



Canal & River
explorers

Canals: Building
and Carrying
Topic Pack

www.canalriverexplorers.org.uk

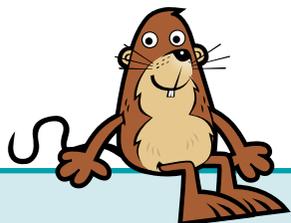


Canal &
River Trust

Working in partnership with:



The Inland
Waterways
Association



Contents

Chapter 1

Why were canals built?	2
Who designed and paid for the canals?	3
Where were canals built?	4
Canals that weren't built	6

Chapter 2

Types of waterway	7
How were canals built?	8
Navvies	9
Other workers involved in the construction	10
Chief engineers and other significant people	11
Tools	14
Why was water such a big problem?	15

Chapter 3

Building boats	16
Types of boats	17
Who owned the boats?	20
The parts of a boat	21

Chapter 4

Bridges	22
Tunnels	25
Aqueducts	27
Locks	28
Lock alternatives	29
Dry docks	31
Wharves and warehouses	32
Waterway furniture	33
Associated buildings	34

Chapter 5

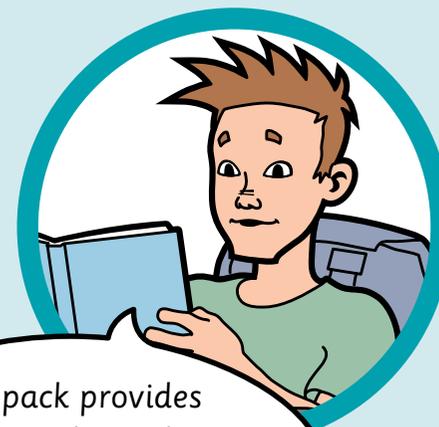
A-Z of cargoes	35
Memories of carrying	36
Loading boats	37
Tolls	38

Chapter 6

Changing Waterways	39
Maintenance	40
Day-to-day work	41
Fascinating Facts 2009	42

Appendices

Appendix A – Toll records	43
Appendix B – Plan of motor boat	44
Appendix C – Plan of butty	45
Appendix D – Standedge Tunnel	46



This pack provides a good starting point to find out about the people who lived and worked on the canals!

Always remember to stay SAFE near water – Stay Away From the Edge.

This is the second in our series of topic packs about the waterways. I thoroughly enjoyed writing the first pack 'Life on the English Waterways' and this has given me a fantastic opportunity to research the structural side of waterways. The pack explores the design, production and technology used in waterways in England, Scotland and Wales over the years.

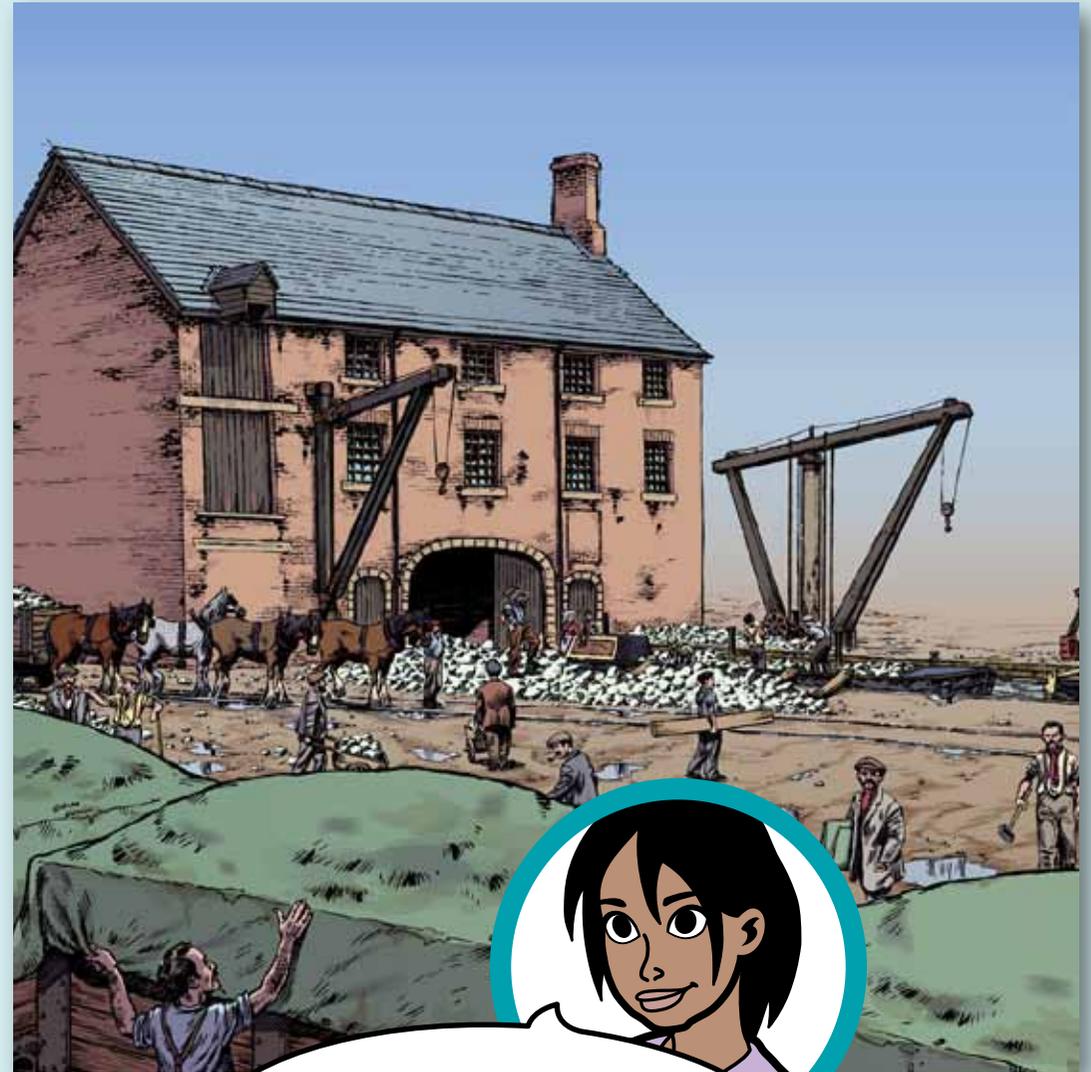
Once again I have hidden myself away at The Waterways Archives and found a whole collection of images I hope you will enjoy looking at. They really are a great way to learn about the past. Alongside this I have read many books, interviewed people and collected articles and other artefacts about boats and the waterways they travelled on.

I hope you like this pack and that it will help you with your project or research. Let me know if you've enjoyed it and how you've been using it. I'd love to see any work you've done too!

You can find out more about individual canals, life on the waterways, and wildlife at www.canalriverexplorers.org.uk

Katie

Katie Donlon
Education Coordinator



The pack explores the design, production and technology used in waterways.

Why were canals built?

Chapter 1

Canals were built as a way of transporting goods around the country.

Before canals were built, moving goods around was difficult as there were no engines. Items such as coal and food had to be moved by horse and cart. This was slow and one horse could not pull much weight across the bumpy ground. The uneven roads also provided other problems.

 **What do you think might have happened when they tried to move fragile pottery?**

Rivers provided some areas with water transport, but the rivers weren't always located where they were needed because they are natural features of the landscape. Not all rivers could take boats as some were too shallow, fast flowing or their depth varied too much. In some cases rivers were already being used by millers or other industries to turn water wheels and they had ancient rights over the water.

The manmade canal system provided a smooth route for goods around the country. Canals could not be built to go everywhere. They were built to join up key areas of production (coal mines, mills, quarries) with large towns or ports.

 **Why do you think they would want to take goods to the ports?**



Horses didn't lose their jobs when traffic moved to the canals as carts and carriages were still needed. They also pulled the boats along. They could pull much heavier weights on the water than they could on land.

Who designed and paid for the canals?

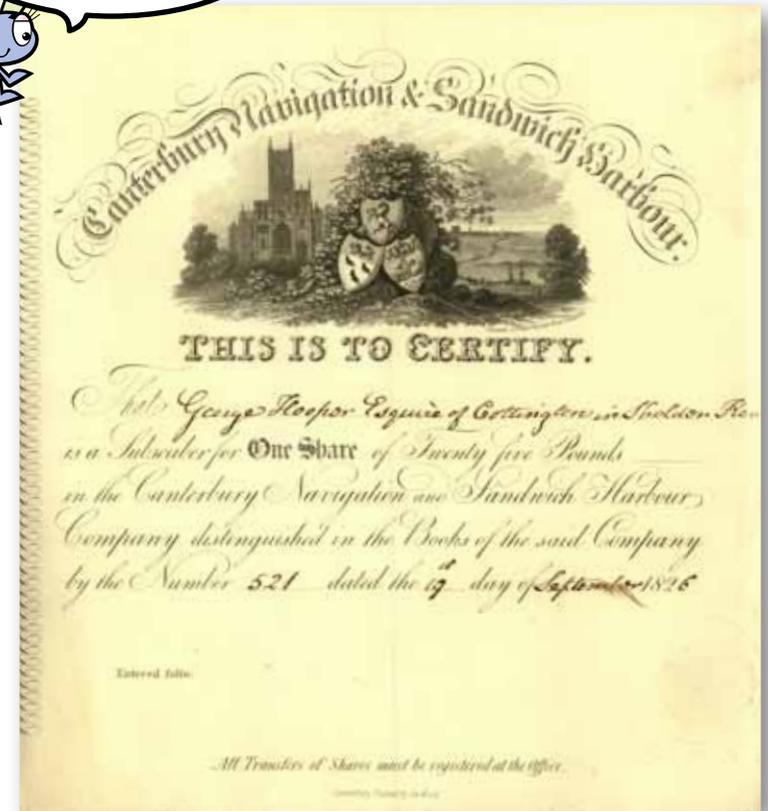
Lots of people were involved in deciding if a canal was going to be built: landowners, business owners, local people and the government.

When the idea of building canals for transport became popular in Britain in the mid 1700s and the first canals were successful, everyone wanted one and plans to build canals popped up in lots of places.

Businessmen decided that they wanted to build a canal to make more money. The support of others was important and public meetings were held to convince people it was a brilliant idea. The idea was then sent to the government, and members of Parliament discussed whether or not they would allow the canal to be built. They then said 'no' to the idea or passed an Act for the canal to be built. Only after this could any building work start.

Some landowners along the canal's length were not happy about a waterway **cutting their land in half**. They demanded that **expensive bridges were built** to connect the two sides; some built elaborate bridges, such as that at Severn Acre, then charged it to the canal company to get their own back for the canal being built.

Landowners and businesses **paid for the canal and owned shares in it**. This meant that by buying shares in the canal company, they got some of the profits if any extra money was made (hopefully more than they'd paid for the shares). This only happened when the canal was working. Other people **hoping to earn money** could buy shares too.



People can still buy shares in businesses today

Fascinating Facts



Where were canals built?

Canals were built to join up the most important places of industry with large towns and ports.

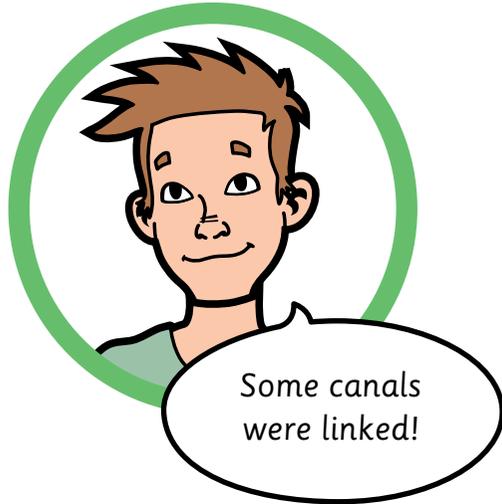
The land had to be surveyed and plans drawn up (to check whether it was possible to build the canal where people wanted it) before permission was given for the canal to be built.

Some canals were isolated and served a particular purpose, such as the Caledonian Canal in Scotland. This was built to allow boats to go across the country rather than all the way around the coast in dangerous seas. Other canals were joined together, allowing boats to travel from the north of England all the way to Bristol or London in the south. People still enjoy taking their boats around the canal system for pleasure today.

The land had to be surveyed and plans drawn up.



Where were canals built?

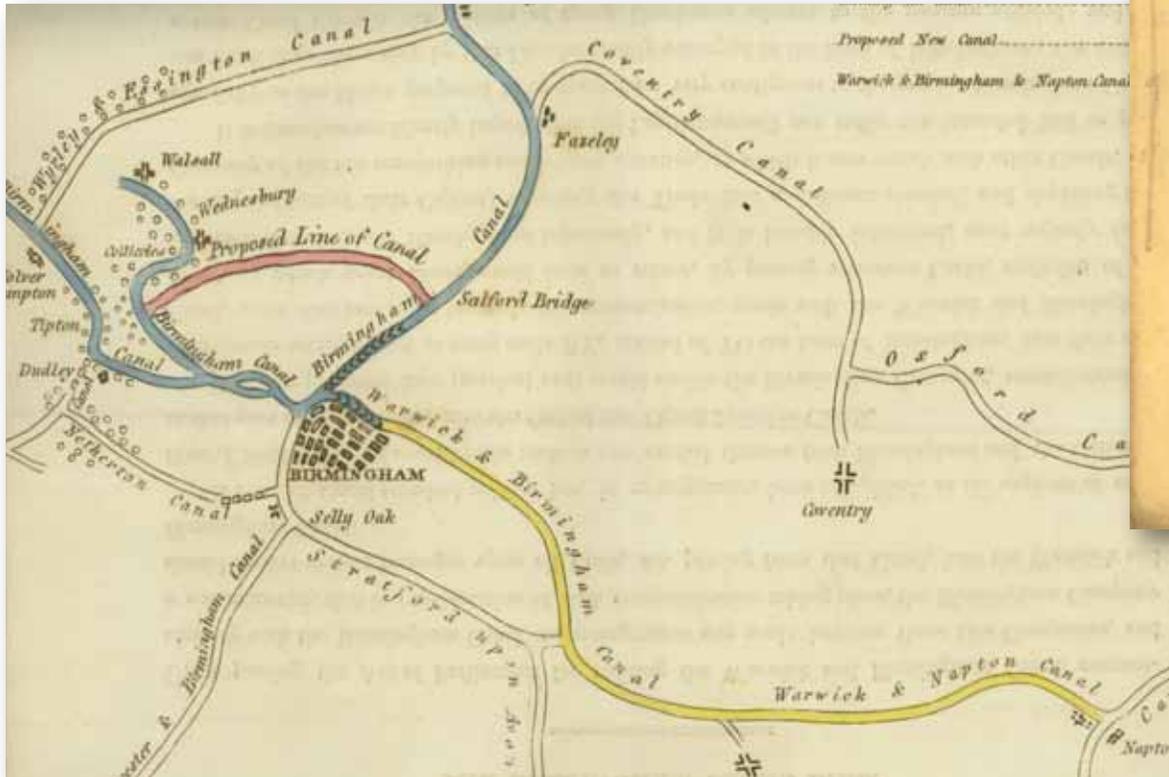


-  Can you find where you live on the map?
-  Do you live near a canal?
-  Find out what it is called.
-  Where does it go?

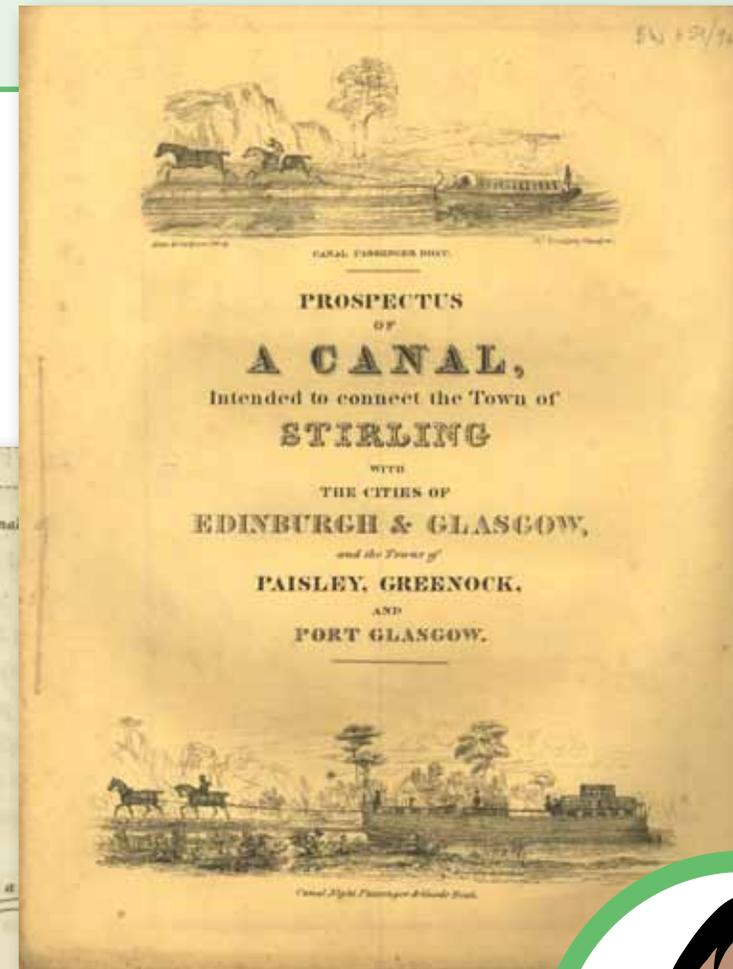
Canals that weren't built

Many canals were planned but never built.

Some canals were not approved by Parliament and never made it to the building stage. They exist now as little more than grand ideas and persuasive booklets.



Even though some canals were never built, their routes were planned and the land surveyed. This map shows a proposed canal (in red) that would link sections of the Birmingham Canal, a shorter route for boats that did not need to go into the city.



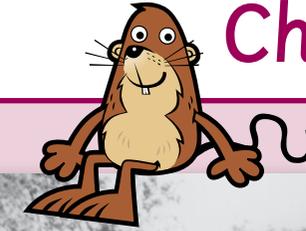
Route for proposed waterway near Stirling



That's a shame. Why do you think the government said no?

Types of waterway

Chapter 2



Not all canals and waterways are the same.

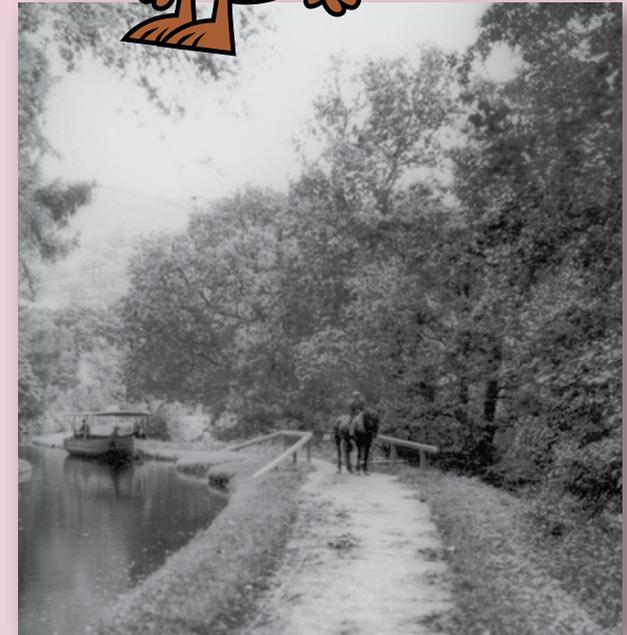
Canals

Some canals are known as narrow canals and others are called broad canals. Broad canals are wider and have large locks, bridges and tunnels. This allows wider boats to use them whereas the thin locks, tunnels and bridges on a narrow canal limit the types of vessels which can travel on them.

Early canals were usually contour canals, which went around hills rather than cutting a straight passage through the land. These were easier to build. As technology improved on and engineers became more experienced, they could build canals straight through or over hills. These had more complicated structures, such as aqueducts and longer tunnels.



Broad canal



Narrow canal

Navigations

Sometimes rivers could be adapted or diverted from their course to create a route for boats such as the Weaver Navigation in Cheshire. This was dredged to create a channel and diverted as needed. The owners would make special 'cuts' for the boats so that they could avoid weirs and other dangerous parts of the rivers.

Reservoirs

Sometimes reservoirs had to be built to provide canals with extra water. This happened particularly in places where the canal was in the mountains or did not have a good alternative water source such as a large river.



Sometimes reservoirs had to be built to provide canals with extra water.

How were canals built?

Building a canal was a hard and dirty job that took many years to complete.

First a channel was dug out; the sides had to be supported by wooden frames in deeper sections so they didn't collapse in on the navvies (the builders). It was dangerous work and they didn't have the tools and protective clothes available to builders today.

Once the channel had been dug, it had to be lined to make it waterproof so all the water didn't soak into the ground. The materials used for building depended on what was available in the area. Limestone could be used to build the sides but in many places clay kept the water in the canal. Stone or brick and wood were used to build locks.

Finally the canal could be filled with water (they didn't have hose pipes). They used water from nearby rivers and streams redirected into the canal. Rain and sometimes reservoirs would have been used to keep the water topped up.



 **What tools and building methods can you see being used?**

Often parts of canals were finished and opened before other sections. The bits that were difficult to build were often the last to open.



The completed Manchester Ship Canal being filled with water



**Strange
but True**

In some places, particularly rural areas, the workers used local **cows to flatten the clay** in the channel to ensure there were no air bubbles, cracks or sharp lumps. They walked the cows up and down the clay (before they put any water in!) as it was much **cheaper and quicker** than getting the workers to do it.

Navvies



 Would you liked to have been a navvy?
What sounds do you think you would have heard on the building site?

Navvies built canals. Some were local men and others were workers who travelled to different areas.

The word 'navvy' comes from 'navigator'. They were the unskilled labourers employed to do manual work.

Men made up most of the workforce but sometimes women and children could be involved in building tasks, such as the Bourne family who worked on the Standedge Tunnel. There are very few records about the individual navvies.

It could take many years to build a canal



Huts were built for the travelling workers to live in as they moved along the length of the canal. It could take many years to build a canal, especially if it was a long one or went through places where construction was difficult.

Navvies built up a bit of a reputation as drinkers (and I'm not talking about water!), but as with all stereotypes, probably **not all navvies** were like this.

They were probably better off with beer anyway as the water was not very clean to drink.

Fascinating
Facts

Other workers involved in the construction

Navvies would not be the only people working on the canal. They generally were the lowest level of workers.

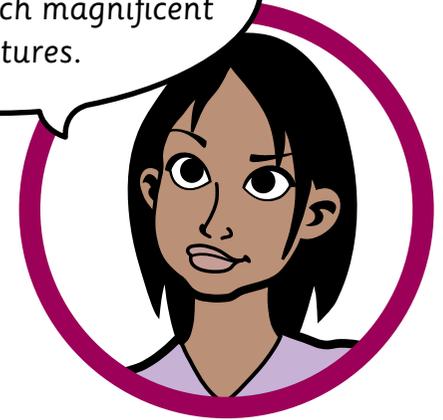
There would have also been skilled craftsmen, who were trained to do a specific job. Unlike many of the navvies they could read. They would include stonemasons (people who carved and cut stone to the right size and shape), bricklayers and blacksmiths. These labourers would often have apprentices with them, who were training to do the job themselves.

Other people on the ground would include the surveyors who originally plotted out the canal and ensured it was in the best possible place. The engineers supervising the project on site were often the people dealing with day-to-day problems. However, chief engineers tend to be the remembered for being responsible for building the canals.



This is a blacksmith at Dobson Locks Forge

It must have been quite amazing to have been part of building such magnificent structures.



One of your ancestors might have been involved.

Chief engineers and other significant people

Some engineers are still remembered today for their contribution to the canal network.



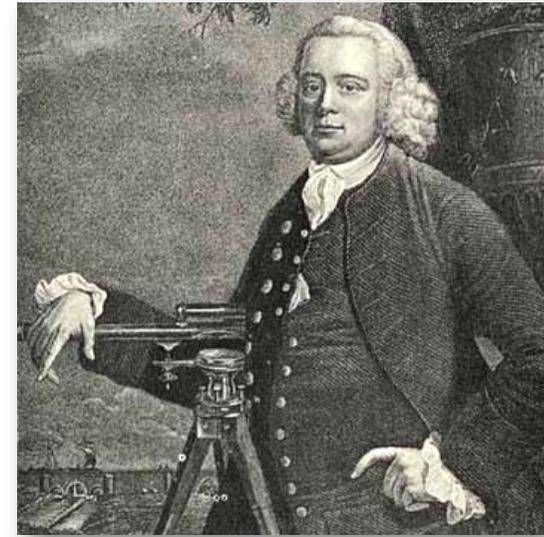
**Strange
but True**

Thomas Telford came from a very poor family. His father was a shepherd and died when Telford was very young. I bet he never thought his son would become so famous.



Thomas Telford (1757 – 1834)

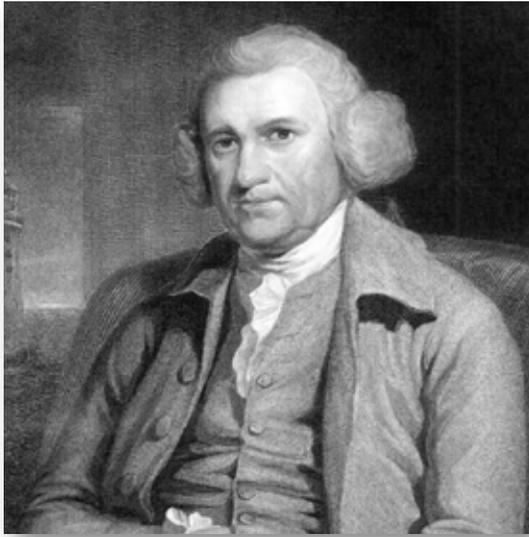
Telford was a stonemason when he was younger but was noticed for his skill and became a surveyor. He worked on projects such as restoring Shrewsbury Castle. His first big canal project was the Ellesmere Canal, where he was responsible for the impressive Pontcysyllte Aqueduct (on the section named the Llangollen Canal). He was also involved in the Caledonian Canal, the Crinan Canal and went on to work on many other waterways, including some abroad. Telford was also responsible for the second Harecastle Tunnel, which made travel on the Trent & Mersey Canal easier.



James Brindley (1716 – 1772)

The son of a farm labourer, it seemed unlikely he would go on to be an important engineer. Yet after being apprenticed to a mill owner and proving his skill, he went on to build many mills. Following this Brindley was asked to survey areas for possible canals. He became an expert on inland waterways and was often called on as it looked good to have his name on the project. He went around surveying canal after canal with his workers, taking over the building and day-to-day management. Brindley was also involved in designing new bridges.

Chief engineers and other significant people



John Smeaton (1724-1792)

Smeaton's father was a lawyer. Smeaton was expected to go into the same profession but did not suit him. Instead he ended up creating 4 windmills, 43 watermills and a lighthouse in Plymouth. While he was building the lighthouse he was asked to become involved in the Calder Navigation. From there he went on to work on other waterways, including the Fossdyke Canal, and spent a considerable amount of time working on the Birmingham canals.



William Jessop (1745-1814)

Jessop was born in Plymouth and worked with Smeaton on the Eddystone lighthouse and was trained by him as an engineer. He worked with Smeaton on many other projects, including inland waterways. Jessop went on to be responsible for many of his own projects and became an expert in building British inland waterways. His projects were primarily based in Yorkshire and the East Midlands, although he was also chief engineer on the West India Docks in London. In addition to his work on the docks, Jessop worked with Telford on the incredible Caledonian Canal in Scotland.

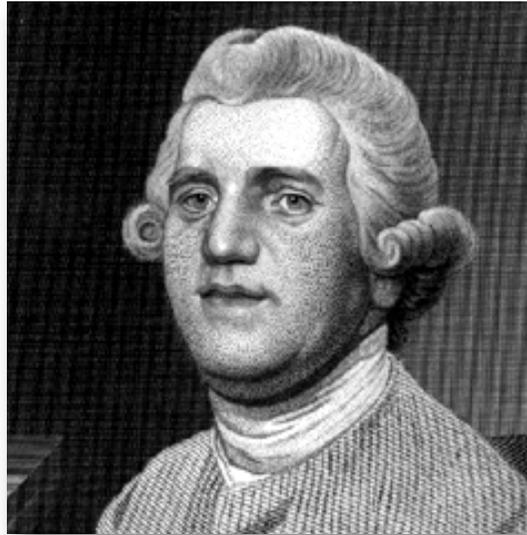


Chief engineers and other significant people



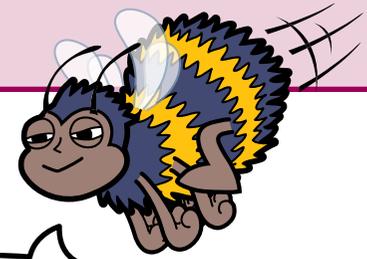
John Rennie (1761 – 1821)

Coming from a wealthy family, Rennie had a good education. He started his engineering career building mills. After gaining recognition, he was employed to do surveying work for canals. His biggest waterways project was the Kennet & Avon Canal, which he surveyed and then became its chief engineer. Rennie went on to work on many other waterways and designed London Bridge, which his son completed after Rennie died. Two of his sons went on to be notable engineers too.



Josiah Wedgewood (1730 – 1795)

Wedgewood was one of 13 children born into a Potteries family. He became a potter at an early age, working first for his brother and then later set up on his own. He helped in promoting the building of a local canal, gaining the support of important people. If a canal was built it would mean his business could expand and his pottery could be transported around more safely. When an Act was passed to build the Trent & Mersey Canal, he became treasurer and built a new factory alongside the canal.



Poor old Thomas Dadford doesn't get to have his picture here like everyone else. This is because there are no known portraits of him.

Thomas Dadford (c.1761 – 1809)

Dadford and his son were responsible for the construction of many canals, particularly in South Wales. Dadford also worked with the Earl of Dudley on the Dudley Canal but left the project in 1783. Dadford worked with his son, also named Thomas, on many of his later projects. He also took over from his son John on the Montgomeryshire Canal, which was to be his final project.

Tools

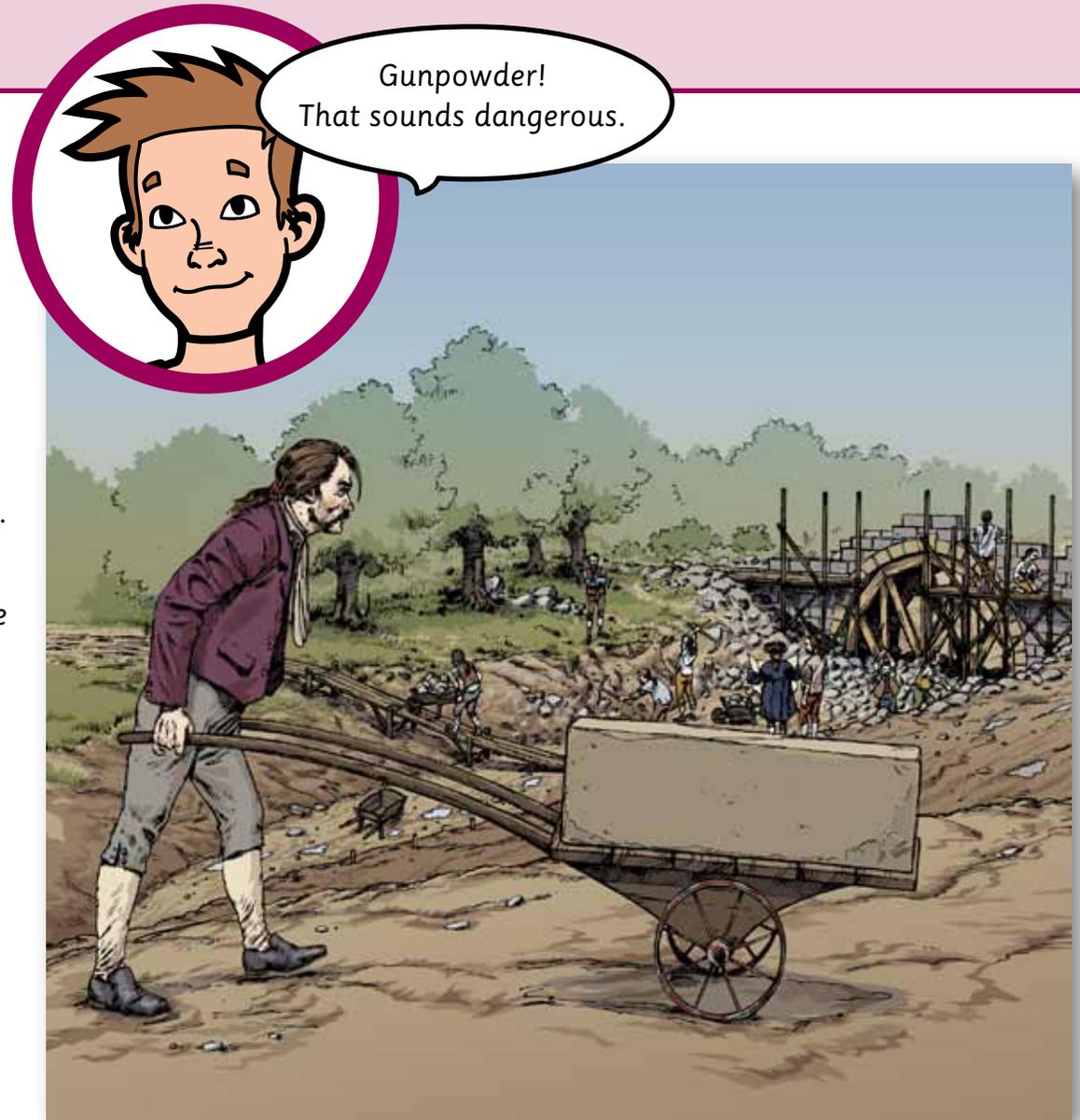
The tools used to keep the canal in good order today are different from those used to build them 250 years ago.

The canals were dug out using shovels and pick axes – no electric equipment or diggers were around at the time. In rocky areas gunpowder had to be used to blast a way through the rock, making it a dangerous job. Other basic tools such as saws, hammers and wheelbarrows were used.

Today's engineers have a much wider choice of tools and the work is much safer. They have workshops alongside the canal, to complete specialist jobs, and different craftsmen to work on various types of building maintenance.



This navvy is using a special barrow to move blocks of stone. How many other tools can you spot in the illustration?



Navvies working on the Leeds & Liverpool Canal in the 1770s

Why was water such a big problem?

In some places water caused big problems as there simply wasn't enough of it.

Water to fill the canals came from rivers, reservoirs and direct rainfall. The canal companies were not the only ones who wanted water from the rivers. Mill owners built their mills next to rivers and powered machines using water wheels. If there was not enough water then the wheels would not turn and products couldn't be made. As the mill owners were there before the canals they got very cross about water and if there wasn't enough water on a particular day, they blamed it on the canal companies.

Locks

Locks allow boats to travel to different levels on a waterway. Water can only move down hill, not back up again and every time a lock is used thousands of litres of water are moved lower down the canal. If there is not a good water supply, or paddles on the lock gates are left open this can result in there no being enough water for the boats to pass through the locks and travel on to their destination.

Water management

In some places pumps were used to move the water to where it was needed and reservoirs were built to store water as an added supply.

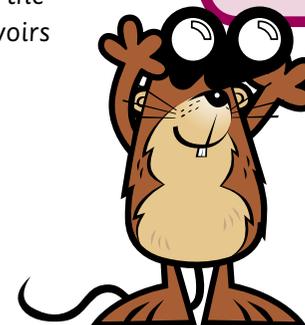


Reservoirs are still used today to keep the water levels constant in canals. Reservoirs are also used for pleasure boating.

**Strange
but True**

Townshend Reservoir (also known as Banton Loch) was built to supply water to the Forth & Clyde Canal.

The reservoir was built where the **Battle of Kilsyth was fought in 1645**. When excavating the area in the early 1770s, the engineers found dead soldiers preserved under the boggy land. One was still sitting on his horse!



Building boats

Boats were originally made from wood, then iron and now steel, and built in docks or yards next to the waterways.

Materials used in boat building

Wood – used to build the main frame of most boats, although later boats were made of a wider variety materials. The wood had to be a hard wood, such as oak.

Iron – iron sections were used to strengthen the boat and for parts made for the rudder and towing. Iron was also used for nails and fixings. Sections were made by local blacksmiths.

Oakum – made from old bits of rope and used with tar to plug up gaps between the wooden planks to ensure the boat is waterproof.

Rope – an essential part of boating. Before engine, boats were pulled by horses attached to the boats by rope. Rope was also needed to moor boats to the side of the waterway and for fenders (which stop the boats getting damaged if they bump into anything). Rope makers began to work near boat building yards.



This is a yard where boats are made

Strange but True

During the two world wars a lack of resources and a need to build boats quickly led to **bizarre materials** being tried out for boat building, such as **concrete!** Not a popular material today but a few concrete boats still remain in museums.

Chapter 3



Fascinating Facts

Boats were often built parallel to the side of the waterways and launched into the water sideways.

Types of boats

There were many different boats on the inland waterways, often depending on the size and type of waterway.

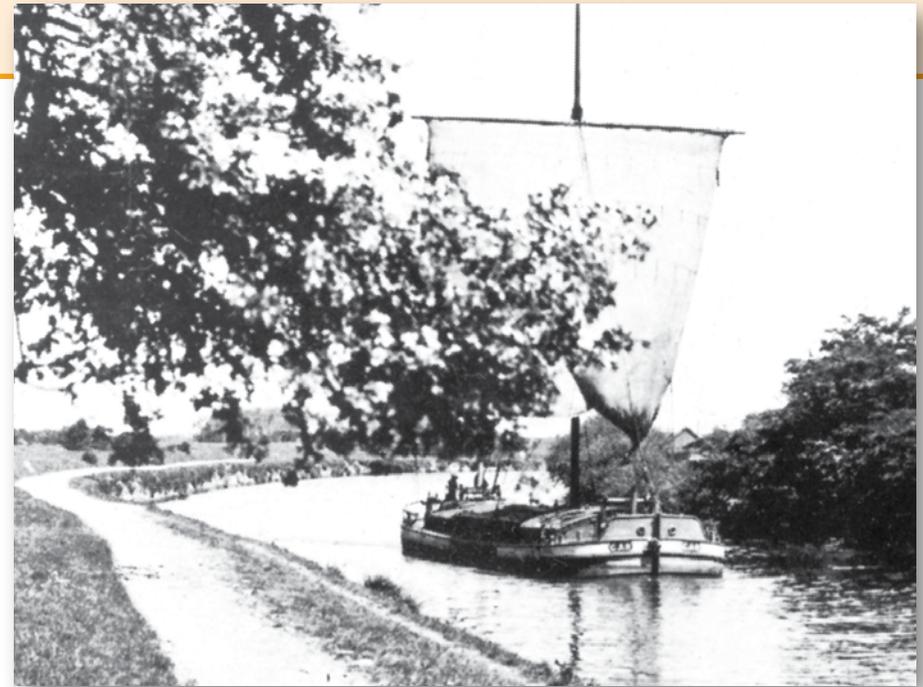


Narrowboat

earliest painted boats, basic geometric designs in bright colours. Horses pulled one or two boats together. Later when the engine was introduced, motor boats, which were also loaded up with cargo, could pull a non-powered boat (butty) as well – meaning that two boats were almost always operated at once. You can see a plan of a motor boat in Appendix B.

Narrowboats

Narrowboats were designed for narrow canals. They are traditionally 21m (70ft) long (but short enough to fit in the locks, which are usually 22m (72ft) long and 2m (6ft 10in) wide. Narrowboats in the Midlands area became famous for the ‘roses and castle’ style of painting. This is still popular on modern boats in all parts of the country. In other areas the designs were simple such as those of the



Barge

Barges

Barges are wider than narrowboats and in some places were operated by sail rather than being towed by a horse. Some had living accommodation on them, others were day boats. Later, as with narrowboats, barges were powered by steam or diesel engines. Different types of barges worked on different waterways and carried varied cargoes. They often had flat bottoms to avoid scraping the canal or river bed when they were fully loaded. Barges were much more resilient on larger rivers than narrowboats.

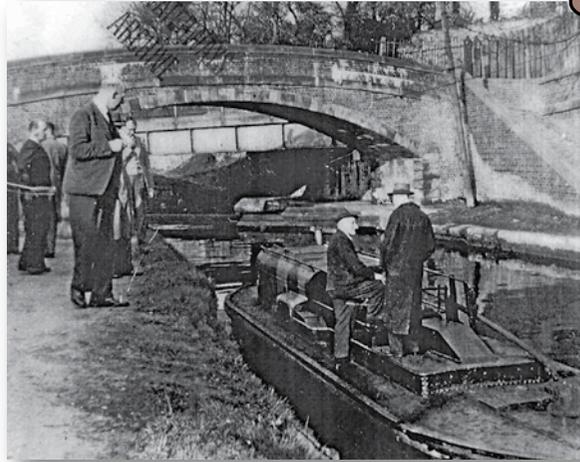
Types of boats



Pleasure boat

Some boats were built for passenger transportation although most waterways primarily carried cargo rather than people. The paddle steamers on the Caledonian Canal were popular with tourists and Queen Victoria went along the canal by boat. By the 1950s, cargo carrying on the canal reduced and people began to boat for pleasure.

They adapted old working narrowboats or had special ones built that were more like a floating house. Cruisers also became popular, some made of wood but more commonly made of fibreglass or plastic.



Tug

Tugs were designed to pull other boats. On some rivers, currents and the tide made other methods of powering boats risky. Tugs could pull several boats at once. Tugs on narrow canals were less popular as the wash could damage the banks. However tugs were used to pull boats through tunnels, which was quicker than the earlier system of 'legging' (moving the boat along with feet against the sides of a tunnel).



Fly boat Fly boats travelled without stopping. They carried lighter and often valuable products as well as passengers and had priority over other boats, but paid higher tolls. They worked through the night in order to get to their destination as quickly as possible. They could also carry food, which on a slower boat would have gone off before it arrived at its destination.

Types of boats

Tall ship

On rivers and large canals such as in Gloucester and Manchester, seafaring vessels could travel inland to the docks to load and unload. These waterways were deep enough to take these boats but had to have very large locks.

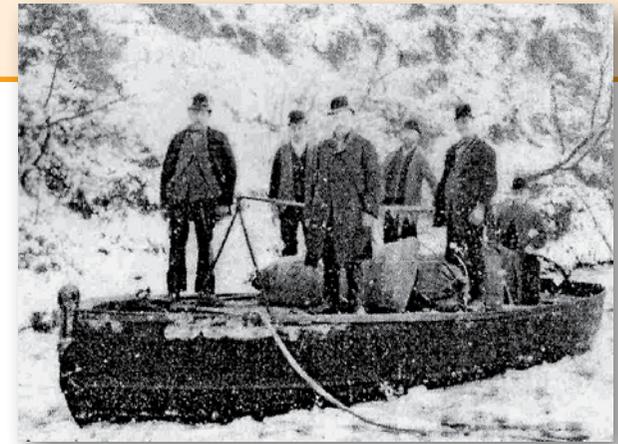


Ferry

In some places ferries are used to transport people or things across a wider river or canal, such as on the Manchester Ship Canal.

Fishing boat

Fishing boats were particularly common on canals such as the Caledonian and the Crinan, where they provide an alternative, shorter route to the sea. Boats can travel across Scotland instead of going all the way around the coast.



Ice breaker

Boats relied on keeping moving in order to deliver their cargo and get paid. Ice breaker boats had an iron hull and were worked by men leaning backwards and forwards on a bar in the middle of the boat to rock it and break the ice. Ice breaker boats could be pulled by up to 24 horses.



Fishing keel

Who owned the boats?

Boats were owned by individuals, by boaters or by companies

Number ones

Some boats were owned by individuals or families who took on work where it could be found. They were paid when they delivered a cargo so it was important to work quickly and have an empty boat for as little time as possible. In the 1920s a narrowboat pair was earning £8 a week on average for the boatman and his family. This was quite a good wage.

 Do you think it was better to work on your own boat or for a company?



Company boats

Companies owned whole fleets of boats, which were worked by a captain and his crew (often members of his family). Work was regular and organised by the company, which also paid the tolls and charges. Some boaters were only paid when they delivered the cargo; others were paid a weekly wage. Many companies were taken over by railway companies when railways started being built around the country.

Fascinating Facts

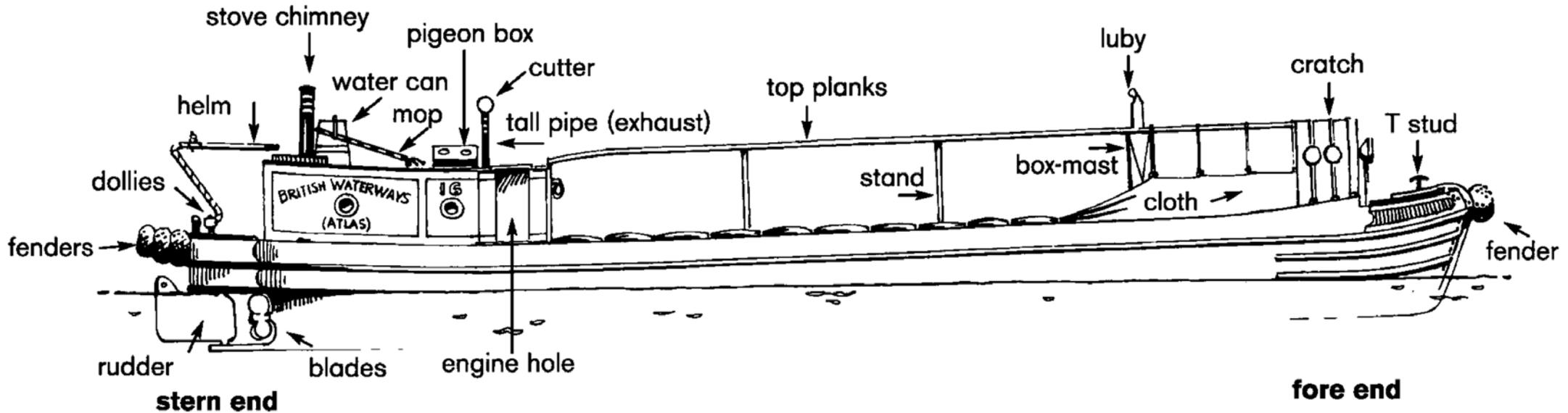
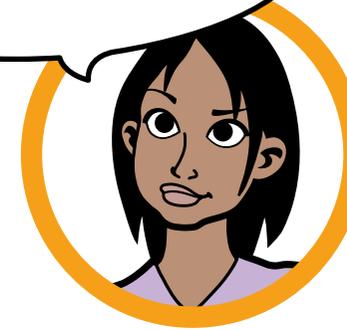
As work became less well paid and less frequent, **families moved on to the boats** to help out. This avoided the cost of having a house as well as a boat. The family could also help crew the boat, although **only the captain was paid**. However, if he didn't have his family as a crew, he would have had to pay some one else. An exception to this was Cadbury's boats who also paid women on boats.

“Joe took lime in barges down to ICI Ltd at Manchester and brought back coal for Bollington.”

The Memoirs of Mrs Martha Barnes.
Courtesy of the IWPS

The parts of a boat

Next time you visit the canal, see if you can spot any of these parts on the boats.



There are many different types of bridges. The type was chosen to suit the location and intended purpose.



Over / Arched

Bridges were built from local materials: brick in the Midlands and South, stone in the North and sometimes iron bridges in Yorkshire and the Midlands.



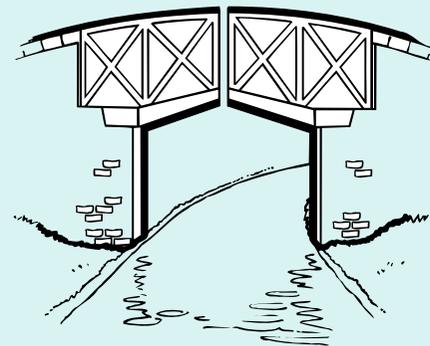
Swing bridge

These were used where railways and roads crossed the canal as they were flat. They were also suitable as they did not require much power to turn.



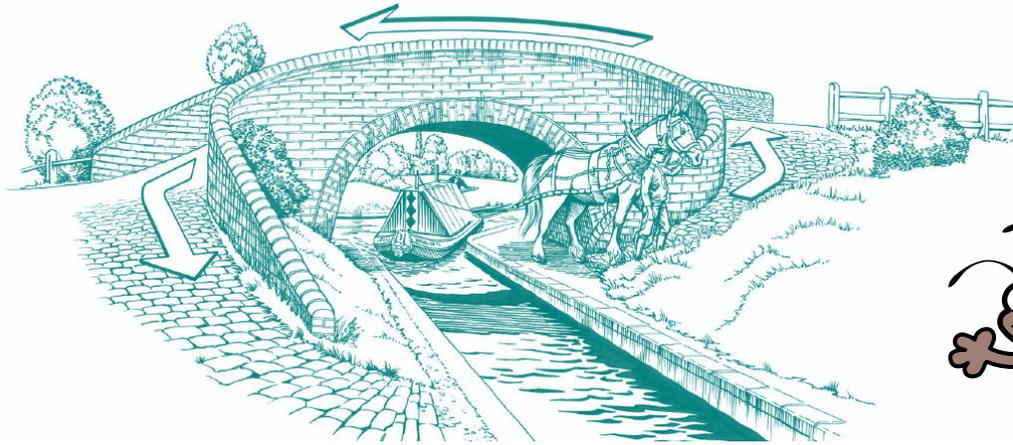
Accommodation bridge

Landowners were allowed to build a bridge if a canal cut through their land so they could get to both sides. They could charge the canal company, which led to some expensive bridges being built; the company usually tried to build the cheapest bridge it could.



As you can see, bridges come in all shapes and sizes. Can you work out which type of bridge these are?

Bridges



Turnover bridge

Sometimes the towpath crosses from one side of a canal to the other. A turnover bridge allows the horse towing the boat to cross from one side to the other without having to be disconnected from the towing harness.

Lift bridges are a cheap solution for getting pedestrians across the canal



Lift bridge

Lift bridges are a cheap solution for getting pedestrians across a canal, but can also be used on a much larger scale to allow taller boats and ships to pass.



Split bridge

A split bridge is exactly as it sounds; it has an opening in the middle to let a tow rope through. It is often used when the towpath crosses from one side of a canal to the other and the rope can pass between the split without having to untie the horse and boat. Split bridges are often used near locks. They are cheaper to build as they don't have a towpath underneath and are therefore smaller. They were often built from cast iron.

Bridges



Lock bridge

Most lock gates act as bridges. This is necessary for their working. Once one gate is opened the person operating the lock needs to be able to cross to the other side of the canal to open the other gate. In some places a special bridge speeds up traffic, particularly on broad canals.



Fascinating Facts

All the bridges have numbers on them. Why do you think they need to be numbered?

“During the war the hump-back bridge was carrying tanks coming down from Liverpool and it was decided that the old Brindley bridge over the canal was a weak structure. It was therefore decided to infill it with concrete.”

Max Sinclair. Courtesy of the Droitwich Canal Making Connections Project

Tunnels

Bridges go over something whereas a tunnel goes through something.

At first tunnels were avoided as they were difficult and expensive to build. As engineering techniques improved, it became increasingly possible to build challenging structures. Nevertheless they were kept as narrow as possible as this was cheaper and easier to build.

Legging

Boaters had to 'leg' through most tunnels using their feet. This was because many narrow tunnels had no towpath running through them (as it was cheaper and easier to build them without). The boat horse had to walk over the top of the tunnel while the crew did the hard work.



 Would you like to have to push a boat for hours using just your feet?

Longest canal tunnel

The longest canal tunnel is on the Huddersfield Narrow Canal and runs underneath the Pennines. Standedge Tunnel is about 3 miles long and has no towpath. Boaters had to leg through, which took 3 to 4 hours. The canal company managing the tunnel hired people to leg through the tunnel, which meant the boats got through quicker. There are only three passing places in the tunnel.



You would need good boots to leg all the way through Standedge Tunnel!



The Standedge tunnel took **17 years** to build and was used to **help build the parallel railway tunnels** that run alongside it.

Fascinating
Facts

More about Tunnels

Top 5 tunnels (longest operational canal tunnels in the country)

1. Standedge	Huddersfield Narrow Canal	5,029m
2. Dudley	Dudley Canal Line No.1	2,900m
3. Blisworth	Grand Union Canal	2,794m
4. Netherton	BCN Netherton Branch	2,768m
5. Harecastle	Trent & Mersey Canal	2,676m

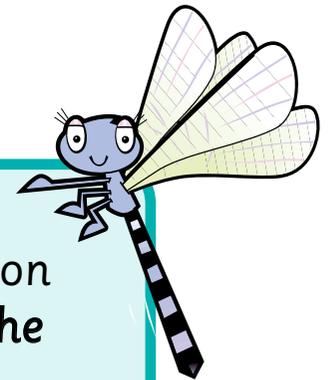


An electric tug boat pulling lots of boats through Harecastle Tunnel

Strange but True

There are ghodt stories linked to many tunnels, which is hardly surprising since it must have been very dark and lonely legging through a tunnel. Look out for the **Harecastle Boggart** on the Trent & Mersey Canal, a candlelit phantom in **Blisworth Tunnel** and a centurion in Roughcastle Tunnel in Scotland.

A cow fell in the canal near Foulridge Tunnel on the Leeds & Liverpool Canal and **walked all the way through** before getting out!



Aqueducts

Aqueducts carry water over something, such as a valley, river, road or railway.

Aqueducts have been used to carry water since Roman times; however, they didn't carry boats until the 15th century. Canal aqueducts carry the navigation channel.

First boat aqueduct in Britain

The first aqueduct to carry boats in Britain was on the Bridgewater Canal. It carried the canal over the River Irwell and into Manchester and was still high enough to allow sailing boats to pass underneath on the river.



Have you walked across this aqueduct?

It feels really high and you get some great views.

Building aqueducts

Aqueducts were not easy structures to build. They had to carry water and the clay used to make the aqueduct waterproof. It was difficult to build arches to support all this weight, so they were built as low as possible. Aqueducts were originally made from stone and brick but as engineering adopted new methods, cast iron became available and this was used instead. Iron was a much lighter way to carry water and aqueducts could be built much taller.

Longest and highest aqueduct in Britain

Pontcysyllte Aqueduct in north Wales was designed by Thomas Telford and opened in 1805. It has an iron trough with stone piers, which are partially hollow. It has been awarded World Heritage Status because of its unique nature and revolutionary building techniques.

Pontcysyllte
Aqueduct in north Wales
was designed by
Thomas Telford



Locks

Locks are like staircases for boats.
They allow boats to move up or down a hill.

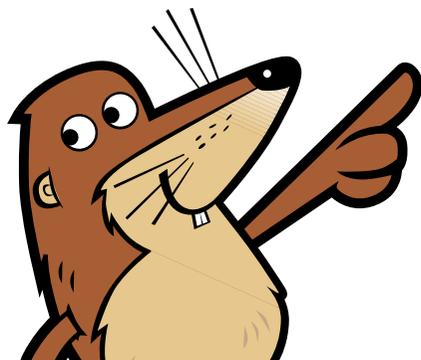
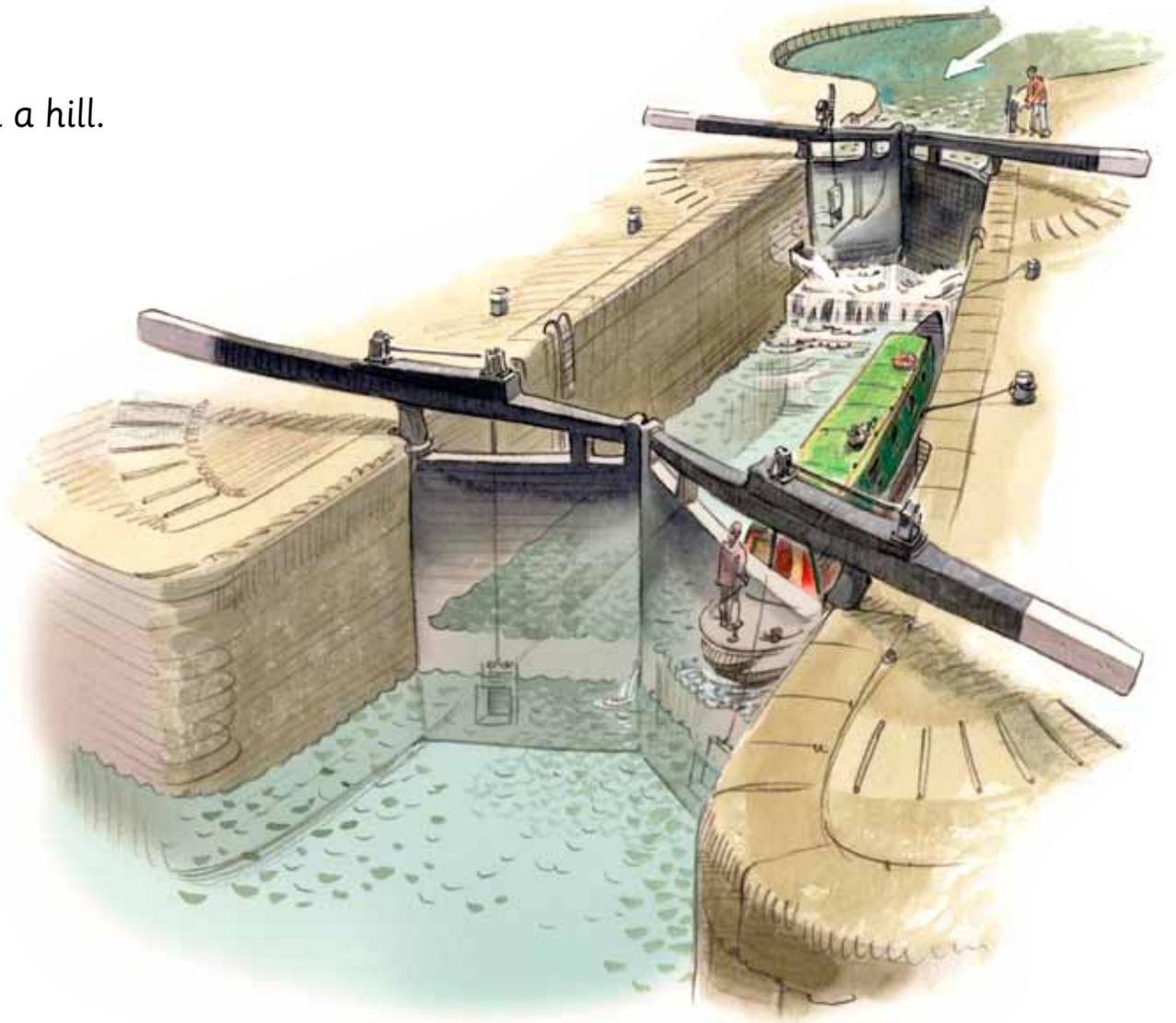
Flight

A flight is a group of locks that are near each other but have a pound (section of water) in between each one.

It means that all the hard work comes at one point rather than constantly getting on and off the boat.

Staircase

Less common are staircase locks, where two or more locks are placed together, with the top gates of one forming the bottom gates of the next. Staircase locks are often used when there is a steep climb over hills.



You can find this image of how a lock works, and others, along the Rochdale Canal.

Alternatives to locks



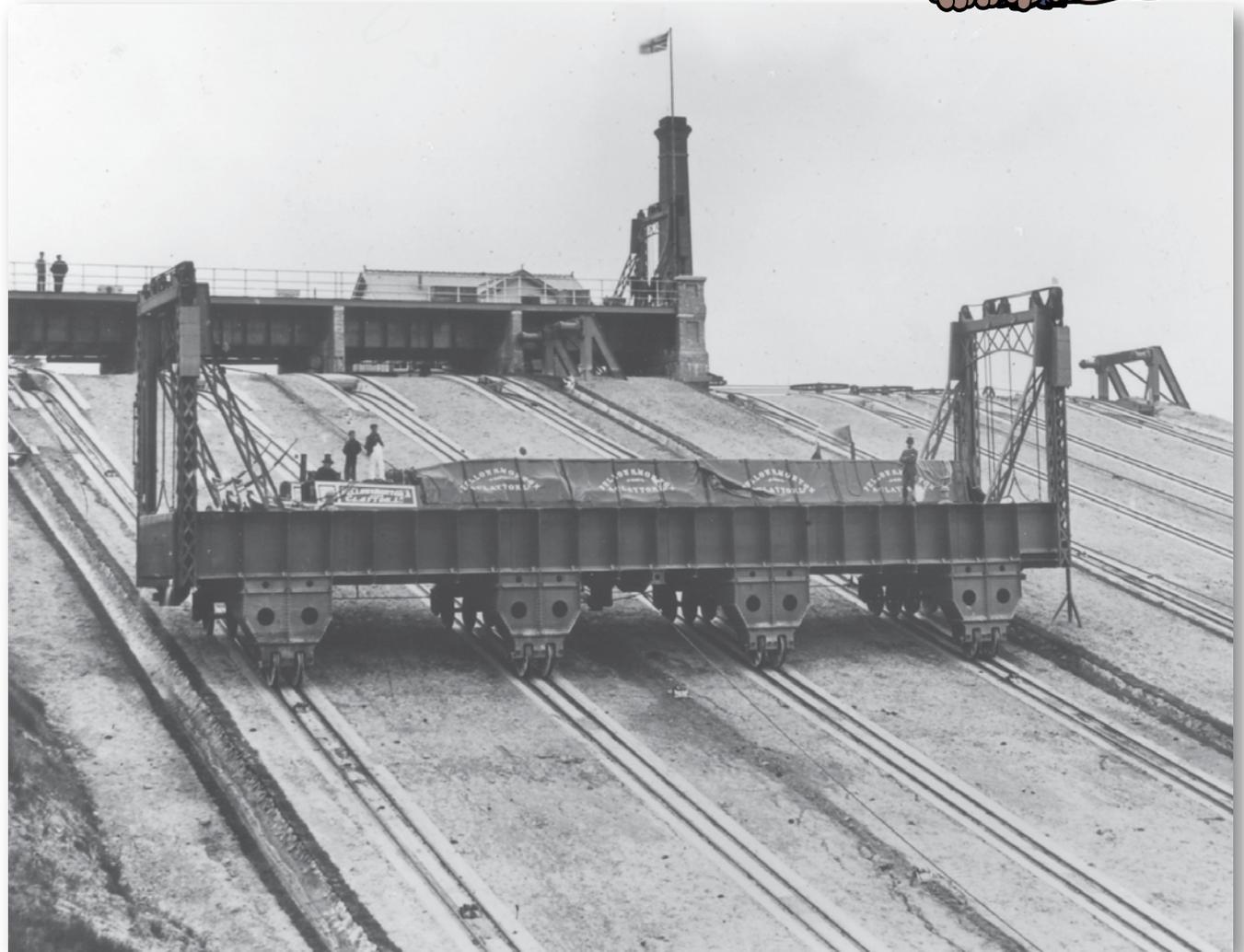
Locks are not the only way to move boats from one level to another. There are varieties of lifts and other solutions.

Foxton Inclined Plane

Inclined planes are used where there is a big change in level, not much water, confined space or locks were too slow.

The problem is they require skilled people to operate them, unlike locks which can be operated by boaters.

The inclined plane at Foxton was completed in 1900 and took boats up a slope in a caisson (like a water tank). It was pulled by steel wires powered by steam engines. Unfortunately there was not enough traffic to make the plane profitable and the locks, which were still there, fully reopened for boats in 1911.

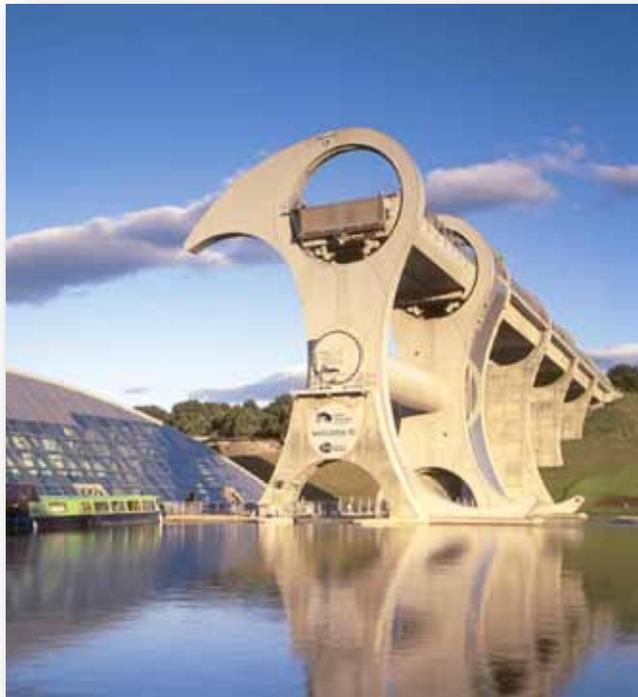


Foxton Inclined Plane

Alternatives to locks

The Falkirk Wheel

The Falkirk Wheel was part of an exciting project to restore canals in Scotland and is a relatively recent addition to the waterways. It is like a giant Ferris wheel moving the boats in a circular motion. It is very energy efficient and uses very little water or electricity on its short journey, which is much quicker than using the 11 original locks.



The Falkirk Wheel



Anderton Boat Lift

Anderton Boat Lift

Anderton Boat Lift was opened in 1875. It took boats vertically up or down the Weaver Navigation to the Trent & Mersey Canal using hydraulics. Unfortunately the salt in the river (from the salt works in the area) caused the hydraulics to rust and stop working. In 1908 the lift was converted to electricity and the caissons were moved up and down by huge weights hung over a large frame. This worked well into the 20th century when it was repaired and the hydraulic operation was restored.

Fascinating Facts

The original weights are no longer on the lift. They now form a maze in the grounds of the visitor centre.

Dry docks

Dry docks are places in which boats can be built and repaired. They vary in size depending on the size of the boats they are designed to take.

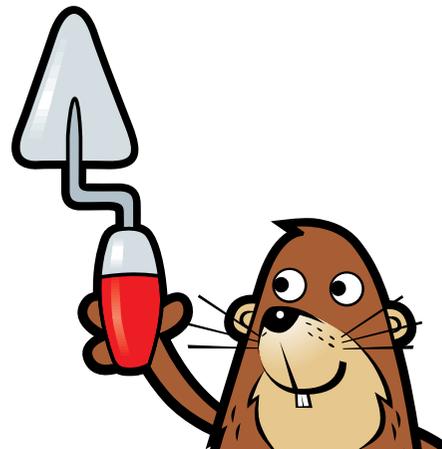
Slipways (where boats are hauled in and out of the water to be repaired or launched) are much cheaper than dry docks. In places where larger, heavier boats need repair work, carriages with wheels are used to move them.

Dry docks are expensive so are generally found in larger centres. It is quicker and easier to put a boat in a dry dock. The boat has to be lined up, steered in and then the gates or stop planks seal the entrance and the water is let out. Then work can begin. Smaller docks tend to be covered to allow work to carry on regardless of the weather – this is important if the boat has paint or tar that needs to dry.

 Where do you think the water from the dry dock goes?

“At Bugsworth [George] had a little tool shed by the wide hole. Mended the boats in the open. Three men operated a crane to lift the boats out of the water. Put boats on a frame on side. Got wood from Jenks.”

The Memoirs of Mrs Martha Barnes. Courtesy of IWPS



This is a huge dry dock built to take very large boats at Gloucester Docks

Wharves and warehouses

A wharf is a landing place for boats to tie up and be loaded or unloaded.

Wharves provided a larger area of land for boats to tie up and drop off their cargo or be loaded up with more. This could be near a business, a small rural setting or part of a much larger development with warehouses.

Warehouses were essential where large amounts of goods were moving in and out of a place. They were also important for goods that could be damaged by the weather or that needed to be stored until they were used. Warehouses had to be well positioned, to make it easier to load and unload goods. They were often on more than one level, so pulley systems and cranes were used to unload cargoes into the higher levels.

It became popular to build an arm (extra bit of canal) right into the warehouse, making it even easier to load and unload. If this was not possible a cover might be put along the front of the warehouse, particularly on public wharves so boats could be unloaded in all weathers. Warehouses varied in size, design and grandeur depending on their location and purpose. Canal companies often built their own warehouses and rented them out to businesses.



What do you think it was like to work in a warehouse?



What do you think might have been stored there?

Waterway furniture

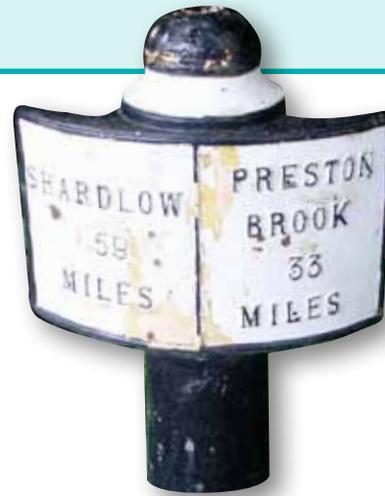
There are all sorts of other equipment and features along the waterway that are part of its workings.

Cranes

Cranes or the remains of cranes are often seen alongside the canal outside warehouses, in towns or at wharves.



Cranes on the side of a warehouse at Ellesmere Port



Mileposts

Posts show boaters on the waterways where they are in relation to important waterway locations. Because tolls were charged by the mile it was necessary to mark distances carefully. Some mileposts even mark $\frac{1}{4}$ and $\frac{1}{2}$ miles.



Bollards and mooring rings

Watch out for these near the edge! They are positioned to tie up boats next to the bank.



Signs

There are many types of signs to be seen along the waterside. It is interesting to see some of the old warnings and notices that were put up. Some are still where they were originally, while others can be found in waterways museums.



Stop planks

You may see a pile of planks next to the towpath, which are used to section off or seal off part of the canal so it can be repaired. They are slotted into grooves on either side of the canal bank and two sets are usually used – one at each end of the section. The water can then be drained without losing water in the rest of the canal.

Associated buildings



The waterways are not just about water and boats – they have many other buildings around them that are important to their operation.

Lock keepers, or workers cottages

Houses facing the canal were common in places where operation or maintenance was required. They can still be found along the canal today.

A house alongside the canal meant the lock keepers could see when boats were coming along and go out to help. Being close to their work meant they could help throughout the day, although the working boats often kept on going long after the lock keeper had gone home for the night. Boaters knew where to find the lock keeper or tunnel manager if they needed help.



 Would you like to live in a house like this?

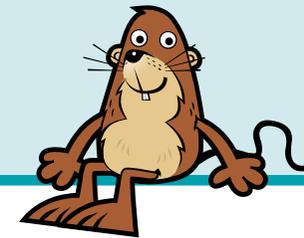


The canal companies didn't just build the canal. They also built warehouses, wharves, houses and offices. This is the plan drawn up to build a lock keeper's cottage.

“The hours were from 6 in the morning until half past 7 at night, but it was okay if you were a regular lock keeper, because you worked outside your own home. There wasn't a self service then. The canal locks were operated by the lock keepers.”

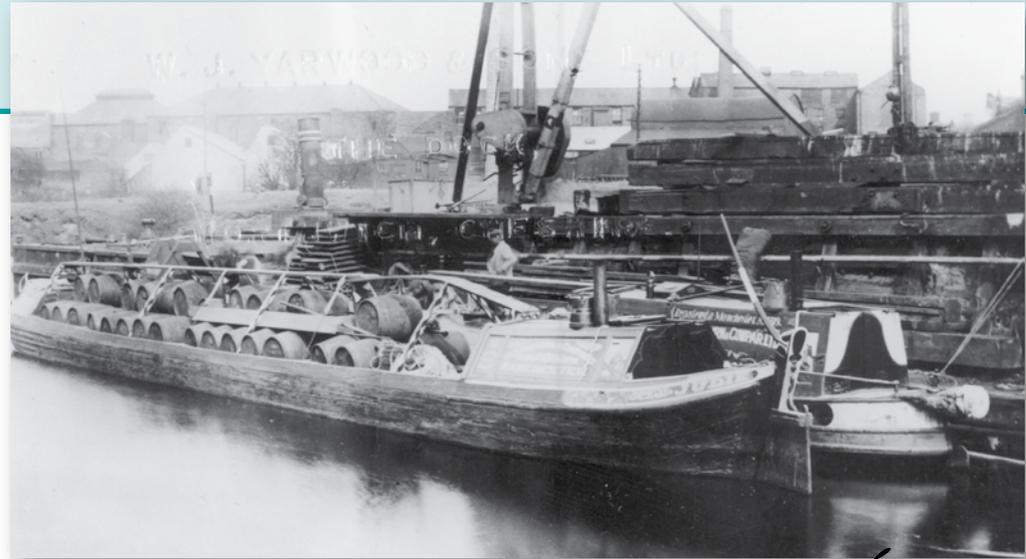
James Purdie, retired lock keeper remembering his working life on the Crinan Canal before 1972 when the 40-hour week was introduced. Courtesy of the Dalriada Community History Project

Cargo is the name for goods that are carried on boats.
Different cargoes came from different areas.



- A** asphalt, ashes
- B** bark, barite (a mineral used in chemical processes), breeze and coke ashes, bricks, brick rubbish, builders' materials
- C** cement, chalk, clay, clinker, coal, coke, concrete, concrete slabs, creosote, cocoa, calcified flint, chocolate crumb, cotton, cheese
- D** drainpipes, drainpipes/glazed
- E** empties
- F** fibre dust, fibre, flints for road marking, flint, food
- G** grain, gravel, gunpowder
- H** hard core, hay and straw
- I** iron
- L** lime, litter peat or moss, limestone
- M** manure, machinery, mangel wurzel (a vegetable used to feed farm animals), mineral waters, mud
- N** nuts, bolts and other building material
- O** oil, oil cake, old bagging, old junk
- P** paper, paper bags, plaster, pottery
- R** rubbish
- S** sand, sweepings, soda-spent oxide, sugar, strawboards, sulphate of ammonia, sundries, salt, stone, sawdust
- T, U** tan or spent bark, tiles, timber
- V, W** vitrol, whiting, wood pulp, wood chips, waste paper or cotton waste, wool
- X, Y, Z**

Memories of carrying



They'd teach you how to steer a boat for a start off, at an early age, and then they would set you off getting the locks ready for the boats to travel into, so they would gain time.

Edward Ward remembering his childhood in
Voices From the Waterways, Jean Stone



What do you think this boat is carrying?



It was a good form of transport. Cheap and safe. They reckon it saved a terrific amount of breakages because the journey was so smooth.

Jim Morgan in *Voices from the Waterways, Jean Stone*



This boat is empty. What do you think it might carry next?

The wagons used to come up and tip the coal down a shoot and it used to go on the boats. Later it would be unloaded with a crane that grabbed it, but before that, there was a big bucket and we used to have to shovel it in.

Leonard Waller in *Voices from the Waterways, Jean Stone*

Loading boats

Boats had to be loaded carefully to get the maximum amount in without causing the boat to lean in one direction or worse, sink.

When loading a boat (this was done by hand or cranes), it was important that the weight was spread out.

Loaded boats were sometimes covered with tarpaulins and ropes to protect the cargo from weather and theft. This depended what was being carried. The cargo could be all the same or sometimes a mixture of different goods. The amount of weight carried depended on the type of cargo. For example pottery had to be packed in straw and barrels and so did not weigh as much as a cargo of coal.



 **Where do you think all this coal might be going?**

Boats often carried more than one type of cargo and had to be cleaned in between. Cargoes such as coal could be very messy and manure was also unpleasant! If a boat had to travel empty to get to its next cargo, it would be cleaned while on the move.



Loading boats



This boat is being loaded with salt

**Strange
but True**

When boats are loaded they sit **lower in the water**. How much weight a boat is carrying can be worked out by seeing how low they are in water. This was important so the boat could be charged the **right amount of tolls**.

 **What do you think would happen if too much weight was loaded at one end?**



Tolls

It wasn't free to carry cargo on most waterways and boats had to pay tolls to the canal companies.

The tolls helped to pay for maintenance and repay the cost of building the waterways. It was not a new idea; tolls had been charged on boats travelling along rivers for centuries. Canal and Navigation Acts passed by the government helped to fix the tolls. There were different amounts depending on how much a boat was carrying and the type of cargo being carried, as cargoes varied in value. Fly boats, which travelled through the night, had to pay high tolls for their priority to pass other boaters in order to deliver their important cargoes as quickly as possible. Toll rates were also set for using inclined planes, lifts and tunnel tugs.

Tolls were paid in cash to the toll collector unless the company had an account, in which case they would be sent a bill to pay after a certain amount of time. Whether they were paying later or by cash, they received a toll ticket as a receipt. This included information, such as the name of the boat, the owner and the cargo carried.



 Why do you think toll tickets were important?

TELEGRAPHIC ADDRESS-
"CANAL LIVERPOOL"
TELEPHONE No. 3960 CENTRAL.

Leeds and Liverpool Canal Company.
SECRETARY & ACCOUNTANTS' OFFICE.
Ball Mill.
Liverpool. 37th Jan 1938

Dear Sir,
Your Toll debit for the Month of Dec. 1937
is as follows :-

For week ending <u>4th Dec</u>	: 2 : 6
• <u>11th</u>	: 6 : 8
• <u>18th</u>	2 : 10 : 0
• <u>25th</u>	1 : 13 : 8
• _____	: : :
	<u>24 : 12 : 10</u>

Yours truly,
W. H. Bell,
per W.H.B.

Mr. E. Perry
Lland

Payment of tolls letter

As other faster methods of transporting goods came along, the canals and waterways were used less.

Although canal companies tried to compete with railways and roads by lowering tolls, they did not manage to keep cargoes on waterways. Waterways began to have a different purpose. People enjoyed working on the waterways and many of the original boaters began to work for new companies operating pleasure craft. Boating for pleasure became increasingly popular. Canoeing, towpath walking and cycling have also become popular pastimes, and canals and rivers provide a great place to do this.

Towpaths are great places to spend time, as they are not often used now by horses pulling boats. People can enjoy fishing, cycling, walking and wildlife spotting. The inland waterways are part of our country's heritage but they have a great part to play in our modern world as well. Who knows – we might even use them for carrying cargoes again as the roads become busier and fuel becomes more and more expensive.



“Canals are a great place to try out canoeing as they are close to home, safe and with lots to see – you can even creep up on a moorhen!”

Edward Moss, British Canoe Union Coach

Maintenance

Now that the waterways are used for leisure purposes, they need to be kept in good condition for the millions of people that use them every year.

When the canals were built they were run by separate companies, which charged tolls to the boats carrying cargoes. As the waterways changed an organisation, called British Waterways, was set up (in 1962) to continue to run and maintain many of the waterways.

Repairs and maintenance

Many of the canals and navigations are more than over 200 years old and, as with most things, they need repairs to keep them in good condition. Banks need replacing, lock gates need to be renewed and structures need to be kept safe for use today.

Silt and mud collects at the bottom of waterways and it is a big job to clear this out of all 2,200 miles of UK waterways as well as maintaining land at the sides of the canals and rivers.



Lock gates need to be replaced over time



Repairs on the Caledonian Canal called for a local company to make fabric as part of the lining of the canal (just as they did when it was built).

Day-to-day work

The canal does not run itself. It takes a lot of people doing a lot of different jobs to keep things working.

British Waterways employs staff to operate some sections of canal, such as larger locks and marinas. Length inspectors have to regularly check that everything along their section of a waterway is in working order and respond quickly if any emergencies occur. Licences have to be issued to boaters and information provided.

Waterways are important historically as well as having a wide variety of wildlife. They have to be properly taken care of to conserve them for the future.

 **Why do you think British Waterways need divers?**



What do you think this man is doing?



“ I’m a harbour master and I’ve been working with waterways for about 30 years. When I started, about 1979, the canal was quite different then.

We had the old diving system. It was what we called the Sieb-Gorman, where the diver got into one of these big brass helmets and the old canvas and leather suit and the big heavy boots and they had to trust the people upstairs. We had a big old wooden box that was trolleyed out to the lock side and you sat and wound the handle and that was the bellows that pumped the air down to the diver.

Alex Hardy, harbour master, remembering his early working days.

Courtesy of the Dalriada Community History Project

Fascinating facts 2009

British Waterways looks after 2,200 miles of canals across the UK today.

Half the population of the UK lives within 5 miles of a canal.

There are 33,000 licensed boats on the waterways – more than when they were used to carry cargo!

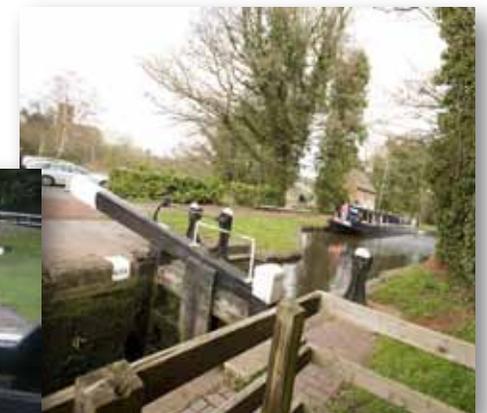
Fascinating Facts

There are:
1,654 locks
54 tunnels
3,115 bridges
417 aqueducts
91 reservoirs
600 miles of hedgerow

Along the waterways there are:
1,000 wildlife conservation sites
400 miles of conservation area
2,756 listed buildings
51 scheduled monuments
5 World Heritage Sites



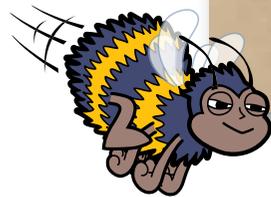
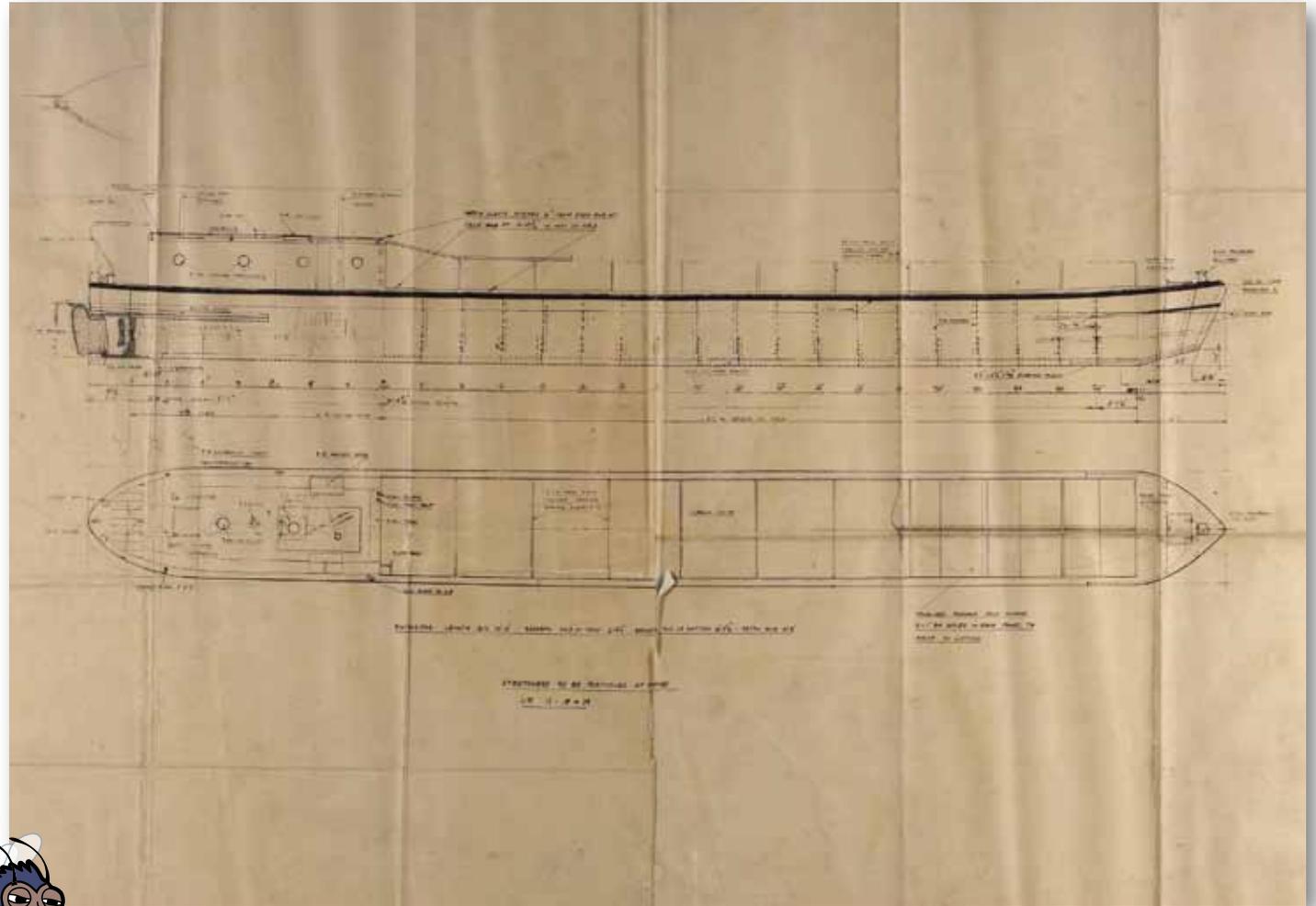
Look at all the different types of locks there are.



Appendix B

This is a plan of a motor boat.

- ❓ One image is looking down on the boat and one from the side. Can you tell which is which?
- ❓ What are the advantages and disadvantages of having a boat with an engine?

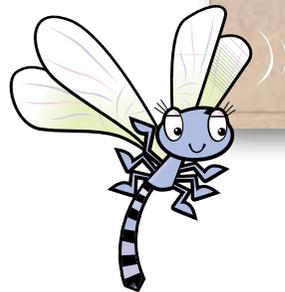
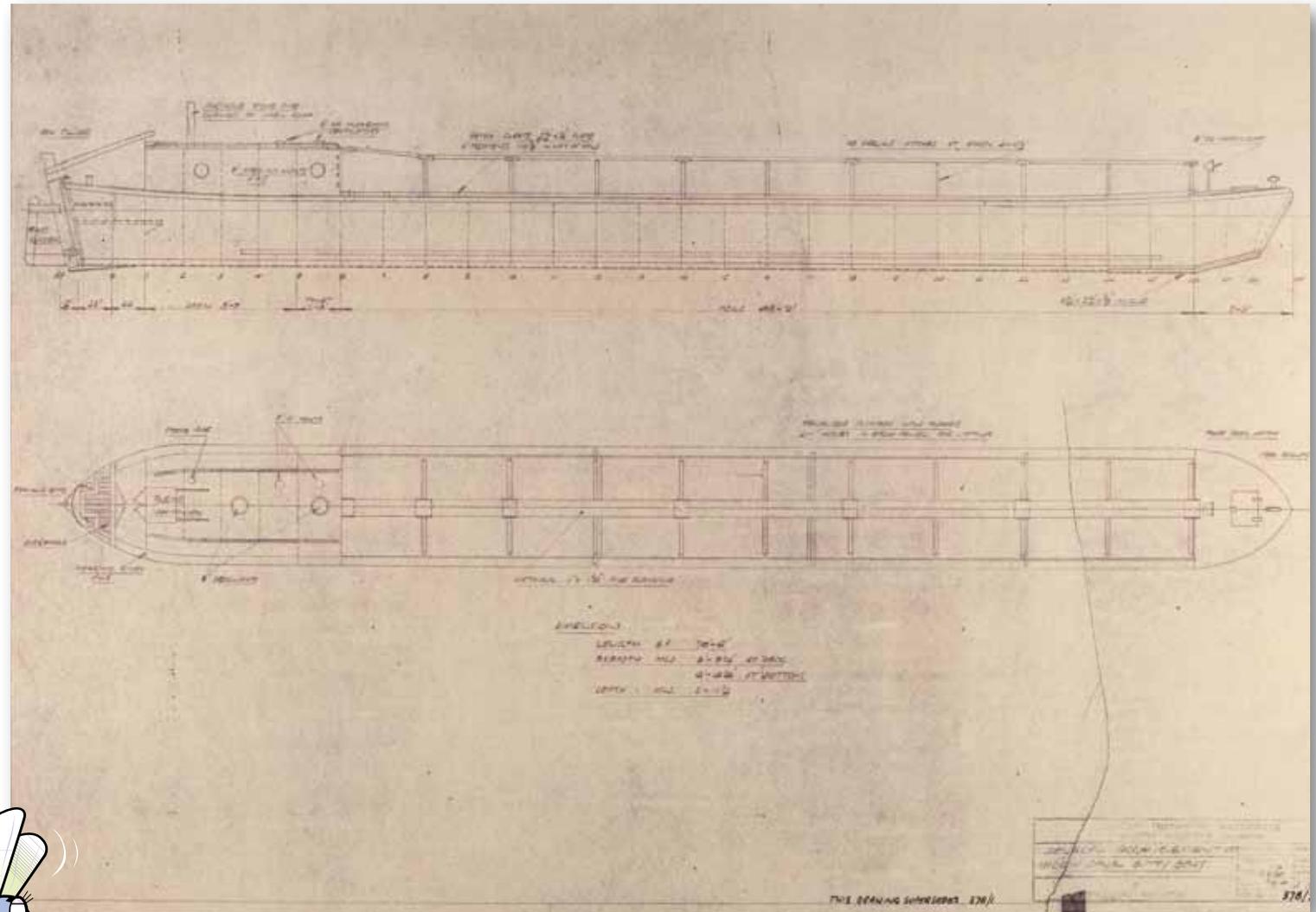


Appendix C

This is a plan of a butty
(a boat without an engine).

Look back at the motor boat plan.

 What are the differences
between the motor boat
and the butty?



Appendix D

Take a look at this record of boats going through Standedge Tunnel.

 Can you work out which boat went through in the shortest time?

 In which month did the greatest number of boats go through the tunnel?



Boats passing through

Boats entering Tunnel Marsden End			Boats coming out of Tunnel Diggle End				
Date	Time	Owners Name	Date	Time	Owners Name		
1894			Tunnel reopened				
Sept	6	12-0 Midnight	Buckley & Newton	Sept	6	1894	
"	10	3-20 P.M	J. Brierley	Sept	7	2-0 A.M	Buckley & Newton
"	12	7-0 A.M	Buckley & Newton	"	10	6-0 P.M	J. Brierley
"	18	9-0 "	J. Brierley	"	12	9-15 A.M	Buckley & Newton
"	20	2-45 P.M	Buckley & Newton	"	18	12-0 "	J. Brierley
			5 Boats	"	20	5-10 P.M	Buckley & Newton
Oct	2	2-45 P.M	J. Brierley	Oct	2	6-0 P.M	J. Brierley
"	4	9-0 A.M	J. Potts	"	4	7-0 "	J. Potts
"	9	8-15 "	J. Brierley	"	9	10-40 "	J. Brierley
"	"	9-20 "	- do -	"	"	11-0 "	- do -
"	15	2-0 P.M	J. Potts	"	15	4-20 "	J. Potts
"	16	9-0 A.M	J. Brierley	"	16	11-30 "	J. Brierley
"	18	7-0 P.M	Buckley & Newton	"	18	7-15 "	Buckley & Newton
"	24	2-30 "	J. Brierley	"	24	6-0 "	J. Brierley
"	"	" "	- do -	"	"	6-30 "	- do -
"	31	10-0 A.M	- do -	"	31	1-15 "	- do -
			10 Boats				