

Building Bridges

Teacher Guidance Notes

Overview of the pack

Bridges are found all over the country forming links across a range of natural and artificial barriers to travel. There will be a range of examples in the local area around your school. This resource pack, which mainly references canals, is designed to fit into a variety of subjects within the National Curriculum but is best used within a cross-curricular project.



National Curriculum links

- **Science** – uses of everyday materials, materials and their properties, forces and friction.
- **History** – linked with historical events in your own locality.
- **Geography** – human features in the local environment, water and its effect on the environment, and field sketches.
- **Design Technology** – working characteristics of materials, practical work – working with tools.
- **Art, Craft and Design** – subject matter for 3D as well as 2D creative work.
- Links with English and Maths will be indicated where they occur.

Online resources

- [Canal & River Trust 'Bridges' information](#)
- [Canal & River Trust 'Canal Bridge' information](#)

Learning objectives

- Understand the wide variety of structures crossing our rivers, canals and other barriers to travel.
- Appreciate the design and engineering that goes into bridge building.
- Understand how building bridges changes society/communities.



Success criteria

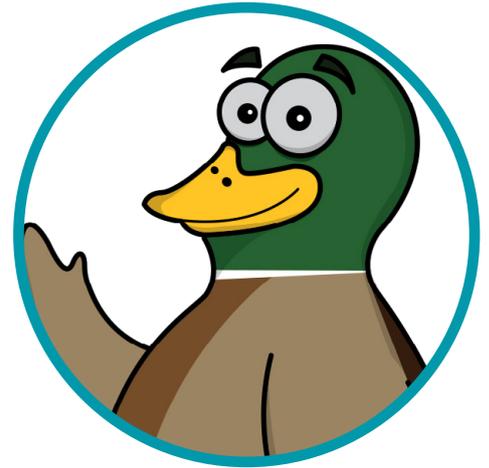
- All will know that there are many types of bridge.
- Most will understand their effect on the environment.
- Some will understand their effect on the local and national community.

Prior learning

- An ability to read local maps and diagrams.

Follow up

- A field trip to a local waterway to observe a variety of types of bridge.



Slide discussion points

Additional teacher information and discussion points on each slide to help you:

Slide 1: Key words

- Print out for a wall or table display as a reminder to pupils while they work.
Other words include:
 - Year 1 & 2 – link, join, string, tower, strong, wood, iron.
 - Year 3 & 4 – architect, building, position, strength, wooden, timber.
 - Year 5 & 6 – stretching, materials, secure, measure, calculate, calculation.

Slide 2: Sensory words

- These words support descriptive writing and are useful for writing the newspaper article about the need for a bridge. Pupils could discuss and write their own list thinking about smell, sight, sound, touch, and taste.

Slide 3: Complete the sentence

- Pupils could work in pairs and write their answers on sheets of paper to be displayed in class. Pupils should be allowed time to view other answers, and collectively create a final definition.
- A bridge is a structure built to span physical obstacles such as a body of water, valley, road or railway for the purpose of providing passage over the obstacle.
- You may wish to inform the pupils that designs of bridges vary depending on the function of the bridge, the nature of the terrain where the bridge is constructed and anchored, the material used to make it, and the funds available to build it.

Slide 4: Where are the bridges?

- You should provide a map of your local area to pairs or groups of pupils to look at. Younger pupils may need a larger scale map.
- Pupils could circle each place where they find a bridge:
 - Bridges over rivers should be circled in blue.
 - Bridges over canals should be circled in green.
 - Bridges over railways should be circled in black.
 - Bridges over roads should be circled in red.
 - All other bridges e.g. over estuaries or valleys, should be circled in purple.
- Pupils could present their findings in a bar chart to see which bridge is most common in the local area.

Slide 5:

Beam bridge (The Lee Navigation)

- This is the oldest and simplest of the four types of bridges. Originally people used a long piece of stone or tree trunk to cross small streams.
- It is possible that bridges made of stone slabs found in south west England are the oldest in the world. We don't know exactly when they were built but they are still standing.
- Many of the beam bridges that you see above roads are made of steel or concrete to make sure that they are strong enough to hold the weight. The size of the beam, and especially its height, controls the span of the bridge. Its possible to put more weight on the beam by increasing it's thickness or it's height.

Arch bridge (The Leeds & Liverpool Canal)

- This type of bridge was invented by the Romans. They realised that a wedge shaped stone called a voussoir could carry heavy loads if built in the shape of an arch.
- A wooden framework has to be built to support the stones while building the arch bridge. After putting the locking stone in place the wooden frame is removed and the arch should stand by itself.
- An arch bridge is stronger than a beam bridge because the force of the weight is transferred out to the ground through the arch. A beam bridge transfers its weight through the beams which break more often.
- Originally arch bridges were built using materials such as stones and bricks that can withstand compression. Many modern bridges are built using concrete or steel. Strong support is needed on each side of the arch to stop it from spreading out.



Slide 6:

Suspension bridge (The Aire & Calder Navigation)

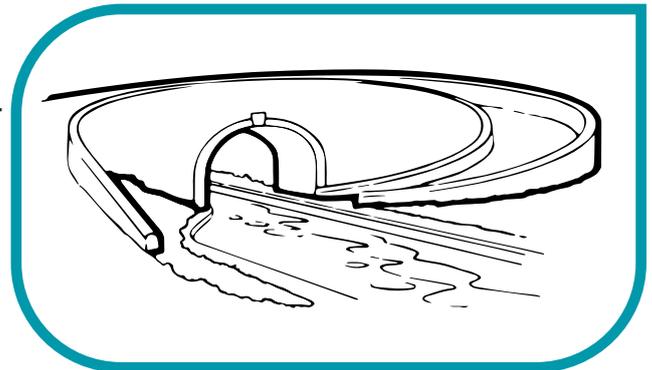
- A suspension bridge can stretch over long distances without much material being needed to build it. Pupils may have seen a simple suspension bridge in a film or adventure story about the jungle on the television.
- Suspension bridges can span much greater distances and have a much higher gap for tall ships to pass underneath e.g. Clifton, Golden Gate, Severn etc.
- Tall towers at either end need to be firmly fixed into the ground and have anchoring cables. The road is suspended above the ground with steel cables.

Cantilever bridge

- Cantilever bridges are made from beams supported on one side only. A cantilever bridge is a form of beam bridge. Two cantilevers with a short beam between them are often used.

Slide 7-10: Bridges over canals

- Some of the types of bridge found on a canal include:
 - **A snake or turnover bridge** is a special type of arched bridge, specially made for canal boats being towed by horses. The snake bridge allows the horse to change from one side of the canal to the other, without being untied from the boat.
 - **Split bridges** were often built next to locks so that the boater could get from one side of the lock to the other. As the horse pulled the boat out of the lock the towrope could pass through the gap in the middle of the bridge.
 - **Swing bridges** need to open to let boats through. They swing on a pivot until they are parallel with the bank. Manual swing bridges can usually be moved with a good push after unhooking a retaining chain – they are likely to be used for pedestrians only.
 - **Manual lift bridges** have a chain which hangs from the 'balance arm'. When the bridge is open care needs to be taken to ensure the bridge doesn't fall back down again. Sometimes there is a special mechanism and sometimes a person needs to sit on the balance arm until the boat is clear.
 - **Mechanised bridges** are either opened using a windlass, or are powered and operated with a key.



Slide 11: Bridge dilemma

- You could discuss with pupils that not only can bridges over canals be damaged by boats going underneath but also by traffic going over the top. Many bridges were built well before cars were on the roads.
- Pupils should create a poster to answer the following question “What can the Canal & River Trust do to conserve the bridge and keep traffic moving?”.

Slide 12: Bridge anagrams

The answers are as follows:

- nalca = canal
- mabe = beam
- levreilcant = cantilever
- snusseponi = suspension
- harc = arch
- gwins = swing