Build a Bridge

The following practical activities and challenges should be completed in groups, and can be undertaken over a series of lessons.

It is time to put theory into practice and create your own class bridges.
The ‘Building Bridges’ resource pack provides information and activities on different types of bridges built across canals and rivers.

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Build a bridge: Beam

Test your beam bridge to see how strong it is.

Equipment: Per group - a selection of books, 10 strips of card, selection of small weights such as pennies or multilink (alternatively, replace the books with plastic cups)

Step One
Place the books in two piles of equal height and ensure that there is a gap of 10cms between the two piles.

Lay one strip of card across the two piles of books so that it covers the gap.

Step Two
Place the small weights onto the strip of card until your card falls into the gap. How much weight did it hold?

Test your bridge by changing the amount of card used and the width of the gap, using the chart on the next page.
Build a bridge: Beam

<table>
<thead>
<tr>
<th>Gap</th>
<th>1 strip of card</th>
<th>4 strips of card</th>
<th>7 strips of card</th>
<th>10 strips of card</th>
</tr>
</thead>
<tbody>
<tr>
<td>10cm</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
</tr>
<tr>
<td>13cm</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
</tr>
<tr>
<td>16cm</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
</tr>
<tr>
<td>19cm</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
</tr>
</tbody>
</table>

Record how much weight each bridge took.
Test your arch bridge to see how strong it is.

Equipment: Per group - a selection of books, 10 strips of card, selection of small weights such as pennies or multilink (alternatively, replace the books with plastic cups)

Step One

Place the books in two piles of equal height and ensure that there is a gap of 15cms between the two piles. Cover the gap between the two piles of books with one strip of card. Place another strip in an arch shape between the two piles of books. Make sure the top of the arch meets the underside of the cover.

Step Two

Place the small weights onto the strip of card until your card falls into the gap. How much weight did it hold?

Test your bridge by changing the amount of card used and the width of the gap, using the chart on the next page.
Build a bridge: Arch

Record how much weight each bridge took.

<table>
<thead>
<tr>
<th>Gap</th>
<th>1 strip of card</th>
<th>4 strips of card</th>
<th>7 strips of card</th>
<th>10 strips of card</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 cm</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
</tr>
<tr>
<td>18 cm</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
</tr>
<tr>
<td>21 cm</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
</tr>
<tr>
<td>24 cm</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
<td>weight</td>
</tr>
</tbody>
</table>
Compare the results between your beam bridge and your arch bridge.

Which type of bridge is stronger?

_____________________________________________________________________________

Why?

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________
Build a bridge: Cantilever

Equipment: Per group - a selection of books, 2 plastic cups, strips of card or rulers, selection of small weights such as pennies or multilink

**Step One**

Place the books in two piles of equal height (and the same height as your plastic cup) and ensure that there is a gap of 30cms between the two piles.

Place a plastic cup approximately 5cms away from each pile of books, inside the gap.

**Step Two**

Lay a strip of card or ruler on each pile of books, with 5cms of card resting on the pile, and the rest of the card laying over the plastic cup.

Place a small weight on top of the card which rests upon each pile of books. Make sure the weight is the same on each.

Create your own cantilever bridge.
**Build a bridge: Deflection**

Architects and engineers wish to avoid any deflection when designing and building a bridge.

**Key terms**

<table>
<thead>
<tr>
<th>Compression</th>
<th>How to calculate deflection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**Tension:** The process of stretching something tight.

**Compression:** The process of pushing something together.

**Deflection:** The amount of movement that occurs when an object is put under stress from a load.

When testing your beam bridge, did you notice any deflection?

- Height of unloaded bridge: 8cm
- Height of loaded bridge: 6cm
- Deflection: 2cm
Could you change the materials used to make your bridge stronger?

Experiment with the sheets of card. Can the sheets of card be folded in a different way to make it stronger? Try a cylindrical or concertina shape. Record your results in the same way as before so that you can easily compare.

<table>
<thead>
<tr>
<th>Could you change the materials used?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange your strips of card for:</td>
</tr>
<tr>
<td>Plastic, sugar paper, straws, balsa wood, lollipop sticks</td>
</tr>
<tr>
<td>Exchange your small weights for:</td>
</tr>
<tr>
<td>A variety of coins, pencils</td>
</tr>
<tr>
<td>Exchange your pile of books for:</td>
</tr>
<tr>
<td>Plastic cups, wooden blocks, balsa wood, lollipop sticks, straws</td>
</tr>
</tbody>
</table>

Have you discovered which bridge building technique and which type of material forms the best bridge to span a waterway? Draw your final design, remember to label it and include all specifications.
Build a bridge: Suspension Challenge

Is your class up to the challenge of creating a giant suspension bridge?

Materials you could use to create your suspension bridge:

<table>
<thead>
<tr>
<th>Chairs</th>
<th>String</th>
<th>Masking Tape</th>
<th>Tables</th>
<th>Wood</th>
<th>Plastic</th>
<th>Rope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sticky Tape</td>
<td>Tubes</td>
<td>Tin Foil</td>
<td>Cardboard</td>
<td>Staples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe Cleaners</td>
<td>Tins</td>
<td>Small Weights</td>
<td>Corriflute</td>
<td>Glue</td>
<td>Straws</td>
<td></td>
</tr>
</tbody>
</table>
Always remember to stay SAFE near water - Stay Away From the Edge!