

Forth Bridges Family Quest Level 3



Name:

Date:

Welcome to your Forth Bridges Family Quest!

Complete as many challenges as you can using the information in the CEC exhibition area, the bridges viewing platform and the booklets found in the centre. Good Luck!

Engineers

Unscramble the letters to work out what engineers do.

n l p a		n o u t s c r t c	
d i b u l		v i e n n t	
g e d i n s		i x f	

All engineers do the things listed above. All of the skills used are problem-solving skills. As there are different types of problems, there are different types of engineers. **How many different types of engineer can you name?**

Civ _ _	Env _ _ _ _ _
Me _ _ _ _ _	Tra _ _ _ _ _
El _ _ _ _ _	Che _ _ _ _
Geote _ _ _ _ _	F _ _ _
Str _ _ _ _ _	Aero _ _ _ _ _

Please turn over





The Forth Bridges

Three bridges cross the Firth of Forth at Queensferry. Each bridge has a different structural design.

Sketch the three bridges below – complete your sketch in under 10 minutes.

Mark on your drawing

Mark on your drawing the bridge that....

- Is the oldest
- Is the longest
- Is the tallest
- Has 23,000 miles of cable
- Has 30,000 miles of cable
- Has rivets.

Why do you think the deck on the Forth Road Bridge and Queensferry Crossing is curved (higher above water in the middle than at each side)?

.....

Queensferry Crossing Challenge

Using the information panels within the Contact and Education Centre's exhibition area, find out facts about the Queensferry Crossing to answer each of the questions below.

You have 30 minutes to complete this challenge.

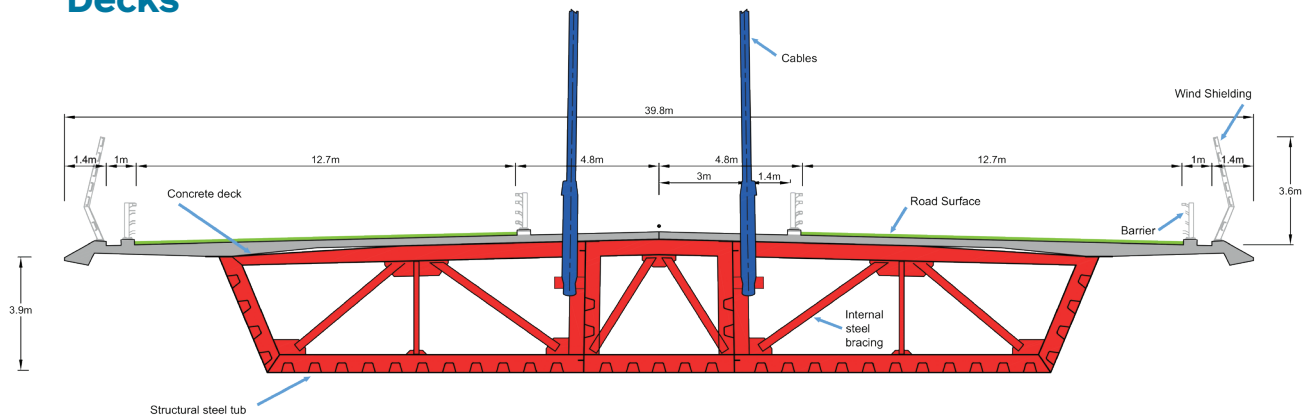
Queensferry Crossing overview



1. The Queensferry Crossing is km in length.
2. The Queensferry Crossing has towers.
3. The distance between each tower is metres.
4. Construction of the Queensferry Crossing required thousand metres cubed of concrete and thousand tonnes of permanent steel.



Decks

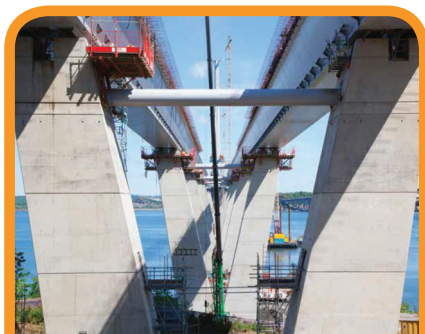


1. The blue cranes (erection travellers) began lifting the bridge deck sections into place on the Queensferry Crossing in (month) (year)
2. A typical deck section is metres across and helps to provide two lanes and a hard shoulder in each direction.
3. There are cables attached to each deck section.
4. The Tak Lift, the giant floating crane, lifted pieces of temporary steel into place.
5. A deck section can range from tonnes to tonnes in weight.

Foundations – Caissons

1. The diameter of the south tower caisson is metres across.
2. The height of the south tower caisson is metres.
3. The water at the south tower is metres deep.





Piers



Towers



Cables

Piers

1. In total, piers support the Queensferry Crossing.

2. There are piers supporting the south approach and

piers supporting the north approach.

3. The tallest pier is metres high.

Towers

1. The central tower rises to metres above water.

2. The south tower and north tower rise to metres above water.

3. The jump form was used to create the tower mould and build the tower up in sections.

This creates sections that are metres tall.

4. The towers were built in sections, each around 4 metres in height.

Cables

1. Each cable strand is made up of wires.

2. Each wire has a diameter of mm.

3. The largest cables on the Queensferry Crossing have strands.

4. If laid out end-to-end, the total length of all of the Queensferry Crossing's cabling would be thousand miles.



Bridge Design and Forces

The three bridges you can see crossing the Firth of Forth are all different structural designs:

cable-stayed , **cantilever** and **suspension** . Do you know which is which?



Forces

Tension and **compression** are two key types of forces involved in building any structure. Every material has the ability to hold up to a certain amount of tension and a certain amount of compression.

A **tension** force is one that pulls materials apart.

A **compression** force is one that squeezes material together.

Tension and **compression** are present in all bridges.

They are both capable of damaging part of the bridge as varying load weights and other forces act on the structure.

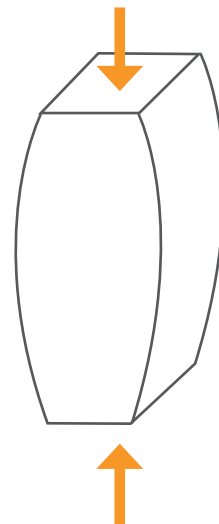
Normal



Tension

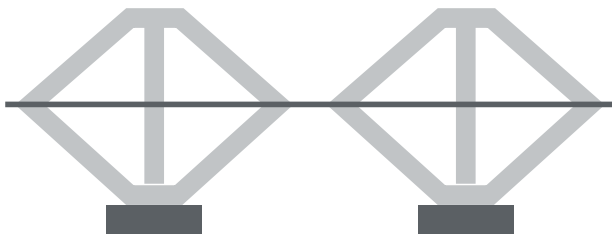


Compression

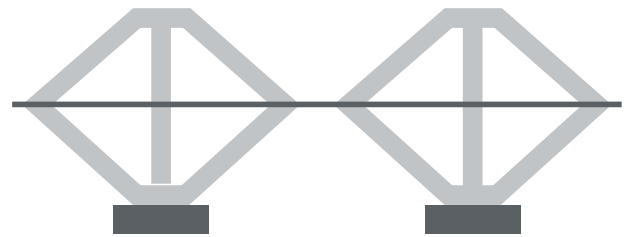


For each of the bridges crossing the Firth of Forth, mark on one drawing where you think the bridge would experience compression, i.e. pushing forces. Mark on the other drawing where the bridge would experience tension, i.e. pulling forces.

Cantilever Bridge

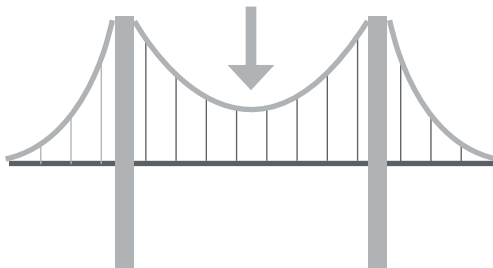


Compression

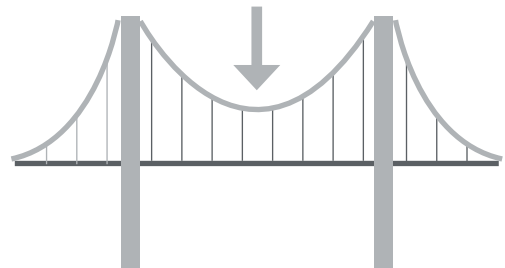


Tension

Suspension Bridge

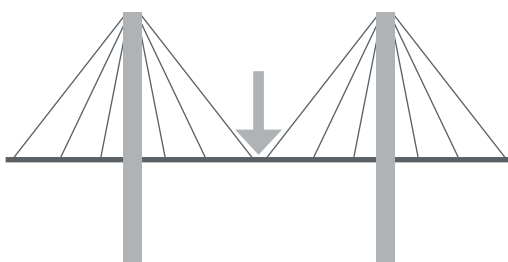


Compression

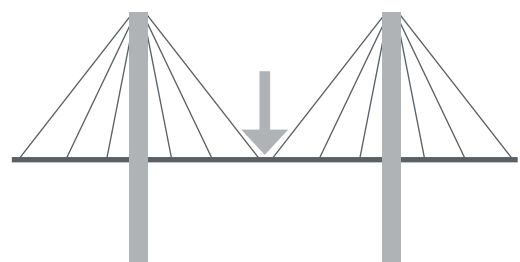


Tension

Cable-stayed Bridge



Compression



Tension



Bridge Crossing Logic

Four people are on a mission to arrive in Rosyth dockyard in time to see the opening ceremony for the Queensferry Crossing. They arrive on the Edinburgh side of the Firth of Forth.

There is only one way to cross, using an old footbridge that is broken in places and can only take the weight of two people at a time. They need to carry a special torch to see holes in the bridge and see where they can place their feet.

Your Challenge



Your challenge is to get every one of the four people across the bridge in the least amount of time.

Everyone walks at a different speed.



A Person A takes **1** minute to cross the bridge



B Person B takes **2** minutes to cross the bridge



C Person C takes **5** minutes to cross the bridge



D Person D takes **10** minutes to cross the bridge

Challenge rules

1. For each journey across the bridge **one person** must carry the torch.
2. Only **two people** can be on the bridge at any one time.
3. It is ok for someone to be left alone at either side of the bridge.
4. No one can swim across – they all must use the bridge.

How quickly can you get all four across the Forth?

Record your answer in the box below.

I managed to get all four people across the bridge in

minutes.



Well done!