

## STRESS THROUGHOUT A STRUCTURE

Engineers design structures that can withstand the forces that will act on their parts. The towing bar on a tow truck must be able to withstand the tensile stress that results from pulling a car. The blade mechanism on a bulldozer must be able to withstand the compression stress that results from pushing against earth and heavy objects. Do you think loads applied directly to one part can affect other parts? For example, does stress on a bulldozer blade affect the joints holding it to the cab?

**Questions & Predictions** Predict and record answers to these questions. Observe and measure for Evidence & Proof below.

1. Can stress applied to the bottom of a glass affect the rim of the glass?
2. Do wood and metal react to stress about the same as glass reacts?

### EVIDENCE & PROOF

**Materials:**

- drinking glass (made of glass);
- shirt button;
- thread;
- wood pencil or craft stick;
- solid metal strip or utensil;
- safety glasses;
- thick gloves

**Process:** Follow these steps. Compare your results with your predicted answers to the questions.



**Caution:** Wear safety glasses. Wear thick gloves when picking up the pieces of metal by their sharp edges.

1. Put the thread through two holes of the button. Hold the ends of the thread so that the button is suspended in air.
2. While your partner holds the glass firmly on the table, dangle the button until it is balanced on the rim of the glass. You do not need to let go of the thread. You do need to let the thread go limp. (See fig. 1)
3. While still holding the glass firmly so that it won't move, your partner should flick the glass near the bottom with his or her fingernail.
4. In the Fig. 2 box sketch the appearance of the button and glass after you have completed Step 3 of the process.
5. Use the button and thread to test how stress reacts in wood and metal. (i.e., Balance the button on the top of a pencil or craft stick. Holding the pencil firmly, flick it near the bottom with your fingernail. Repeat with the metal.)
6. Was the type of stress you tested compression stress or tensile stress? Why?

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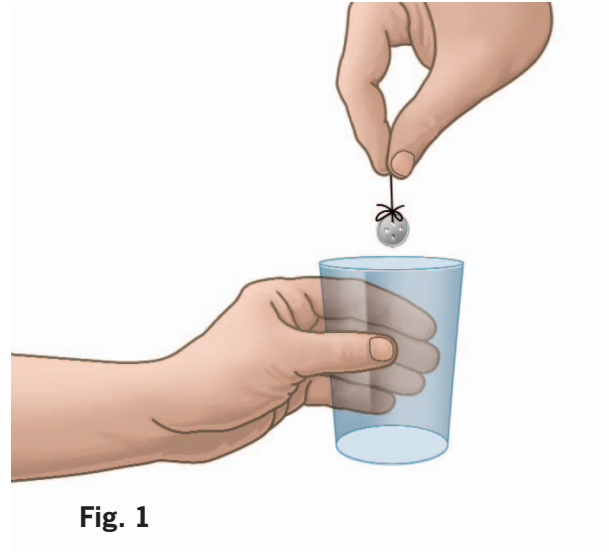


Fig. 1

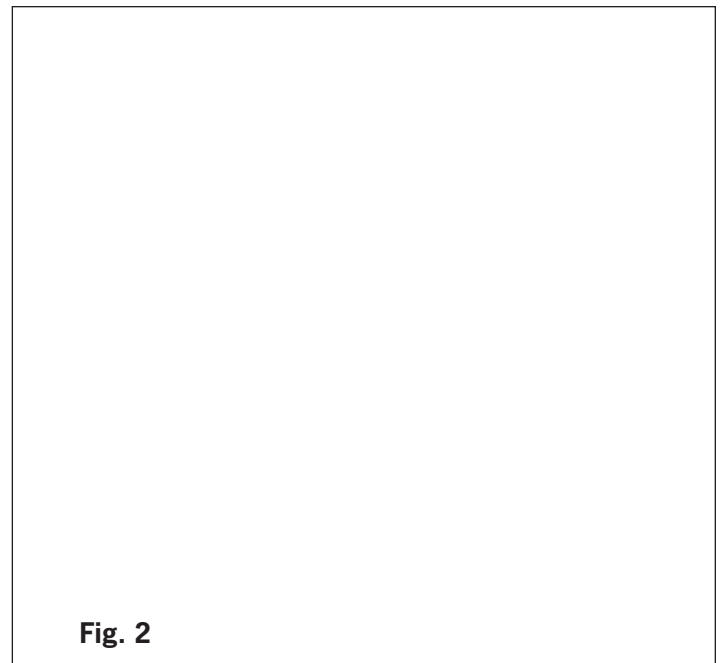


Fig. 2

### CONCLUSIONS & INFERENCE

Bridges are subject to constant vibrations. The vibrations exert stress on the bridge. Do engineers need to worry about

waves and currents in the river when they design the top of the bridge? Why?