

SELF-LED ACTIVITY

AMAZING ARCHES



KS2

Recommended for

KS2 (History, Design and Technology, Maths)

Learning objectives

- Learn about the arch at Richborough and its significance.
- Understand construction techniques used by the Romans.
- Develop students' knowledge of shapes and structures.

Time to complete

Approx. 60 mins



This reconstruction by Peter Lorimer shows what the monumental arch at Richborough may have looked like in around AD 120.

SUMMARY

Use this activity to introduce the significance of arches in Roman architecture and explore Roman construction techniques to understand how Richborough's arch was built.

DESIGN INSPIRATION

Introduce key background information about arches, and Richborough's Roman monumental arch and its significance to the population of the town, by using our Historical Information on page 10 and the Teachers' Notes on page 56. You could show students a reconstruction image of Richborough's arch at this stage for added context (Source 5 on page 51).

Ask students to discuss the steps they think Roman builders would have to follow to make an arch before revealing the methods used (page 57).

Remind students of these 'Roman Construction Rules' as they work in pairs to create arches using our templates on page 59 and support them using the instructions on pages 57–58.

You will need:

- The templates on page 59 printed on thick paper or card (one sheet per pair).
- A sheet of thin card.
- Scissors.
- Glue.
- Small stones or weights (two pair pair).

Extend this activity by challenging students to create a new structure with their bricks using their understanding of 'Roman Construction Rules' (page 57) and the forces they've learned about. They could team up in larger groups to create another successful Roman structure like a bridge, aqueduct or viaduct.

MORE LEARNING IDEAS

Research buildings in your local area that use arches in their design. Have the principles of Roman building been used in new ways to support new technologies?

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TEACHERS' NOTES

KEY BACKGROUND INFORMATION ABOUT ARCHES

- Arches were very important to the Romans as they were used to celebrate victories and significant people as well as commemorating important events. The people who designed Richborough's archway and other arches across the Roman Empire were experts in maths and engineering.
- When a flat stone is placed on top of two columns the weight of it (the load) causes the bottom of the stone to be pushed down and stretched as the top is compressed. This means that it can only take a limited amount of weight (dependent on its length) before the stone breaks – flat stones can only be used in this way over relatively small distances.
- Arches are incredibly strong structures due to their shape and can support a lot of weight, like the bronze statues on top of the arch at Richborough. The two main forces acting on arches are compression and tension. When a load is placed at the top of an arch (compression), the force is spread across the structure evening out the tension. This allowed the Romans to build impressive structures that spanned large distances.

KEY BACKGROUND INFORMATION ABOUT RICHBOROUGH'S ARCH

- The height and weight of the arch at Richborough were supported by 10-metre-deep foundations made of layered flints.
- The arch was made of precisely cut blocks, each fitting snugly together to create a strong structure.
- Richborough's arch was a quadrifrons. This means it was an archway made up of four individual arches arranged in a square. Students may be familiar with the Arc de Triomphe in Paris which is a nineteenth-century example of a quadrifrons.

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TEACHERS' NOTES

ROMAN CONSTRUCTION RULES | HOW DID THE ROMANS BUILD ARCHES?

- **DIG DEEP FOUNDATIONS** – the Romans' 10-metre-deep foundations at Richborough ensured that they could create a large and impressive structure.
- **BUILD UP COLUMNS** – the Romans began building their arches by constructing stone columns (piers) up to where the curve of the arch would begin.
- **PROVIDE SUPPORT** – then, they built a wooden structure (known as centring) to support the arch while it was being constructed.
- **PLACE YOUR ARCH STONES** – next, the Romans built the arch on top of the centring using cut stone blocks. Specially shaped stones known as voussoirs were used and the keystone (centre stone) was placed last.
- **CAREFULLY REMOVE THE SUPPORTS** – once the arch was finished, the wooden centring was carefully removed.

INSTRUCTIONS FOR CREATING YOUR OWN ARCHES

Part A

- Divide students into pairs. They will work together to build a Roman arch.
- Distribute a template sheet (page 59) to each pair. Ask students to cut out the nets on their template sheet and assemble their bricks. Remind them to only apply glue to the flaps on the templates that say 'glue'.
- Once the bricks are made, invite students to begin constructing their arches. One student in the pair will support the structure as the other puts the bricks in place. They should not glue the bricks together – the forces acting on their arch should keep the bricks in place. Students may find it helpful to place a small stone (or small weight) inside each of the base bricks of the arch as a foundation to steady their structure.
- Students will have succeeded at this stage if their arch is self-supporting.

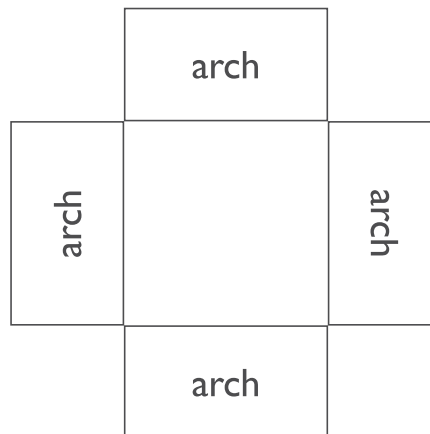


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TEACHERS' NOTES

Part B

- Ask each pair to join with three other pairs so that they can make a quadrifrons – a four-way arch – using the arches each pair has made.



- Place a piece of card across the top of the quadrifrons. Students will have succeeded at this stage if the quadrifrons supports the piece of card.
- If the quadrifrons does not support the piece of card, this may be because the force is not equally spread across the structure. Encourage students to reconfigure their arches and try again.

Part C

Test the strength of the quadrifrons further by adding extra weight on top of the piece of card. Students could create a statue like those on top of the Roman arch at Richborough. Which group's quadrifrons is the strongest?



Cut out these brick nets and fold along each of the lines.
Connect the flaps together with glue to make five bricks.
Position your bricks together to create an arch.

FLAP	FLAP	FLAP	FLAP
GLUE	GLUE	GLUE	GLUE

FLAP				GLUE
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TIP: Put a small stone or weight inside each of the two bricks at the base of your arch to act as foundations. This will help keep your bricks in place.