## Lesson 5 Building a Suspension Bridge

Objectives: Students will have the opportunity to construct a suspension bridge with constraints. They will experience that the roadway is actually suspended from the cables.

Materials: For whole class:

- Computer with video of Tacoma Narrows Bridge collapsing (download from http://www.archive.org/details/Pa2096Tacoma)
- TV Monitor or Projector
- Small toy car

For each group:

- Two chairs, about 4 feet apart
- Four pieces of cardboard 6x14 inches and taped together to make one long, floppy roadway
- 2-7.5 ft long strings tied to 1 ft rulers at 2 and 10 inches
- 6-17 in strings with clothes pins tied to either end

For each student:

- Balancing a Suspension Bridge handout (Engineering is Elementary)
- Journal
- Pencil

Sponge: Students glue pictures from last session into journal.

Handout: Three Kinds of Bridges

Initial Discussion: Ask students to describe or show bridges they made at home with their families with file cards.

Go over the handout Three Kinds of Bridges.

Ask students what kind of bridges they built in the previous sessions using newspaper (beam bridge). Tell them that they will be building suspension bridges today.

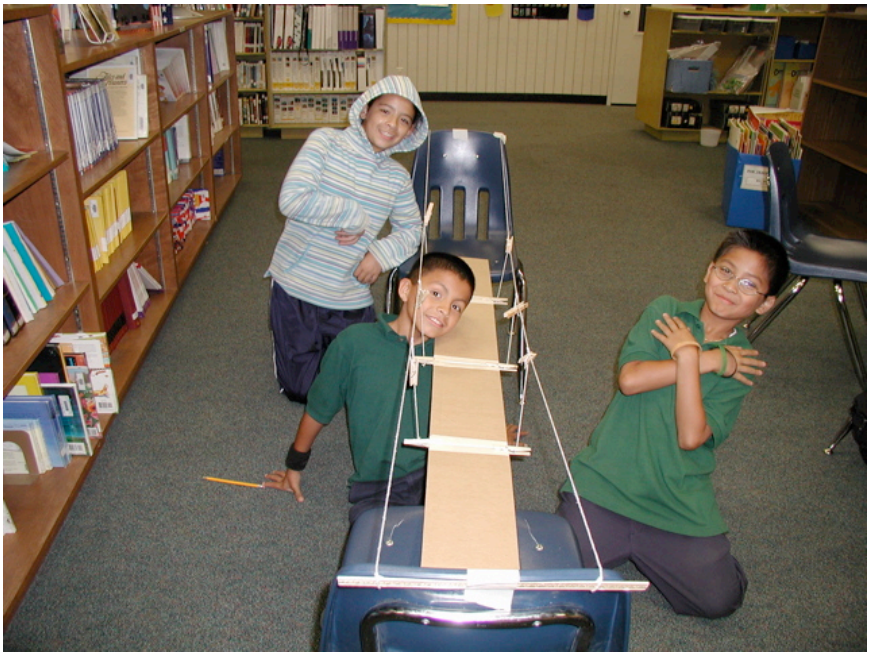
Project: Tell students that suspension bridges are usually used for very long spans where it is not possible to build piers to hold another type of bridge such as a beam bridge.

Show students materials. Tell them that they will tape the ruler with the two long strings to the backs of the two chairs, but that they will use no other tape.

Students will need to hang the roadway from the long strings using the shorter strings attached to clothes pins.

Give the students the Balancing a Suspension Bridge handout. Tell them that they will have 10 minutes to build their bridges, and then they will stop and, as a group, we will test each bridge by pushing the toy car over the bridge. After the tests, they will have an opportunity to make modifications.

After 10 minutes, test each bridge. Have students draw a picture of their bridges on their handout. Give students time to modify their designs. Remind students that engineers often need to make modifications to their initial designs.



Vocabulary: Balance – A state of equilibrium; opposing forces are equal.
Pier – a supporting structure that holds up both ends of a span of a bridge.

Final Discussion: Test final bridges. Have students fill in the rest of their handouts and glue them into their journals.

Talk about the importance of balance and how forces affect structures.

- Forces start things moving and stop them from moving.
- Forces change the direction of movement.
- Forces change the shape of things or even break them.

(From Engineering is Elementary)

Tell students that even after a lot of work, sometimes what seems like a good design fails. Show students the video of the Tacoma Narrows Bridge disaster. Discuss.

Clean up: Make sure that strings do not get tangled

Credits: Based on Museum of Science (Boston) curriculum Balance and Forces & Civil Engineering (see http://www.mos.org/eie/).