Historic England

# Education

## Teacher's Kit

# Industrial Heritage - Transport

## Introduction

The expansion and improvement of transport routes can be seen as a primary factor in the development of British industry. Early developments in transport were driven by the need to access and move raw materials. The coal and limestone industries were often the earliest to improve the routes along which their product was transported. New manufacturing techniques improved efficiency and reduced costs but required larger capital investments. There was a need for industrialists to seek out larger markets for their products in order to see an acceptable return on their capital. In order to access larger markets it was essential to reduce transport costs, to move high volumes and to obtain large quantities of raw materials.

Regionally-based industries such as the Lancashire cotton industry and the Staffordshire Potteries relied entirely on their ability to transport raw materials and finished goods swiftly and efficiently. As transport routes developed, new manufacturing techniques spread across the country and local craft-based industries declined. Greatly reduced transport costs in the late-nineteenth century brought about changes in retailing with the development of national chains of shops and as the Victorian cities grew increased demand for food, goods and services.

Three key components are central to the story of the construction and expansion of the transport network: capital investment, civil engineering skills and mechanical engineering capabilities.

The phases of the development of transport are usefully identified in the Council for British Archaeology, Industrial Archaeology: A Handbook (p234) as:

- Pack horse routes
- Drove roads and other early roads
- River navigations
- Coastal shipping routes
- Turnpiked roads
- Inland navigations
- Horse-worked early railways
- Steam-powered main line railways
- Post-railway motor vehicle based development

# Industrial Heritage - Transport - Roads

## A History of Roads

### Pack animals

Until the Turnpike Acts, Britain's limited road network saw little or no improvement. As many roads were impassable for wheeled traffic for most of the year, goods were carried by pack horse. A typical pack horse train would have included 30 or 40 animals, sometimes under the control of one man. Each animal could carry loads of up to 250lb (113kg) travelling distances up to 25 miles (40km) per day.

### Turnpikes

Road maintenance was the responsibility of the parish through which the road ran. Under a statute of 1555 each parishioner was required to spend four days per year maintaining the roads which ran through their parish. This system worked reasonably well for small local roads but when a large thoroughfare passed through the parish, sufficient labour was hard to find. The first Turnpike Act of 1663 sought to remedy this problem by allowing local justices to erect gates and levy tolls on a section of the Great North Road in Hertfordshire, Huntingdonshire and Cambridge.

In 1706 the first act was passed to allow independent trustees to raise tolls. Trusts were established with the power to collect road tolls, to use the revenue to maintain the road and to raise loans against the security of the toll income. In the 1830's, at the peak of the turnpike system, there were over 1,000 Trusts covering 18,000 miles(28,967 km) of road. These new roads had improved surfaces and more even gradients and were responsible for significant improvements in the speed of travel, the distance covered and thus were of great benefit to the local and national economy.

### Rebecca riots

The payment of tolls was not always well received by road users who protested about the increased cost of transporting raw materials and products to market. A series of riots took place in rural parts of West Wales between 1839 – 1843 when tenant farmers, disguising themselves as 'Rebecca and her daughters' attacked the toll gates.

### Road surfaces

In the 1820's Thomas Telford, John Metcalfe and John Loudon McAdam developed techniques which led to great improvements in road surfacing, recommending solid foundations with carefully graded top dressings. These new surfaces allowed vehicles carrying heavier loads to travel at much greater speeds (10mph or 16 km/hour averages were common for stage coaches in the 1830s).

### Toll houses

Toll houses provided living accommodation for toll collectors and were often built at each gate or turnpike point. In design, toll houses were usually single storey dwellings with three large bay windows (the centre bay projecting), situated very close to the roadway with a large blank space above the door where a board listing the tolls would have been displayed. Although road widening schemes have led to the widespread demolition of toll houses there are many surviving examples which are often listed because of their special architectural or historic interest.

# Industrial Heritage - Transport - Roads

## Milestones

Mid-eighteenth century legislation made it compulsory for Trusts to erect roadside milestones along their routes. Many Trusts developed their own distinctive style of road marker from stone blocks to cast-iron pillars and large numbers still survive.

## Bridges

Turnpike Trusts commissioned many of the major bridges built in Britain, designed by some of the most eminent engineers of the day. The forefather of modern bridges was Abraham Darby's Iron Bridge of 1779. Thomas Telford took on the mantle, building the iron bridge at Craigellachie on the River Spey in 1814, Waterloo Bridge (1815) over the River Conwy at Betws-y-Coed and Holt Fleet and Mythe bridges over the River Severn in 1828.

The early-nineteenth century saw the development of the suspension bridge for larger spans. Notable early examples are Telford's Menai Bridge of 1826 and Isambard Kingdom Brunel's Clifton Suspension Bridge of 1864.

The twentieth century saw steel replace iron in large road bridges; the Tyne Bridge of 1928 and the new Wearmouth Bridge of 1929 are the outstanding examples. Louis Gustave Mouchel pioneered the use of concrete reinforced with iron and steel in bridge construction. The late-twentieth century saw new road bridges built across many of the largest estuaries in Britain. Examples include; the Firth of Forth Road Bridge of 1964, the Severn Bridge of 1966, and the Humber Bridge of 1981.

## Decline and the introduction of the motor car

Competition from the railways led to a decline in road transport and many Turnpike Trusts were wound up between 1873 and 1878. A Local Government Act of 1888 passed the responsibility of the maintenance of the roads to the county councils and the last turnpike closed in 1895. Many of today's major roads follow the routes created or improved by Turnpike Trusts and often, evidence of structures remaining from the original turnpike roads can be seen on bridges, cuttings or embankments.

Main roads fell into decline in the latter part of the nineteenth century until the motor car brought about their revival. Road surfaces were improved to reduce the problem of dust. A network of arterial roads was planned and construction started soon after the end of World War One with the Great West Road and the East Lancashire Road among the biggest projects. By-passes around villages and ring roads around cities started to be built and roads were classed as 'A' or 'B' from 1921.

But changes in roads did not make much impact until the 1960s. Turning roads into dual carriageways and by-passing villages continued throughout the 1950s, Britain's first motorway, the Preston by-pass (now part of the M6) opened in 1958 and the first part of the M1 followed in 1959.

It was in the 1960s and 70s that the motorway system was developed to cover much of the country and inner ring roads, such as those at Birmingham and Coventry, became a feature of many English cities, altering them for ever and cutting them off by a physical barrier from their suburbs. At the same time, many town and city centres were pedestrianised. In recent years, people have questioned the wisdom of what was done in the 1960s in building inner ring roads and have tried to 'calm' them, replacing subways with pedestrian crossings, taking away fencing and reducing traffic speed.

# Industrial Heritage - Transport - Roads

## Street design

Many of our streets are increasingly cluttered with traffic signs, bollards and guardrails. This results in streetscapes that are both unsightly and lack character. Historic England has produced guidance to promote the restoration of the character of our streets. This includes a 'street clutter audit' where you can carry out a simple assessment and send the results to your local council. The website address can be found in the sources listed below.

## Sources

Palmer, M, Nevell, M, Sissons, M. (2012) *Industrial Archaeology: A Handbook*, Council for British Archaeology Practical Handbooks.

Morrison, K M & Minnis, J (2012), *Carscapes: the Motor Car, Architecture and Landscape in England* (Yale University Press).

Minnis, J (2014), *England's Motoring Heritage from the Air* (English Heritage).

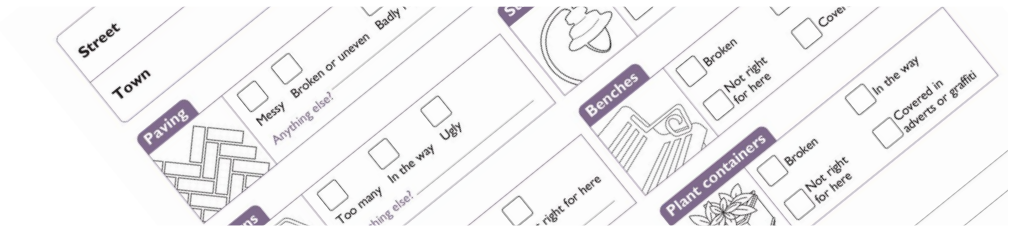
Ironbridge Gorge Museum Trust. Scroll down for an image of the 'table of tolls' (ironbridge.org.uk/explore/the-iron-bridge-tollhouse/)

National Archives. (nationalarchives.gov.uk/education/resources/rebecca-riots/)

Historic England: see a list of regional guidance documents and case studies. (historicengland.org.uk/advice/caring-for-heritage/streets-for-all/)

The last case study has advice on doing a street audit and can be found here: (content.historicengland.org.uk/images-books/publications/streets-for-all-10-how-to-do-a-street-audit/how-to-street.pdf/)

Shown below is a form you can use for your audit, it is available from this link: (content.historicengland.org.uk/content/docs/caring-for-heritage/street-clutter-audit3.pdf)




## Additional sources related to the history of roads, canals and railways

For details and links to some Historic England selection guides see the end of page nine.

# A History of Canals

## Navigable rivers

Until the dawning of the age of canals, the navigation of rivers formed the main trade routes in Britain. Improvements during the seventeenth century meant that many of the major river navigations were dredged and water courses straightened. Flood damage and the conflicting demands of mill owners however, coupled with land drainage and navigation issues made them far from ideal transport routes.

## 'Canal mania'

Britain was initially slow to develop non-river navigation canals, falling well behind the rest of Europe. The Newry Canal opened in Ireland in 1742 and was the first non-river navigation in the British Isles. The Sankey Canal opened in 1757, followed by the Bridgewater Canal in 1761. The Bridgewater Canal halved the price of coal in Manchester and so began a period of 'canal mania'. Over 100 canals were built in Britain between 1760 and 1820, with the total mileage of navigable rivers and canals rising from around 1000 miles (c 1610km) in 1750 to 4250 miles (c 6840km) by 1850.

Canals, with their constant depth, proved extremely efficient routes for the transportation of mineral resources (mainly coal and limestone) to their end market. One horse could tow 50 tons (50.8t) in a canal barge compared with 30 tons (30.48t) by river boat or 2 tons (2,03t) by wagons on a surfaced road. James Brindley was the foremost engineer in the early canal building phase. Prior to the development of canals all major cities lay on the coast or on the banks of a major river.

Canals joined up the major river navigations of the Humber, Thames, Mersey and Severn, helping to solve the transportation problems of the Midlands and facilitating the development of a number of large inland cities.The Grand Junction Canal was completed in 1805 with the Birmingham and Liverpool Junction Canal opening in 1835. William Jessop, Thomas Telford and John Rennie, the great engineers from this later period, developed new surveying and estimating techniques and managed huge engineering projects on a scale not seen before in Britain.

## Decline

Competition from the railways from the 1850s onwards led to a period of rapid decline in Britain's canal network. As canal share prices fell, many canal companies were purchased by competing railway companies who starved the canals of investment. In the twentieth century, road competition made many narrow canals obsolete.

Canals were nationalised under the 1948 Transport Act, leading to many canals being abandoned and others categorised as 'remainder waterways', with no requirement to maintain them in a navigable condition. In 1962 management of Britain's canal network was transferred to British Waterways, and in 2012 passed to the Canal and River Trust for England and Wales (an independent charity). Although commercial traffic has continued to dwindle to almost nothing today's canals have become important leisure destinations.

## Canal Buildings and Structures

The most commonly surviving canal buildings are houses built for the lock keeper or lengthsman which are often in private ownership now. Toll houses, with their characteristic bay windows, can also be found at most canal junctions. Many canal companies built grand offices in urban locations and maintenance workshops and warehouses alongside canals.

### Bridges

Bridges were built wherever a road crossed the canal or to allow access to fields separated by a canal. Many elegant, iron tow path bridges are to be found. Those built by the Horsley Iron Works are common In the West Midlands.

### Locks and inclined planes

Where steep gradients occurred flights of locks were often built. These differ from staircase locks because the locks are separate from one another and there is a navigable stretch of water between the locks. The Tardebigge Flight on the Worcester and Birmingham Canal is the longest flight of locks in the UK, comprising 30 narrow locks over 3.6km and raising the canal some 200ft (60.96m). Where there was a sudden change of level staircase locks were built. The longest of these is the set of eight locks at Banavie on the Caledonian Canal. Moving through locks was time consuming and wasted water, canal lifts or inclined planes were occasionally used as an alternative. Inclined planes used gravity and water power and often ancillary steam power to move boats on trolleys between the levels.

### Aqueducts

Large span masonry aqueducts are impressive features of the canal age. Jessop and Telford developed an iron trough to contain water inside a masonry structure and from modest beginnings in Derby and at Longdon-on-Tern, they went on to build the great aqueduct at Pontycysyllte on the Ellesmere Canal which opened in 1805 and is now a World Heritage Site.

### Tunnels

Tunnels were costly to build and maintain and often caused long delays in the completion of the canal, but where a canal passed through a hilly area, there was often no alternative. The longest canal tunnel was the Standedge Tunnel on the Huddersfield Narrow Canal through the Pennines which is over 3 miles (4.8km) long and has recently been reopened.

### Sources

Palmer, M, Nevell, M, Sissons, M. (2012) *Industrial Archaeology: A Handbook*, Council for British Archaeology Practical Handbooks.

Crowe, N (1994) *English Heritage Book of Canals.*

McKnight, H (1975) *The Shell Book of Inland Waterways* (David and Charles).

The website for the Canal and River Trust contains further useful information on the history of inland navigations, visitor attractions and museums. (canalrivertrust.org.uk/)

WOW is The Inland Waterways Association's programme of activities and resources for children aged 7 – 11 years and their teachers, group leaders and families. (waterways.org.uk/waterways/activities/wow/wow)

### Additional sources related to the history of roads, canals and railways

For details and links to some Historic England selection guides see the end of page nine.

# A History of Railways

## Early railways

Archaeological evidence suggests that track-guided vehicles were used in German mines as early as the fifteenth century with early railway technology coming to the British Isles in the middle of the sixteenth century. The earliest English horse-drawn railway for which documentary evidence exists was built in 1603 by Huntingdon Beaumont from pits at Strelley and Billborough to Wollaton, near Nottingham.

Early railway tracks consisted in design of two parallel wooden tracks which carried four wheeled, horse-drawn wagons. Two different types of rail were used, each favoured by different engineers: the plateway, in which a flat wheel was guided along an L shaped rail; and the railway, in which the wheel was flanged and guided along edge rails. The flanged wheel eventually replaced the plateway and wooden or composite rails were replaced by wholly metal rails.

The huge expansion of canals in the late-eighteenth century led to a boom in the construction of early railways. Where the terrain was hilly, railways were often used as an alternative to building expensive locks. Railways were also used as feeder routes from mines to canals.

These early railways followed the same engineering principles as canals; long stretches, tight curves and a route which followed a contour. They mainly relied on horse-power and gravity.

Where a change of level was necessary inclined planes were sometimes used. Gravity was employed when the flow of traffic was downhill and a winding engine or water balance used when the traffic went in both directions or against the gradient.

## Steam railways

The opening in 1825 of the Stockton & Darlington, followed in 1830 by the Liverpool to Manchester line (famous for Robert Stephenson's Rocket locomotive) is deemed the start of the age of the modern railway. The first long distance lines were opened in the early years of Queen Victoria's reign, the London and Birmingham in 1838, part of Brunel's London to Bristol route the same year. A railway boom followed during the 1840s. By 1845, 2441 miles (3928 km) of railway were open and 30 million passengers were being carried.

The railways offered new opportunities for travel and commerce for passengers across the social spectrum. Acts of parliament ensured that trains conformed to standards of speed and comfort and offered affordable fares. Time-tabling brought about a regularisation of time throughout Britain. Excursions and day trips, particularly to the seaside, became part of British social life.

'In 1851 many of the six million visitors to the Great Exhibition travelled by train to London in organised excursions. Queen Victoria made her first train journey on 13 June 1842 and then became a regular user of the rail network, for speed and convenience and because it gave her ample opportunity to show herself and her family to her subjects'

'Between 1861 and 1888 railway mileage grew by 81 per cent and the traffic carried increased by 180 per cent. By 1900, 18,680 miles (31, 625 km) of rail were in use and over 1100 million passengers were being carried, along with huge quantities

of freight. From 1852 the carriage of freight provided the railway companies with the bulk of their income. Safety standards gradually improved with advances in signalling and vehicle technology. By the end of the century trains ran regularly at speeds in excess of 70 miles (113 km) per hour. Comfort also improved. The first lavatories appeared in family saloons in the 1860s, the first proper sleeping cars were introduced in 1873 and dining cars came into use from 1879'.

Atterbury, P, *Victorian Technology*, 2011, BBC (see link below in the railway sources).

### Railway Buildings: Stations

A large proportion of the infrastructure and a great many of the buildings of today's railways are survivals from the nineteenth century. Post 1840 the station building developed in form and grandeur as railway companies employed leading architects to impress their customers. Station buildings often represent the early use of materials such as cast iron, wrought iron and concrete. St. Pancras and Paddington and Brunel's Bristol Temple Meads are iconic stations of this period.

The train shed which stands above the station platform are often viewed as 'cathedrals of the industrial period'. There are many surviving examples including those at York, Newcastle and Hull and Brunel's Bristol Temple Meads. The former Manchester Central train shed has been successfully reused as an exhibition hall.

### Railway Buildings: Hotels and railway housing

Many railway companies built hotels near their principal stations. The former Midland Hotel in Derby is one of the earliest. There are many fine railway hotels in London including the recently reopened Midland Grand at St. Pancras (now known as St. Pancras Renaissance).

Railway companies needed large volumes of staff during building periods and for the maintenance of the railways. Extensive housing was often built close to large stations and railway engineering works. There are excellent examples of railway housing surviving in Derby, Swindon and Crewe. The engineering works at Swindon is now a designer outlet shopping centre.

### Railway Structures: Bridges and viaducts

The great railway engineers are credited with the widespread use of the skew arch which allowed bridges to span spaces at angles other than right angles and for the use of iron and steel for bridges. Robert Stephenson's 1849 High Level Bridge in Newcastle is a good example of this new type of railway bridge. Many bridges of this period are still in use, needing careful conservation when the lines are upgraded.

Britain's network of viaducts, although not new in engineering terms, can be seen as one of the great achievements of the railway age. Viaducts were often employed to carry the railway for miles above the countryside or towns. The great cast-iron viaduct which carries the railway over the Castlefield Canal basin in Manchester is an excellent and evocative example of the great Victorian viaduct. Opened in 1880, the Manchester viaduct demonstrated the difficulties of traversing the city of the nineteenth century. Hundreds of houses were demolished further along the line to make way for the railway and station.

## Preservation and reuse

The Castlefield Viaduct is an interesting case study in adaptive reuse of a redundant engineering structure as there are currently plans to turn it into a 'hanging garden' based on the New York High Line project in New York. The urban garden will feature allotments, a café, a herb garden and seating areas.

Although many stations and branch lines were closed from the 1930s, in most cases the buildings were retained and, on the whole, railway infrastructure changed little until the 1960s when losses mounted. The demolition of Euston Station in the early 1960s was the most notorious example which led to a public outcry, although the destruction of stations and the ancillary structures that went with them continued into the 1970s. The establishment of the Railway Heritage Trust in 1985, which provided funding to restore railway buildings and find new uses for them, marked a turning point in the approach to transport heritage.

Many railway buildings lend themselves to reuse and some examples include King's Cross granary (now Central Saint Martins College), Cromford Station (offices and holiday lets), Alton Towers Station (Landmark Trust holiday accommodation), Denmark Hill Station (the Phoenix & Firkin pub), Canterbury West goods shed (a food market) and Walsingham Station (a Russian Orthodox chapel).

## Sources

Palmer, M, Nevell, M, Sissons, M. (2012) *Industrial Archaeology: A Handbook*, Council for British Archaeology Practical Handbooks.

Biddle, Gordon (2011), *Britain's Historic Railway Buildings* (Ian Allan).

An article by Tom Airey about the Castlefield Viaduct project can be found here:
(bbc.co.uk/news/uk-england-manchester-20158919)

BBC, Paul Atterbury, Victorian Technology.
(bbc.co.uk/history/british/victorians/victorian_technology_01.shtml)

## Additional sources related to the history of roads, canals and railways

The Historic England Selection Guides have been produced to explain the approach to the statutory protection for different types of heritage asset, many also contain useful background information related to transport, including:

Designation Listing Selection Guide Transport Buildings (2011).
(historicengland.org.uk/images-books/publications/dlsg-transport-buildings/)

Scheduling Selection Guide Transport Structures (2012).
(historicengland.org.uk/images-books/publications/dssg-transport-sites/)

Designation Listing Selection Guide Street Furniture (2011).
(historicengland.org.uk/images-books/publications/dlsg-street-furniture/)

# Activities – Transport - Roads

## Curriculum Links.

**History:** Chronological understanding – summarising the progression of change in the development of roads and road transport.

Knowledge and understanding of key events, people and changes in the past – analysing the key engineers and the development of road building techniques.

Historical interpretation & enquiry – examining a variety of source materials to discover the impact of road building and transport.

**Literacy:** Reading historical source materials - gathering information from a number of sources and writing imaginative and factual accounts.

**Mathematics:** Counting, calculations and solving numerical problems via milestone and table of tolls exercise.

**ICT:** Using ICT to examine a range of source materials. Presenting findings using ICT.

**PHSE:** A wider study of the environmental impact of roads and urbanisation and community and personal issues relating to road safety.

# Activities – Transport - Roads

## Activities – use the images in the pack to assist you with the following activities:

- Examine the types of vehicles and animals described in the Table of Tolls (see link below). Use ICT to investigate the relative speeds and uses of the differing modes of transport. Use ICT to find images and facts about the types of vehicles and animals mentioned. Create a class display, mini booklet or Power Point presentation featuring class findings. (ironbridge.org.uk/explore/the-iron-bridge-tollhouse/). Scroll down for an image of the 'table of tolls'.

- Describe the use of milestones on early roads. Using the pictures of milestones for inspiration ask pupils to design their own milestone. Think about the information they want to convey, where they might position their milestone and the materials they might use to construct it.

- Using the interactive whiteboard, draw a road with milestones positioned along it. Ask pupils to calculate the length of the road and to use calculations to discover distances travelled along the road.

- Divide the class into two groups:
  **Group One** will represent a Turnpike Trust and will be divided into engineers and trustees.
  **Group Two** will represent the people of the town soon to be made accessible by the new road. This group could be made up of townsfolk of a range of ages and include traditional craft workers.

  Debate the positive and negative impacts of the new road and ask the class to decide whether or not the road should be built. After the debate ask each member of the class to write a short imaginative account expressing the views of their character and those of a character with an opposing viewpoint.

- Investigate the Rebecca Riots – for an excellent source visit the National Archives nationalarchives.gov.uk/education/resources/rebecca-riots/

- Discuss the environmental and ecological impacts of the development of the road.

- Compare a picture of a street in your local area during the Victorian period with a picture of a street now. Research and discuss different modes of transport and the changing appearance of the street.

- Using a range of primary and secondary sources and ICT, examine the impact of road transport in your local area. Ask older members of the community to discuss their memories of the area. How has it changed over time? How have the roads, the appearance of the street and methods of transportation changed?

- Conduct a traffic survey near to school and discuss issues relating to road safety.

# Activities – Transport - Canals

## Curriculum Links.

**History:** Chronological understanding, understanding of the progression of change in the development of canals. Knowledge and understanding of key events, people and changes in the past – a study of the key engineers and canal building techniques.

**English:** By examining a range of historical sources and creating a piece of imaginative writing pupils will demonstrate the core skills of reading, writing and speaking and listening.

**Mathematics:** Calculation activities based around speed, distance travelled and load capacities.

**ICT:** Researching canal history and presenting your findings using ICT.

**Science:** Exploring canals as natural habitats for wildlife and supporting ecosystems.

**Geography:** Investigating physical processes and natural landscapes via a discussion on natural and man-made transport routes.

**Design & Technology:** Exploring the impact of ideas, design decisions and technological advances.

**PHSE:** Developing an awareness of the issues around water safety, personal responsibility and choice.

# Activities – Transport - Canals

## Activities – use the images in the pack to assist you with the following activities:

- Forces – inclined planes and locks. Explore gravity and forces by examining the difference between gravity, water balance and winding engine systems.
- Explain and list the differences between a natural, navigable river and a man-made canal.
- Create a class canal by digging a trench in a box filled with wet sand, line the trench with food wrap and sail a boat along it.
- Future of canals – investigate the positive environmental impact of canals today as a habitat for wildlife and an important destination for leisure activities.
- Investigate the famous canal engineers James Brindley and Thomas Telford and find out about their achievements.
- Use ICT to research the health and safety issues of building a canal, and living and working on a canal boat in the Victorian period.
- Discuss appropriate behaviour around canals and water safety issues.
  Learn the **SAFE** rule (**S**tay **A**way **F**rom the **E**dge).
- Research the life of a child living and working on a canal boat. Create a piece of imaginative writing based on your research. Use your research to write and present a class play or role play activity.
- WOW is The Inland Waterways Association's programme of activities and resources for children and has an excellent set of downloadable teaching resources on canals including 'Life on the English Waterways', 'Habitats', 'Building and Carrying' and 'Waterways at War'. You will also find a downloadable fact sheet about the canals near you and much more.
  waterways.org.uk/waterways/activities/wow/wow

# Activities – Transport - Railways

## Curriculum Links.

**History:** Chronological understanding – understanding progression and change in the development of the railways. Knowledge and understanding of key events, people and changes in the past – a study of the key railway engineers, building techniques and structures.

Historical interpretation and enquiry – examining primary and secondary source materials, investigating past events, understanding change and continuity.

**Geography:** Landscapes and contours and the development of early railways, environmental and sustainability issues.

**Design & Technology:** Exploring how products have been designed and made in the past, exploring how products contribute to lifestyles and consumer choices, exploring the impact of ideas, design decisions and technological advances.

**English:** Through creative writing exercises, roll play and examining a range of historical sources pupils will demonstrate the core skills of reading, writing and speaking and listening.

**Mathematics:** Using numerical skills and knowledge to solve problems and make calculations based on length of journeys, speed of travel, etc.

**ICT:** Gathering, analysing and presenting information about the development of the railways using a variety of media.

**PHSE:** Develop a sense of personal responsibility in relation to rail safety issues.

# Activities – Transport - Railways

## Activities – use the images in the pack to assist you with the following activities:

- Build a railway – develop a problem-solving activity by asking pupils to devise a route for an imaginary railway. Ask them to consider a number of options and scenarios. How might they create the shortest route? Spend the least money? Cause the least environmental impact? Span a housing estate, river or construct a tunnel?
- Inclined planes – explore energy and forces by examining the difference between gravity, water balance and winding engine systems.
- Calculate travelling speeds and journey times, ask pupils how far they have travelled on a train and plot the locations on a map. Calculate the total distance travelled by the class.
- Investigate famous railway engineers and their achievements - George Stephenson, Isambard Kingdom Brunel.
- Imagine a railway journey – evacuees in World War Two or a Victorian child's first railway journey to the seaside. Younger children may enjoy buying a ticket, packing a suitcase and role playing a trip to the seaside on a steam train.
- Research a Victorian railway accident and examine rail safety issues today.
- Compare the Victorian railway building with the picture of a modern railway building, list the differences and similarities, and think about the design of the two buildings and the differing materials used to construct the two stations. How are the two stations lit and heated? What power source is employed to make the trains run? What other types of transport might we see in and around the two stations?
- Adaptive reuse. Think about railway buildings and structures and how we might reuse defunct or derelict station buildings, signal boxes, train sheds, railways, bridges and viaducts.

# Education

## Teacher's Kit

# Images – Transport - Roads


**Mile Post, West Witton, North Yorkshire**

Mile Post approximately 20 meters south-east of Swinithwaite Hall. It is a cast iron post. On the left face is a hand pointing right and "LEYBURN 5 MILES". On the right face is hand pointing left and "HAWES 12 MILES". It dates from after the re-organisation of the highways authorities under the County Councils Act of 1888.

# Images – Transport - Roads

Kingston Bridge, Kingston upon Thames, London

The old bridge over the River Thames at Kingston was replaced with a toll bridge, opened in 1828. This photograph was taken in 1863. It shows a ceremony of some type taking place at the toll gate on the Hampton Wick side. Following a local campaign, the bridge was released from toll in 1870.

# Images – Transport - Roads

The Iron Bridge, Ironbridge, Telford and Wrekin

This was the worlds first single span cast iron bridge. It was built by Abraham Darby III in 1779 using iron cast by the Coalbrookdale Company to designs by Thomas Pritchard. It was built with the intention of making money and tolls were charged to cross it.

# Images – Transport - Roads

A Motor Cab and Driver, London

This early cab was evidently based on the design of the horse-drawn hansom cab. The motor car was developed independently by Gottlieb Daimler and Karl Benz in the 1880s. This picture was probably taken in the 1890s and the car would have been a rare site at the time. The cab shown may be a Bersey electric cab, introduced to London in 1897.

# Education

## Teacher's Kit

# Images – Transport - Roads


**Holborn Viaduct, Camden, London**

This photograph from September 1869 shows the construction of Holborn Viaduct, looking west. It connected Holborn Street with Newgate Street and was completed in 1869. The hoarding in the foreground advertises the newly-opened St Pancras Station, which opened in 1868.

# Images – Transport - Roads

Spaghetti Junction, Birmingham, West Midlands

The Gravelly Hill Interchange or Junction 6 on the M6 is better known as Spaghetti Junction. It was opened in 1972. It cost £10m to build and is held up by nearly 600 concrete columns. It was the last piece of this part of the 1960s motorway network to be completed. The junction and the section of the M6 through Birmingham is carried on a three and a half mile long viaduct. The motorway transformed the local area.

# Images – Transport - Canals

Blue House, Thames & Severn Canal, Siddington, Gloucestershire

Labourers working on the canal at Blue House Reach in the process of puddling or making the canal base watertight through the use of a clay mix. The canal was built in 1789 which was too early to be recorded by a photograph. However this image of the canal being restored to be reopened between 1900 and 1904 shows the techniques that would have been used.

# Images – Transport - Canals

Former toll house at Tarvin Lock, Great Boughton, Cheshire

This building was built in the mid-nineteenth century. It was a canal toll house, used to collect money from those using the canal. It is an unusual survival of such a building. Interestingly it was not built at the same time as the canal.

# Images – Transport - Canals


Manchester Ship Canal, Barton Aqueduct, Greater Manchester

General view of the Barton Aqueduct looking along the Manchester Ship Canal. It was built in 1893 as a replacement for an earlier stone design by James Brindley, built in 1761. This images was taken some time between 1945-1980.

# Images – Transport - Canals

Lock Cottage, Lowsonford, Warwickshire

A Lock keeper's cottage of c1816 for the Stratford-on-Avon Canal. It is one of six lock-keepers cottages on the Stratford-on-Avon Canal. The Canal was started in 1793 and opened in 1816. The unusual curved roof was built using techniques similar to those used for canal bridges.

# Images – Transport - Canals

Five Rise Locks, Bingley, West Yorkshire

One of the greatest feats of canal engineering of its day, this lock was built by John Longbottom in 1773 to James Brindley's design. It raises boats on the Leeds and Liverpool Canal by over 35 metres. To the right of the picture the overflow channel can be seen as a small water inlet.

# Images – Transport - Canals

The Giant's Basin, Potato Wharf, Manchester

In 1759, following the Bridgewater Canal Act, Francis Egerton, third Duke of Bridgewater, started work on the canal between his coal mines at Worsley and Manchester. The canal opened to Cornbrook in 1763 and then to Castlefield (here in Manchester) in 1764. At Castlefield it terminated at a basin in this giant 'cloverleaf' weir at a junction with the river Medlock. The weir took the overflow from the canal into the river.

# Images – Transport - Railways


**Euston Station, Camden, London**

A view looking down platform one and showing passengers waiting for and getting on a train. Built in 1851-2, it was the London terminus for the Great Northern Railway. There are signs for the 'Enquiry Office', 'Telegraph Office' and 'Cloak Room'.

# Images – Transport - Railways

The Royal Train

An interior view of the sitting room on Queen Victoria's Royal Train taken in 1902. Victoria was the first monarch to use this mode of transport; her first journey took place on 13th June 1842 and took her from Slough to London Paddington in 25 minutes.

# Images – Transport - Railways

St Pancras Station, Euston Road, London

Elevated view looking down onto the south facade of St Pancras Station with the hotel in the foreground. The St Pancras Hotel was built to the Italianate Gothic designs of Sir George Gilbert Scott in 1868-74.

# Images – Transport - Railways


Liverpool Street Station, City of London

The station was first built in 1871-5 by the Great Eastern Railway Company as a terminus for trains to East Anglia, and to provide suburban services for city workers. People can be seen getting off a train, buying newspapers and magazines from a stand and looking at the destinations boards. The destinations listed include Enfield, Walthamstow, Croydon, Waltham Forest, Romford, Brentwood and many others. There is also a 'Gentlemans Lavatory & Dressing Rooms' behind the destination board.

# Images – Transport - Railways

Great Western Railway, Slough, Berkshire

A general view of steam trains on the track in the vicinity of Slough Railway Station in 1883. There are two gauges of track seen here, the broad 7' track favoured by Brunel and the narrower 4'8" track still in use today. The last broad gauge train ran in 1892.

# Education

## Teacher's Kit

# Images – Transport - Railways

Railway Viaduct, Chester Le Street, Durham

This railway viaduct carries 2 tracks over the valley of the Chester Burn. It was built in 1868 for the North Eastern Railway Company.