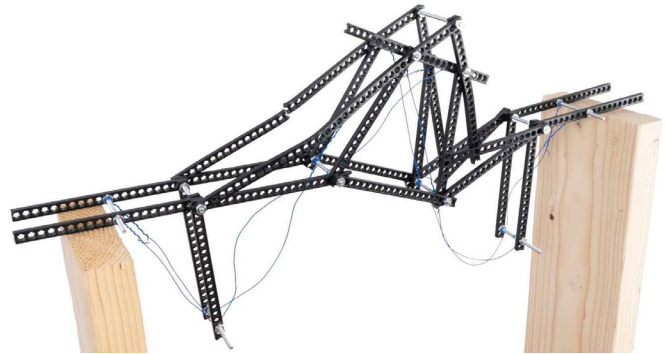
Water and sand allow you to measure the height of the material and extend learning with volume/density calculations. Use two buckets (see Step 7) to help avoid spills.

Other Ideas

Stones. Metal parts. Oranges. Anything dense and cheap can be used as weights. You want weights that can be added in small increments, not in huge chunks.

DESTRUCTIVE TESTING

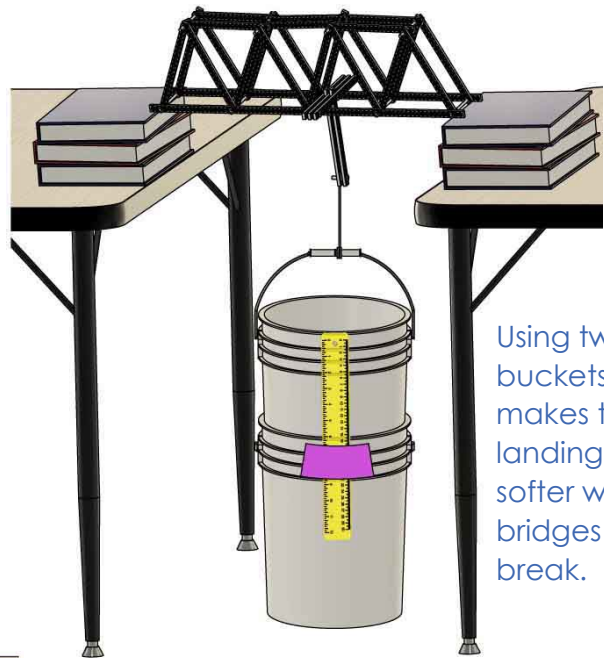
Are you ready to break a bridge? Realize that some bridge members will permanently break and will need to be replaced if you plan on fixing the bridge after this test.



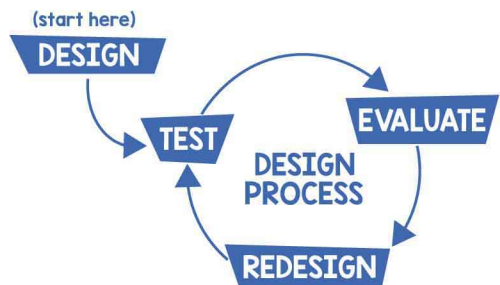
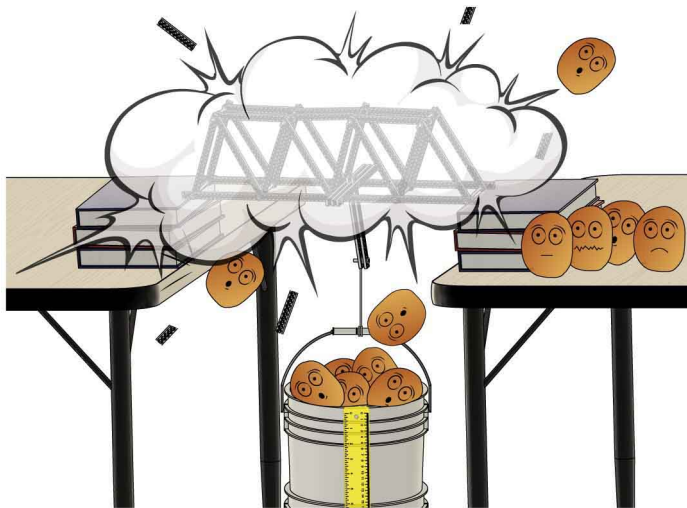
Want to bring mathematics into your testing? Before you break your bridge, check out the optional **Hooke's Law Lab**.

Documents available at teachergeek.com/bridges

12 Set up the bridge as you did in non-destructive testing.



13 Add weights to the bucket until the bridge breaks!



Done with testing? Redesign stronger bridges! The Design Process never ends – there is no perfect design.