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## **Teacher Guide**

Institution of Civil Engineers is a Registered Charity in England & Wales (no 210252) and Scotland (SC038629)

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## 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 engineering.

The website is designed for young people who are approaching key education and career decisions. It allows them to explore career pathways in an interactive and bite-sized format.

www.ice-futures.com

Engineering is one of the top career choices for young people (BBC Bitesize careers survey, Appendix 3). ICE Futures bridges the gap, turning interest into action through interactive career exploration.

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 short gamified challenges and have the opportunity to explore more in-depth content about civil engineering.

## The engineering context

Your students will see how civil engineers build the world around us, keep us safe, protect our natural environment and mitigate man-made climate change.

ICE Futures 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.





## Website activities & learning outcomes

Era	Character	Activity	Learning outcomes.	Subject link 1	Subject link 2	Case study	UN SDG links
			'Students will learn that'				
Present day	Omar	Quiz question – which type of materials to use	Engineers have different options for designing and building sus- tainably.	Design Tech- nology: cre- ation of new materials.	Chemistry: carbon re- lease from concrete.	https://www.ice.org. uk/what-is-civil-engi- neering/what-do-civil- engineers-do/materi- als-4-life	SDG 12 - Ensure sustainable con- sumption and pro- duction patterns
Present day	Mae	Puzzle: con- nect the train network	Engineering projects need careful plan- ning.	Business and Management		https://www.ice.org. uk/what-is-civil-engi- neering/infrastruc- ture-projects/the-lon- don-2012-games	SDG 9 – Build resilient infrastruc- ture
Present day	Robyn	Tap to build a community centre	Infrastructure has a social purpose. Engineers have to be good commu- nicators.	Geography: understanding social	English: communica- tion skills.	https://www.ice.org. uk/news-insight/ news-and-blogs/ice- blogs/the-civil-engi- neer-blog/things-en- gineers-shouldnt-for- get-when-engag- ing-with-communities	SDG 11 – Make cities and human settlements inclu- sive, safe, resilient and sustainable.
2045	Omar	Tap to build a green building	Engineers ensure that developments plan to in- crease biodi- versity and car- bon capture.	Design Tech- nology: ethical design	Science: habitats and biodiversity.	https://www.ice.org. uk/news-insight/ news-and-blogs/ ice-blogs/ice-com- munity-blog/ civil-eng-land- marks-with-sustaina- bility-features	SDG 15 - Protect, restore and pro- mote sustainable use of terrestrial ecosystems and halt biodi- versity loss

## Website activities & learning outcomes - continued

Era	Character	Activity	Learning out- comes.	Subject link 1	Subject link 2	Case study	UN SDG links
			'Students will learn that…'				
2045	Mae	Quiz question: investing in new technology	Understand that civil engineers evaluate and use cutting edge tech- nological tools to provide the data needed for infra- structure design.	Computing: applications of technology in engineering.	Art: creation and use of digital visual- isations.	https://www.ice.org.uk/news-in- sight/news-and-blogs/ice-blogs/ the-civil-engineer-blog/us- ing-ai-to-step-up-digital-trans- formation	SDG 13 - Take urgent action to combat climate change and its impacts
2045	Robyn	Puzzle: drone delivery network	Civil engineers are designing and delivering innova- tive new types of infrastructure.	Geography: How people, place and environ- ment interac- tions shape cities.		https://www.technologyreview. com/2023/05/23/1073500/ drone-food-delivery-shen- zhen-meituan/	SDG 11 – Make cities and human settlements inclu- sive, safe, resilient and sustainable.
2075	Omar	Puzzle: water supply pipelines	Our essential ser- vices are provided by civil engineers.	Science (chem- istry & biology): Drinking water processing.	Science (physics): fluid dynamics of water supply.	https://www.ice.org.uk/ what-is-civil-engineering/infra- structure-projects/thames-tide- way	SDG 6 – Clean wa- ter and sanitation
2075	Mae	Tap to build: sky- scraper regener- ation	Civil engineers look after (retrofit) and maintain our aging infrastruc- ture.	Physics: Struc- tural stability and founda- tions.	Art & Design: Inter- section of engineer- ing with architec- ture and design.	https://www.ice.org.uk/ what-is-civil-engineering/in- frastructure-projects/stabilis- ing-the-leaning-tower-of-pisa	SDG 9 – Build resil- ient infrastructure
2075	Robyn	Quiz: disaster support meth- ods	Civil engineers are both the creators of and decision-makers for the essential services infra- structure we rely on.	Sociology: Eco- nomic, political, and cultural understanding of communities.		https://www.ice.org.uk/ what-is-civil-engineering/ infrastructure-projects/re- dr-uk-disaster-relief	SGD 1 – End pov- erty



## **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

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## **Diversity and inclusion**

Civil engineers come from diverse backgrounds, representing different races, genders, and socio-economic experiences, and they enter the profession through a wide range of pathways.

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

The ICE Futures characters are reflective of ICE's global membership of incredible 'invisible superheroes' – keeping us safe and providing the infrastructure 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 ICE Futures homepage.



## **ICE Futures characters**

#### Omar

Omar, inspired by the environmental challenges he witnessed while visiting his family in Mali, pursued a degree in civil and environmental engineering. Passionate about making a positive impact, he is driven by the fight against climate change and its effects. Drawing on his personal experiences, he deepens his knowledge at university and now designs climate-resilient housing to withstand extreme weather.



#### Mae

Mae, a creative and hands-on problem solver, joins the industry through an apprenticeship, drawn to design and innovation. She uses cutting-edge technology and software to protect historic buildings and mitigate the effects of flooding. As her career progresses, she gains the experience and confidence to shape her own path, eventually forging her own agenda as an entrepreneur.



## Robyn

Robyn's curiosity and outgoing nature fuel her passion for understanding how the built environment shapes human interaction. Drawn to the social impacts of engineering, she uses creative solutions to transform communities. Her groundbreaking work is set to have a lasting impact on the industry and improve lives for generations to come.





## 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 (e.g. a bridge, sports stadium, tall or historic building, rollercoaster or a train station) 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 in length. 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.

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



careers@ice.org.uk



## **Appendix 1: Civil engineering labour market information**

#### High demand for civil engineers

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.<sup>1</sup>

#### Stereotypes to overcome still...

Since 2021, we have seen an increase in female membership at the ICE for those under 40, with 3,170 female members. However, one of the biggest challenges and opportunities we face is addressing the gender gap in engineering careers.

The following stats from Engineering UK's research in 2024<sup>2</sup> 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.

#### Key statistics

The following information is from ICE's guide to careers in eivil engineering.<sup>3</sup>

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.

<sup>1</sup> https://www.newcivilengineer.com/opinion/addressing-the-construction-skills-shortage-is-a-national-imperative-01-07-2024/

<sup>&</sup>lt;sup>2</sup> https://www.engineeringuk.com/research-and-insights/our-research-reports/key-stats-infographic/

<sup>&</sup>lt;sup>3</sup> https://www.ice.org.uk/news-views-insights/latest-news/careersguide



## **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

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## Appendix 3: Teenagers rank 'engineer' as a top career choice

The 2025 BBC Bitesize Careers survey gathered responses from over 4,000 13-16-year-olds across the UK. According to the survey, engineering remains one of the most popular career choices among teenagers, ranking second after doctor and ahead of teacher.

Teenagers today are seeking careers with purpose, where they can feel good about what they do, be happy, and help others. These are priorities that ranked above salary in the survey. With engineering placed as the second most popular job choice, it's clear that many young people see this path as a way to make a real difference in the world.

As engineering continues to shape the future, it's clear that the next generation is eager to be part of it, designing solutions for global challenges, from climate resilience to infrastructure innovation.

Read more: bit.ly/top-10-jobs-teens-want