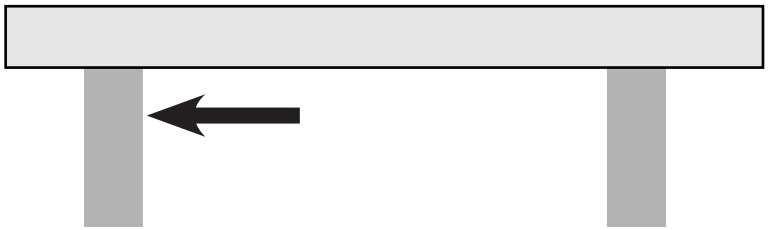
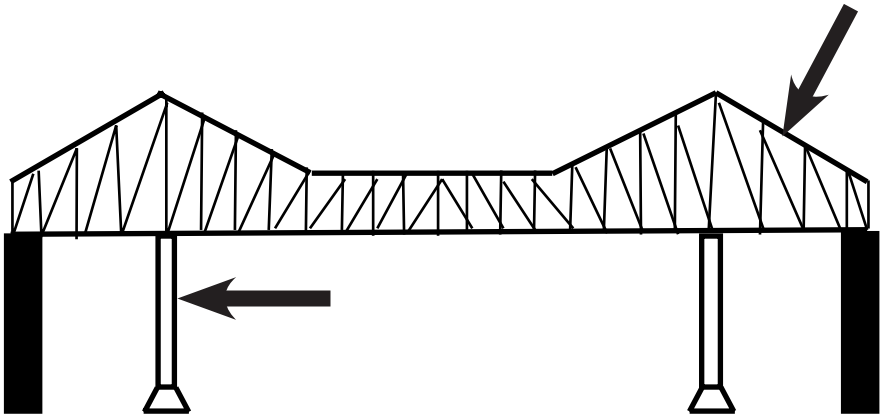
Diagram four different types of bridges.





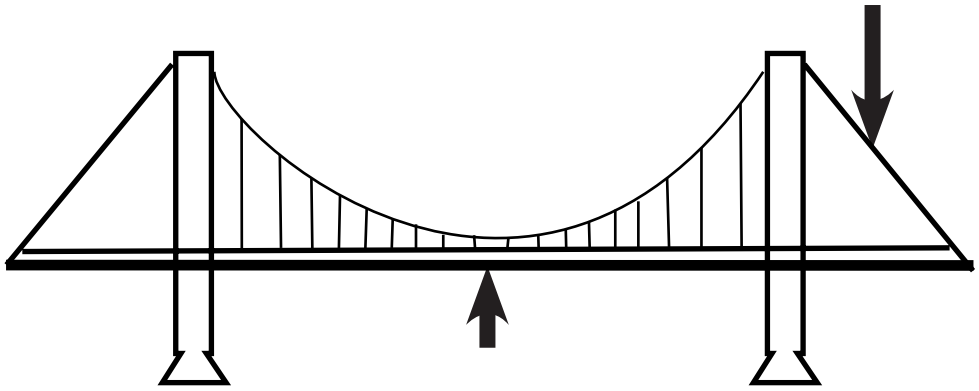
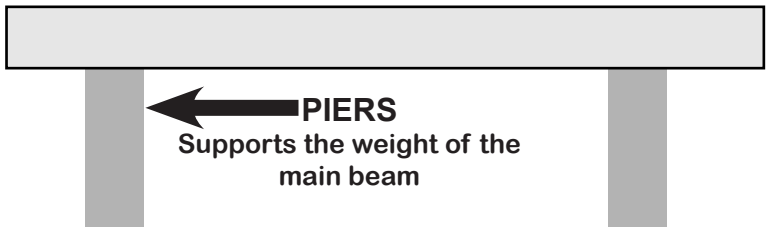


Diagram four different types of bridges.

BEAM

Weight of the beam pushes straight down



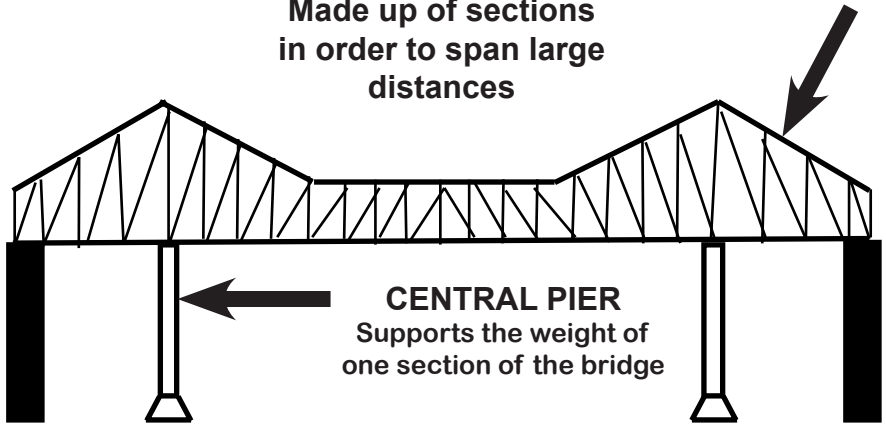
ARCH

Weight is spread evenly

CANTILEVER

Made up of sections in order to span large distances

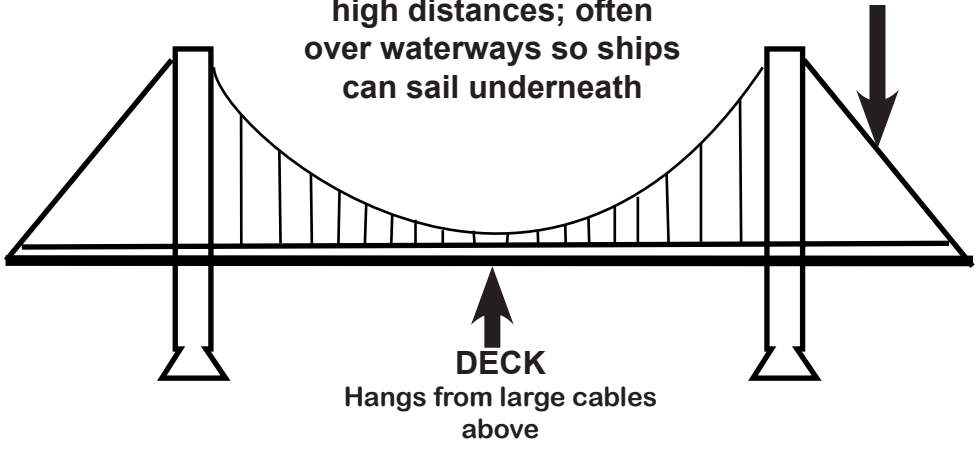
TRUSSES
Patterned rods that strengthen the main beam on any type of bridge



SUSPENSION

Able to span wide and high distances; often over waterways so ships can sail underneath

CABLE
Attached to the ground beyond the towers



Building Bridges

Before looking at the Matchcard, the students can experiment with ways to build bridges to make them stronger. You will need:

- A stack of books (they act as the piers)
- Some index cards (bridge supports)
- Toy cars - Matchbox size is fine
- Yarn or string (tooth floss will also work)
- Tape

Let's Start with a Beam Bridge

Make two stacks of books the same size and close enough together that an index card can span the space between. There's your beam bridge.

Drive a car across the bridge. The index card may sag a bit, but the bridge should hold. What if you added a second car? It's probably getting a bit shakey. I wouldn't want to be in one of those cars if it was a real bridge.

So what would you do?

Experiment Time

Let the student(s) experiment a little with the index cards and see what ideas they have for making a stronger bridge. Than we will build the next three types.

Arch Bridge

To make an arch bridge you may need to raise or lower the height of your bridge by changing the number of books.

Take another index card and bend it into an arch and set it under the beam of your beam bridge. The arch will take the weight and spread it out.

Now try driving your two cars on the bridge. You will notice that the index card is stronger.

Point out that bridges may have a series of arches. Some of the arches may be on top rather than underneath the beams, but they will learn about that coming up.

Cantilever Bridge

Sometimes bridges have to span long distances, for instance when crossing a wide river. You can demonstrate this by taping two index cards together and increasing the space between your books.

You *know* this isn't going to hold your toy car. So we need to make the central pier. Fold an index card in 3rds and tape it to make a triangular post.

Make three more triangular piers. Slide them under each the center of each index card on both sides. They are called central piers because they are in the middle of the section.

You may need to adjust the number of books to make the bridge the right height for your piers.

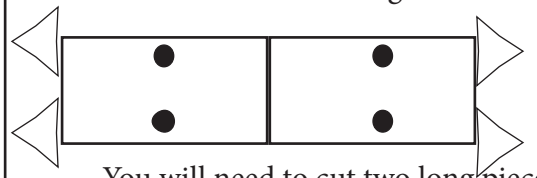
Suspension Bridge

I always thought they were called suspension bridges because everyone in the car was in suspense when we crossed them. Not really. But if I had known they were called suspension bridges because the entire bridge and all those cars were being suspended from the upper beams I would have been in even more suspense.

First, take the piers that were built for the cantilever bridge and turn them into the towers of the suspension bridge. They will be place on either side of each edge of the index card. The triangle should be pointing out and away from the middle of the bridge.

Cut two little snips in the outer corner of the triangular towers. This will help hold the string.

Using a hole punch or a sharp pencil, punch four small holes in the index cards. Punch the holes in the middle of each edge of the card.



You will need to cut two long pieces of string. They should be long enough to go over both towers, across the stack of books, and reach to the table top. Make sure the strings are threaded into the little slits that were cut into the towers. This helps hold them in place.

(Suspension Bridge Continued On Next Page)

Suspension Bridge, continued

Tape the four edges of the cable firmly to the table top with tape.

Now we need to attach the index card beams to the cable suspended from the towers. Cut four more pieces of string about 12 inches long. This is longer than needed, and will be trimmed later. But shorter string will be harder to work with.

Thread one of the stings through the hole in the index card. Then tie it at the age of card with two simple knots.

Now take the other end of the string and loop it around the cable above. Trying to tie a knot the right length can be difficult. Instead, loop it five times around the cable. Then lash it to the vertical string by going around the upper horizontal cable then around the shorter vertical cable five times. That should hold it.

Repeat the process with the other three index cards.

You now have the index card suspended by the cables. Drive your toy car over it. What is holding the weight of the car? What holds your weight when you drive over a suspension bridge?

Poster

There are some truly amazing and beautiful bridges all around the world. Look on the internet for different pictures of large and famous bridges.

Print some of the pictures and make a poster showing samples of the four types of bridges.

Local Bridges

While there are truly spectacular bridges in major cities around the world, it is quite likely that you barely notice the bridges your car travels over day in and day out.

Notice the bridges now. Stop and take pictures if you are able. What type of bridges are most popular in your area?

Trusses

Trusses are triangular rods that give additional strength to the bridge. They are often on the side and act as a railing as well as a source of support. What patterns of trusses can you find on the bridges in your area.

Bridge Building Kits

Commercial bridge building kits are available. You might even do a bridge science fair experiment or compete in a local contest.

Science Fair Idea

Balsa wood is popular for building bridge models. Try this experiment.

What is the difference in the amount of weight a bridge can hold if you add an arch? All other dimensions must be the same.

Technology Information Pieces

BEAM T-1
ARCH T-1
CANTILEVER T-1
SUSPENSION T-1
Weight of the beam pushes straight down T-1
Weight is spread evenly T-1
Made up of sections in order to span large distances T-1
Able to span wide and high distances; often over waterways so ships can sail underneath T-1

PIERS T-1
ABATEMENTS T-1
CENTRAL PIER T-1
TRUSSES T-1
CABLE T-1
DECK T-1
Supports the weight of the main beam T-1
Foundations anchored firmly in the ground T-1
Supports the weight of one section of the bridge T-1
Patterned rods that strengthen the main beam on any type of bridge T-1
Attached to the ground beyond the towers T-1
Hangs from large cables above T-1

To Make Your **MatchCard** more durable:

1. Put the student MatchCard in a clear plastic page protector.

2. Laminate the information pieces. You can also make them sturdier by covering the paper with transparent tape prior to cutting the pieces out.

3. For more ideas on how to use the MatchCards, and for keeping a notebook for review, see the Instructor's Guide.

4. The complete Technology Unit Study provides the student worksheets, answer key, and teaching activities for this and 5 other objectives. See the website for more information.