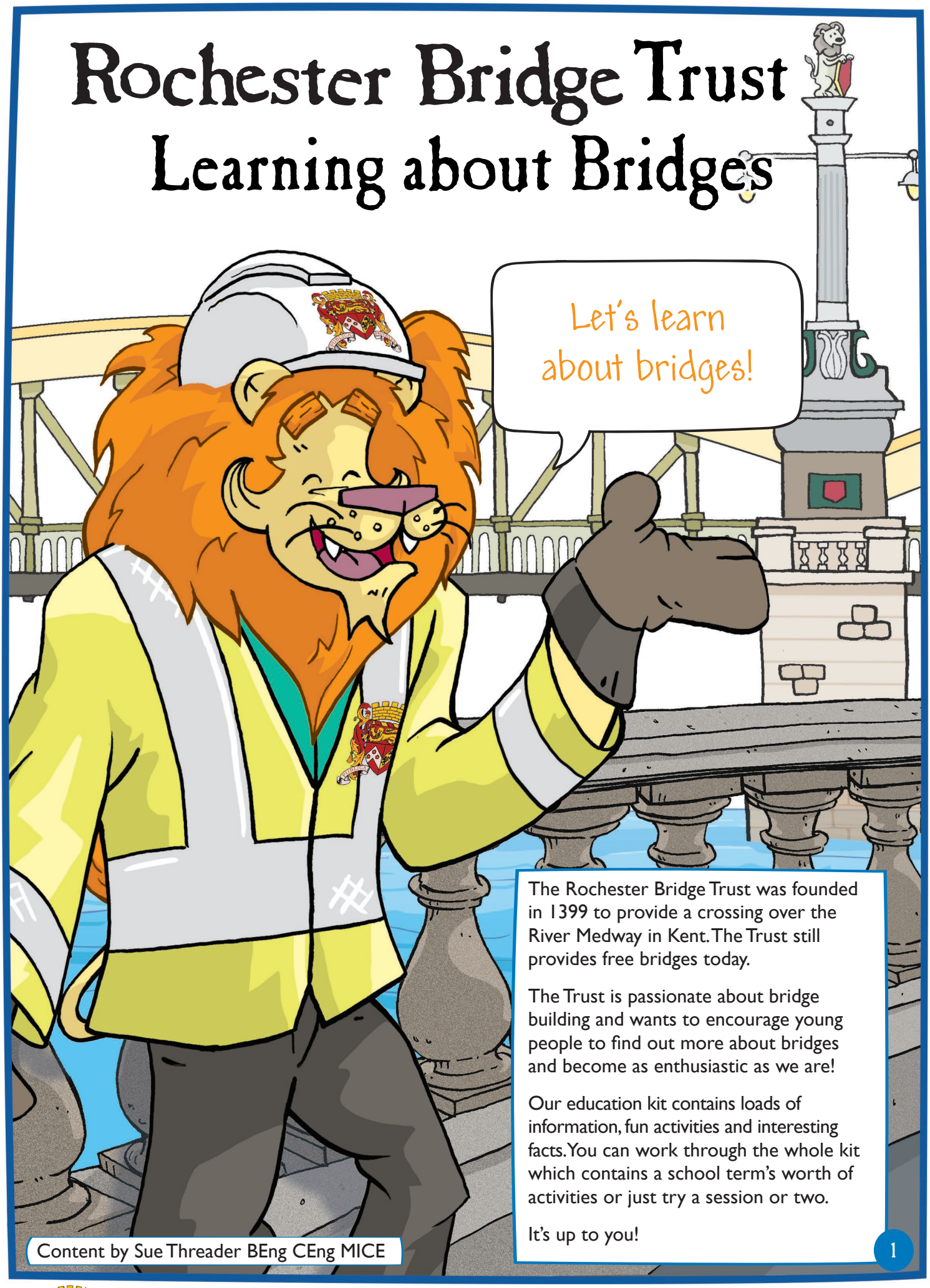
Rochester Bridge Trust
Learning about Bridges



The Rochester Bridge Trust was founded in 1399 to provide a crossing over the River Medway in Kent. The Trust still provides free bridges today.

The Trust is passionate about bridge building and wants to encourage young people to find out more about bridges and become as enthusiastic as we are!

Our education kit contains loads of information, fun activities and interesting facts. You can work through the whole kit which contains a school term's worth of activities or just try a session or two.

It's up to you!

Content by Sue Threader BEng CEng MICE

About the Rochester Bridge Trust

The first bridge at Rochester was built by the Romans soon after the invasion of Britain in AD43. Once the Romans left, their bridge was maintained by the local people of Kent until the 14th century. In 1381, the River Medway froze solid and, when the thaw came, the ice and floodwater swept away the Roman Bridge.

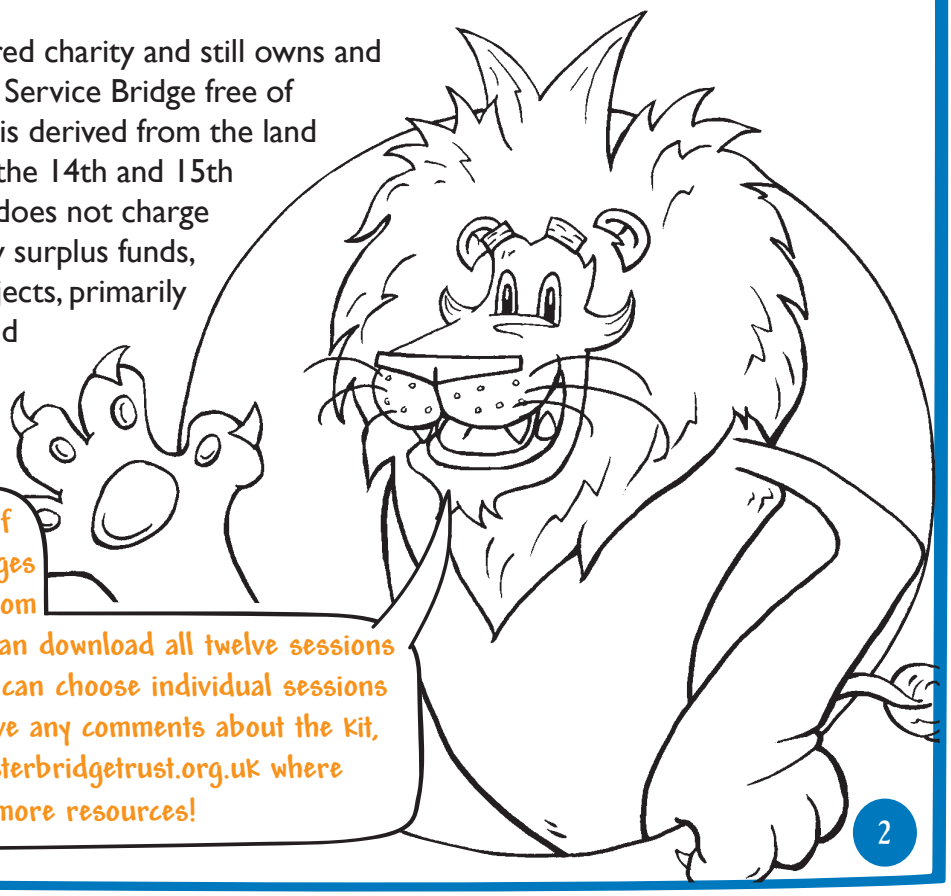
Two benefactors built a new stone bridge one hundred yards upstream which was opened in September 1391. Their names were Sir John de Cobham and Sir Robert Knolles. Together the benefactors also persuaded their friends and acquaintances to make donations of land and money for the perpetual maintenance of Rochester Bridge. In 1399, King Richard II granted letters patent which allowed the Rochester Bridge Trust to be set up to care for the bridge and its property. Two Wardens were appointed to manage the bridge.

For the next 457 years, the Wardens looked after the medieval bridge. Major improvements were carried out by the civil engineer, Thomas Telford, in 1827. However the increase in road and rail traffic as a result of the industrial revolution meant the stone bridge's days were numbered.

In 1856, the Trust completed a new cast-iron arch bridge on the line of the original Roman Bridge. It was designed by Sir William Cubitt who had been the civil engineer for the Crystal Palace built for the Great Exhibition in 1851. The old medieval bridge was then blown up for the Wardens by the Royal Engineers using gunpowder.

The Victorian Bridge was reconstructed in 1914 as a bowstring truss and is today known as the Old Bridge. A second road bridge, the New Bridge was opened to traffic in 1970. Between the two road bridges there is the Service Bridge which carries pipes and cables across the river.

The Rochester Bridge Trust is a registered charity and still owns and maintains the two road bridges and the Service Bridge free of charge to the public. The Trust's money is derived from the land and money given by the benefactors in the 14th and 15th Centuries. It receives no public money, does not charge tolls and does not raise funds. With any surplus funds, the Trust supports other charitable projects, primarily the preservation of historic buildings and education projects in the field of engineering, particularly civil engineering.



Hello! I'm Langdon the Lion, guardian of Rochester Bridge. Welcome to my Bridges Education Kit, which was downloaded from www.rochesterbridgetrust.org.uk. You can download all twelve sessions along with presentation slides, or you can choose individual sessions with supporting worksheets. If you have any comments about the kit, please visit our website www.rochesterbridgetrust.org.uk where you will also find lots more resources!

Session 5 – Truss Bridges (Part 1)

Aims & Objectives

- *To understand that triangles are the strongest shape for building bridges*
- *To show how triangles can be used to make stronger bridges*
- *To introduce the* **Truss Bridge**

You Will Need:

- ☐ PowerPoint Presentation C
- ☐ Laptop, projector & screen
- ☐ For each pair of children:
  - 7 identical lengths of card with a hole punched in each end (30 centimetres x 3 centimetres)
  - 1 longer piece of card which will fit across the diagonal (43 centimetres x 3 centimetres)
  - 7 paper fasteners
- ☐ A K'nex® set, preferably the K'nex® Education "Bridges – Introduction to Structures" set per group of 4 children
- ☐ HANDOUT: Building a Truss Bridge With K'Nex

It can be difficult to design beam bridges that are strong enough to carry railways so engineers often use Truss Bridges.

Context

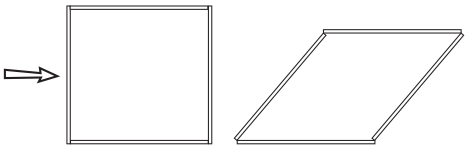
Truss Bridges *are one of the oldest types of modern bridge and were widely used throughout the 19th century, especially for railway bridges. They are very economical to construct because they make efficient use of materials. Initially they were built using timber but gradually iron and steel came to be used. It is relatively straightforward for engineers to calculate the forces in a* **Truss Bridge**.

Session Activities

1. How Can Shapes Make a Bridge Strong?

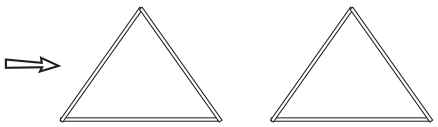
Show the children PowerPoint Presentation C of images of structures from around the world. Ask the children if they notice anything that is similar about the structures. Lead the children to see that all the structures include a combination of triangle shapes.

- In pairs, ask the children to make a square from four strips of card of the same length and some paper fasteners. When they have made their squares, get them to hold the square with one side resting on the table and pushing or pulling on any side of it. They will see that the square immediately loses its shape and becomes a diamond. It is not a rigid shape.

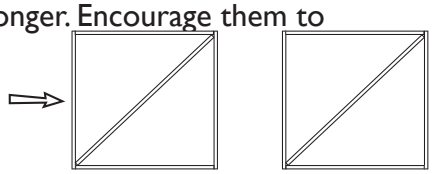


- Next, get the children to make a triangle (with equal sides) in the same way. When they push or pull

the sides, they will see that the triangle holds its shape. Triangles do not twist, bend or collapse easily in comparison with rectangles and other shapes. A triangle, is the only shape that cannot be pushed or pulled out of shape without changing the length of one of its sides. It is a rigid shape.



- Now get the children to think about how the square could be made stronger. Encourage them to add one strip of card across the diagonal of the square and fasten it with the paper fasteners. Again, get them to test the shape to see how much strong it has become by making it into two triangles.

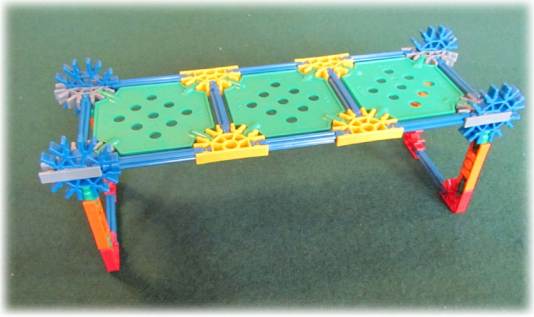


2. Exploring Truss Bridges

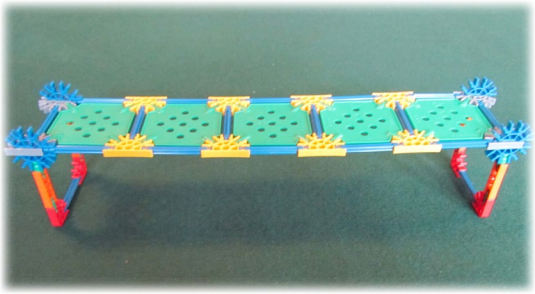
For your convenience, there is an illustrated guide on the following page.

- In groups of 3 to 4 children, construct a simple **Beam Bridge** using K'nex® (3 deck slabs).
- Push gently on the centre and show this is a strong structure.
- In groups, extend the **Beam Bridges** to 5 deck slabs.
- Again, push gently on the centre. Notice that the long bridge is much more "bendy" in the middle and not as strong as the short bridge.
- Lead the children in a discussion about the limitations of **Beam Bridges**. They are great for short distances, but what if you want to span a longer distance? As they get longer, **Beam Bridges** get weaker.
- How can we make it stronger? Ask what is the strongest shape? (Answer: The Triangle.)
- Explain that a bridge made of triangles in this way is called a **Truss Bridge**. In groups, use the 5 deck slab bridge and add triangles to build different models of **truss** (one per group). There are lots of different ways to arrange the triangles. Some ideas are given in the K'nex® pack or you could ask the children to experiment.

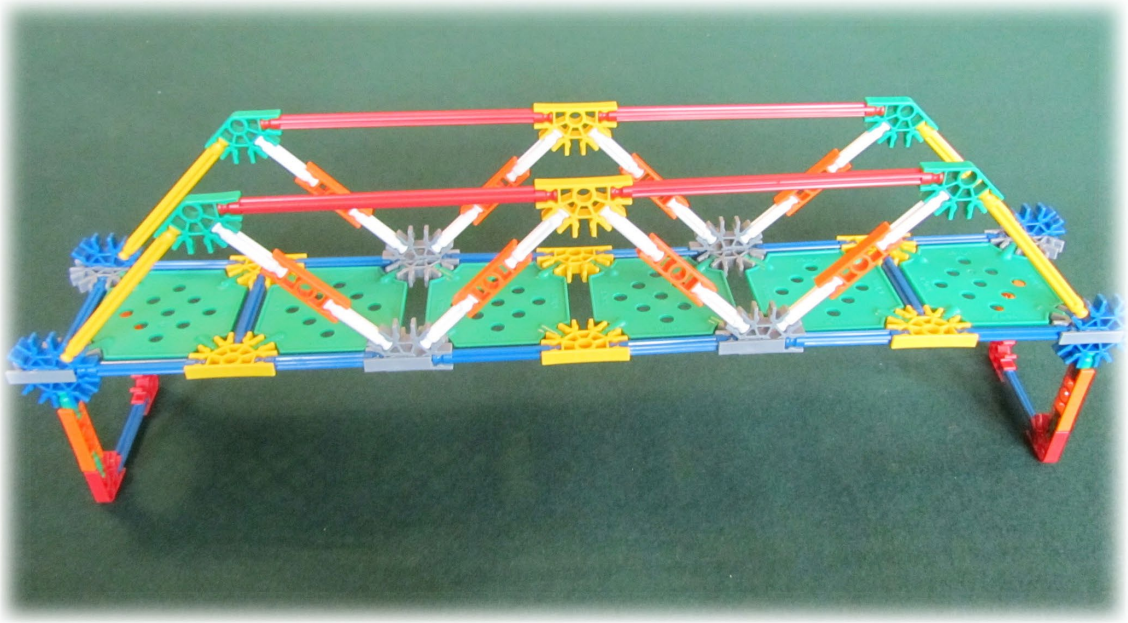
Building a Truss Bridge With K'Nex (Handout)



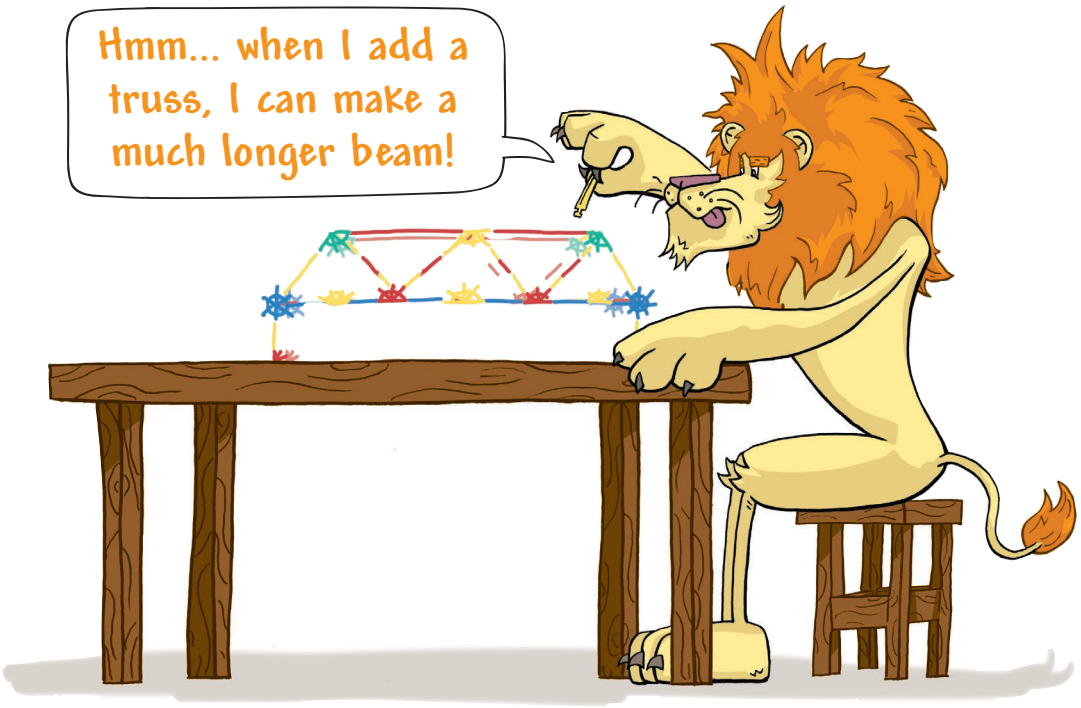
Beam Bridge made from K'nex®
with three deck slabs.



Beam Bridge made from K'nex®
with five deck slabs.



Truss Bridge made from K'nex® with five deck slabs.



SESSION 5