INVISIBLE SUPERHEROES

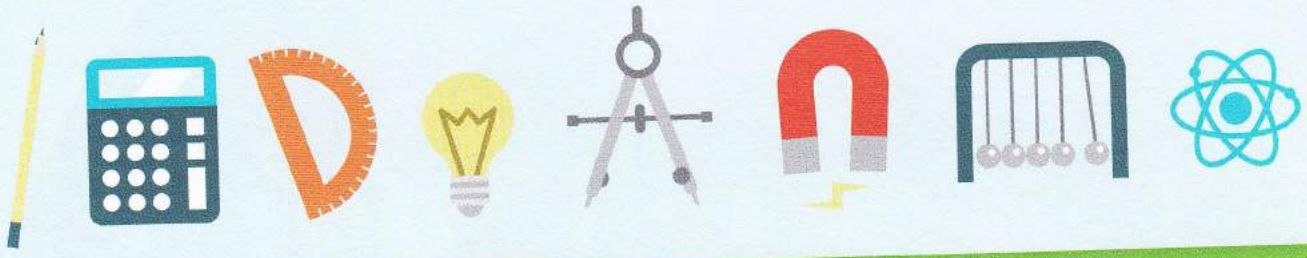
HOW CIVIL ENGINEERS TRANSFORM LIVES AND SHAPE THE WORLD AROUND US

AN ADVENTURE BROUGHT TO YOU BY

ice 200
Institution of Civil Engineers

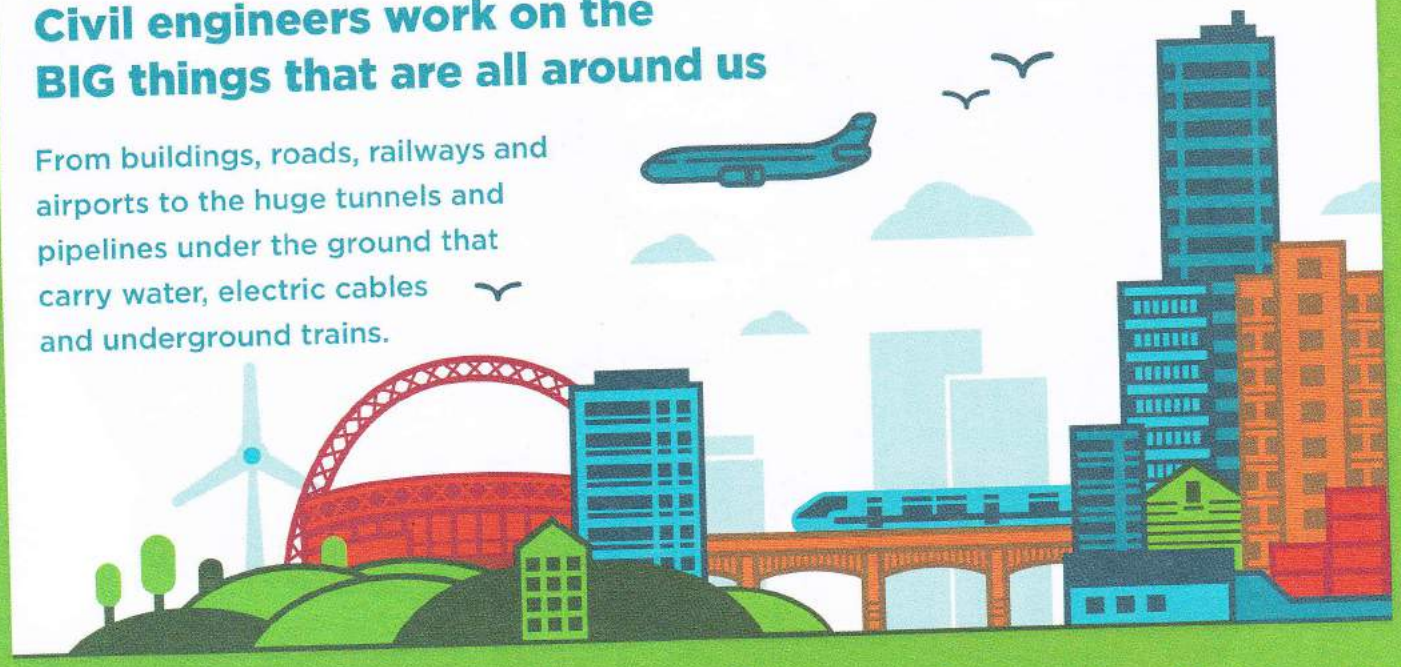
What is engineering?

Engineers use **maths** and **science** to solve problems.



Civil engineers work on the BIG things that are all around us

From buildings, roads, railways and airports to the huge tunnels and pipelines under the ground that carry water, electric cables and underground trains.

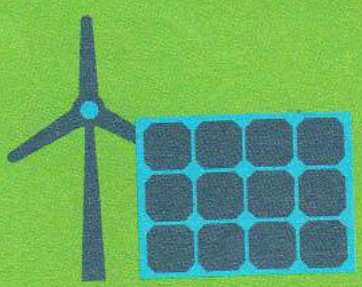


How does civil engineering help us?

Can you imagine a world where we didn't have buildings to keep us safe and warm, with no transport or energy?

Civil engineers have created our modern world. They're working right now on today's problems like...

Getting **clean water** to people, including those in the poorest parts of the world



Pollution-free **energy**

Designing **buildings** that won't fall down during earthquakes

Offshore Wind Farm

generating electricity off our coasts

Burj Khalifa

the world's tallest building

These are all civil engineering

Crossrail

digging giant tunnels for new underground railways in London

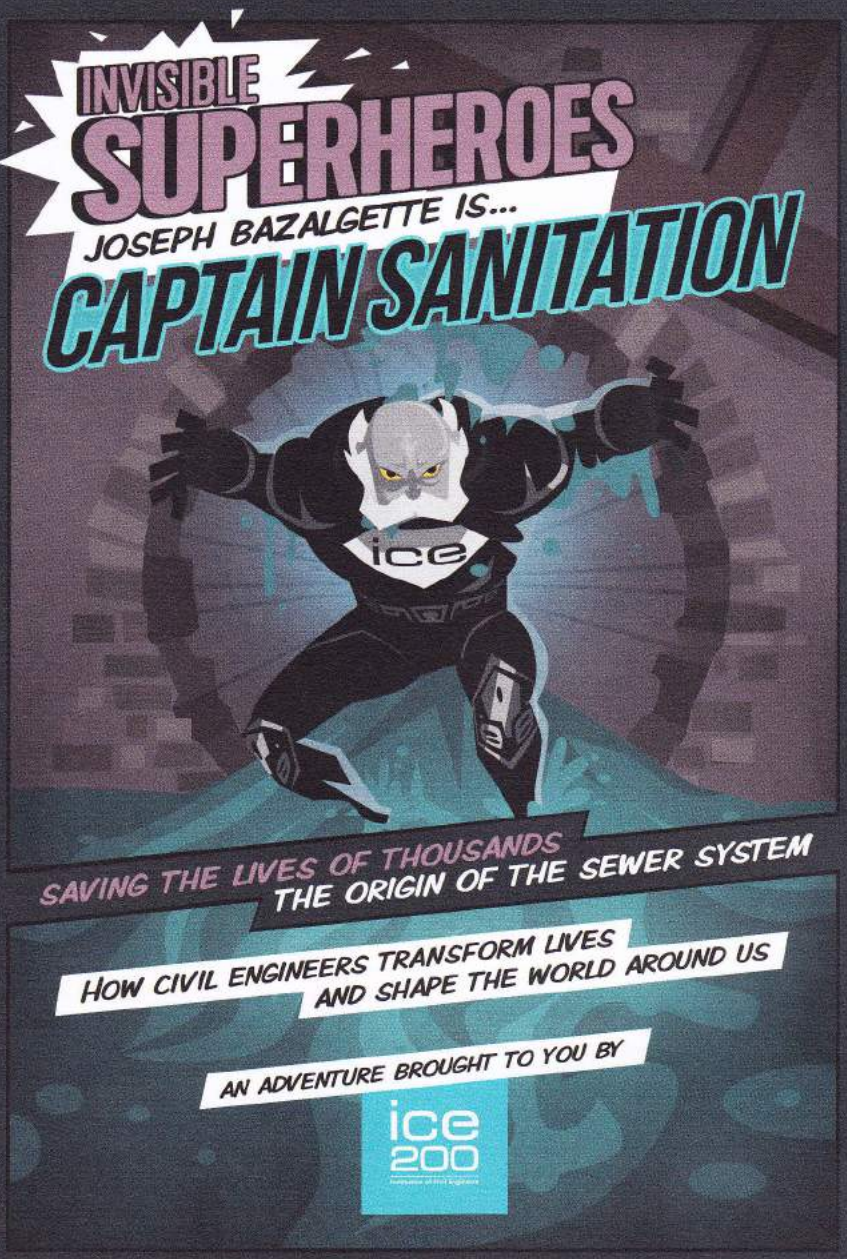
Fantastic facts

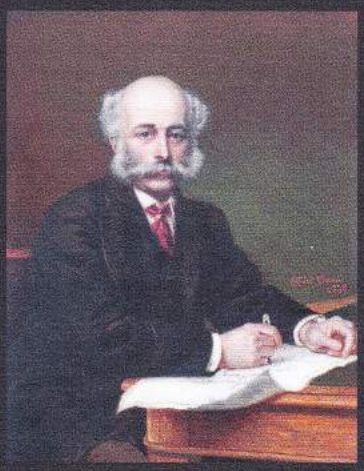
Did You Know...?

Civil engineers are working on **hyperloops**: high-speed travel in 'pods' whizzing through tubes with no tracks or air. These could let us get around at 1000km/h – more than three times as fast as Japan's bullet train!

More fun facts at... *ice.org.uk/wice*

The **Danang Bridge** in Vietnam has a 600m long dragon sculpture built into it which breathes fire and water in a spectacular show every Saturday night!





CAPTAIN SANITATION

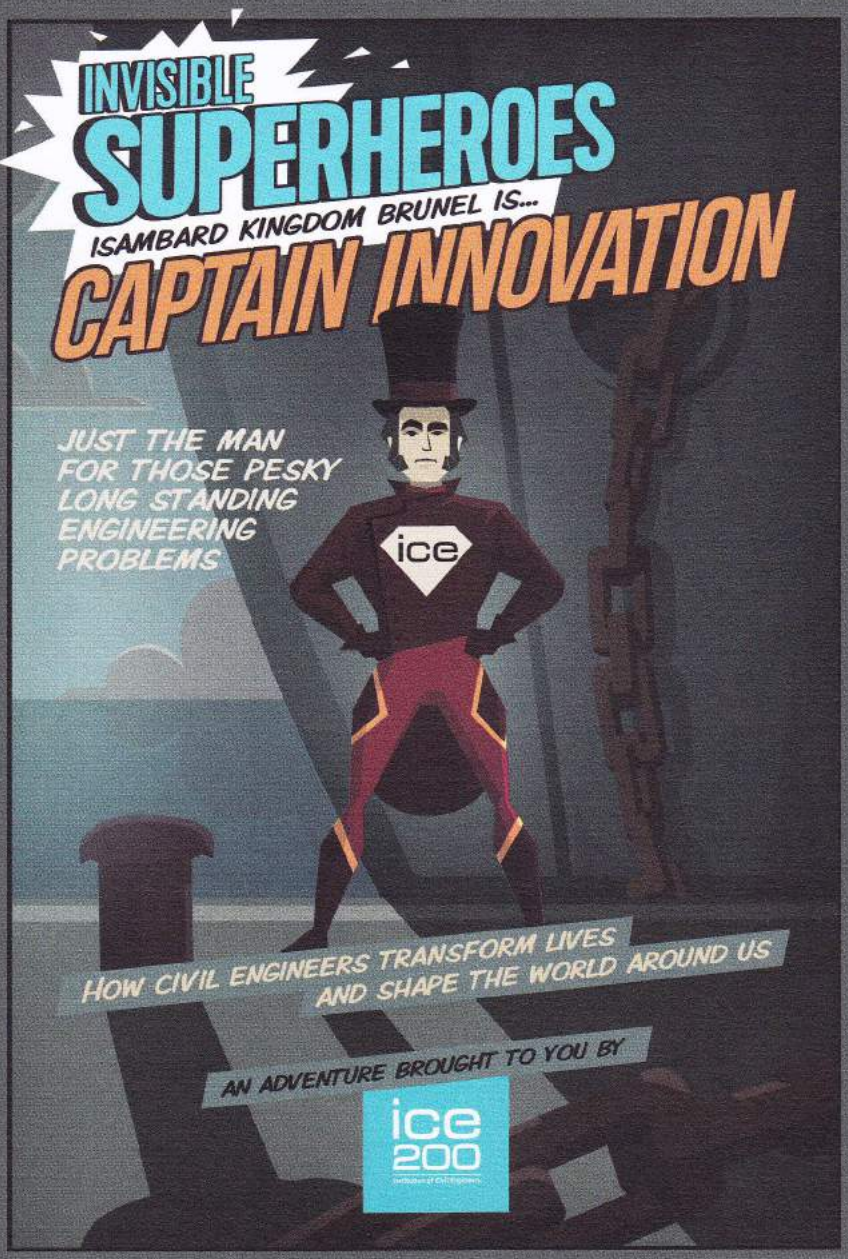
Joseph Bazalgette

Chief Engineer, London Metropolitan Board of Works

Former President of ICE and celebrate
19th-century Civil Engineer

Beginning his career as a railway engineer, Bazalgette gained experience in land drainage and reclamation. Elected chief engineer to London's Metropolitan Board of Works in the mid-19th century, he had a huge impact on London's appearance and, through his sewage system design, on the health of Londoners. Cholera killed more than 10,000 Londoners in 1853-1854. This and the 'Great Stink of London', overwhelming anyone near the Thames, caused work to begin on sewers and street improvements. By 1866, most of London was connected to Bazalgette's sewer network. Bazalgette trained civil engineers and gave independent advice to other British towns and cities - as well as places such as Budapest and Port Louis, Mauritius.

Meet the superheroes at *ice.org.uk/superheroes*



CAPTAIN INNOVATION

Isambard Kingdom Brunel

Chief Engineer of the Great Western Railway

Celebrated innovative, pioneering and ingenious 19th-century Civil Engineer

Isambard Kingdom Brunel was one of the most versatile 19th-century engineers, responsible for designing tunnels, bridges, railway lines and ships. His first notable achievement was planning the Thames Tunnel and later his designs won the competition for the Clifton Suspension Bridge. He is probably best remembered for his construction of the tunnels, bridges and viaducts for the Great Western Railway. Appointed their Chief Engineer in 1833, work began on the line linking London to Bristol. Brunel also designed famous ships: the 'Great Western', The 'Great Britain', the world's first iron-hulled, steam-powered passenger liner and The 'Great Eastern', by far the biggest ship ever built up to that time.

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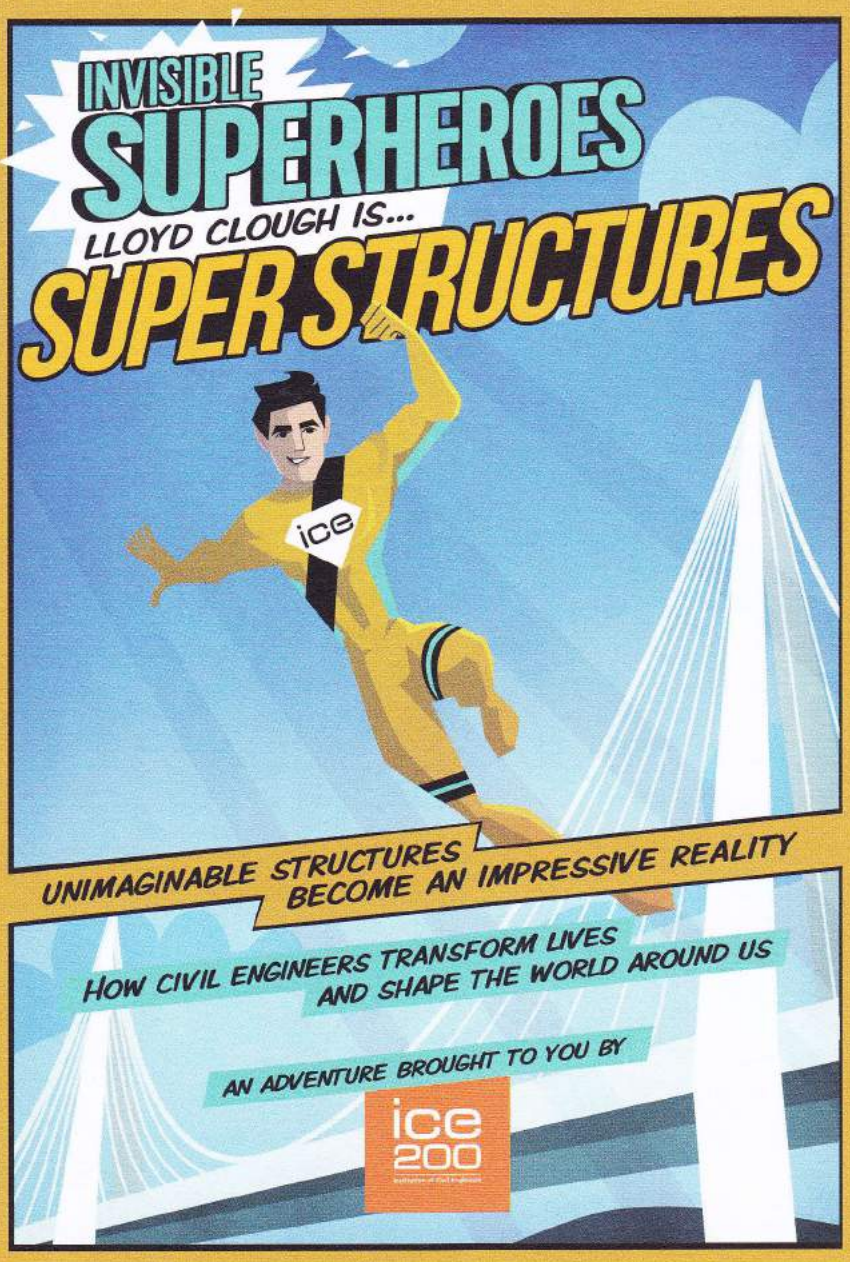

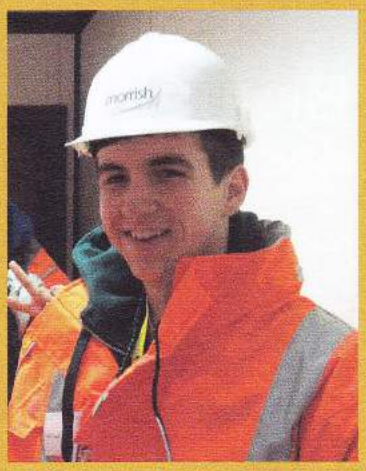

SUPER STRUCTURES

Lloyd Clough EngTech MICE

Structural Engineering Technician

Works in Structural Engineering

Lloyd Clough is a Technician for Morrish Consulting Engineers. Lloyd uses his skills to design and create a digital version of a project before construction to make sure it all fits together. He is also a STEM ambassador working with local schools and colleges to show pupils that they can transform people's lives if they become civil engineers.

Meet the superheroes at *ice.org.uk/superheroes*

URBAN ANGEL

Dr Ellie Cosgrave

Senior Lecturer in Urban Innovation, UCL

Works in Urban Planning and Innovation, Smart Infrastructure

Dr Ellie Cosgrave is a Research Associate at UCL's department for Science Technology Engineering and Public Policy (STEaPP). Her work, part of the Liveable Cities research programme, focuses on how information technology changes cities across the world. She has a passion for broadening access to engineering and a strong belief that diversity in engineering is the cornerstone to solving some of the world's greatest and most complex challenges. She is also very proud to be the Director and Co-founder of ScienceGirl – an organisation that supports women in science and engineering careers.

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DISCOVER THE AMAZING WORLD OF...

CIVIL ENGINEERING!

ANDY MITCHELL
INFRASTRUCTO

INFRASTRUCTO'S WORDSEARCH

HELP INFRASTRUCTO FIND ALL THESE STRUCTURES TO KEEP SAFE.

SKYSCRAPER
STATUE
RAILWAY STATION
MOTORWAY
AIRPORT
SHOPPING CENTRE
POWER STATION
SEWER PIPES
SUSPENSION BRIDGE
SOLAR FARM
SCHOOL
ROAD
TUNNEL
HOUSES

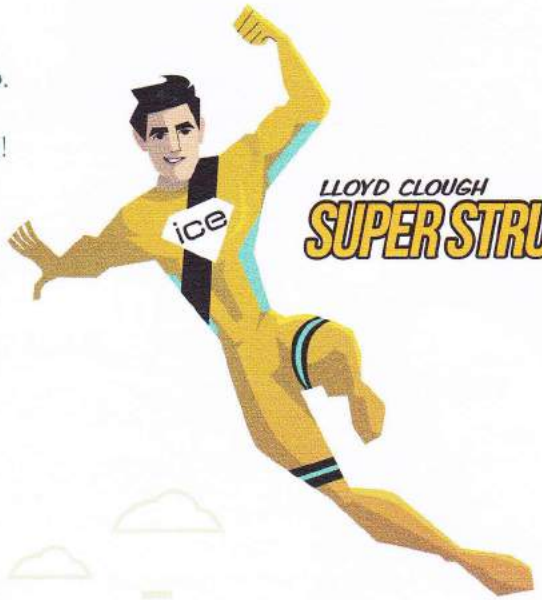
G C S K Y S C R A D A R A I E R F O H N
F R D A I Y A W R O T O M S R R E A B R
H A F T O N E M D E N R E O T J G S R A
N I G S E W E U G H T V S L N L O E I I
O L E B R I D G T E F H B A E C J P D J
W W C O S W E R E A G T H R C Y J I E W
D A D M K P O K N J T D B F G K G P E G
F Y G L Y H O B E A B S G A N L P R F H
V S G U S P E N S I O N B R I D G E M E
B T E B C E N T R R O A D M P Q T W O W
A A C S R G H B N P T T H A P I P E T E
T T V U A S C H O O L U U L O U H S O S
P I N N P I P E R R S T N N H O U S D S
V O U T E A N F U T E R S N S A R M E M
W N W R R Y U H O U S E S Y E G D O R O
G B P O W E R S T A T I O N I L N T D T

Fantastic facts

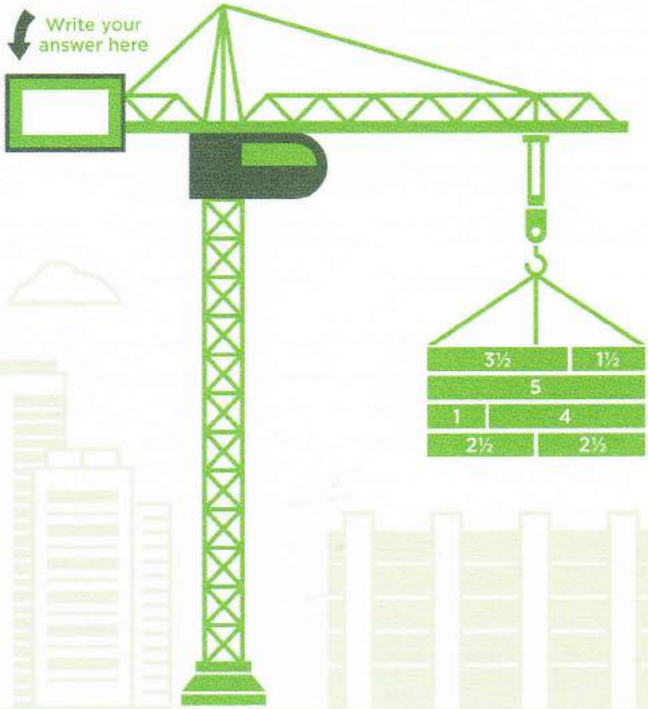
Did You Know...?

Civil engineers stopped Italy's famous **Leaning Tower of Pisa** toppling over about 20 years ago. The 800 year-old building still leans a bit (more than 3 degrees)!

*More fun facts at... **ice.org.uk/wice***



LLOYD CLOUGH
SUPER STRUCTURES



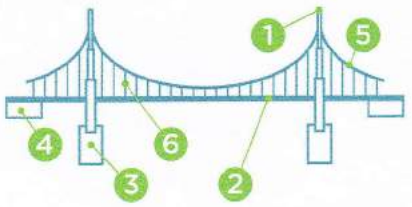
SUPER STRUCTURE'S FORCES

SUPER STRUCTURES IS BUILDING A NEW SKYSCRAPER AND HAS TO WORK OUT HOW TO LIFT THE IRON GIRDERS SAFELY. THE WEIGHT OF THE GIRDERS NEEDS TO BE BALANCED BY THE COUNTERWEIGHT AT THE BACK OF THE CRANE. WRITE IN HOW HEAVY THE COUNTERWEIGHT SHOULD BE.

Meet the superheroes at ***ice.org.uk/superheroes***

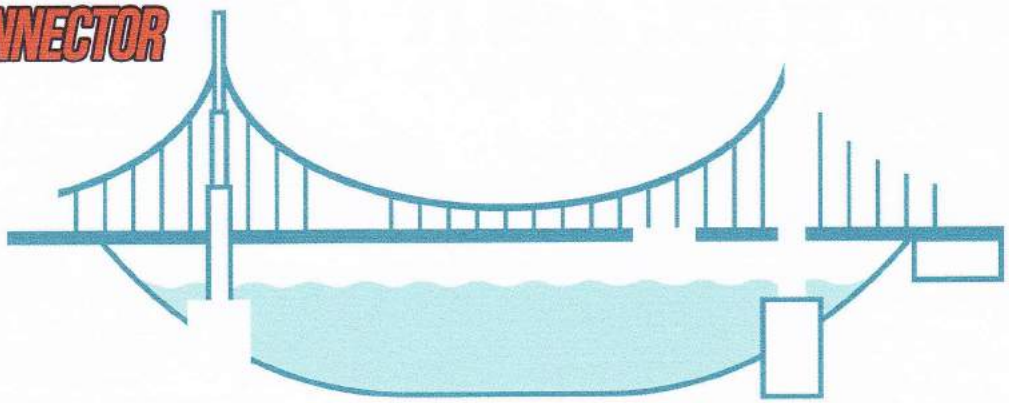
CAPTAIN CONNECTOR'S BRIDGE

FINISH BUILDING THE BRIDGE:
CAPTAIN CONNECTOR IS BUILDING A BRIDGE TO HELP PEOPLE CROSS THE RIVER. USING HIS PLANS, DRAW IN THE MISSING PIECES IN THE DIAGRAM BELOW. (TIP: THERE ARE 6 PARTS MISSING.)



1. Tower
2. Deck
3. Pier
4. Anchorage
5. Main Cable
6. Suspender Cable

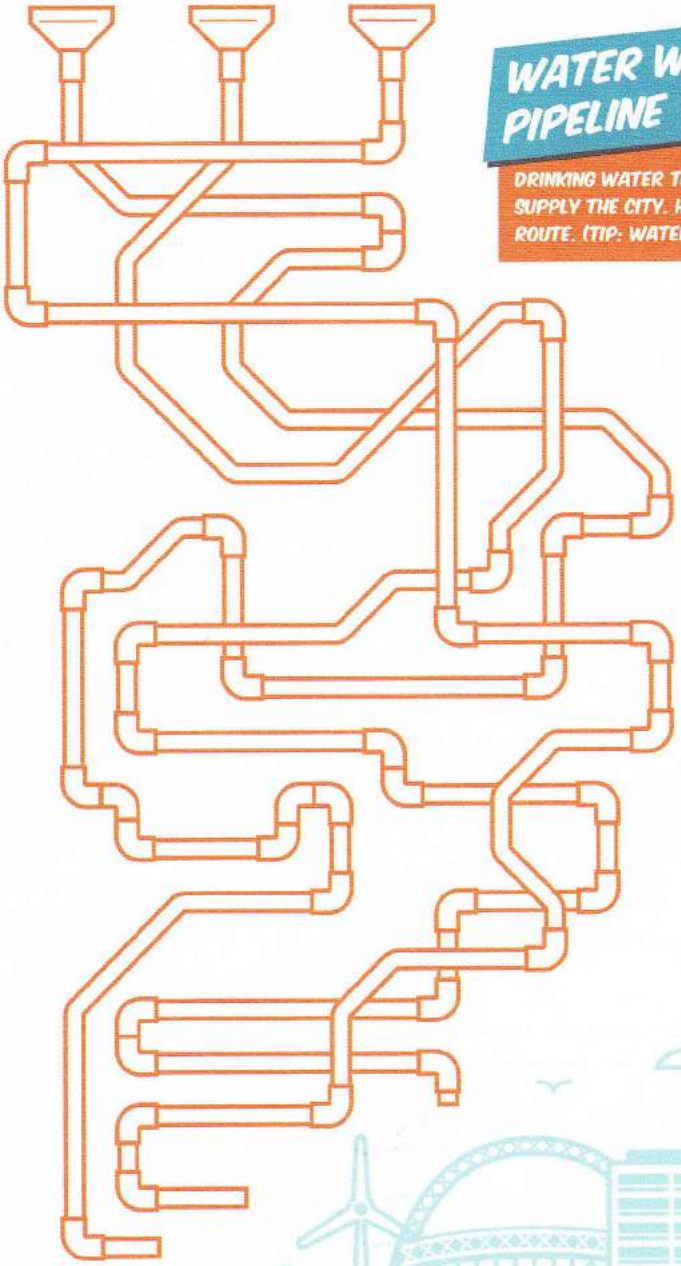
DR ROBIN SHAM
CAPTAIN CONNECTOR



A B C

WATER WOMAN'S PIPELINE

WATER WOMAN NEEDS TO GET DRINKING WATER THROUGH A PIPELINE TO SUPPLY THE CITY. HELP HER FIND THE RIGHT ROUTE. (TIP: WATER WON'T FLOW UPHILL.)



BRITTANY HARRIS
WATER WOMAN

Fantastic facts

Did You Know...?

The **Eden Valley Biodome** (glass house) in Cornwall is higher than 11 double decker buses stacked on top of each other!

Civil engineer John Brodie who designed the **Mersey Tunnel** also invented the football net.

More fun facts at...
ice.org.uk/wice

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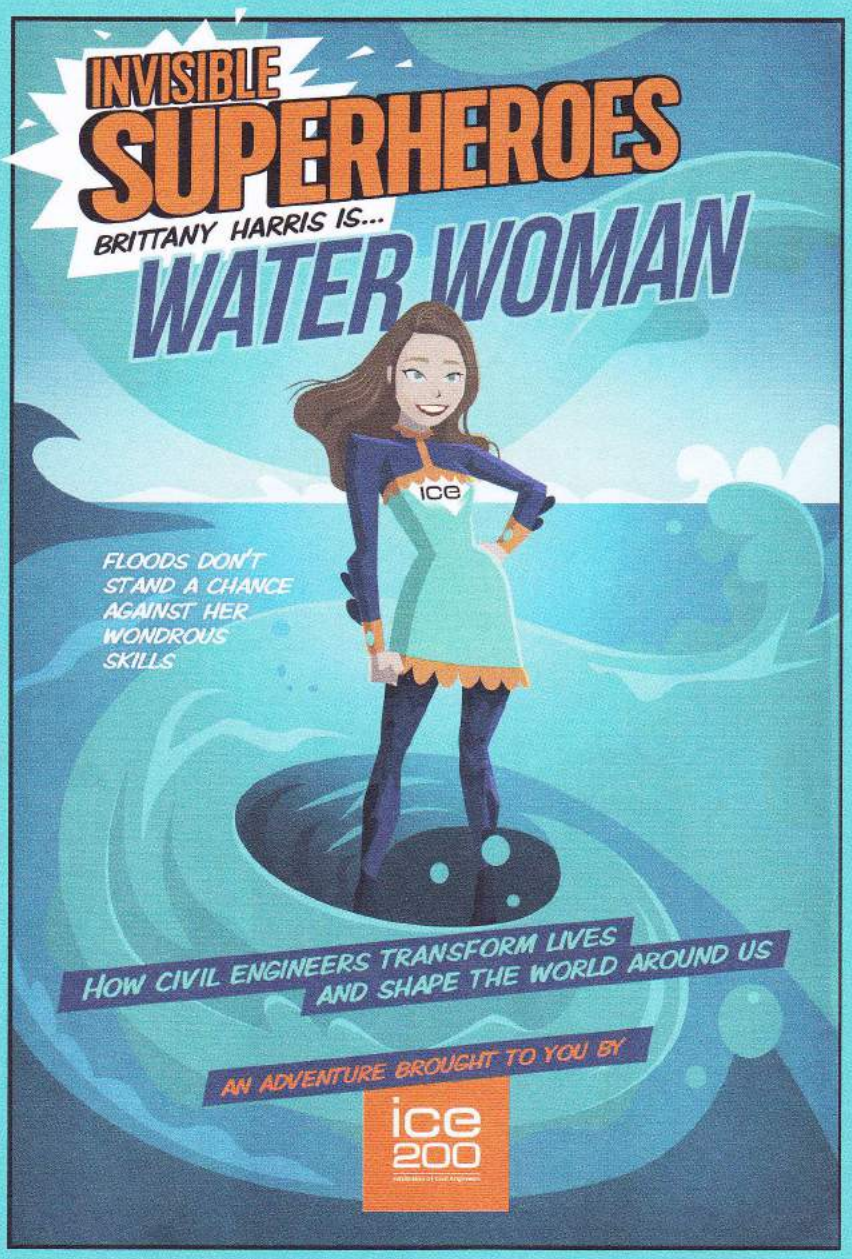


WATER WOMAN

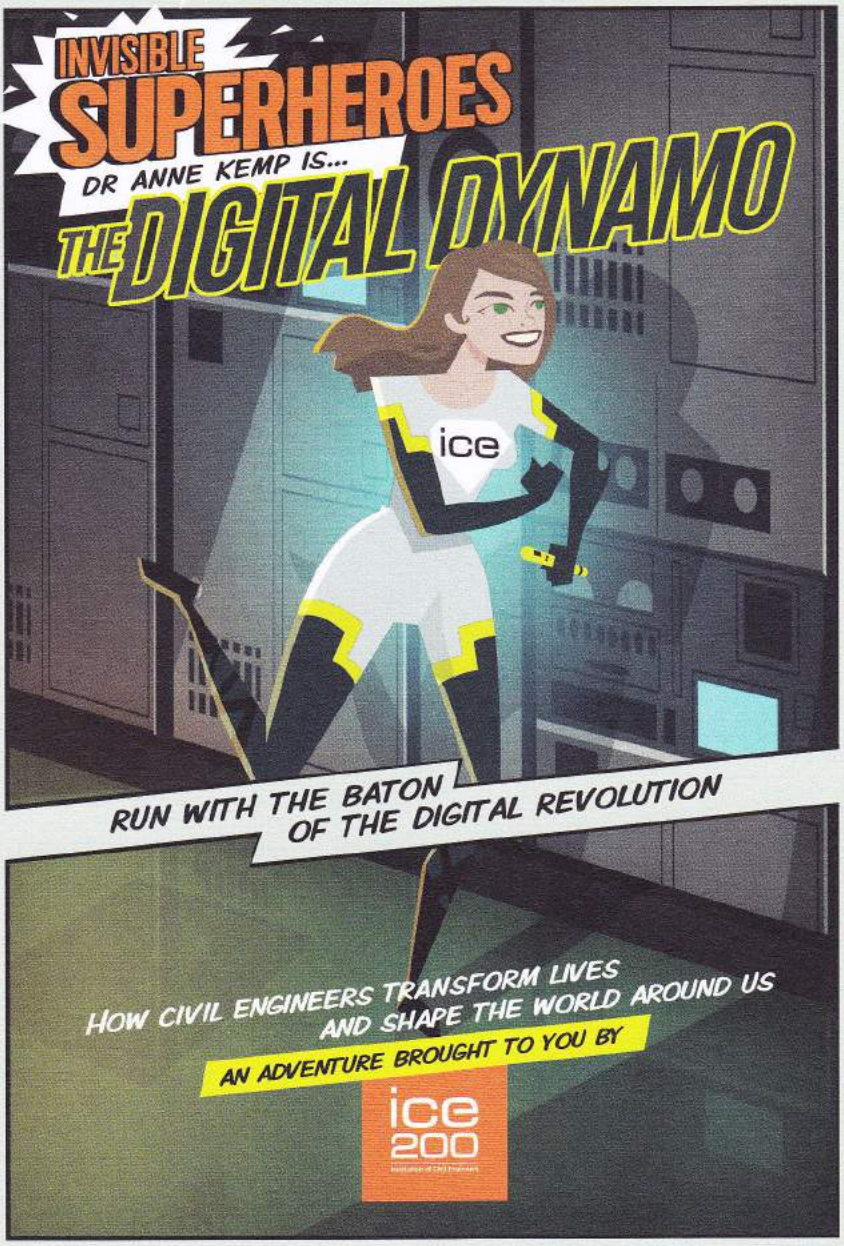
Brittany Harris CEng

Graduate Engineer, BuroHappold

Works in Water and Environmental Engineering

Brittany Harris works for BuroHappold as a Civil Engineer in Water and Environment in Bath. She is passionate about making a difference in the world by providing basic needs like clean water and sanitation. She joined World Merit in New York to develop an action plan for the United Nations Sustainable Development Goals (SDGs), which she then presented in the UN.

Meet the superheroes at *ice.org.uk/superheroes*



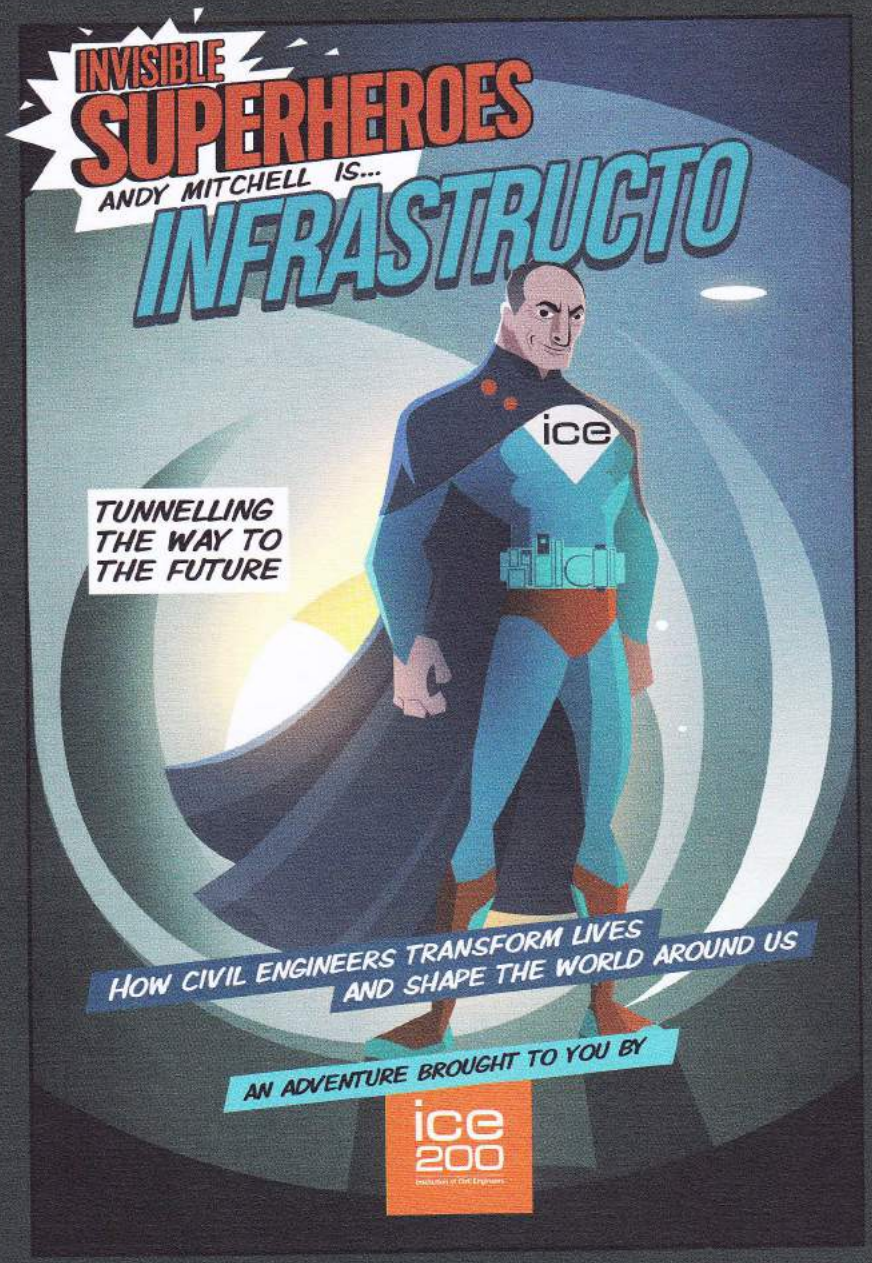
DIGITAL DYNAMO

Dr Anne Kemp FICE

Technical Director, Atkins Ltd

Anne is using digital technology to help improve the lives of people across the world. She has worked on a wide range of projects on managing and exploiting data and information better, from military training areas and contaminated land projects to the London Olympics, Environment England, Highways Agency and HS2.

Meet the superheroes at *ice.org.uk/superheroes*



INFRASTRUCTO

Andy Mitchell FICE

CEO, Thames Tideway Tunnel Ltd

Works in Infrastructure, Structural Engineering and Environmental Engineering

Andy is helping to make the River Thames cleaner through the Tideway Tunnel project. He previously spent 12 years working in the United Arab Emirates, France and South Africa, and on major developments such as Hong Kong Airport and the Hong Kong West Rail, before joining Network Rail in 2001. Andy was the programme director for the £14.8bn Crossrail and was the leading engineer on the Crossrail Board responsible for delivering the largest infrastructure programme in Europe. Andy has also been involved in other substantial infrastructure programmes, including Programme Director on the £5bn Thameslink project. Andy is Chairman of the IUK Infrastructure Client Group and is also a Visiting Professor at Leeds University.

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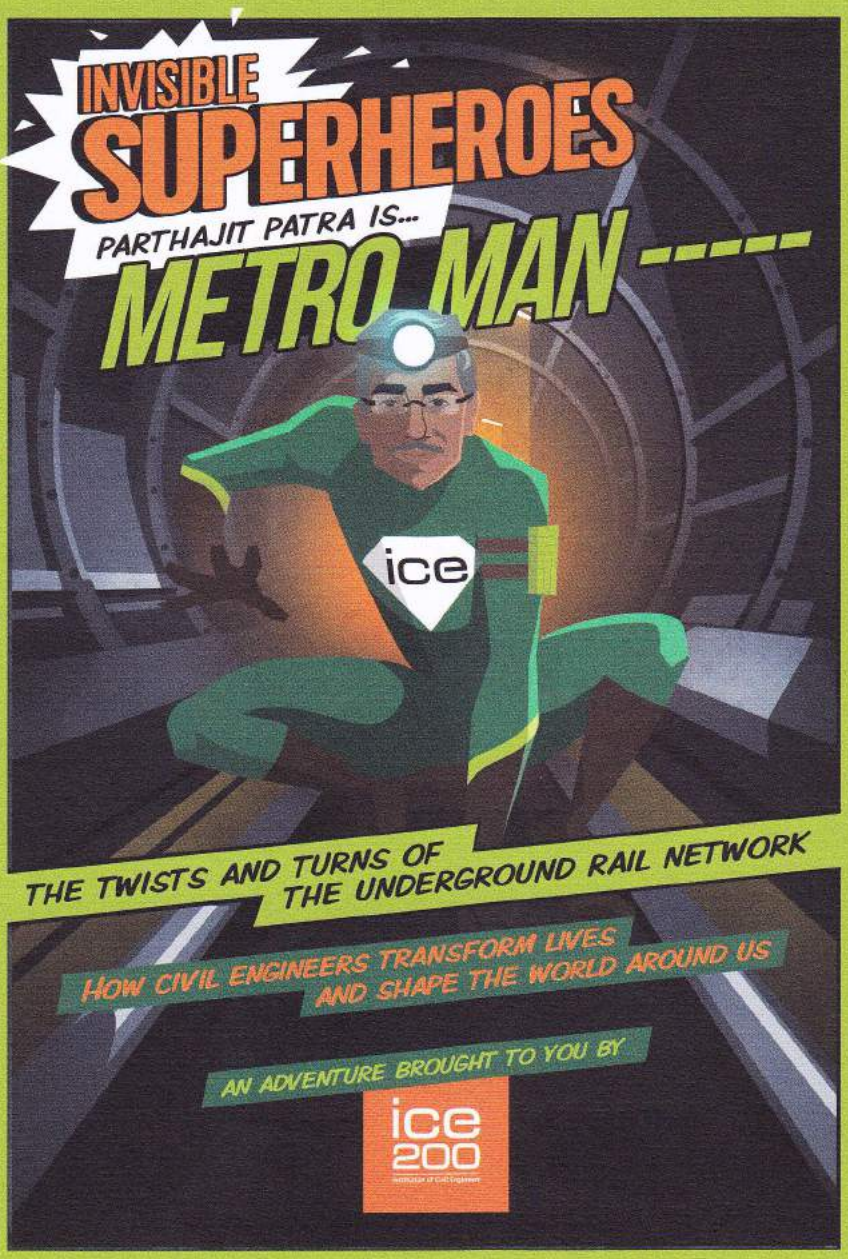


METRO MAN

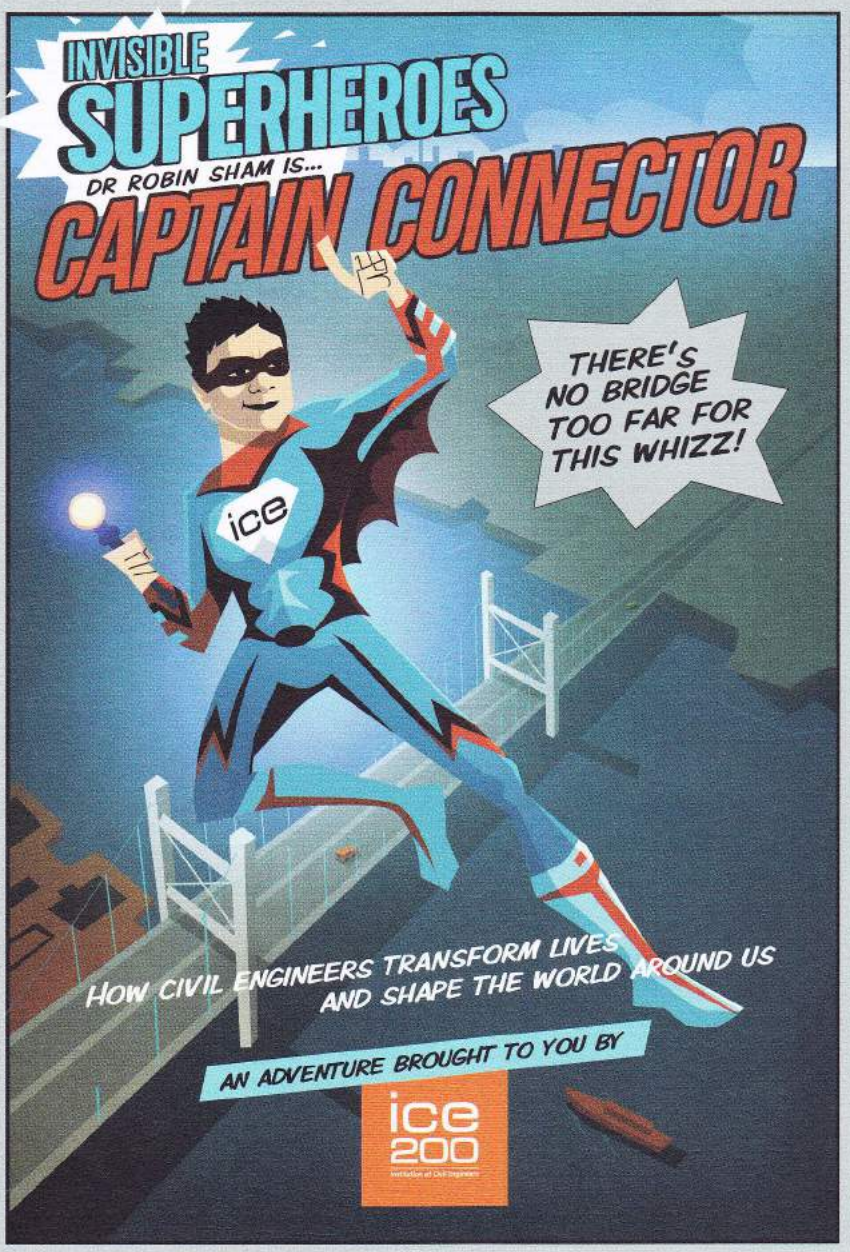
Parthajit Patra CEng MICE

Consultant Engineer

Works in Water Management, Environmental Engineering and Urban Infrastructure

Parthajit wants to make the most of the water which is all around us and has vast experience in the water and sanitation sector. He has lived in Kolkata (previously Calcutta) all of his life and worked on projects across India and internationally. One of his first large projects was supervising construction on India's first underground railway system, the Metro Railway. More recently, he developed different system components in the design of the Guwahati Water Supply Project, which was one of the largest-scale projects of its kind in India.

Meet the superheroes at *ice.org.uk/superheroes*



CAPTAIN CONNECTOR

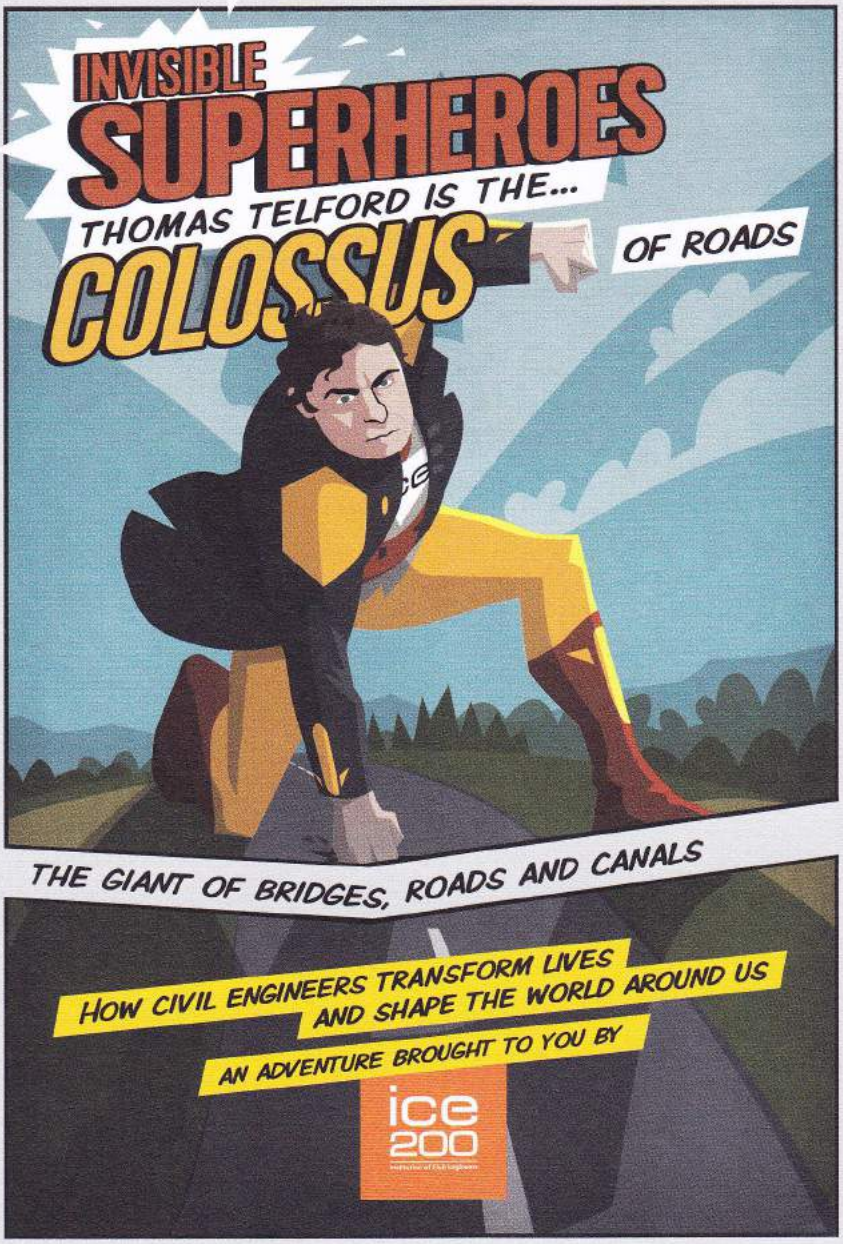
Dr Robin Sham FICE

Global Specialty Bridges Director, AECOM

Works in Bridge Engineering

Dr Robin Sham has helped connect people across the world by designing some amazing bridges. His recent work contributed to the Suton and Stonecutters Bridges, which are two of the world's longest cablestayed bridges; the Taizhou Bridge, the first long-span, three-pylon, continuous suspension bridge; and one of the longest sea crossings built in recent history, the Second Penang Bridge.

Meet the superheroes at *ice.org.uk/superheroes*



COLOSSUS

Thomas Telford

First President of ICE

Celebrated road, bridge and canal engineer in the 19th-century

Telford constructed more than 1,000 miles of highway in his lifetime. The London to Holyhead road included the Menai Suspension Bridge, which was the longest suspension bridge of its time, spanning 180 metres across the Menai Strait. In his early career, he was appointed Shropshire's Surveyor of Public Works and went on to build 40+ bridges in Shropshire, including his first iron bridge, which crossed the River Severn. As engineer of the Ellesmere canal he built the Chirk and Pont-y-Cysyllte aqueducts, establishing his reputation as a canal engineer. The King of Sweden consulted him on the construction of the Göta Canal and his plans were adopted. His achievements led to his position of President of the newly formed Institution of Civil Engineers in 1820 – a post he held until his death 14 years later.

Meet the superheroes at *ice.org.uk/superheroes*

URBAN ANGEL'S SPOT THE ANIMALS

CIVIL ENGINEERS HAVE TO THINK ABOUT PROTECTING THE WILDLIFE LIVING WHERE THEY ARE WORKING, MAKING SURE THERE ARE STILL PLACES TO LIVE (HABITAT) AND SAFE CROSSINGS OVER OUR ROADS AND RAILWAYS. HELP URBAN ANGEL FIND THE ANIMALS SHE NEEDS TO LOOK AFTER IN THIS STREET.

DR ELLIE COSGRAVE
URBAN ANGEL

DORMOUSE

HEDGEHOG

BAT

TOAD

MEET THE SUPERHEROES AT ICE IN LONDON OR TAKE A VIRTUAL TOUR AT

ICE.ORG.UK/SUPERHEROES

#ICE200

DESIGN CREATE
Civil Engineers: Shaping the World

ice 200
Institution of Civil Engineers

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