

# ABOUT THE WORKSHOP

Our opening workshop was held in September 2007 with 83rd Scouts, Cairneyhill based in Dunfermline, Fife. We were joined by civil engineer Phil Wilkins and benefited from the expertise of past President of the Institute for Civil Engineers and current RCAHMS Commissioner Gordon Masterton, to explore 'Bridge Building'.

This workshop enabled the Scouts to work alongside RCAHMS staff, as well as a practising engineer, to explore the design, construction and history of some of their area's most iconic bridges. It also provided the opportunity for the young people to learn more about the engineering profession through meeting those already working in the field.



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Cairneyhill Scout troop.

# LOOKING AT BRIDGES



< An aerial photograph of the Forth Rail Bridge taken by the German Luftwaffe during the early stages of the Second World War.

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The workshop began with activities introducing the Scouts to different types of bridges and the basic principles behind them.

To help understand the different bridge types, the Scouts also explored images of bridges held in the RCAHMS collections, including old photographs, drawings, RAF and Luftwaffe aerial photographs and maps. This inspired discussion on how bridges have developed and changed over the years, and that different styles are suited to different purposes.

# LOOKING AT BRIDGES

We looked at four main bridge types during the workshop:

**Beam** – These consist of a horizontal beam supported at each end by piers. A single beam bridge rarely spans more than 80m so in order to span greater distances, several beam bridges can be linked together. This is known as a continuous span bridge.

**Arch** – These form a semi-circular shape with abutments on each end. The shape has great natural strength and doesn't need extra supports or cables. Arch bridges have been built for thousands of years, such as the stone versions built by the Romans. Today, steel and concrete can also be used. Single arch bridges can span up to 350m. To span greater distances, several arch bridges can be joined together to create what is often called a viaduct.

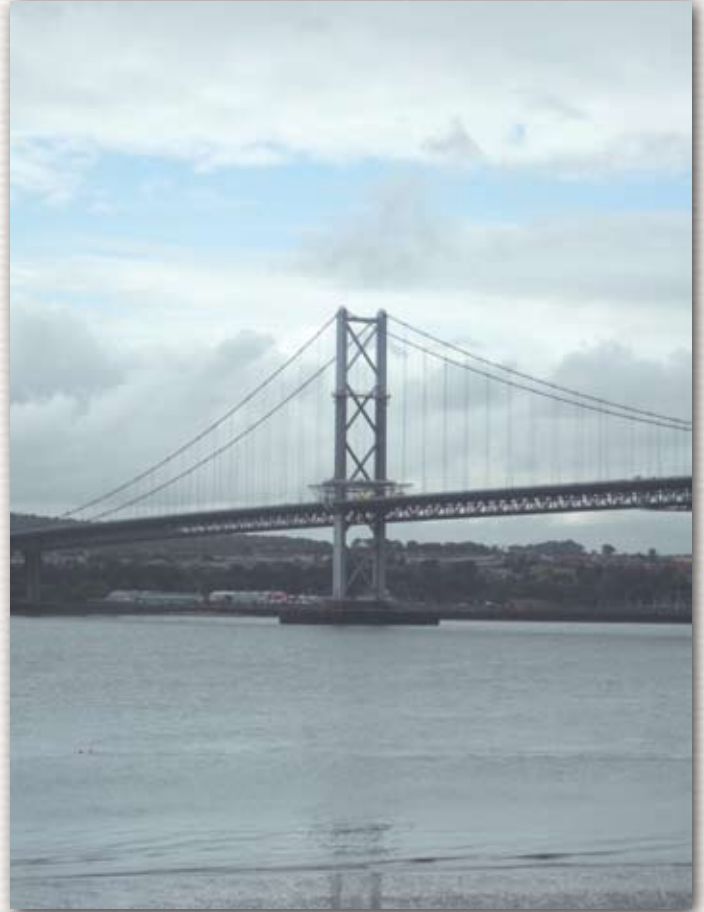


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The Scouts visiting an example of an arch bridge.

# LOOKING AT BRIDGES

**Suspension** – In this type, the road hangs from massive steel cables which are draped over towers and secured by anchorages at each end. These bridges can span further than any other type. Most have a system of trusses (crossed steel bars) beneath the road to stop them twisting.

A photo taken by one of the Scouts > shows the Forth Road Bridge, an example of a suspension bridge.



**Cantilever** – These have two arms called cantilevers projecting from a central pier, with weights at the other ends of the arms to balance them.

An aerial view of the > Forth Rail Bridge, one of the world's most famous cantilever bridges.  
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# GETTING ACTIVE



During the workshop, the Scouts took part in various team games and quizzes. These enabled them to test out their new knowledge and gain some hands-on experience of designing bridges.

< A brave Scout leader testing out one of the first construction challenges.

One fun activity was 'Human Bridges', during which the Scouts demonstrated how they would form arch, beam, suspension and cantilever bridges, using only themselves as building blocks!



< The Scouts experience the forces of tension and compression when making their human bridges.

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# FIELD RESEARCH

In the morning of the second day of the workshop the group went on a field trip to South Queensferry and Pittencrief Park in Dunfermline. This gave the Scouts the opportunity to visit and study the structure of the iconic Forth Rail and Road bridges, as well as discover smaller, more varied bridges found throughout Pittencrief park. Civil engineer, Phil Wilkins, was on hand to answer any questions about the structure and design of the bridges.

Each Scout was given a recording pack so that they could take photographs, make sketches and scribble notes to assist them in their upcoming design challenge.



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The group visiting one of the bridges in Pittencrief Park.



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A detail of one of the bridges taken by a Scout photographer.

The Forth Road Bridge >  
photographed by one  
of the Scouts.



# THE DESIGN CHALLENGE

For the afternoon of the second day of the workshop, the Scouts were split into three teams and challenged to use all they had learned to design and build models of their own bridges.

Each team was supplied with a design kit consisting of a booklet of inspirational bridge images, paper and pens to plan their design, and building materials including balsa wood, lollypop sticks, pipe cleaners, wire, Styrofoam – everything our budding engineers needed to build their model bridges. The teams were also given a frame into which the model needed to fit - this ensured that they all bridged the same size gap.

First of all, the teams created research boards from the drawings, notes and photographs that they made during the site visits.



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One of the finished research boards.

# THE DESIGN CHALLENGE

The clock started ticking and the teams had just three hours to complete the challenge.



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Two of the Scouts at work during the design challenge.



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One of the teams displaying their finished design before its presentation to the judging panel.

After the bridges were complete, each team presented their design to a panel of judges consisting of the workshop leaders Calum Price and Phil Wilkins, who were joined by Gordon Masterton and Alan Robertson, the Scouts' Area Commissioner. Friends and family were also welcomed along to the event.

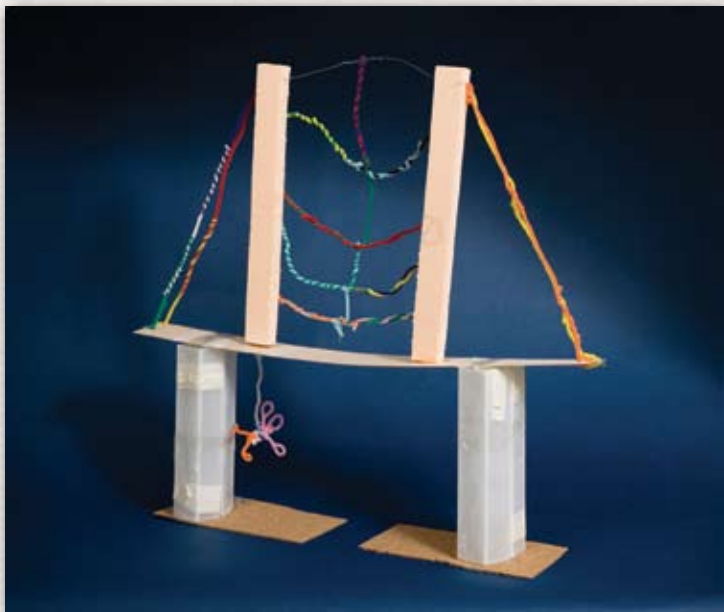
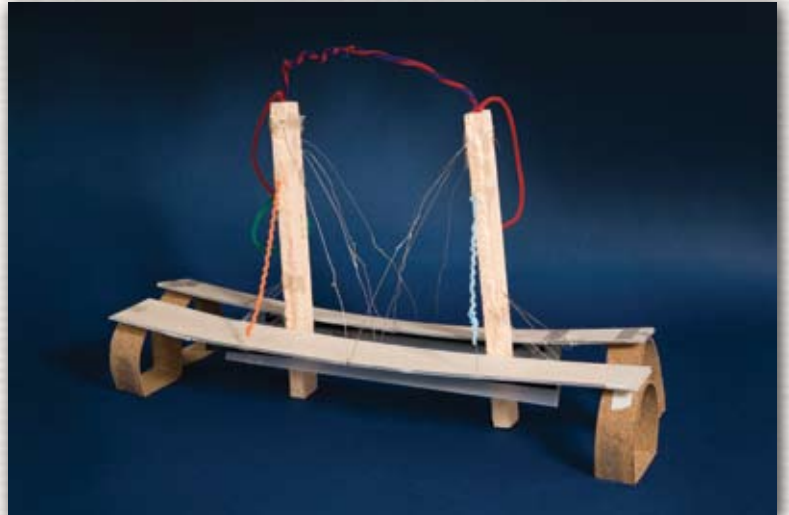
The judging panel questioned the teams on their design and all the bridges were tested for strength with a weight (a full bottle of water!). Designs were examined for safety and durability, as well as good looks. Although a difficult decision, a winning team was eventually selected, earning a box of craft materials for their Scout group.



# THE FINAL RESULTS

And here are the three finished models.

This model shows the various craft materials, > including pipe cleaners, card, balsa wood and wire, used by the Scouts.



< One of the groups took on the facts that they learned about suspension bridges to construct this model.

Another group designed a truss bridge, > held together with some well applied lolly sticks.

