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| **Lesson Ten: Thomas Telford** |
| Lesson Ten focuses solely on Box 4 and the life of Thomas Telford. Telford was a designer and civil engineer who over a twenty year period embarked on a building project that involved constructing over nine hundred miles of roads and over a thousand bridges to create links between towns across the Highlands. He designed and oversaw the construction of the Caledonian canal as well as hundreds of harbours and slipways. Telford’s impact on the Highlands is immeasurable and hopefully this lesson can form an introduction to a hugely important figure in Scottish history.  |
| **Curriculum Links - Social Subjects (People, Past Events and Societies)** |
| Experiences and Outcomes | Benchmarks |
| **I am aware that different types of evidence can help me to find out about the past. SOC 0-01a**I can make a personal link to the past by exploring items or images connected with important individuals or special events in my life. SOC 0-02a**I have explored how people lived in the past and have used imaginative play to show how their lives were different from my own and people around me. SOC 0-04a** | * **Identifies at least two different types of evidence which can provide information about the past, for example, pictures, family stories, artefacts.**
* Recalls past events from their own life or that of their family, for example learning to ride a bike, a special party.
* **Recognises that people in the past lived differently.**
* **Uses knowledge of the past to demonstrate a difference between their life today and life in the past. For example, diet, lifestyle, clothing.**
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| **Wider Curricular links** |
| **Technologies (Awareness of Technological Developments; Past, Present and Future):**I explore everyday materials in the creation of pictures/models/concepts. **TCH 0-10a****Technologies (Application of Engineering):**I explore a variety of products covering a range of engineering disciplines. **TCH 0-12a** |

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| **Learning Objectives** |
| I know that Thomas Telford was an engineer. |
| I know how bridges help us. |
| I know engineers build bridges. |
| I recognise bridges in my local area. |

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| **Resources and Suggested Reading** |
| **Required Resources - Supplied in the boxes or from ARCH website** |
| Objects: Allt na Fearna Mor bridge model, Arch blocks (Box 4)Information Sheets: Thomas Telford, Additional images: Thomas Telford Bridges in the Highlands |
| **Additional Required Resources** |
| Dried spaghetti, midget gems or marshmallows, paper, blocks |
| **Essential Reading - Information sheets supplied in the box or from ARCH website** |
| Thomas Telford object sheet |
| **Suggested Additional Reading - Information sheets supplied in the box or from ARCH website** |
| None |

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| **Introduction** | **10 minutes** |
| **What is engineering?** (10 minutes) | **Resources**Additional images: Thomas Telford bridges in the Highlands |
| * This introduction focuses on what engineering is and the role of the engineer.
* There is scope to expand this introduction and conduct research on local feats of engineering.
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| Write the wording **engineer** on the board. As a *think-pair-share* exercise, ask the class ***What do you think an engineer does?*** Collate their answers on the board. An engineer uses science and maths to solve problems. This could range from construction to robotics.Show the class bridges designed by Thomas Telford. A sheet with four bridges is supplied, and a simple internet search of the term “Thomas Telford Bridges” will bring up other examples. It is worth focusing on these three:1. Telford Bridge, Invermoriston
2. Menai Suspension Bridge
3. Pontcysyllte Aqueduct

Two of these bridges are in Wales but are excellent examples of impressive structures design by Telford.Explain to the class that these bridges were all built by an engineer. |

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| **Main** | **40 minutes** |
| **Who was Thomas Telford?** (10 minutes) | Resources: Information Sheets: Thomas Telford object sheet; Additional Image: Thomas Telford Bridges in the Highlands |
| * These activities are designed to introduce the work of Thomas Telford to the class. It is possible some pupils have never heard of him and therefore will know nothing about his life and work.
* Thomas Telford had a huge impact on life in the Highlands.
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| Show the class the portrait of Thomas Telford by S. Lane (on the back of the Thomas Telford object sheet). As a *think-pair-share* exercise, ask the class ***How long ago do you think this person lived?*** Have the class share their answers (around 200 years is correct - b. 1757 and d.1834). Follow up with the question ***How can you tell?*** Even though the concept of hundreds will be unfamiliar to most early level pupils, it is worth asking the question. The important discussion points are the clues that show Thomas Telford lived a long time ago (the picture is a painting rather than a photograph, the clothes he is wearing, etc.).Show the class the pictures of the bridges created by Thomas Telford once again. As another *think-pair-share* exercise, ask the class ***What do you think these bridges are made of?*** Collate the class’ answers on the board.*OPTIONAL: At this point you could have the class draw their own bridge design, using the Thomas Telford images as an inspiration.**OPTIONAL: Ask the class* ***What jobs do you think are involved in building these bridges?*** *There would be carpenters, stone masons, labourers, blacksmiths etc. It is unlikely that the pupils will know the name of the jobs but they may respond with “someone to lay the stones” or similar. You can then explain the different roles. To extend this, you can complete a short role play exercise where they act out the different roles of people working on Telford’s bridges. There are plenty of videos available online of the different roles used in bridge construction to use as inspiration.*  |
| **Engineering** (30 minutes) | Resources: Objects: Allt na Fearna Mor bridge model, Arch blocks (Box 4)Other Resources: dried spaghetti, midget gems or marshmallows, paper, blocks |
| * This is a practical session which challenges the pupils to complete some engineering type tasks.
* One group will work with the teacher to discuss the Allt na Fearna Mor Bridge model and the construction of arches.
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| *Depending on numbers, split the class into small groups. This part of the lesson features a few separate activities split into two sections which the groups rotate around. These activities are to be completed at the same time and repeated as the groups move around. They can be split up and completed in separate lessons if you wish.***Bridge building:**The bridge building activity can be completed in a few different ways. Essentially you are tasking the pupils with building a bridge out of different materials. Pupils can simply build bridges on their tables or on the carpet or to make the tasks more intricate you could have them build bridges over the image of a stream or a river. However you decide to run the session you will need a few different materials for the pupils to experiment with. Some examples are detailed below but most bridge building tasks will work just as well.1. Spaghetti and Midget Gem Bridge:

Using spaghetti and midget gems (marshmallows will work as well and some pupils find them easier to use), the pupils are to make a bridge. Allow them to experiment, but have them build the bridge over a 20cm gap. This could be between two tables, two books, some chairs etc.You could have a car run over the bridge if you wish. Otherwise this bridge is to explore the use of shapes. Once the pupils have finished their bridge, as a class see what shapes can be seen in the design. It is important to store the midget gems in a warm space (near a radiator is perfect) as this will make them a little softer and make it easier to push the spaghetti into the sweet.1. Paper Bridges.

Again, pupils are tasked with bridging a small gap of 10cm using scrap A4 paper. Each pupil or small group can be given one sheet of paper. Some pupils will be tempted to lay the paper between the gap, however, show the class that this will not work as, to test their bridge, you will be placing a block on it to see whether it can carry the weight.Demonstrate to the class that they will need to fold the paper to make it stronger. Allow them to experiment with their designs.1. Block Bridges.

The final bridge type is a block bridge. In this task the pupils are simply to create a bridge out of wooden blocks. It is worth having something (such as the image of a river or stream) for the pupils to build over. Encourage the pupils to make their bridges as interesting as possible. At the end of the task have the pupils show their bridge to the rest of the class. **Allt na Fearna Mor**This activity is teacher-led and involves the bridge model and the wooden arch pieces from Box 4. Show the pupils the model bridge. Ask ***What type of bridge is it?*** Explain that the stones of the arch have been shaped to fit into place. Show the pupils the wooden “former” under the archway. Explain that this was used to shape the archway, and would have been made up of a framework of cut timber. The stones would be built on the former until the final central stone (keystone) was placed at the top of the arch. Once it was in place the former could be removed. You can demonstrate this with the model.Give the group(s) the pack of large wooden blocks. Ask the group(s) to build an arch using the wooden blocks. When the archway is complete, ask the groups to test how strong it is. Have one pupil push down on the middle top stone (given enough force the archway should collapse). Have the pupils to rebuild the arch. Ask ***How can we stop that happening?*** Demonstrate the strength of a correctly built arch by asking two pupils to hold the bottom stone on each side. Make sure they are only holding the bottom block. Have a pupil push down on the middle stone again. It should be obvious, if done correctly, just how strong an archway is.Explain to the class groups that arches are incredibly strong. All the load pressing down on the bridge is directed down either side of the archway. The lower stones are supported by abutments which prevent the bottom stones from being forced outwards.*Ten minutes is a reasonable length of time for each activity. Show a timer on the board and when it has elapsed move each group to the next activity. During the changeover you can inspect each group’s work. The results can then be recorded on the board and collated at the end of the lesson. You could incentivise the groups with a prize but that is obviously up to you.*  |

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| **Plenary** | **5 minutes** |
| **Ask a question** (5 minutes) | Resources: Portrait of Thomas Telford (on back of Thomas Telford object sheet) |
| * This plenary is simply a reflective exercise to generate discussion of the pupils’ learning.
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| Show the class the picture of Thomas Telford once again.Ask each pupil to think of a question they would like to ask Thomas Telford if they could. Have the pupils share their questions with the rest of the class. Following that, as a *think-pair-share* exercise, ask the pupils ***What is the most surprising thing you learnt today?*** Collate the class’s answers. |

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| **Total Lesson Time: 55 minutes** |
| **Links and Further Information** |
| ARCH Experimental Archaeology Project: [www.archhighland.org.uk/experimental-archaeology.asp](http://www.archhighland.org.uk/experimental-archaeology.asp) There is a video about Telford and a blog. The ICE (Institute of Civil Engineers) booklet “Invisible Superheroes” can be found in the box (until they run out) and can be downloaded from the Lesson Resources . More information about ICE can be found at <https://www.ice.org.uk/>On line Resources[Biography](http://doi.org/10.1093/ref%3Aodnb/27107) by Roland Paxon of ICE in Oxford Dictionary of National Biography, updated in 2013. This gives details about Telford and his works.There are also a wealth of articles, pictures and other material about Telford on line – too many to list here! The [Highland Historic Environment Record](http://her.highland.gov.uk) (HER) and [Canmore](http://canmore.org.uk) both record information about Telford buildings, piers, harbours etc.Books and articlesCommissioners for Highland Roads and Bridges Reports. The full set is in Inverness Reference Library, while Reports 1-9 and 20 onwards are in Highland Archive Centre. This is an invaluable source detailing progress and developments through the years.Curtis, G.R. 1978-80. ‘Roads and bridges in the Scottish Highlands: the route between Dunkeld and Inverness’, Proceedings of the Society of Antiquaries of Scotland vol. 110, 475-96. Although focussing further south, it still has a good summary of Telford’s activities and a typology of his bridges. Available Inverness Reference Library, Dingwall Library or [on-line](file:///C%3A%5CUsers%5CDave%5CAppData%5CLocal%5CPackages%5Cmicrosoft.windowscommunicationsapps_8wekyb3d8bbwe%5CLocalState%5CFiles%5CS0%5C1622%5CAttachments%5Carchaeologydataservice.ac.uk%5Carchives%5Cview%5Cpsas%5Ccontents.cfm%3Fvol%3D110%26CFID%3D92dd8541-1bcc-466f-8542-ac59539107bd%26CFTOKEN%3D0).Haldane, A.R.B. 1962.New Ways through the Glens. The best overview of Telford’s activities. Available in some Highland Libraries.MacLean, Allan 1989. Telford’s Highland Churches. Available in some Highland Libraries.Paxton, Roland (ed.) 2007. Thomas Telford: 250 years of Inspiration. A very useful booklet published by ICE and available from their bookshop. Many of the articles are available on line. Southey, Robert 1929. Journey of a Tour in Scotland in 1819. London: John Murray. Also available on the internet. Invaluable account of travels just after Telford had completed his works – but biased, because Southey was a close friend of Telford. Telford, Thomas ed. John Rickman 1838. Life of Thomas Telford, Civil Engineer. Telford’s autobiography completed after his death by John Rickman. Contains large atlas with many drawings. Available Inverness Reference Library.ArchivesThe Highland Archive Centre in Inverness has a wealth of archive material on the Caledonian Canal, as well as some Telford plans and other materials. It also houses the local council roads committee minutes which often mention Telford and his work.Other archives relating to Telford’s work are scattered throughout the country but include National Records of Scotland in Edinburgh, The National Archives at Kew and the Parliamentary Archives at Westminster. |

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