As Creatives

Engineers Ireland

STEPS

The Heritage Trail

Engineering Through the Ages

Downloadable Engineering Activities

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Engineering Through the Ages

ENGINEERS IRELAND
STEPS

Rathcroghan: The Gateway to Hell!

Before You Start!

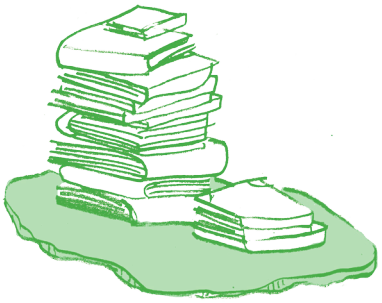
Resources	See the list below. All should be readily available
Time Required	45 - 60 minutes
Group Sizes	Individuals or pairs
Supervision	Younger children may need supervision or help with cutting and assembly
Curriculum Links*	Maths (2D shapes, measuring), Science (friction)
Notes	You'll need a flat surface to work on!

**all of the activities have links to both Irish history and Irish geography.*

Engineering Connection!

Aeronautical engineers reduce friction drag in three mains ways: by using materials that make the surfaces of aeroplanes smoother ... by designing aeroplanes that are more streamlined ... and by coming up with ways to design narrower wings without reducing efficiency.

Rathcroghan:
The Gateway to Hell!



If Rathcroghan could speak, it would tell tales of long ago – tales of prehistory and tales of the ancient Irish myths. But one tale it would prefer to go untold is of what lies behind the Gate to Hell, deep in the Oweynagat – The Cave of Cats. Suffice it to say, tales from the Gate are believed to have inspired many of the rituals of today's Halloween (or Samhain, in the old tongue). Your challenge is to keep the gate closed by building a working portcullis!

You Will Need:

- An empty cardboard box (a used cereal box is ideal)
- Lolly sticks (12)
- Pencil
- Ruler
- Scissors
- String
- Glue
- Scissors
- Masking tape

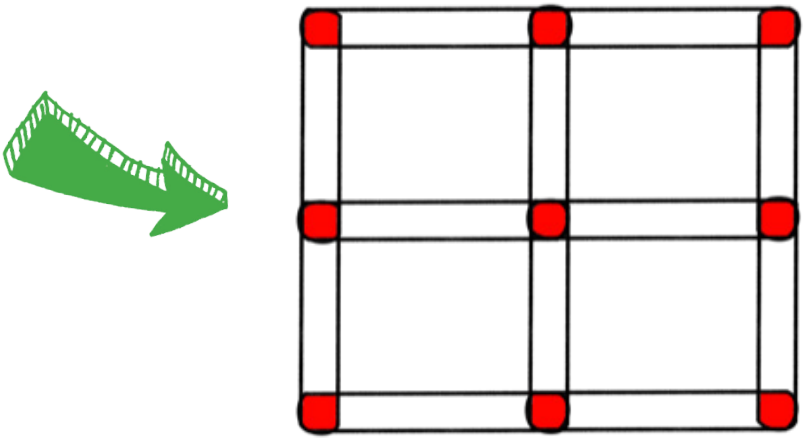
The Process:

Stage 1:

- Cut the four flaps of the top of your cardboard box (ie where you opened it to get at the cereal!). Put them aside for later.

Stage 2:

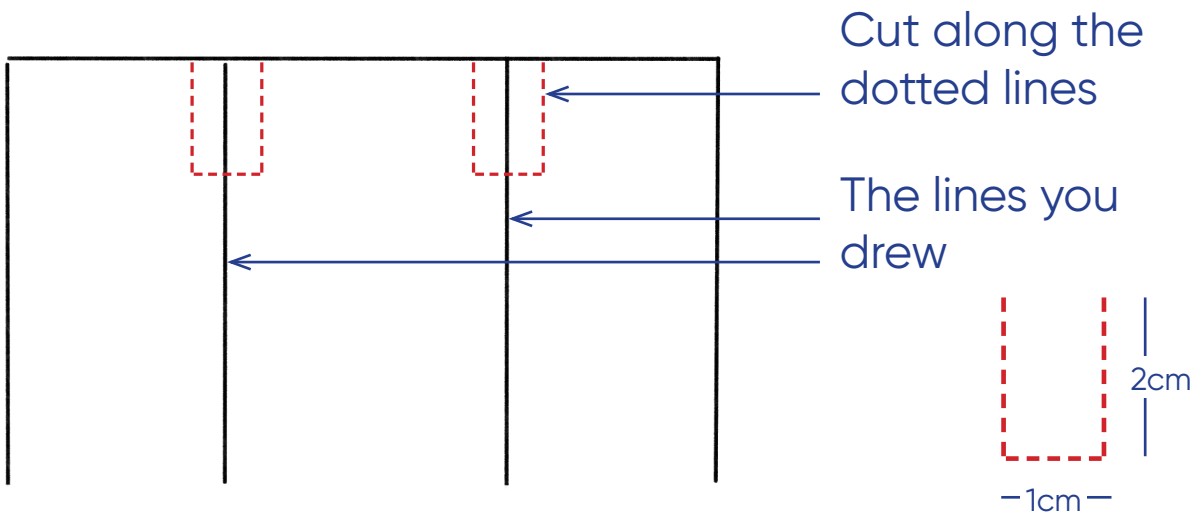
- Carefully lay the lolly sticks out to make the lattice of your portcullis – to look like this (the shaded areas indicate where the sticks will overlap) ...



- Apply glue to the shaded areas – press down firmly, and leave to set (you might want to do this in several stages).

Stage 3:

- Lay your cardboard box on a flat surface – with one of the larger faces uppermost.
- Lay your lolly stick latticework centrally on the box – about a centimetre above the base. Draw roughly round it.
- Use the ruler to draw a faint line from the middle of the top stick on the left to the top of the box. Repeat for the top stick on the right. Put your lolly stick lattice aside.
- Carefully cut two small notches at the top of your box, where you have drawn your lines – like this …



- Using the ruler, turn the shape you drew around the lolly sticks into a rectangle. Cut along the left, right and top of the rectangle. If you want a drawbridge, don't cut along the bottom (but do if you don't!).
  The cutting can be fiddly, so you might want to ask an adult for help!

Stage 4:

- Carefully measure the length of the longer side of your rectangle.
- Using the leftover cardboard from the top of the box, cut two rectangles:
  - Length: the distance you have measured
  - Width: 2cm
- Take the two rectangles you have just cut. Fold each in half lengthways.
- Glue the back of one of these to your cardboard box so that it sits neatly along the left long edge of your doorway – with the fold to the left. Your portcullis will sit into channels – and this will form one of them.
- Place the lattice/portcullis on your box – so that its left edge sits neatly in the left channel that you have made. Place the second "channel" into position – and mark where it needs to be. Put the portcullis aside.
- Glue the back of the second channel to your cardboard box, where you have marked it.

Stage 5:

- Stand the box upright – and place your portcullis in position. Cut two pieces of string, each long enough to go from the top of the portcullis … up to the slot … through the slot … and down to a flat edge where it can be secured (masking tape should hold them in place).
- Glue one end of one piece of string to the portcullis – to the top of the top lolly stick on the left. Glue the second to the top of the top lolly stick on the right. Leave these to set.

Stage 6:

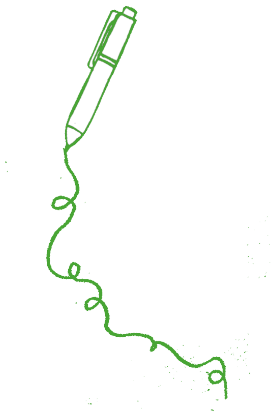
- Pass the two pieces of string up to the top of what is now your castle … through the notches … down to the flat edge … and secure them. Your portcullis should stay in place.
- Pull carefully on the two lengths of strings, applying equal force to each. Your portcullis should now be operational!
  And why not finish the job off by cutting some turrets at the top of the box – and painting it to give it a stonework effect?

Things to Think About:

- When operating your portcullis, friction will be the main force affecting performance as the string passes through the notches. Is there anything you can do about this?

Recording Your Work

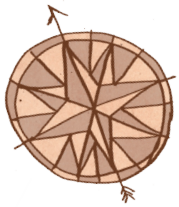
If you'd like to, you can print the worksheet accompanying this challenge – allowing you to keep a record of your work.



This court is now standing in the Tooth,
Walk, answer it, you have to go there
Walk fast without barking at your peril,
Walk! Or tear in the mud behind you!

(from *The Midnight Court*,
by Brian Merriman)

The Gateway to Hell – the Worksheet!



1. Draw a labelled picture of your completed castle, with portcullis, in the box.

2. What was the trickiest part of the construction?

3. If you included winches, you would have more control over raising and lowering your portcullis. How would you make a winch? Write your ideas, or draw illustrations, in this box

ENGINEERS IRELAND
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Rathcroghan: The Curves of Cashelmanannan

Before You Start!

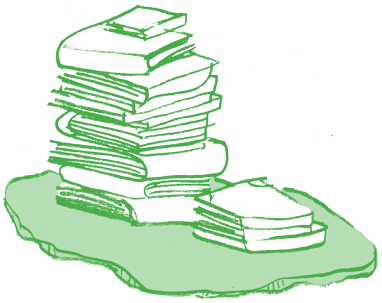
Resources	This challenge requires pebbles and soil – so is ideally an outdoor activity. You can, though, buy bags of pebbles from craft retailers.
Time Required	30 - 45 minutes
Group Sizes	Individuals or pairs
Supervision	If you're working outdoors, you should be aware of the appropriate safeguarding procedures
Curriculum Links*	Maths (2D shapes, measuring), Science (materials)
Notes	If you're working outdoors, part of the challenge could be sourcing the pebbles. Note though, that some sites do not like people doing this!

**all of the activities have links to both Irish history and Irish geography.*

Engineering Connection!

Curved walls are difficult to build – but they do have their advantages. Civil engineers often design and build curved walls for dams – because these structures can hold back much greater water pressure than straight walls are able to. And Catheleen Falls in County Donegal makes use of curved walls!

Rathcroghan:
The Curves of Cashelmanannan



One of Rathcroghan's most impressive structures was the oval fort of Cashelmanannan – about forty metres across inside. It was protected by, not one, but three stone walls – each following the same oval pattern. All of which tells us that whoever – or whatever – was being protected was important. Because building in stone was time-consuming and labour intensive … building three walls takes a lot longer (and more materials) than building one … and building curved walls is tricky!

This challenge will see you building a small part of the curves of Cashelmanannan – using only natural resources!

You Will Need:

- Pebbles of different sizes – about fifty of them!
- Soil
- String
- Lolly sticks

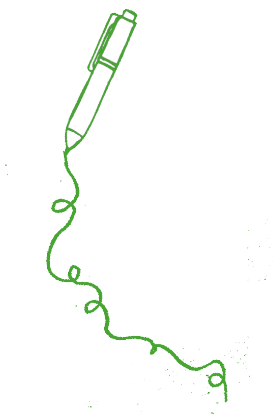
The Process:

- Use the string to mark out an oval shape – between 50cm and 1m long.
- Use two lolly sticks to mark out a clearly curved part of the oval.
- Place pebbles in two rows – one on each side of the string. Fill in the gap with soil – and place another row of pebbles on top. Make sure that the structure is as secure as possible.
- Repeat the process – to make a second row, with a gap of about 5cm between this and the first row.
- Repeat the process – to make a third row, with a gap of about 5cm between this and the second row.

And decide who – or what – is going to go inside your fort!

Things to Think About:

- How can you use pebbles of different sizes to maximise the strength of your fort?

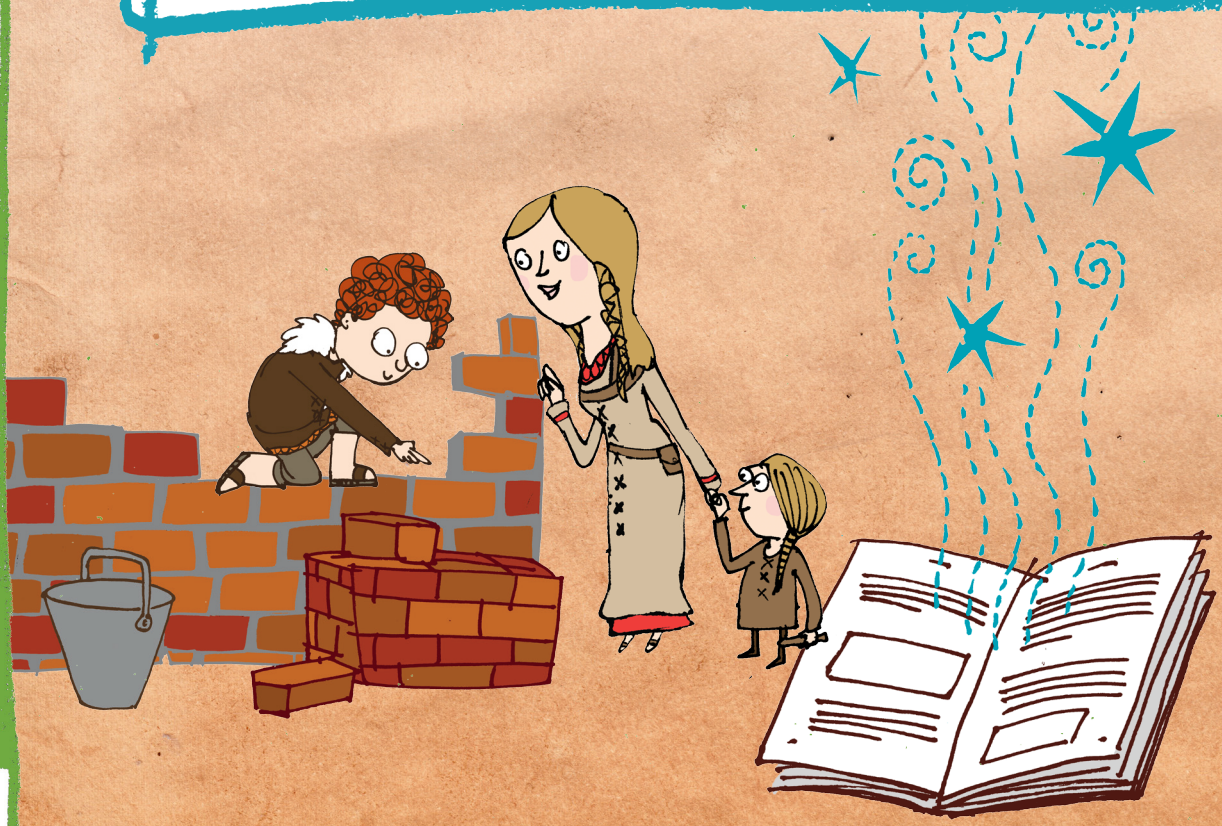


Recording Your Work

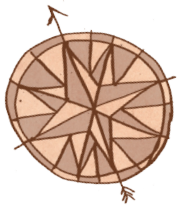
If you'd like to, you can print the worksheet accompanying this challenge – allowing you to keep a record of your work.

I am longing to be with you, and by the sea, where we can talk together freely and build our castles in the air!

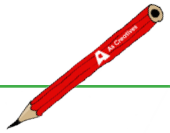
(from *Dracula*, by Bram Stoker)



The Curves of Cashelmanannan – the Worksheet!



1. Draw a labelled picture of your completed fortress.



2. What do you think will be the weakest, or most vulnerable parts of your structure?

3. If you were to build the wall up, how would you try to keep its strength and structure? Use this box to write your ideas down – or draw an illustration!

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Rathcroghan: Cattle Raid Chariots

Before You Start!

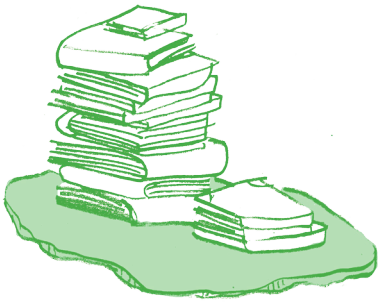
Resources	See the list below. Apart from the cotton reels (and you can get these from craft shops), and possibly the mathematical compass, all should be readily available
Time Required	45 - 60 minutes
Group Sizes	Individuals or pairs
Supervision	Younger children may need supervision or help with cutting
Curriculum Links*	Maths (problem solving, 2D shapes, measuring)
Notes	It may take a couple of goes to get this right – so the engineers will need to be resilient!

**all of the activities have links to both Irish history and Irish geography.*

Engineering Connection!

Although the wheel was first invented around 7000 years ago, in North Africa, it was originally used in the pottery industry! In Ireland, there is no evidence of ancient engineers using wheels for transportation before the Bronze Age.

Rathcroghan: Cattle Raid Chariots



Queen Mebh features in many of the ancient stories centred on Rathcroghan – and while her tactics were unusual, she usually met with success! The battles in the Cattle Raid of Cooley were mostly conducted via a series of single handed combats – and didn't always go her way. But she did achieve her immediate target: Don Cuailnge, a prized and powerful bull. And as the Queen turned up for the raid in her chariot, this challenge is to build a working, weight-bearing model!

You Will Need:

- Cotton reels (4 – all the same size)
- An empty cardboard box (a used cereal box is ideal)
- Thin card
- Modelling clay
- Cocktail sticks (8)
- Lolly sticks (4)
- Pencil
- Scissors
- Mathematical compass
- Cuddly toy
- Sticky tape

The Process

Stage 1:

- Measure the length of one of your cotton reels. Cut out four pieces of thin card:
  - Length: 15cm
  - Width: the distance you have measured + 4cm
- Roll one of the pieces of card lengthways – and see if it will go through your cotton reel. If not adjust until it does. Tape this tube up securely – then put it back through the cotton reel, with 2cm showing at either end. Repeat this for the other three cotton reels.

Stage 2:

- Place all four cotton reels on a flat surface, in a square formation (about 16cm x 16cm). Carefully place the cardboard box on top of them. Use a pencil to mark where to cut to bring it to the size you want – and then use the scissors to cut it to size.
- Select an appropriately sized cuddly toy to sit in the box and represent Queen Mebh!
- Carefully tape the two wooden skewers to the sides of the box – to act as handles.

Stage 3:

- Take one of your cotton reels. Use modelling clay to attach a cocktail stick to one end of the cardboard tube that you have threaded through it – one end of the cocktail stick should almost, but not quite, touch the ground. Repeat the process to attach another cocktail stick to the other end of the cardboard tube.
- Repeat the process for the other three cotton reels.
- Take one of your cotton reels. Use modelling clay to attach a lolly stick horizontally to the upper ends of the two cocktail sticks.
- Repeat the process for the other three cotton reels.
- Put a piece of double-sided sticky tape on top of each lolly stick. Place the box on top of the structure (take Queen Mebh out first!).
- Carefully, turn the whole thing upside down. And (even more carefully!) press down on the lolly sticks to make sure everything is reasonably secure.

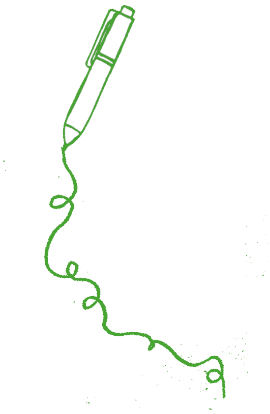
Now you're ready to turn your chariot back the right way up, put Queen Mebh back in – and tow her to the Cattle Raid of Cooley!

Things to Think About:

- The structure will be quite fragile – and the weakest points will be where elements are attached together with modelling clay. Given this, how can you ensure that it is as sturdy as possible?
- And if your cardboard tubes fit too tightly into the cotton reels, they won't rotate in the way you want them to!

Recording Your Work

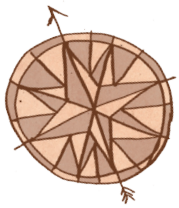
If you'd like to, you can print the worksheet accompanying this challenge – allowing you to keep a record of your work.



Mebh bade MacRoth ...
"Let Darè himself come with his bull, and he shall get a measure equalling his own land of the smooth plain of Ai, and a chariot!"

From *The Book of Leinster*,
translated by Brian O'Looney

Cattle Raid Chariots - the Worksheet!



1. Draw a labelled picture of your completed chariot in the box (don't forget to include Queen Mebh!).

2. What was the weakest part of the structure? How could you compensate for this? Use the box to write your ideas down – or draw them!

3. Traditionally, chariots use only two wheels. What would be the biggest difference that this would make?

Engineering Through the Ages

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Rathcroghan: King Dathi's Stone

Before You Start!

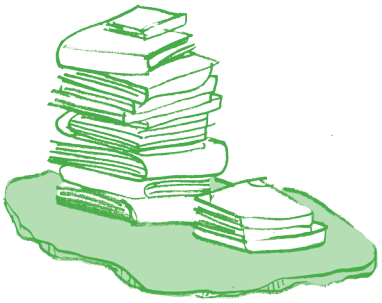
Resources	See the list below
Time Required	15 - 30 minutes
Group Sizes	Individuals, pairs or small groups
Supervision	As the tower gains in height, younger children may need supervision
Curriculum Links*	Maths (dimensions, mass), Science (materials, forces)
Notes	You'll need quite a lot of space for this – so you may want to clear tables beforehand!

**all of the activities have links to both Irish history and Irish geography.*

Engineering Connection!

Engineers ensure the stability of the world's tallest towers – skyscrapers – by designing and creating giant, steel skeletons first. The tallest tower on the island of Ireland is the 86 metre high Obel Tower in Belfast.

Rathcroghan: King Dathi's Stone



A number of kings and queens of Ireland are honoured and remembered at Rathcroghan. And the monument to King Dathi is a two metre tall sandstone standing stone on top of Dathi's Mound. The challenge is to attempt to use specified household materials to build a stable column, as tall as you are!

You Will Need:

- Books
- Building blocks
- Cardboard boxes
- Cardboard tubes
- Egg boxes
- Lolly sticks
- Straws
- Tin cans
- Trays

You'll also want a long tape measure – and a stopwatch or timer would come in handy, too!

Resources You Cannot Use:

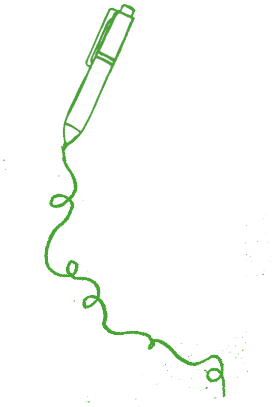
- Glue or tape
- Ladders
- Modelling clay

The Challenge:

- You can use more than one object to create the base of your tower. But the base must measure no more than 30cm x 30cm.
- As you add each object, you might like to record it on the worksheet (otherwise you'll never be able to recreate it!).
- As you add each object, leave the tower to stand for 10 seconds – then measure and record its height.

Things to Think About:

- The size and mass of the objects you select will be very important.
- Your tower does not necessarily have to get thinner and thinner as it rises. You might like to consider occasionally inserting thin but rigid items with a large surface area. This will give you more options.



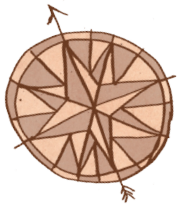
Recording Your Work

If you'd like to, you can print the worksheet accompanying this challenge – allowing you to keep a record of your work.

I pace among the battlements and stare
On the foundations of a house, or where
Tree, like a sooty finger, starts from the earth

(from *The Tower*, by WB Yeats)

King Dathi's Stone – the Worksheet!



1. Use the boxes to record which materials you used for each attempt – and the maximum hight your towers reached.

Tower 1

Tower 2

Tower 3

2. What did you learn as you went on? Write – or draw – your thoughts in this box.