Ravenglass & Eskdale Railway and Museum

Resources and activities for Primary Schools

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Theme 2: Ingenuity - building the Ravenglass and Eskdale Railway

Contents

Introduction

Ingenuity is an important theme at the Ravenglass Railway Museum. Alongside the science-based resources, these session explore the ingenuity of ‘Ratty People’; the characters who have worked on the railway and in some cases still do.

In this series of activities, children investigate how the railway was built and look in more detail at strong structures. During a visit to the railway, children look for examples of strong structures and then back at school develop their understanding of structures to tackle a bridge-building challenge.

Curriculum ideas

Investigating the Navvies who built the railway has links with the history curriculum (a local study) and also gives opportunities for exploring literacy.

The practical activities allow children to practise design, refine and make skills in design technology and illustrate forces and gravity from the science curriculum.

Wider curriculum connections can be made by researching information about bridges in different parts of the world. Facts about the bridges, such as height and span, can lead into numerical comparisons and representations. Changes in bridge design and capabilities over time can be interpreted in the light of the available materials and technology. How could new materials of the future allow bigger and higher bridges?

Bridges can be used to directly link with the Ravenglass and Eskdale railway and local transport links. Children can research the use of bridges in the local area and this can lead to questions that allow children to develop in-depth and thoughtful responses.

How and why are foot bridges different to those that need to carry cars, lorries or trains? The floods of 2015 caused major disruption as roads and bridges were damaged. What effect would a local bridge being out of use have on the children's daily life? How could children build a case for the bridge being repaired as quickly as possible or for the construction of a new bridge in their area?

Ratty People

Ratty People is a theme that can link into STEAM (science technology engineering arts and maths) to bring human faces to science, design and technology activities. It also leads into social history, with a focus on:

- Navvies
- Local characters
- Modern day people who work on the railway.

There are many other stories of Ratty People in the museum that can be used for inspiration.

Session 1: The Navvies				**Museum or school**
This session looks at how people have contributed to the history of the Ravenglass and Eskdale Railway. The navvies built the railway through backbreaking work. Used in conjunction with the STEM practical activities, these notes will help children to explore chronology and look at how working conditions have changed over time. This session will work in the museum and back in class. Children can create a display about the navvies who worked on the railway.				
Introduction	**Activities**			**Follow up**
Explain Explain that today the children will explore the lives of the people who built the railway, using old photographs. The photograph supplied is the only known photograph of the workers who built the railway. It shows a gang of navvies under the bridge at Irton Road.	**Compare** Compare this picture with a modern day engineer. What do the children notice that is similar and different? Ask the children to draw an outline of a person. Ask them to dress half as a navvy and half as a modern day engineer. Who do they think would have been the: strongest, safest, most adventurous, most hard-working? How have things changed between 1870 and today?	**Research through objects** The museum has objects that belonged to the navvies. Children can touch these items and read stories about navvies. Navvies had to travel for work and even though they were very hardworking, the local people were often suspicious of them. Put yourself in the shoes of a navvy working to create the Ravenglass and Eskdale Railway. Write a short blog about a day in your life.	**Ingenuity (back in school)** Compare the tools used by navvies with the tools used today (Crossrail Video at https://youtu.be/65ok77gPdXo). What are the big changes in large engineering projects? Is all of the hard work carried out by people or machines? What about the size and scale of equipment? Write a short story about a day in the life of an engineer working on Crossrail. Then compare the two stories.	**Plan** Ask the children to make detailed plans for their exhibition. Use the background information and feedback from the visit for inspiration. What will the theme be? Which objects will they use to tell their stories? What sort of objects will they use? Old objects or will the children create items to display? How will they gather information and objects (friends and families)? How will they let people know about their display?

Supporting information for teachers

1873 - The story of Navvies

Ravenglass and Eskdale Railway was built in 1873, and first opened on 24th May 1875.

Here is an extract from the Whitehaven News from 23rd November 1876:

> *Whitehaven News, 23rd November 1876 – 'The long talked-of Ravenglass & Eskdale Railway was opened for passenger traffic on Monday last. The first train, gaily decorated with flags, left Ravenglass at 8:35am, stopping at all stations and reached Boot, the Eastern terminus of the line, at 9:20am. Lord Muncaster, MP, the Rev H.Bell, Mr J.Ross and several other local gentlemen accompanied the train, Lord Muncaster riding upon the engine. A service of trains in connection with the trains on the Furness Railway is now running regularly into Eskdale. It is hoped that this little enterprise will be a means of bringing a large number of visitors to the truly beautiful valley of the Esk. We may add that the district was quite en fete over the event, flags being displayed at Ravenglass and various places along the line. In one instance, viz, that of Mr Vicars, Gill Bank; the flag was hoisted on the top of a high cragg known as 'The Burrows.''*

In the 1870s the demand for iron ore for Victorian construction projects was at its peak. Although there have been records of haematite (iron ore) in the Esk Valley since Roman times, it had only ever been smelted from time to time. In 1871 the Whitehaven Iron Mines Ltd was set up to mine in the area.

The Ravenglass and Eskdale Railway was built to transport iron ore from the mines above Boot and bring it to the main-line railway at Ravenglass. The Railway had permission to create a track no smaller than 2 ft 9 inches around (83 cm). The decision was taken to build the railway to a gauge of 3 ft, (91.44 cm).

Navvies built the line. 'Navvies' were named after the navigations (canals) they built. In the 1800s canals were the equivalent of motorways; a way of transporting goods quickly and cheaply. When the railways came, they gradually put the canals out of business.

Navvies were economic migrants of their time, many coming from Ireland. Life in Ireland was tough particularly for people who relied on farming or agriculture to make their living. Even before the potato famine in 1845, people were leaving Ireland in search of a better life.

The work of a navvy was tough. They didn't have the modern day tools we have today. They used pick axes, shovels and wheel-barrows to physically cut and lay the railway tracks. It was back-breaking, dangerous work.

Fifty navvies started to work on the Ravenglass railway in February 1874 and had laid the whole seven miles of track by April 1875.

Use the background information to explain that you are going to look at, and create a display about, the lives of the Navvies who built the railway.

This photograph is the only known photograph of the workers who built the railway. It shows a gang of Navvies under the bridge at Irton.

Compare this picture with a modern day engineers as shown in the video clip and information available at:

- Crossrail construction video clip at: https://youtu.be/65ok77gPdXo
- Examples of current-day engineers and role models, see Tomorrow's Engineers web site: http://www.tomorrowsengineers.org.uk

What do the children notice that is similar and different?

Prompt them to look at clothes, equipment and the work environment.

Session 2: A day in the life of a steam engine driver				**School or railway**
This session is based on an interview with an engine driver at the Ravenglass and Eskdale Railway. It can be used in the classroom. Equally children could arrange to conduct their own interviews with staff on site, by prior arrangement.				
Introduction	**Activities**			**Share**
Explain Today children are going to find out what it is like to work at the Ravenglass and Eskdale Railway. There are full-time and part-time jobs and lots of people volunteer their time. Some children may have family members who work at the railway. Use the interview with Anna Tilsley to explore some of the jobs involved. Team read the interview or read in role with one person asking questions and the other being Anna.	**Ask** What is Anna's job now? What does she do when she first arrives at work? Why does she have to set a fire in the engine? How long does it take for the engine to build up pressure? Which roles has Anna already carried out? Which job does she want to do? What does Anna like about the railway?	**Design project** Anna would like to see many more young people volunteering at the railway and museum. She would like the children to design a poster or an advertisement to encourage young people to volunteer to help at the railway. What sorts of images would you use? What sorts of words. See PPT of photographs and old posters to use as inspiration.	**Interview** Ask the children to prepare interview questions to find out about the jobs that people do at the railway but also perhaps around school or at home. Encourage them to think about : The sort of questions to ask How to record answers (the interviewer recorded Anna's replies on a smartphone) How they will write up the interviews and how they will share what they have learned with classmates.	Ask the children conduct their interviews and then report back. Can they provide a short report on What it was like to interview someone. What they learned. What they might do differently next time.

Supporting information for teachers

A day in the life of a steam engine driver

This interview with Anna Tilsley may provide inspiration for a thematic study of the types of jobs at the railway, how roles have changed over time, or women working on the railway. The museum has more information on these topics.

The early images of the Ravenglass and Eskdale Railway show mainly men working on the railway. This is no longer the case. There are three women engine drivers and women have other prominent roles such as guard, engineer and stationmaster.

Anna has worked her way up from volunteer to driver and hopes to continue to train and learn new skills that will allow her to go on to manage the railway.

Engine driver, Anna Tilsley

Interview with *Engine driver, Anna Tilsley*

What do you do on a typical day?

I'm currently a full-time diesel driver but I'm training on steam engines.

I light up the engine first thing in the morning, at 8 o'clock.

Set the fire in the engine to build up steam pressure. That takes a couple of hours.

While that is happening I polish and clean the engine before driving the train up the valley.

Each day I can do two or three round trips and then I get back and do all the shed jobs in reverse.

I make sure the fire has died down enough, clean out the smoke box and then polish the engine again.

I also paint the coaches throughout the winter. So when we are doing winter maintenance I'm in the paint shop and that's pretty much what I do.

What attracted you to this job?

When I came here I wasn't massively into trains. My father and brother were, though largely interested in mainline railways but I really enjoy it. I think the things that make it good here are the location and the people. I'm really good friends with all the other staff and really enjoy it. I started volunteering as a guard, and then got a paid job on the operations side, being a stationmaster and guard, things like that. Next I did a season in the booking office and now I'm driver so I've done a bit of everything really.

Are you the only female in those roles?

I'm the only female driver. We've got two volunteer diesel drivers that are female but I'm the only full-time female member of staff on the operations side.

So how would you encourage other girls (or anyone) into this role?

I think it's important to make it clear to anyone that it's not just the stereo-type that you think of; men with beards driving steam engines. It's not that any more. We actually have a lot of female guards who volunteer so it's about getting across that we do have a wide range of people and a wide range of ages from 16 to 70 volunteering, male and female.

I think a lot of people are put off because we do have more men and it can be a bit intimidating. When I started there weren't that many girls and I was quite intimidated by it. So it's about making people aware that there are girls here and we stick together. We are better at it than boys anyway!

Would you encourage girls to volunteer?

Absolutely, there's no reason girls can't do it.

I've always been into science and I go over to the engineers' workshop whenever I can and try to get a bit more of an understanding about the engineering behind it.

Where do you want to go from here?

I'd quite like to work my way up to jobs in management; controlling the railway and the signal box. I'd quite like to move on to those but for now I'm happy driving.

It sounds like a great job, it's outside, you get to meet people, proper start and finish process each day…

I didn't want to leave the area because I love it so much here. So I set my heart on learning to drive and it's taken me a few years of working up through the different jobs.

Interview techniques

Museum staff are happy to be interviewed by prior arrangement. Ask the children to think of questions for interview. What would they like to know about life at Ravenglass Railway Museum. What sorts of questions should they

ask in interview? (Open or closed etc). Put together a list of the ten best questions that will make the best interview. Ask the children to interview each other to test how well the questions might work. What could they improve in planning their interview questions?

How will they record their answers (video, sound file, making notes)? What are the pros and cons of these methods?

Session 3: The remarkable Mary Fair				**School and museum**
In this session children explore the archive material provided by Mary Fair. Mary Fair was an adventurous Edwardian photographer and writer. She has left the museum with photographs documenting the social history of the railway and the valley. This activity is also suitable for Arts Award Discover and Explore.				
Introduction	**Activities**			**Share**
Explain Use the background information to introduce Mary Fair. Invite children to look at different sources of information about Mary (PPT, background information, obituary). What is different and what is similar about the pieces of writing? Are there any difficult words in either piece of writing? Which gives the clearest picture of Mary?	**Pen portrait, artistic impression** Using the information they have from both the background information and the obituary ask the children to write a short description of Mary or draw a picture of Mary. Invite the children to share their (pen) portraits. Next share the PPT. Did their description accurately reflect Mary? What, in their opinion, is the most powerful source of information about Mary?	**Research** Invite the children to carry on their research about Mary Fair using the objects and records at the museum. There is a display at the museum and a suitcase containing objects that may have belonged to Mary. Use these in an object handling session. Ask the children to select a story they would like to tell about Mary, inspired by her photographs or articles. Make notes about this story. Mary used the pen name Silverpoint, ask the children to choose a pen name.	**Journalism or blog writing** **At the museum** Mary Fair promoted the Eskdale Valley in many magazines and newspapers. **Activity** Ask the children to choose a photograph by Mary Fair and write an article (or blog) for a newspaper based on the photograph. To plan, ask them to think about • What is the purpose of their article • Who will read it • Three facts • An alternative headline.	**Presentation** The children now have a lot of information about Mary. Can they plan an assembly about Mary to share their knowledge about this local character with everyone else in school? Can they think of other local characters they might like to investigate?

Supporting information for teachers

The remarkable Mary Fair (1875 to 1955)

The 400 photographs taken by Mary Fair have provided a great legacy for the Ravenglass Railway Museum. Her photographs show what life was like for people living in the valley between 1900 to the 1940s.

We know very little about Mary Fair's early life. She moved to Eskdale in 1903 aged 29, to be with her mother whose health was failing. Her father was the vicar in the valley.

As a young woman, Mary trained in medical science and was one of the first women to become a specialist in X-Rays and radium science. Later in life she suffered as her hands were scarred from working with radiation. During the First World War she worked at University College Hospital, London.

Mary developed an interest in photography in the 1890s, using one of the first folding cameras made by Kodak.

Over 50 years, she photographed every aspect of life in Eskdale. She often sold her photographs to magazines and newspapers, generating publicity for the area. Mary also wrote many articles and guides about life in the Esk Valley, including a vivid description of the 3ft gauge Ravenglass and Eskdale Railway, 'A Railway in Chancery' which appeared in 'Wide World' magazine in 1903. She often published under a pseudonym, 'Silverpoint' and she even wrote a series of detective novels under the name 'Donald Deane'.

The Ravenglass and Eskdale Railway ran very close to Beckfoot Rectory where Mary lived for a short time and it was a favourite subject to photograph.

Mary had an adventurous spirit. She drove her 1926 Trojan Tourer car all over the fells. She would even drive over Hardknott Pass near Boot. This was the steepest road in England at a time when roads were little more than cart tracks. She also travelled in Europe, serving as semi-official ship's medical officer on a cargo ship.

A keen archaeologist, she was actively involved in digging and recording Eskdale's past, and from the 1930s appeared on BBC radio discussing history and traditions in the Esk Valley.

Mary has left great photographic record along with articles documenting life in the valley. She was a strong personality and a true adventurer.

Mary's work is available to look at in both the museum and the archive.

Obituary

When Mary Fair died in 1955, Lord Rea of Eskdale provided obituary for the Whitehaven Times (17th February 1955).

An obituary usually appears in a newspaper when someone dies and it includes a short biography or description of someone's life.

> Archaeologist, welfare-worker, explorer, genealogist, naturalist, photographer, writer and lecturer… this familiar and friendly figure, sometimes half-tramp, sometimes professorial, trudging up the fells in foul or fair weather to deliver orange juice or medicinal oil out of her knapsack to some infant arrival in a remote farmhouse; or, at midnight, popping up disturbingly from behind a beck-side drystone wall, where she had been recording the seasonal note of an unusual owl… we shall miss her friendly, twinkling eye, her crisp opinions – sometimes inventively ornamented and not infrequently critical – but particularly we shall miss her humanity; her readiness to give a knowledgeable hand wherever it was needed.

Primary and secondary sources

The pieces of writing are examples of primary and secondary sources. Which is which?

One is a primary source (the obituary written by someone who knew Mary at the time of her death) and the other is a secondary source (the background information was written recently and pulled together from different primary and secondary sources).

Mary's photographs often appeared alongside her written articles about Eskdale. Ask the children to research online websites or publications that promote the Western Lakes. Ask them to write an article that could be published on one of these sites about the Ravenglass and Eskdale Railway. It could be about the museum; it could be comparing Mary Fair's work with the children's work publicising their local area or it could be about the Energy Coast.

http://www.eskdale.info

http://www.golakes.co.uk/explore/western-lake-district/?AskRedirect=true

More about Mary Fair

There is more information about Mary Fair at the museum. There are:

- Interpretation panels
- A suitcase containing items that may have belonged to Mary
- Photographs on display
- Photographs, magazines and other writing in the archive.

Session 4: Ratty People Saving the railway				**School and museum**
The very survival of the Ravenglass and Eskdale Railway has been threatened at many points in its history. In 1960, the local community rallied to preserve the railway and it is because of this local enthusiasm that the railway exists today. In this session we look at community and the strength of working together.				
Introduction	**Carousel of Activities**			**Share**
Explain The children will explore the history of the Ravenglass and Eskdale Railway. They can visit the museum and they can use the timeline and their own research. The railway has had a precarious history and there are several dramatic events and periods that will capture the children's interest. Give children a series of facts about the railway and get them to put them in order on a line (washing line and pegs). Ask the children to choose a part of the story they would like to investigate.	**Early history** Early in the history of the line, workers were needed both to build the railway and to mine the iron ore. Both of these jobs were highly dangerous and unpleasant. Look at the archive material about the families of these workers. Ask the children to write a short story imaging what life was like for the children of these families. How might children welcome these children today? What could they do to help them? Write a postcard or send a tweet to make these children feel welcome.	**W. J Bassett Lowke** Bassett Lowke saw the potential to use the railway to experiment with his ideas to make and improve steam engines. What might the problems be? How would children persuade the public to use the coaches pulled by miniature locomotives? Design an advertising campaign to get local people back on the Ratty. Think about the principals of Marketing: AIDA Awareness, interest, desire and action. Also think about Product, Place, Price and Promotion and the people who they are wishing to attract.	**Saving the railway** Ask the children to put themselves in the shoes of Douglas Robinson. How would they go about saving the railway? Today we have social media, great communications and news media. Douglas had very limited resources. Invite the children to think of ways of fundraising for a good cause. They can choose the cause. It could be a local charity, a national charity event or something else. Ask them to choose and plan a fundraising event. Can the children think of enterprising ideas that could be used at the museum?	**Presentation** Use the script of the auction to act out the fateful day when the railway was saved. Children can dress up and act in character. Ask them to rehearse. They may be able to present their drama at the museum.

Supporting information for teachers

The history of the line provides an opportunity to teach chronology. This is a very difficult task for teachers of particularly young children. The collection of model locomotives and toys might be a useful way in to chronology for very young children. What sorts of toys might they have played with at different ages, etc.

The history of the line is provided here in chronological order. The information can be cut up to create key events in a timeline of the Railway's history, using the first paragraph.

Timeline

1873 -1876 Building and opening of the railway

Ravenglass and Eskdale Railway was built in 1873, first opening on 24th May 1875.

In the 1870s the demand for iron ore for Victorian engineering and construction projects was at its height. There was a long history of iron ore being smelted in the Eskdale valley, back to Roman times. In 1871, Whitehaven Iron Mines Ltd decided to mine the area for ore. The Ravenglass and Eskdale Railway was built to transport iron ore from the mines above Boot and bring it to the main-line Furness Railway at Ravenglass.

1876 -1912 Difficult early years

The line opened for goods in 1875 and, after being inspected and passed as safe by the Board of Trade, for passengers in Nov 1876. Unfortunately the iron ore being mined was low-quality and, together with unpaid bills from the railway's construction, forced the line into bankruptcy in 1877.

The receivers continued to run the railway with minimum repairs and investment being made, and although the iron ore mines closed in 1884 the line became a popular tourist attraction.

In 1908, once again, it was considered to be unsafe for passengers and could only carry goods. One of the iron ore mines re-opened to try and provide work for the line

1913 Running out of steam

In 1913, the Nab Gill Mines flooded and the railway and its locomotives finally ran out of steam.

Key people

Both the building of the railway and the purpose of the railway (transporting goods from mines) attracted people from Ireland and Cornwall. The people in Ireland had faced very hard times and often migrated for work so that they could support their families. In Cornwall the tin mines were closing but Cornish tin miners had the skills needed to mine iron ore. The archive has tragic stories of the plight of some of the families that migrated to the area for work.

1913-1920s Invention and ingenuity

Even though the railway closed in 1913, this wasn't the end of the story.

W.J. Bassett Lowke found out about the railway. He was a miniature railway engineer and saw the line as a great opportunity to test his locomotives.

He visited the railway in June 1915 and within two weeks bought the lease and began regauging the railway to make it suitable for his work. Work continued on the line, despite the outbreak of the First World War.

Local passengers were amazed that they were being transported by scale models of locomotives such as the Sans Pareil.

The line extended and its activity expanded through 1920s.

Key people

WJ Bassett Lowke, station staff.

Sir Aubrey Brocklebank, Director of Cunard shipping line and a local railway enthusiast funded the building of a new locomotive in 1919 and in 1922 was a founder of the Beckfoot Quarry Company which used the little railway to move granite to the main-line railway at Ravenglass and provide local employment.

1925 – 48 A change of management

A change of management to Beckfoot Quarry Company saw the development of granite traffic and a lot of investment in new track, buildings, and locomotives and carriages.

More passengers used the line and it became profitable again.

Operations on the line were suspended during the Second World War.

Key people

Mary Fair, social history of area.

1953 – 1960 Railway in danger again

During this period the railway only transported passengers.

However, the 40,000 passengers using the railway during the summer months was not enough to keep the railway going. The railway was in danger of being sold to a scrap merchant.

1960 Saving the railway

Douglas Robinson, clerk of Muncaster Parish Council, worked tirelessly with others to gather donations from local people and people living further afield to save the railway.

This fundraising effort led to the founding of the Ravenglass and Eskdale Preservation Society. The campaign made the news, even appearing on the BBC but the funds gathered did not reach the £14,000 needed. The enthusiasm to save the railway attracted the attention of Colin Gilbert and Sir Wavell Wakefield MP. They had a business interest in what is now known as Ullswater Steamers. They bought the railway for £12,000. The railway is still owned by the Wakefield family.

Auction Script

Ravenglass and Eskdale Railway AUCTION 1960 SCRIPT – assembled from eye-witness accounts and contemporary newspaper reports.

TERRY HODGSON – (AUCTIONEER FROM KENDAL)
Good afternoon, this is a unique sale and a unique occasion when a very wonderful part of West Cumberland is to be sold. The Keswick Granite Company has already received offers of four thousand pounds for the track of the Ravenglass and Eskdale Railway, and two thousand for the ten cottages. I will begin by offering lots one to sixty as a going concern, but if no bids are made I shall offer each lot separately. Lots one to sixty then, the bidding starts at ten thousand pounds. Do I hear ten thousand?

DOUGLAS ROBINSON (BIDDING ON BEHALF OF RERPS)
Ten thousand

UNKNOWN BIDDER
Eleven thousand

HODGSON
I have eleven thousand

ROBINSON
Twelve thousand

Silence

HODGSON
Any advance on twelve thousand?

Silence

HODGSON
I will accept further bids of one hundred pounds

Silence

HODGSON
Very well, going once… going twice…

Hammer

…sold to the Ravenglass and Eskdale Railway Preservation Society
Cheers

Strong structures at the railway

Children look at the design of strong structures and develop their understanding of how strong structures are used around the railway.

Strong structures presentation

Before the visit, use the PowerPoint presentation to introduce children to the idea of strong structures. Teacher notes below the bridge-building challenge give additional information.

Strong structures around the railway

While children are visiting the railway, they should observe the buildings, carriages and other structures to observe how they are constructed for strength. It demonstrates the real-life application of materials, design and construction.

If available, children can take digital images of the strong structures and use these to produce a presentation or discuss the structures back in school. Some structures that the children may identify include:

Posts with supports and beams carry the platform canopy roof, which in turn is made from beams joined as triangles.

Beam bridge which carries the railway.

Arch over doorway.

‘Flattened triangles’ making up the picnic benches.

Railway tracks are made from strong iron and laid on sleepers to take the weight of the trains.

Footbridge over the mainline tracks show triangles making up a beam and a central supporting post.

Session 1: Strong structures at the Ravenglass and Eskdale Railway				**School, museum and railway**
This session links some pre-visit activities with activities when the children are at the railway station.				
Introduction	**Activities**			**Share**
Explain Before the visit, use the PowerPoint presentation to introduce children to the idea of strong structures. Teacher notes below the bridge challenge give supporting information.	**At the railway** While children are visiting the railway, they should observe the buildings, carriages and other structures to observe how they incorporate strong designs and construction. It demonstrates the real-life application of materials, design and construction. If available, children can take digital images of the strong structures and use these to produce a presentation or discuss the structures back in school.	Look for examples of arches, triangular structures, beams and the use of strong materials such as iron. How do these structures and materials relate to the job they are performing? Why have the materials been chosen? In the museum, look at the bridges exhibit. Use the blocks to build an arch. Note how the structure is only stable when the final keystone is in place.	**Resources** Strong structures PowerPoint presentation Strong structures worksheet Digital cameras if available **Safety** Produce your own suitable risk assessment but in addition, remind children not to stray from designated paths and platforms when looking for strong structures. Supervise as appropriate at all times.	Children can share their digital photographs and explain why the structures they have found are strong. Have children explain in terms of the structures and also the materials used. Link this to the purpose of the structure.

Strong structures at the railway

Can you find the strong structures?

Make a list of the structures you find.
What materials are they made from?
Explain why they are strong.

Stay on the platform and paths. Listen to what your teacher tells you to do.

Bridge-building challenge

In this session, children develop their design, build and test skills as well as gaining an understanding of forces. Children build a bridge using craft straws and connectors and test the strength of their bridge.

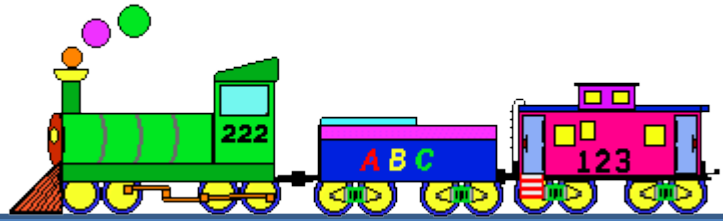
It is advisable to give the children plenty of time to experiment and try different approaches as well as the time needed to build their bridge.

Session 2: Bridge-building challenge				**School**
Children are challenged to build a bridge to span a gap. The bridge is made of commercially-available craft straws with connectors. Alternatively, drinking straws and sellotape could be used.				
Introduction	**Activities**			**Share**
Explain Use the presentation to highlight and describe the different types of bridges. Supporting notes are given below. Introduce the idea of building bridges to span gaps.	**Ask** What bridges do the children use? Do they notice bridges as they cross them? What would it be like without any bridges in Cumbria? How would it affect them getting to and from school and visiting friends and family?	**Build** The challenge is to build a bridge to span a gap (see final slide of the presentation). Choose an appropriate span, depending on the materials available and children's ability. This could be between two blocks, books or two tables positioned a distance apart. The bridges will be tested using a plasticine weight, placed in the centre of the bridge, to see how the different designs perform. For context, if possible use a model train, weighted with plasticine.	**Resources** Craft straws and connectors or drinking straws and sellotape. Bridges presentation and children's sheet (below). **Safety** Produce your own suitable risk assessment. In this case, if scissors are used, remind children of their correct use.	Children test their designs. This can be used as a basis for a report to Ratty on the best design. Which features worked well and which features not so well? How can their design be improved? Have children think about how bridges on the railway or ones they see every day have similar design features. To extend the activity, measurements of weight and the sag of the bridge could be made and put into a table or used to produce a graph.

Bridge challenge

Can you help me build the best bridge?

Design, make and test a bridge to allow the train to cross the gap.



Supporting information for teachers

Activity: Design, build and test a craft straw bridge

This activity can take some considerable time and the children will benefit from being able to make, test, redesign, remake and retest their structures. Some ideas and designs may be successful but equally, children can learn from those which are not so good.

After dividing the children into groups, it would be good to have a 'paper design' stage in which groups discuss and produce some form of drawing to show their proposed design.

On completion of this design phase (and any necessary revisions), give children their allocation of craft straws, connectors and sellotape.

Groups can then build, test, modify and develop their designs.

Test the bridges using plasticine weights and see if bridges can support a block placed in the middle of the span. Successful designs will take the weight. The weight is the force of gravity pulling down on the object and this is what the bridge needs to withstand. For a more realistic context, use a model train, weighted with plasticine as appropriate.

Strong structures and bridges background information

Strong structures tend to have shapes that incorporate triangles, or shapes based on triangles. A simple example is a bicycle frame. It is made up of two triangles joined together.

Triangles can be seen in these lamp posts. Look for similar structures at the top of the posts that support the platform cover.

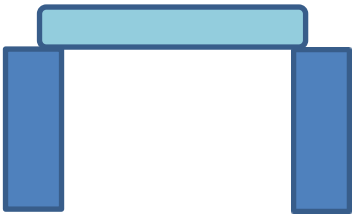
Engineers take into account a number of factors when designing a bridge. They consider:

- The load (weight) it has to carry,
- Its span (the distance it has to cross)
- Materials to use
- How to make it stable so it doesn't move about in high winds for example.

There are four main structures for bridges

- Beam
- Arch
- Cantilever
- Suspension.

Beam bridges

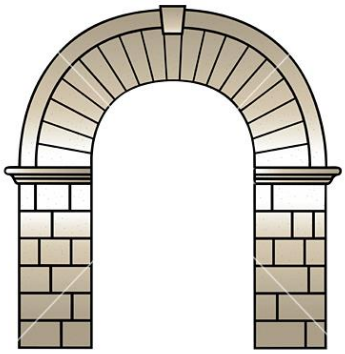


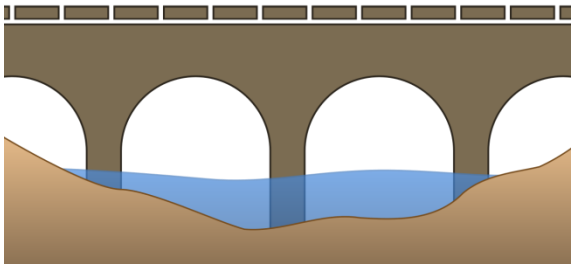
As a load crosses a beam bridge its weight presses downwards. If too much weight is put on the beam it will sag in the middle. Most beam bridges are no more than 60 metres in length.

Arch bridges

The Romans invented a type of cement that allowed them to bind stones together and form a concrete-like material. This invention meant they were able to build very large arch bridges.

Every arch bridge has a keystone at its midpoint. This keystone makes each stone in the arch press against its neighbours and so gives the bridge its strength. A series of arches are linked together when the bridge spans long distances.

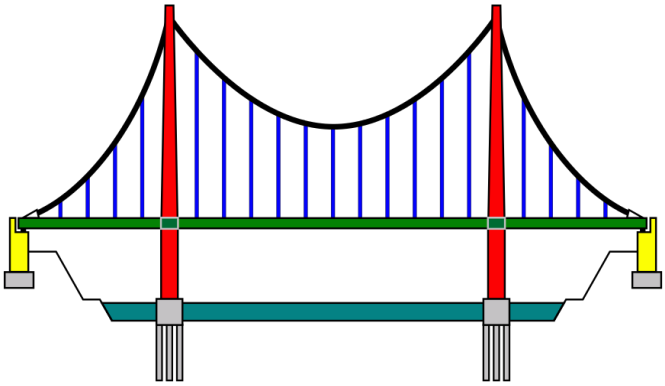




The force is carried outward along the curve to the supports at each end. The supports, called abutments, push back on the arch and prevent the ends of the arch from spreading apart.

Suspension bridges

In suspension bridges the deck hangs from cables from towers or an arch. In the nineteenth century, iron chains were used to construct suspension bridges. Now they are made of cables composed of thousands of steel wires. Suspension bridges can span large distances.



Engineering web links

The Institute of Engineering and Technology (IET) teachers section
http://www.theiet.org/resources/teachers/index.cfm

Faraday schools' web site (The Institute of Engineering and Technology)
http://faraday.theiet.org/

Tomorrow's Engineers (careers information)
http://www.tomorrowsengineers.org.uk