Teacher Guide

V0 March 2025

Contents page

What is ICE Futures?

ICE Futures provides a comprehensive and student-friendly introduction to careers in civil engineering – one of the largest and most essential branches of the engineering professions.

The site is designed for students aged between 13-18, although students from age 10, and adult learners may also enjoy exploring the site content.

www.ice-futures.com

Learners will engage with a fictional story-based digital environment – stretching from the present day until the year 2075 – and meet civil engineers, take part in very short gamified challenges and have the opportunity to explore more in-depth content about civil engineering in the real world.

The engineering context

By exploring the broad areas of civil engineering students will gain an appreciation of the necessity of the work of civil engineers in keeping us safe, healthy, our natural environment protected and in mitigating man-made climate change.

The website activities will help students understand how creativity, problem-solving, and innovation are part of being a civil engineer, inspiring them to consider a career in this exciting field. It also highlights how man-made infrastructure allows us to function in the 21st century and what the implications of poor infrastructure are (for example lack of social integration, poor public health and even critical failure).

Website activities & Learning Outcomes

Era	Character	Activity	Learning outcomes. 'Students will learn that...'	Subject link 1	Subject link 2	Case study	UN SDG links
Present day	Omar	Quiz question – which type of materials to use	Engineers have different options for designing and building sustainably.	Design Technology: creation of new materials.	Chemistry: carbon release from concrete.	https://www.ice.org.uk/what-is-civil-engineering/what-do-civil-engineers-do/materials-4-life	SDG 12 - Ensure sustainable consumption and production patterns
Present day	Mae	Puzzle: connect the train network	Engineering projects need careful planning.	Business and Management		https://www.ice.org.uk/what-is-civil-engineering/infrastructure-projects/the-london-2012-games	SDG 9 – Build resilient infrastructure..
Present day	Robyn	Tap to build a community centre	Infrastructure has a social purpose. Engineers have to be good communicators.	Geography: understanding social	English: communication skills.	https://www.ice.org.uk/news-insight/news-and-blogs/ice-blogs/the-civil-engineer-blog/things-engineers-shouldnt-forget-when-engaging-with-communities	SDG 11 – Make cities and human settlements inclusive, safe, resilient and sustainable.
2045	Omar	Tap to build a green building	Engineers ensure that developments plan to increase biodiversity and carbon capture.	Design Technology: ethical design	Science: habitats and biodiversity.	https://www.ice.org.uk/news-insight/news-and-blogs/ice-blogs/ice-community-blog/civil-eng-landmarks-with-sustainability-features	SDG 15 - Protect, restore and promote sustainable use of terrestrial ecosystems... and halt biodiversity loss

Website activities & Learning Outcomes - continued

Era	Character	Activity	Learning outcomes. 'Students will learn that...'	Subject link 1	Subject link 2	Case study	UN SDG links
2045	Mae	Quiz question: investing in new technology	Understand that civil engineers evaluate and use cutting edge technological tools to provide the data needed for infrastructure design.	Computing: applications of technology in engineering.	Art: creation and use of digital visualisations.	https://www.ice.org.uk/news-insight/news-and-blogs/ice-blogs/the-civil-engineer-blog/using-ai-to-step-up-digital-transformation	SDG 13 - Take urgent action to combat climate change and its impacts
2045	Robyn	Puzzle: drone delivery network	Civil engineers are designing and delivering innovative new types of infrastructure.	Geography: How people, place and environment interactions shape cities.		https://www.technologyreview.com/2023/05/23/1073500/drone-food-delivery-shenzhen-meituan/	SDG 11 – Make cities and human settlements inclusive, safe, resilient and sustainable.
2075	Omar	Puzzle: water supply pipelines	Our essential services are provided by civil engineers.	Science (chemistry & biology): Drinking water processing.	Science (physics): fluid dynamics of water supply.	https://www.ice.org.uk/what-is-civil-engineering/infrastructure-projects/thames-tideway	SDG 6 – Clean water and sanitation
2075	Mae	Tap to build: skyscraper regeneration	Civil engineers look after (retrofit) and maintain our aging infrastructure.	Physics: Structural stability and foundations.	Art & Design: Intersection of engineering with architecture and design.	https://www.ice.org.uk/what-is-civil-engineering/infrastructure-projects/stabilising-the-leaning-tower-of-pisa	SDG 9 – Build resilient infrastructure..
2075	Robyn	Quiz: disaster support methods	Civil engineers are both the creators of and decision-makers for the essential services infrastructure we rely on.	Sociology: Economic, political, and cultural understanding of communities.		https://www.ice.org.uk/what-is-civil-engineering/infrastructure-projects/redr-uk-disaster-relief	SGD 1 – End poverty...

Careers focus

The Gatsby Benchmarks are a framework of eight guidelines designed to ensure high-quality careers education in schools and colleges. Schools and careers advisors can use the framework to create a programme of careers guidance that will prepare young people for the world of work by providing them with the knowledge, skills, and experiences needed to make informed career choices.

ICE Futures meets the following Gatsby Benchmarks:

1. A stable careers programme – ICE Futures can be incorporated as part of a freely available careers information offering for students and parents.

4. Linking curriculum learning to careers – ICE Futures contains rich information about how curriculum learnings are relevant to the work of Civil Engineers.

Find out more: **www.gatsby.org.uk**

.....

Diversity and inclusion

ICE Futures showcases the amazing work of Civil Engineers through the eyes of three fictional but credible young characters.

In the real world, Civil Engineers come from all backgrounds, arrive at the career from a huge variety of pathways and are of all genders (and none).

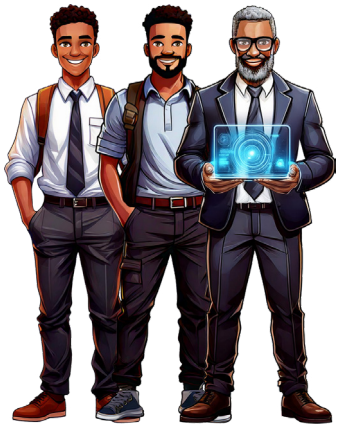
The ICE Futures characters are reflections of ICE's global membership of incredible 'invisible superheroes' – keeping us safe and providing all the infrastructure and services we rely on in modern life. Your students can explore a huge bank of profiles of ICE's members online here: **www.ice.org.uk/meet-the-engineers**

They will also enjoy watching the video profiles of a small selection of Civil Engineers embedded in the Futures homepage.

ICE Futures characters

Omar

Omar has a passion for making a positive difference to the world and is motivated by playing his part in the fight against climate change and its effects. He uses his personal experiences to shape and grow his knowledge and finds his calling through a specialist course of study at university.



Mae

Mae is really creative and likes to be active and hands-on. She isn't a top-achieving student as far as exams go, but her focus and drive are rewarded as her career progresses and she discovers how to use her professional experience to write her own agenda for work as an entrepreneur.

Robyn

Robyn is intensely interested in people – her outgoing nature and curiosity are a magic combination that lead her down a path to discover the fascinating human aspects of engineering. Her ground-breaking work will likely have far-reaching effects on the industry and consequently people's lives.

Suggested classroom activities

You could use one of the following activities to expand and embed learnings from exploring ICE Futures.

Future buildings

Subject focus: Design Technology / Geography

This activity will exercise students' analytical skills to consider the 'whys' behind the design of buildings and choices of construction materials.

Students should pick a piece of infrastructure that they are interested in and create a fact sheet, poster or PowerPoint presentation covering key aspects of the building or structures' design and construction. This could include: what materials it's built with, its appearance and design features, its intended purpose(s), and any evolution it could go through in the next 50 years.

Encourage students to consider external factors such as the influence of, or potential changes in technology, transport and weather.

The completed projects can be used as a wall display or presented to the rest of the class to promote a collaborative learning environment.

Columns and beams

Subject focus: Physics / Design Technology / Maths

This activity will help students understand the forces involved in structures and apply maths to real-world engineering problem.

Materials required: A4 sheets of paper, scissors, sticky tape, ruler, two pieces of hardboard or stiff card, 120 mm square, and gram masses.

Instructions for students

Step 1: Roll an A4 sheet of paper into a tube 210 mm long. Tape the seam, making sure that there is no overlap. Measure the diameter of the tube and write it down.

Step 2: Put the pieces of card at the top and the bottom of the tube. carefully load the tube with gram masses until it collapses. Work out the force in Newtons that made the tube collapse (this is roughly equal to 10 times the total mass in kilograms). Draw a sketch of how the tube collapsed.

Step 3: Repeat step 1 several times, using a smaller diameter each time. Keep the tube walls the same thickness each time. Has changing the diameter of the tube (but not its length!) affected its ability to withstand a compressive force? Write down the findings.

Step 4 (if time): draw a graph to show the results.

Who's Who

Subject focus: Careers / PSHE / Humanities

The learning outcome for this activity is to help students overcome stereotypes and consider diverse career pathways.

Start by reading or performing Benjamin Zephaniah's poem 'Whos who' with your group of students.

You could follow this with a short debate to encourage students to reflect on how societal expectations and stereotypes shape our views of people.

As a group compile a list of questions which people are happy to answer anonymously about their personality, skills and preferences (watch out for questions that might encourage biases of affect anonymity though!). WISE's My Skills My Life quiz – https://myskillsmylife.org.uk/sign-in – can be used. Also compile a list of diverse career options... not forgetting to add civil engineer of course!

Set students the task of creating short profiles of themselves answering some or all of the questions, highlighting their skills, interests, and strengths without mentioning their name, gender or traditional career stereotypes.

Share the anonymous profiles and match them against your careers list, challenging assumptions about who 'fits' certain roles. You can finish the activity concludes with a discussion on how breaking stereotypes can open up opportunities for everyone if there is time.

Water Use Debate

Subject focus: Geography / Humanities / Chemistry

Begin with a quick discussion: “Why is water management important?” Highlight key issues like water scarcity, pollution, and unequal access.

Divide the class/group into groups of 2-3 students. Assign each group a stakeholder role, e.g., farmers, city residents, environmental activists, government officials, or industrial companies.

Each group should prepare a short argument about how water should be allocated and managed based on their priorities. If there is time to do some research online that’s great. You could ask them to come up with for example five key points.

Groups present their arguments and after all groups have presented, you can have a discussion about how to balance competing interests and ensure sustainable water use.

You could collate the top learnings from the discussion into a poster or Powerpoint.

Other resources and activities

ICE Careers Resources Hub: **https://bit.ly/ice-careers-resources**

Get free printed and digital leaflets, posters and more activity ideas.

CityZen competitions: **www.ice.org.uk/cityzen**

Find out how to get involved in ICE's annual competitions for 14-18s, great for skills development, recognition and with exciting prizes to boot!

ICE Virtual Work Experience: **https://bit.ly/ICE-virtworkexp**

Free on-demand virtual work experience for students aged 14-18.

ICE STEM Ambassadors: **https://bit.ly/ICE-meet-STEM-ambassador**

Ask us for a civil engineer STEM Ambassador to support your school or college's career or STEM activities.

.....

Share your highlights of using ICE Futures and feedback with us:

careers@ice.org.uk

https://x.com/ICE_schools

Appendix 1: Civil engineering labour market information

Stereotypes to overcome still...

The first and one of the most important things to note is that there are big challenges to address the gender gap in all engineering careers and challenge the thinking of girls and influencers who have negative impression of engineering careers. The following stats from Engineering UK's research in 2024[1] demonstrate how much work needs to be done:

ONLY 12% of girls say being an engineer fits well with who they are.

ONLY 16% of girls think engineering is suitable for them.

36% of girls say science generally is not for them.

Jobs in civil engineering

There are nearly 100,000 civil engineers working in the UK in 2025. There is however a shortage of future talent, with a number of large infrastructure projects planned and estimates that the construction section overall needs 225,000 new workers to keep pace – many of these Civil Engineer and Civil Engineering Technician roles.[2]

Key statistics

The following information is from ICE's Guide to Careers in Civil Engineering.[3]

Qualified civil engineers are in demand across the construction section, and exciting roles can be found working for consultancies, contracting organisations, local authorities, government departments, utility companies and environmental organisations in the UK and internationally.

Employment:

A study by the Royal Academy of Engineering found 94% of engineering graduates in full-time work, pursuing further study or a combination of both three and a half years after graduate. This figure is 6% higher than for all graduates.

Salary:

The UK National Careers Service reports that the average starting salary for a civil engineer in 2022 is £30,000, rising to £70,000 for senior positions.

Appendix 2: Creating a better future for society

Civil engineers are at the forefront of addressing global challenges like climate change and migration. The infrastructure sector needs and welcomes inspiration and diversity of ideas to create better places to live. We are creating modern vibrant, inclusive places that people are proud to live, work and play in.

Find out more about how ICE is supporting governments to put strategic infrastructure planning into practice:

ICE Enabling Better Infrastructure programme