

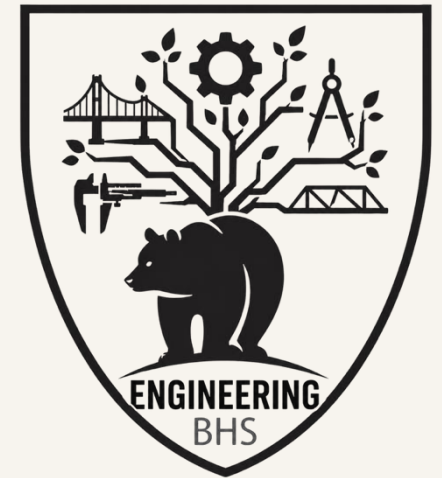
Starter – what do you already know?

- 1 Why do you think we test things before they are sold?
- 2 What does the word ENGINEER make you think of?
- 3 Name one thing you have used today that someone designed.
- 4 Predict – what are the four main types of engineer?
- 5 Name one job you think an engineer might do.

LESSON 1

What is an Engineer?

Introducing engineering and the four main types of engineer.



WHAT IS AN ENGINEER?

ENGINEERS USE SCIENCE, MATHS AND CREATIVITY TO
SOLVE PROBLEMS AND **IMPROVE THE WORLD.**

ENGINEERS ARE PROBLEM SOLVERS

They find challenges in the world around them...

THEY USE THE ENGINEERING DESIGN PROCESS



THEY MAKE A DIFFERENCE

Engineering improves lives today and helps build a better future.

THEY WORK IN MANY FIELDS



...and many more!

THEY USE IMPORTANT SKILLS



Thinking creatively



Analysing problems



Communicating clearly



Working in teams



Being responsible and ethical

THEY BUILD THE FUTURE



Better healthcare



Smarter transport



Sustainable communities



A cleaner, safer planet

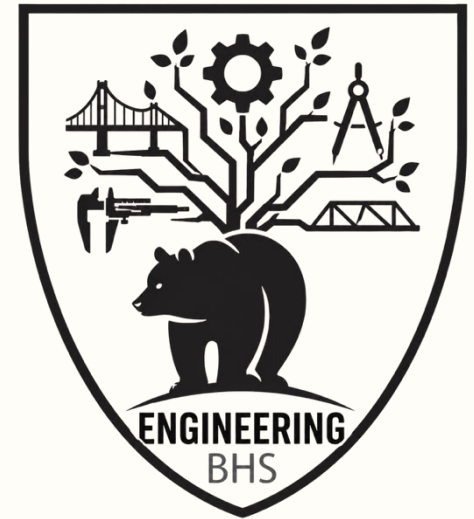


ENGINEERS TURN **IDEAS** INTO REAL-WORLD **SOLUTIONS** THAT **SHAPE OUR LIVES** EVERY DAY.



Today we are learning...

What an engineer is and the four main types of engineer in S3.



SUCCESS CRITERIA

By the end of this lesson...

☐ I can **name the four main types of engineer.**

☐ I can **describe** what different **engineers** do.

☐ I can **explain** how **engineers** work together on one project.

☐ I can **use real examples** in my answers.

☐ I can **explain** my ideas clearly using **what + why.**

What is engineering?

Engineering uses science, maths, technology and creativity to solve real problems.

Engineers...

- design
- build
- test
- improve

Engineers work in teams to make things...

- safe
- reliable
- fit for purpose

What do engineers work on?

Engineers work on the things people use every day.

Things engineers design

- transport (cars, trams, planes)
- buildings and bridges
- power and energy **systems**

More things engineers design

- machines and engines
- materials and products
- everyday objects (kettles, phones, lights)



THE 4 TYPES OF ENGINEER



S3 ENGINEERING SCIENCE

1 CIVIL ENGINEER

They design, build and maintain the structures and infrastructure that people use every day.



EXAMPLES:



Bridges



Roads



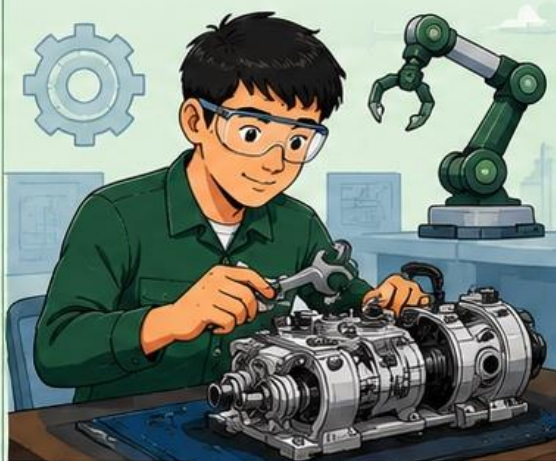
Buildings



Dams

2 MECHANICAL ENGINEER

They design and develop machines, tools and mechanical systems that make life easier.



EXAMPLES:



Cars



Aircraft



Machines



Heating Systems

3 ELECTRICAL ENGINEER

They design and develop electrical systems and products that use electricity.



EXAMPLES:



Power Stations



Electrical Circuits



Lighting Systems



Home Appliances

4 CHEMICAL ENGINEER

They use science and engineering to turn raw materials into useful products safely and efficiently.



EXAMPLES:



Medicines



Plastics



Fuels



Food Processing



ENGINEERS SOLVE PROBLEMS.



DESIGN SOLUTIONS.



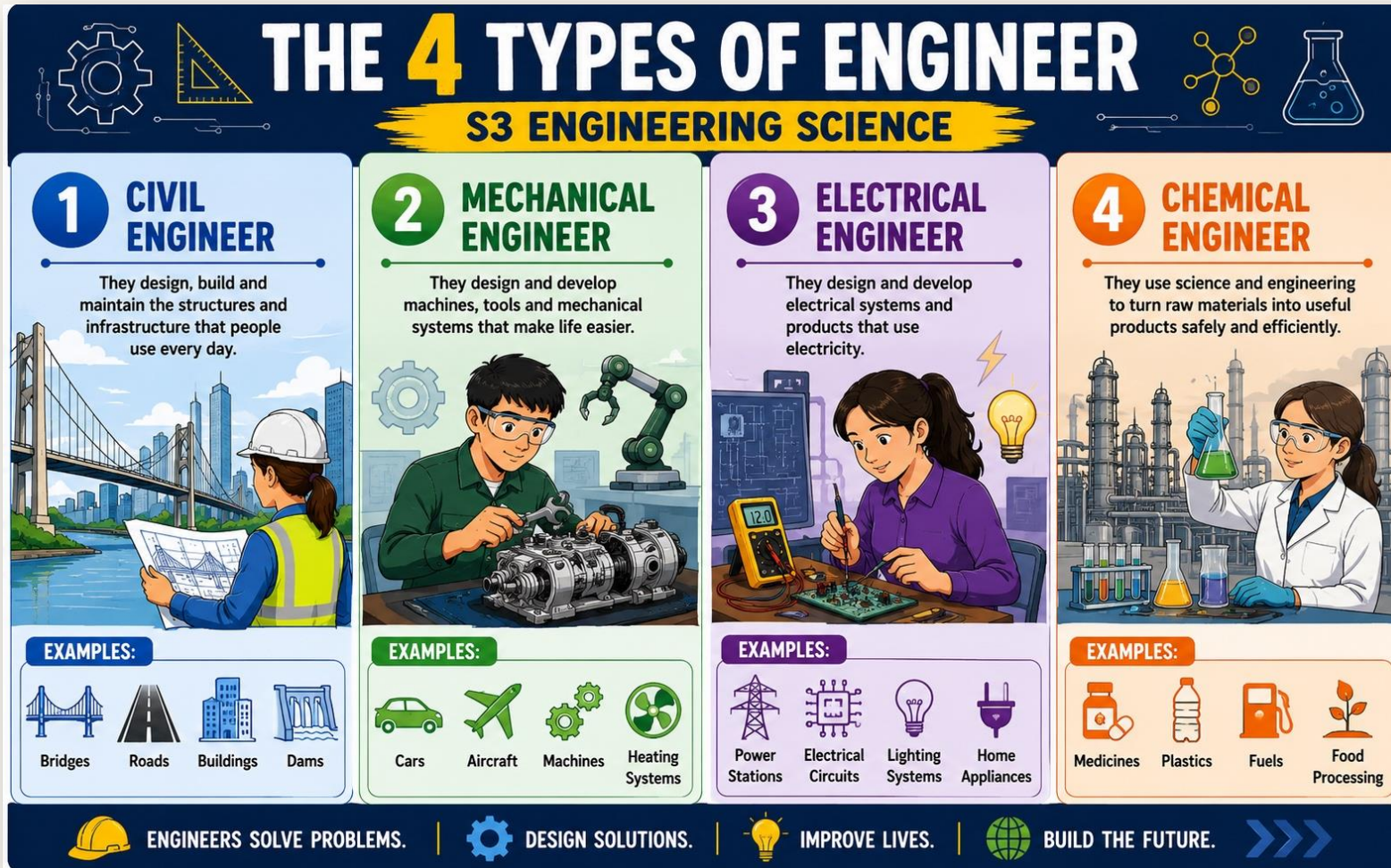
IMPROVE LIVES.



BUILD THE FUTURE.



The four main types of engineer

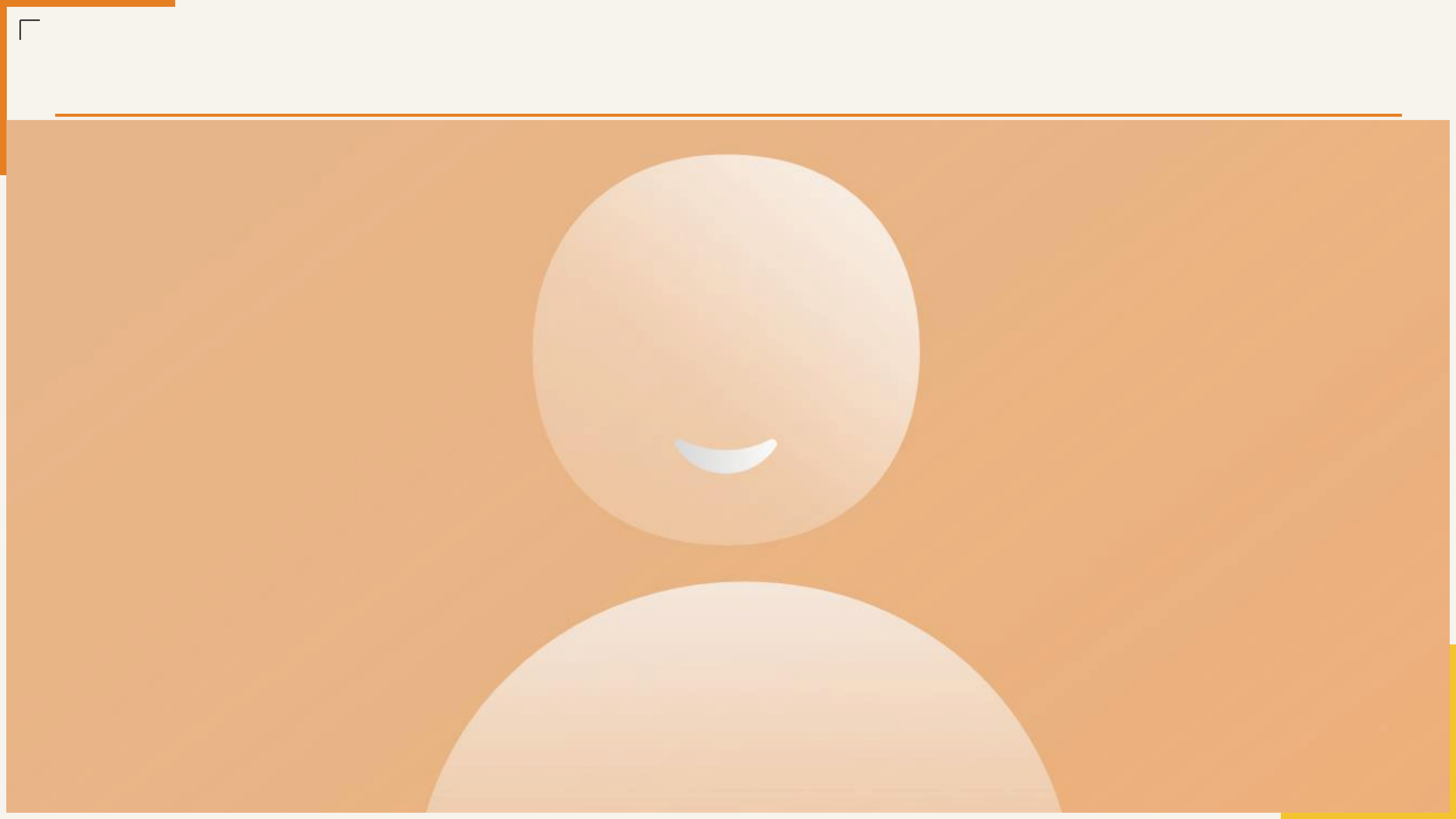


Most projects need more than one type of engineer, working together.

Civil
Mechanical
Electrical
Chemical

Tasks

1. Card sort - pairs
2. Quiz
3. Booklet pages 2 and 3



Pause — check your understanding

Which **engineer** designs bridges and tunnels?

Which **engineer** designs the brakes on a car?

Why do projects often need more than one type of **engineer**?

Prove your I can... statements

1

Name the four main types of engineer.

SC1

2

What does a **mechanical engineer** mainly work on?

SC2

3

Give one job an **electrical engineer** might do on a tram.

SC3

4

Use a real example to **explain** the **civil engineer's** role.

SC4

5

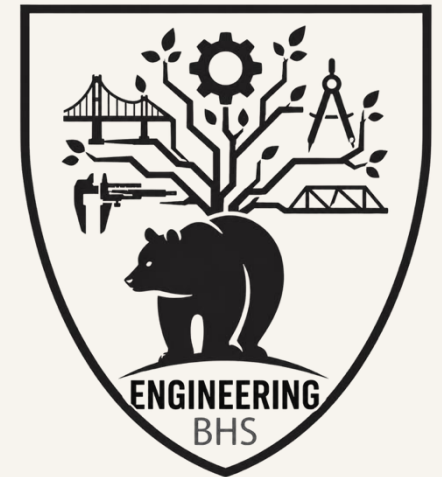
Why would **both** an **electrical** and **civil** engineer be needed to construct a road bridge?

SC5

LESSON 2

Working together – engineers and systems

How engineers work together and the input → process → output idea.

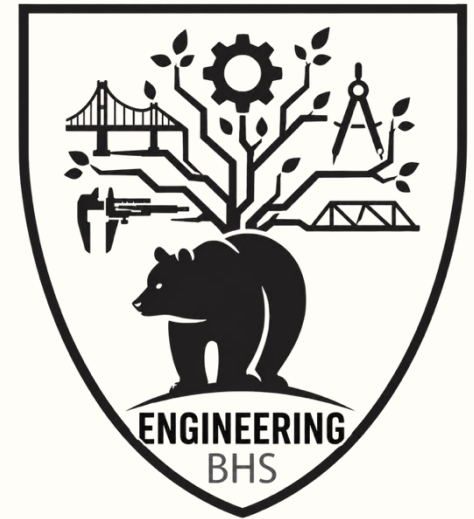


Recap from Lesson 1

- 1 Name one chemical engineer's job.
- 2 Name the four main types of engineer.
- 3 Which engineer mainly works on moving parts and forces?
- 4 Which engineer designs roads, bridges and tunnels?
- 5 Give one job an electrical engineer might do.

Today we are learning...

How engineers work together, and how engineered objects can be described as systems.



By the end of this lesson...

- ☐ I can **explain** why projects need more than one type of engineer.
- ☐ I can **give** a real example of engineers working together.
- ☐ I can **say** what a **system** is.
- ☐ I can **identify** input, process and output in a system.
- ☐ I can **describe** feedback in a system.

One project, many engineers

Most real projects need more than one type of engineer.

Example: a tram system needs...

- **power and electronics**
- **moving parts and braking**
- **tracks, stations and structures**

So engineers must...

- **work together**
- **design a complete system**
- **make it safe, reliable and fit for purpose**

What is a system?

A **system** is a group of parts working together to do a job.

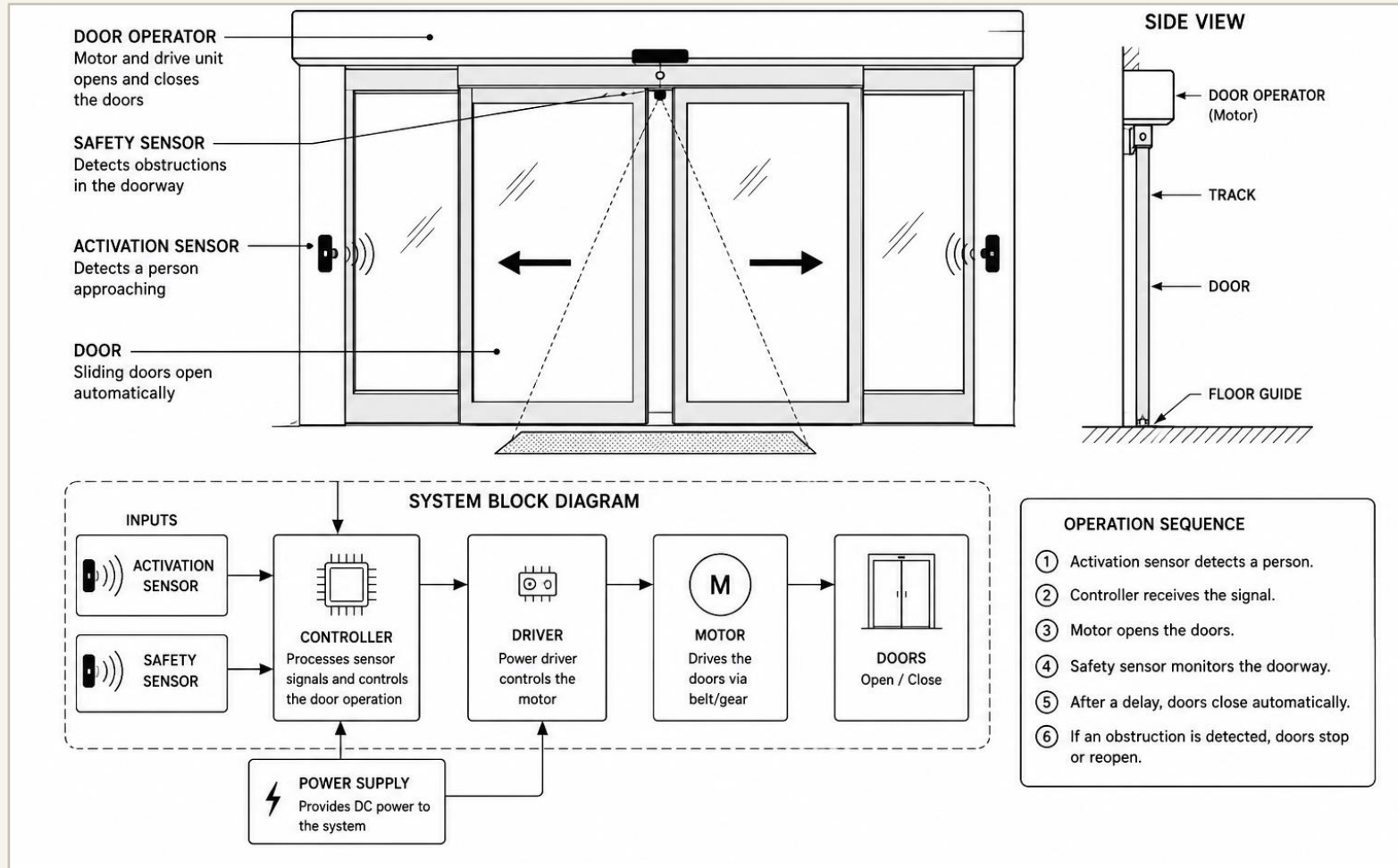
Most systems have...

- an **INPUT** — what goes in
- a **PROCESS** — what happens
- an **OUTPUT** — the result

Sometimes also...

- FEEDBACK** — information used to improve or control the system

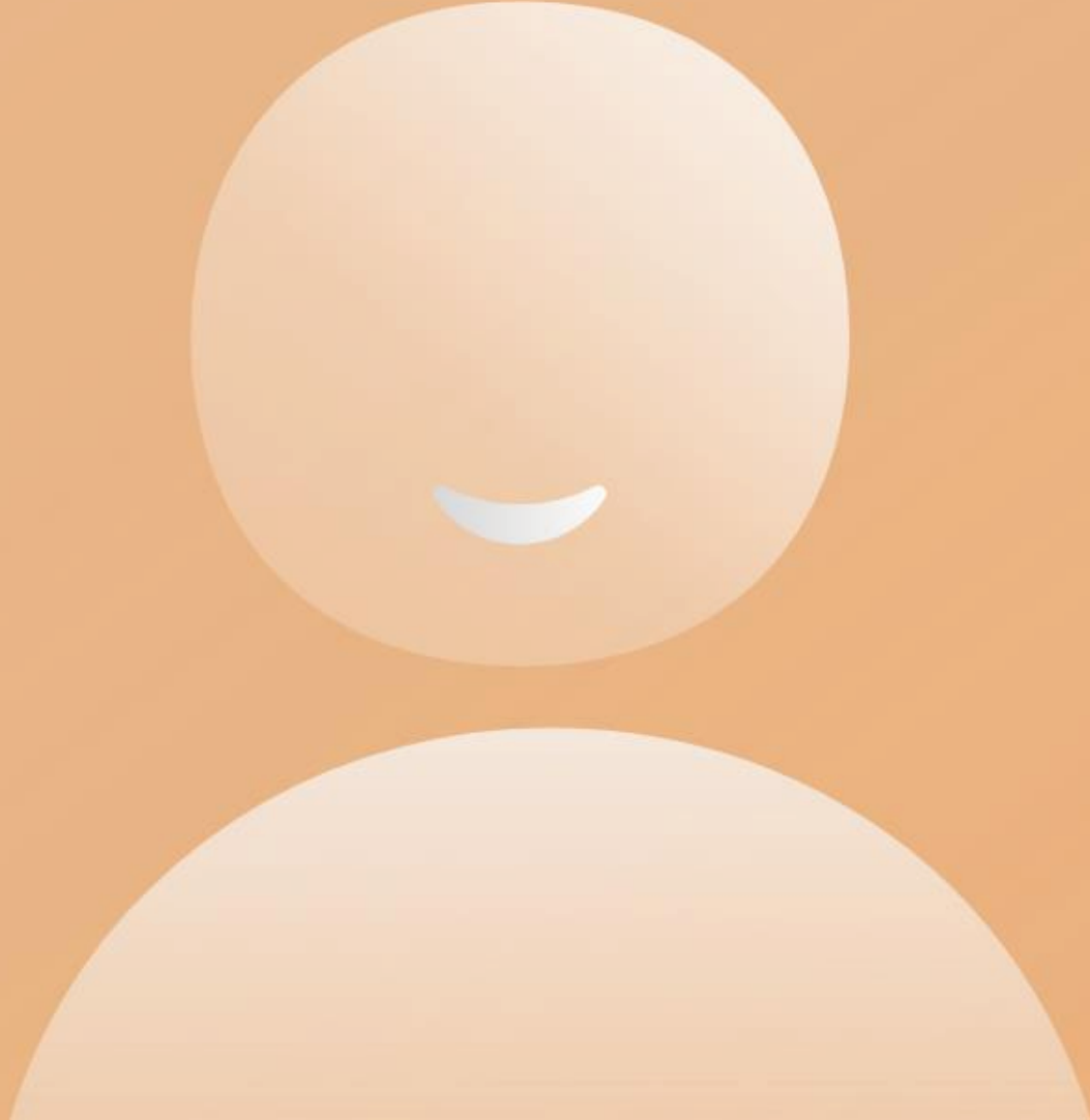
System example – automatic doors



Sensor detects a person → control system sends a signal → doors open.

input
process
output
feedback

Task 2 – Your turn: System thinking – Booklet p. 8



Pause – check your understanding

What is the difference between an input and an output?

Give one example of feedback in a system.

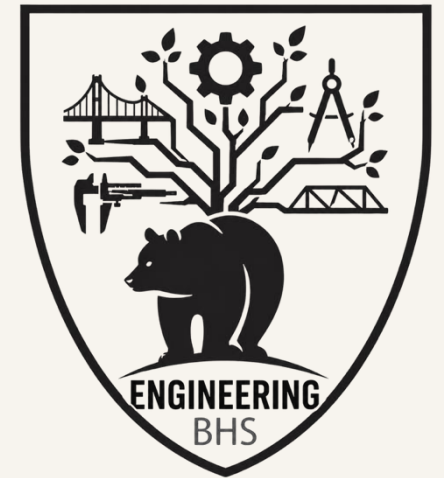
Why does a tram need more than one type of engineer?

Prove your I can... statements

- 1** Why do most projects need more than one type of engineer? SC1
- 2** Define the word **system** in your own words. SC2
- 3** Give an **input**, a **process** and an **output** for a kettle. SC3
- 4** Give one example of **feedback** in any system. SC4
- 5** Use a real example to **explain** how engineers work together. SC5

LESSON 3

Engineers in real Edinburgh Trams, the Queensferry Crossing and SpaceX rockets projects



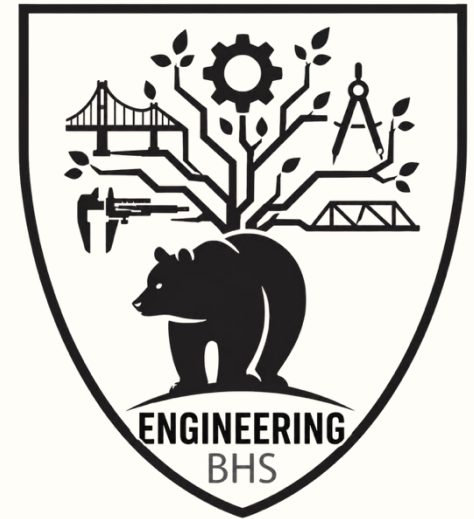
Berwickshire High School • Engineering Science

Recap from Lesson 2

- 1 Name the four main types of engineer.
- 2 What is a **system**?
- 3 Name the three main parts of a system.
- 4 What is **feedback** in a system?
- 5 Why do projects need more than one type of **engineer**?

Today we are learning...

How four types of engineer work together on real engineering projects.



By the end of this lesson...

☐

I can

describe one job each engineer does on a real project.

☐

I can

explain why each engineer's job matters.

☐

I can

use real examples in my answers.

☐

I can

answer using **what + why**.

☐

I can

decide which engineer plays the biggest role on a project.

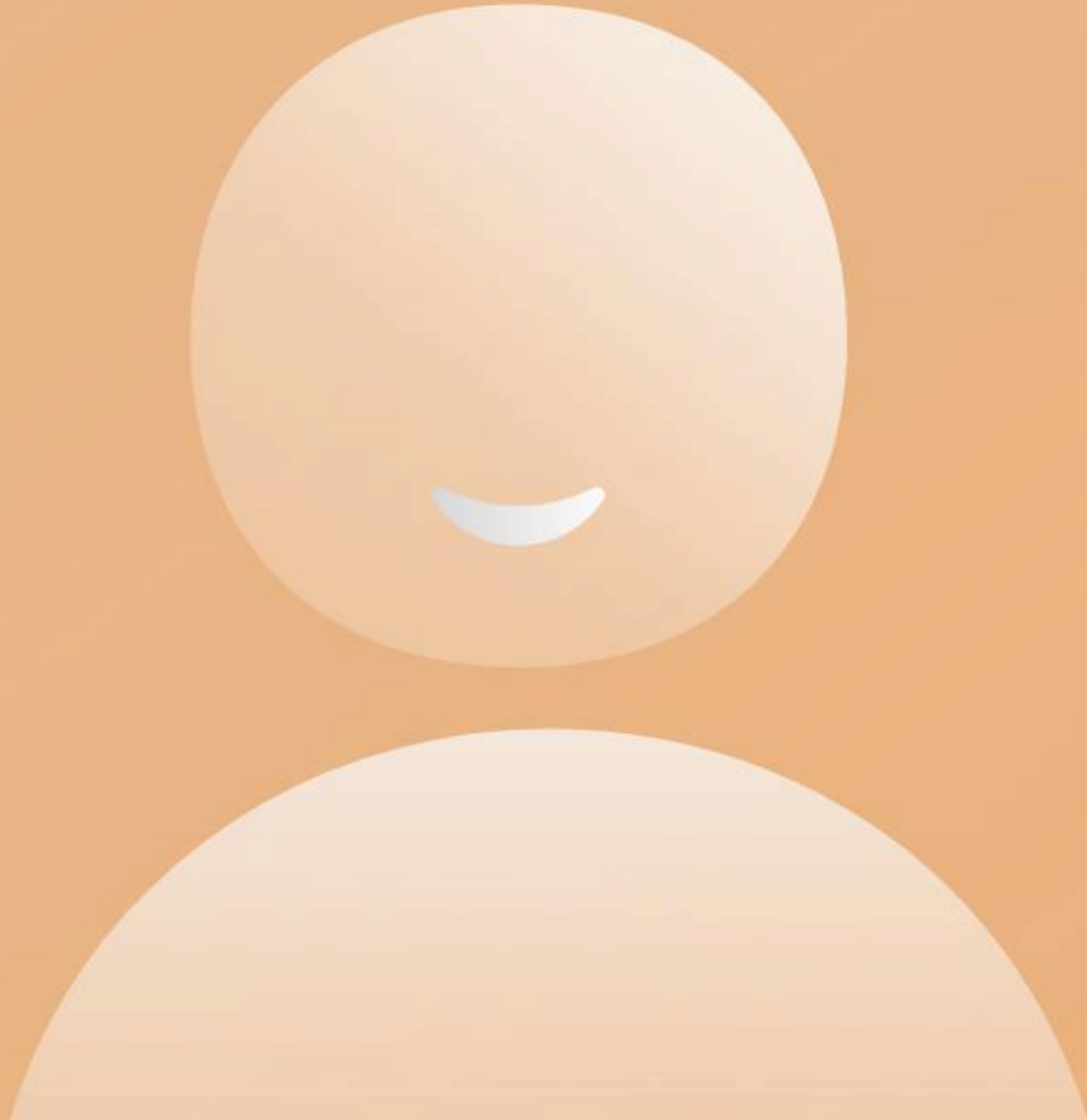
Modelled example – Edinburgh Trams



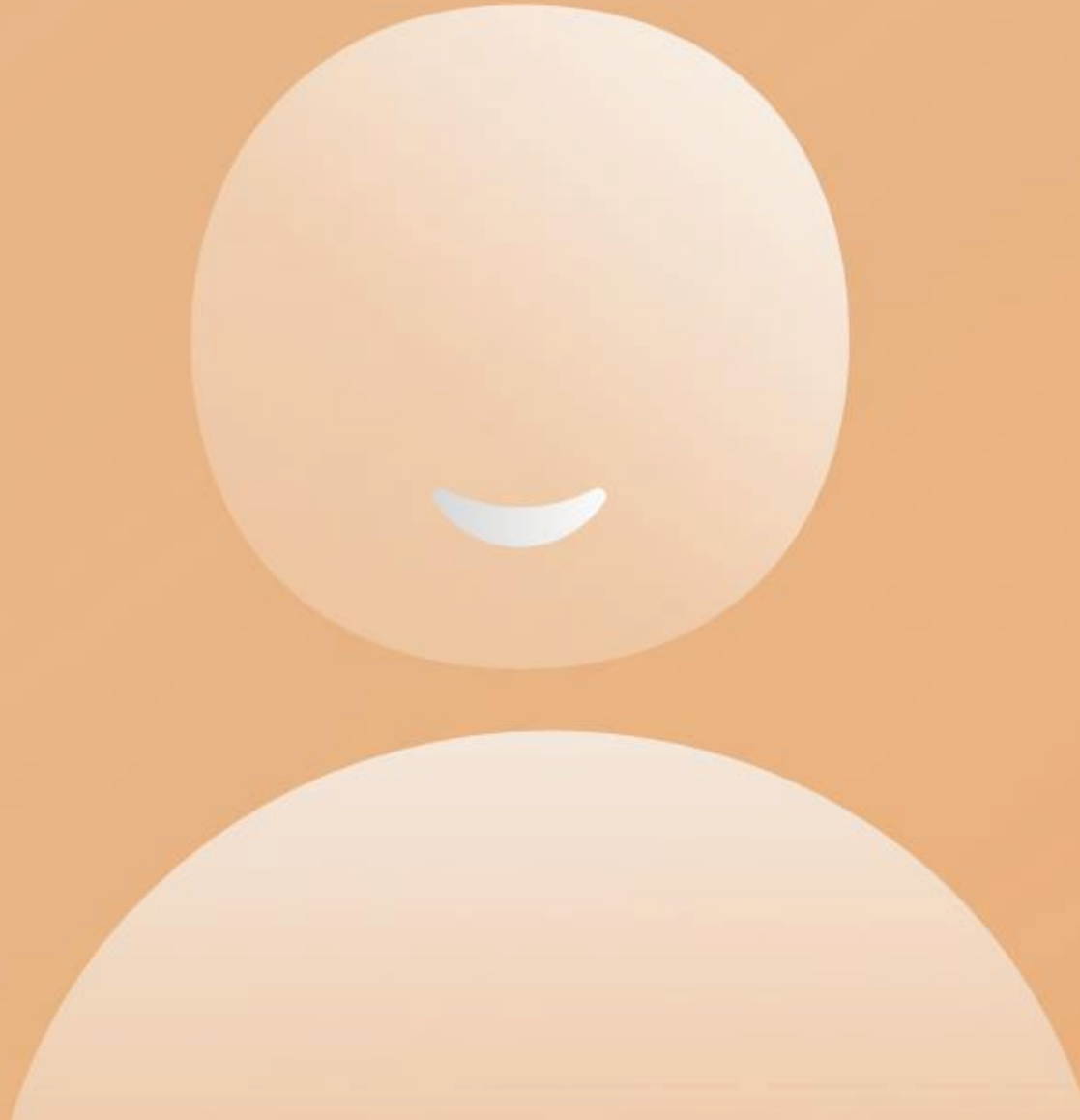
Electrical:
displays, wiring,
lighting, power.
Mechanical:
wheels, brakes,

safe
reliable
strong
efficient
durable
coatings, paints,
materials

Task 3 – Queensferry Crossing – Booklet p. 11



Task 4 – SpaceX Rockets – Booklet p. 12



Practical – Design a Footbridge

Plan how **four engineers** would build a small footbridge for a local park.

Equipment / resources

- Booklet p. 12-13
- pencils
- mini whiteboards or sticky notes

Aim

- each pupil takes one engineer role
- write **one job** your engineer would do

How to do it

Work in groups of four. Each pupil takes one engineer role.

Steps

- **Decide** what the bridge must do (job, users, location)
- **Choose** one engineer role each
- **Write ONE** job your

Share back

- Whose job came **first**? Why?
- Be ready to **explain** with **what + why**.

Record your work

Write your group's plan in your **booklet**.

In your booklet

- Each pupil writes their **engineer role**
- Write **one job** they would do
- Add **why it matters**

Group note

- Record the **order** of jobs on the back
- Be ready to **share** with the class

Pause – check your understanding

Name one job a chemical engineer might do on the Queensferry Crossing.

Why must SpaceX rockets be tested before launch?

Use a real example to explain why one project needs many engineers.

Prove your I can... statements

1

Pick a project. Say what an **electrical engineer** would do.

SC1

2

Pick the same project. Say what a **mechanical engineer** would do.

SC2

3

Why does the **chemical engineer's** work matter?

SC3

4

Give a real example of what **civil engineers** design.

SC4

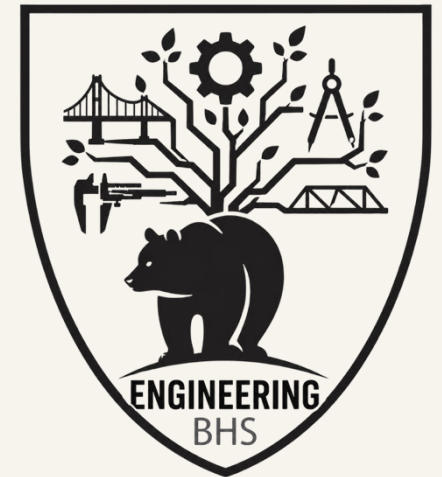
5

Use **what + why** to explain ONE engineer's role on any project.

SC5

LESSON 4

Impacts of Social, economic and environmental impacts. **engineering**



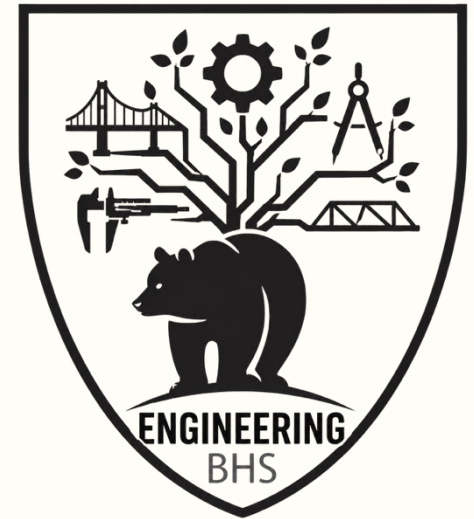
Berwickshire High School • Engineering Science

Recap from Lesson 3

- 1 Name the four main types of engineer.
- 2 What is a **system**?
- 3 Give one job an **electrical engineer** might do on a tram.
- 4 Name one job for a **chemical engineer**.
- 5 Why does the **Queensferry Crossing** need more than one type of engineer?

Today we are learning...

That engineering has social, economic and environmental impacts — both positive and negative.



By the end of this lesson...

☐ I can **describe** what a **social impact** is.

☐ I can **describe** what an **economic impact** is.

☐ I can **describe** what an **environmental impact** is.

☐ I can **tell the difference** between the three impacts.

☐ I can **explain BOTH positive and negative** effects with a real example.

Impacts of engineering

Engineering changes people's lives in good and bad ways. We call these impacts.

Three main types

- social
- economic
- environmental

A good answer explains...

- WHAT the effect is
- WHY it happens
- WHO or WHAT is affected

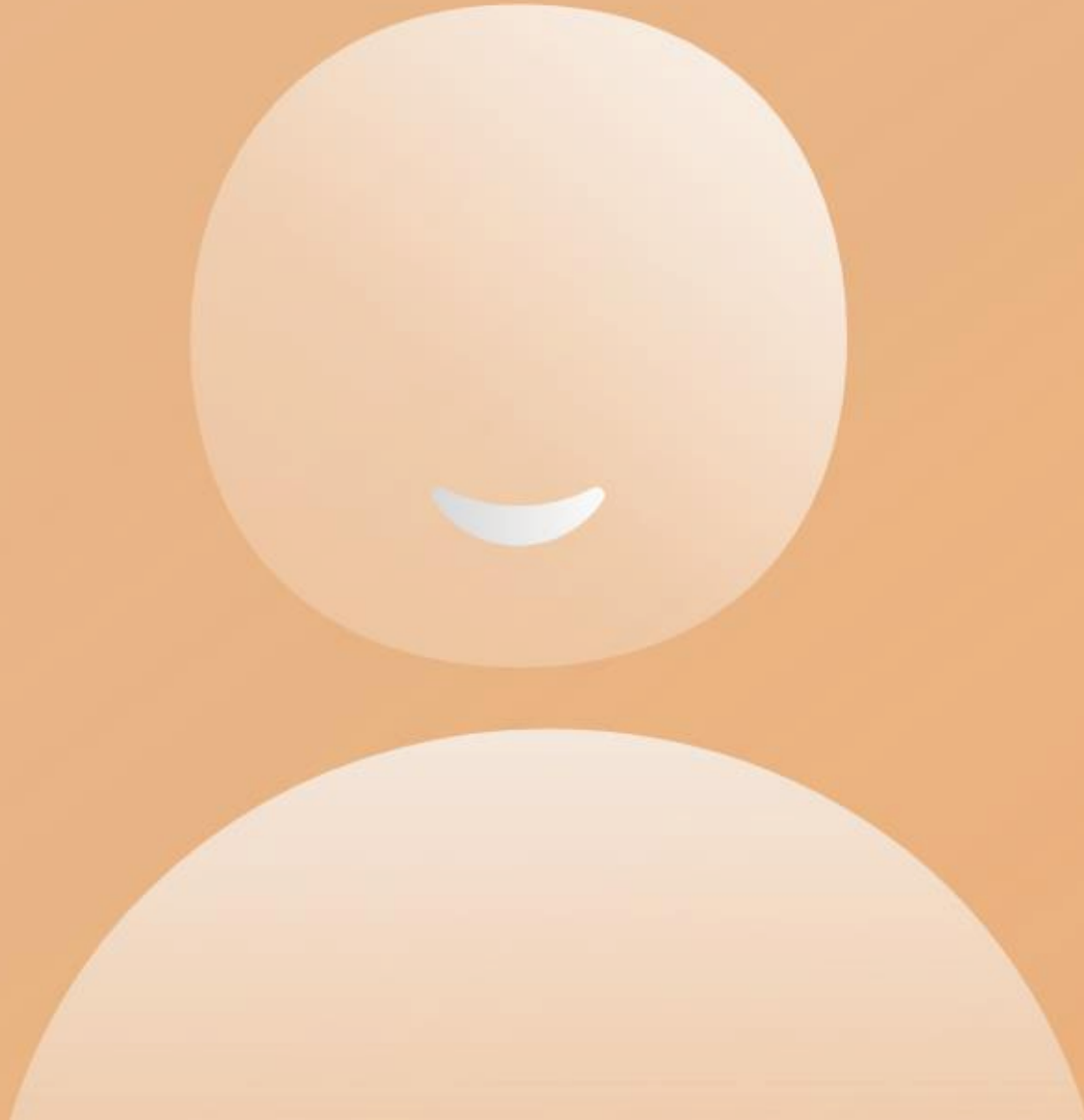
The three types of impact



Social: people's lives. Economic: money and jobs. Environmental: the natural

social
economic
environmental
positive /
negative

Task 5 – Quick starter: what kind of impact? – Booklet p. 14



Practical – Quick Sort

Sort eight examples into **Social**, **Economic** and **Environmental** columns.

Equipment

- Booklet p. 16
- pencil
- mini whiteboard if available

Aim

- Sort eight examples
- Decide which **column** each belongs in
- Compare with a **partner**

How to do it

Work with a partner.

Steps

- Read each item
- Decide on its **column**
- Compare and **discuss**
- **Defend ONE** answer to the class

The examples to sort

- safer travel
- more jobs
- habitat loss
- less pollution
- easier communication
- more tourism

Pause – check your understanding

Name the three types of impact.

Which impact is about money and jobs?

Give one positive AND one negative impact of any project.

Prove your I can... statements

1 Define a social impact.

SC1

2 Define an economic impact.

SC2

3 Define an environmental impact.

SC3

4 A new factory creates jobs AND pollution. Which impacts?

SC4

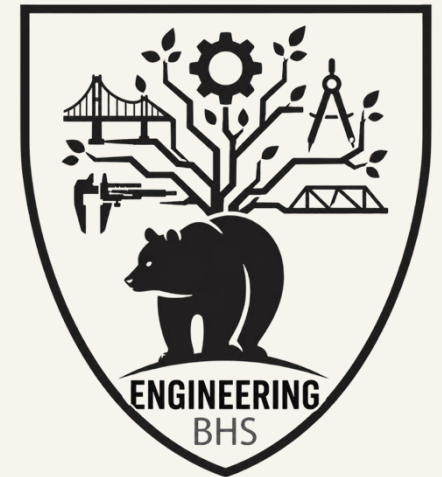
5 Use what + why to give one positive impact of any engineering project.

SC5

LESSON 5

Effects of engineering on people's lives.

Social impacts

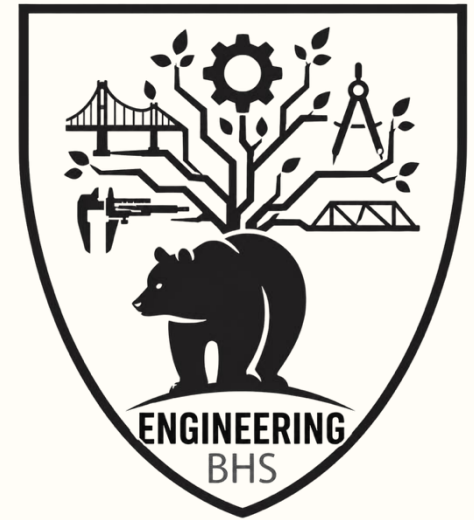


Recap from Lesson 4

- 1 Name the **three types** of impact.
- 2 Which impact is about **people's lives**?
- 3 Which impact is about **money and jobs**?
- 4 Which impact is about the **natural world**?
- 5 Give one **positive** AND one **negative** engineering impact.

Today we are learning...

**That social impacts
are how engineering
changes people's
lives.**



By the end of this lesson...

☐ I can **say** what a **social impact** is.

☐ I can **give** examples of **positive** social impacts.

☐ I can **give** examples of **negative** social impacts.

☐ I can **use** real examples in my answers.

☐ I can **explain** a social impact using **what + why**.

What is a social impact?

Social impacts are about people's lives — not money or jobs.

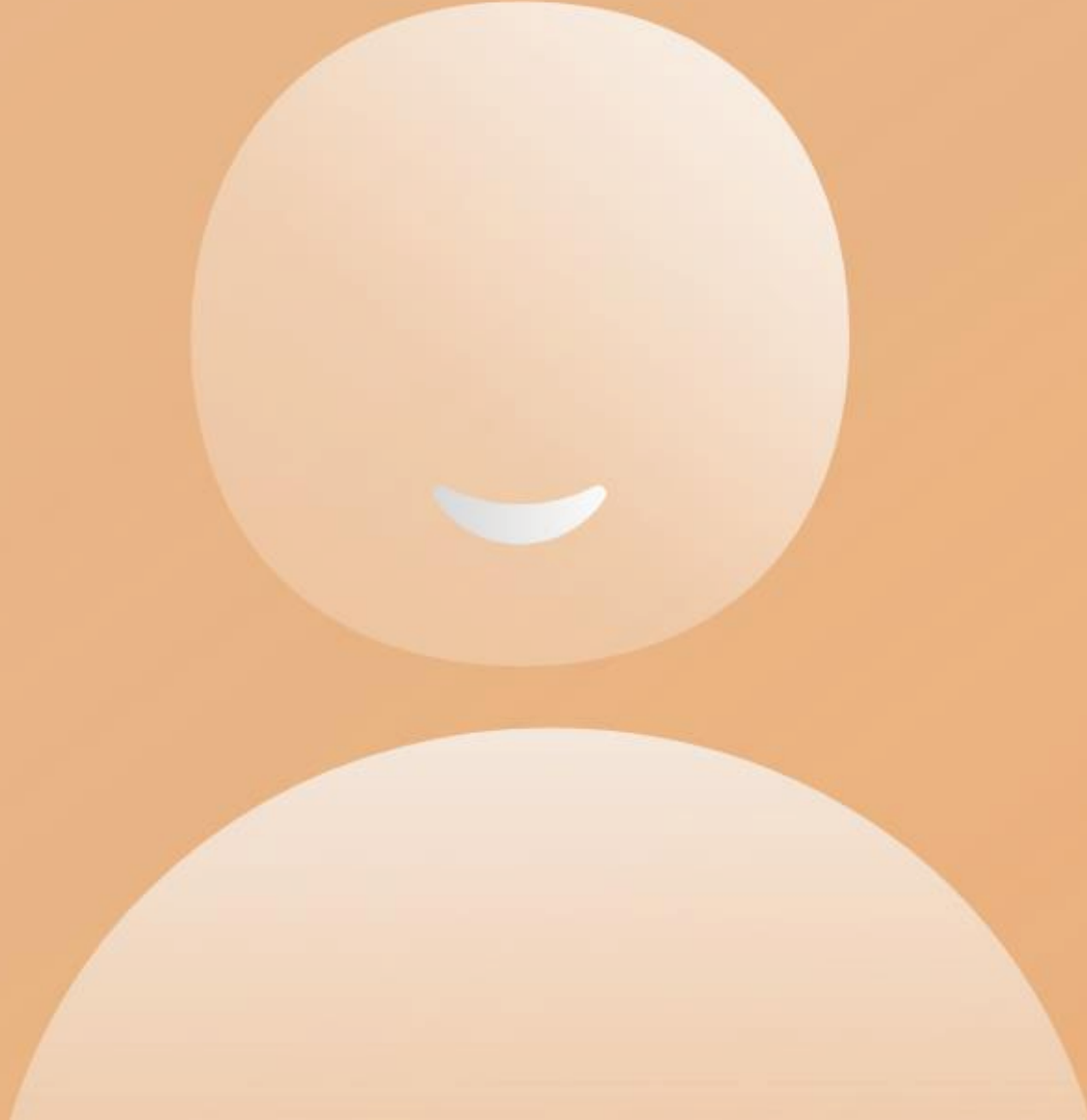
Think about...

- safety
- comfort
- convenience
- communication
- travel

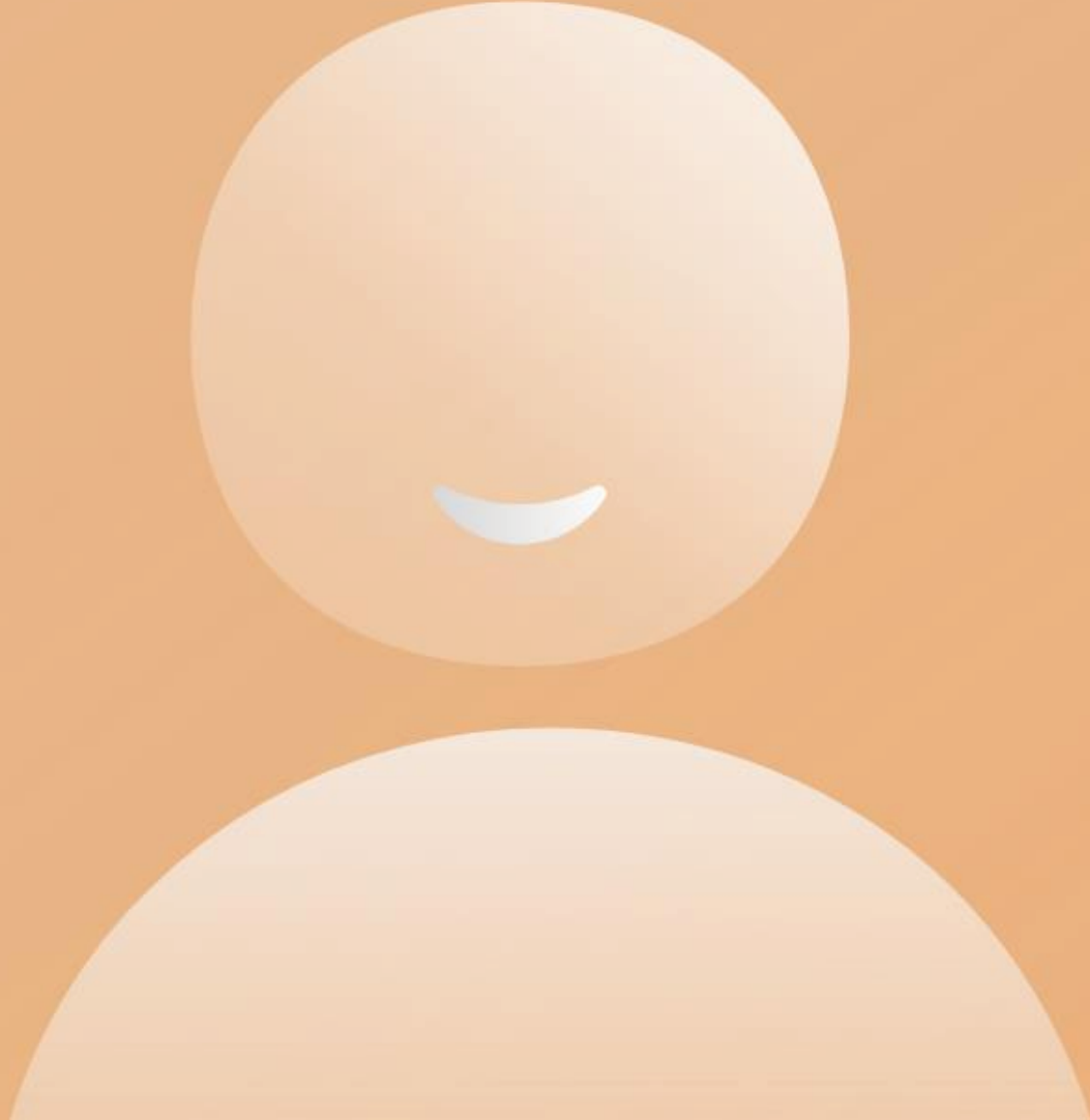
Examples

- safer crossings near schools
- better public transport
- faster internet
- quieter electric buses

Task 6 – Smartphones – Booklet p. 17



Task 7 – Online gaming – Booklet p. 18



Pause – check your understanding

What does a social impact affect?

Give one positive social impact and one negative social impact of smartphones.

Why is faster internet a social impact?

Prove your I can... statements

1 Define social impact.

SC1

2 Give one example of a **positive** social impact.

SC2

3 Give one example of a **negative** social impact.

SC3

4 Use **what + why** to explain ONE social impact of online gaming.

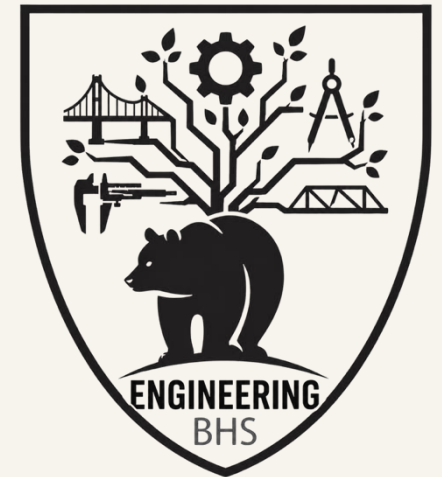
SC4

5 Why does the example matter to **people's lives**?

SC5

LESSON 6

Economic impacts.

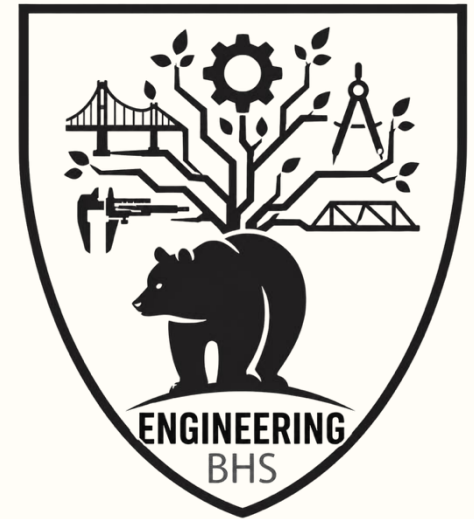


Recap from Lesson 5

- 1 What does a **social impact** affect?
- 2 Give one **positive** social impact of **smartphones**.
- 3 Give one **negative** social impact of **smartphones**.
- 4 Name one social impact of **better public transport**.
- 5 What two parts should a social impact answer include?

Today we are learning...

That economic impacts are how engineering affects money, jobs and trade.



By the end of this lesson...

☐ I can **say what an economic impact is.**

☐ I can **give positive economic impacts.**

☐ I can **give negative economic impacts.**

☐ I can **explain who gains or loses money in an example.**

☐ I can **answer using what + why.**

What is an economic impact?

Economic impacts are about money and jobs.

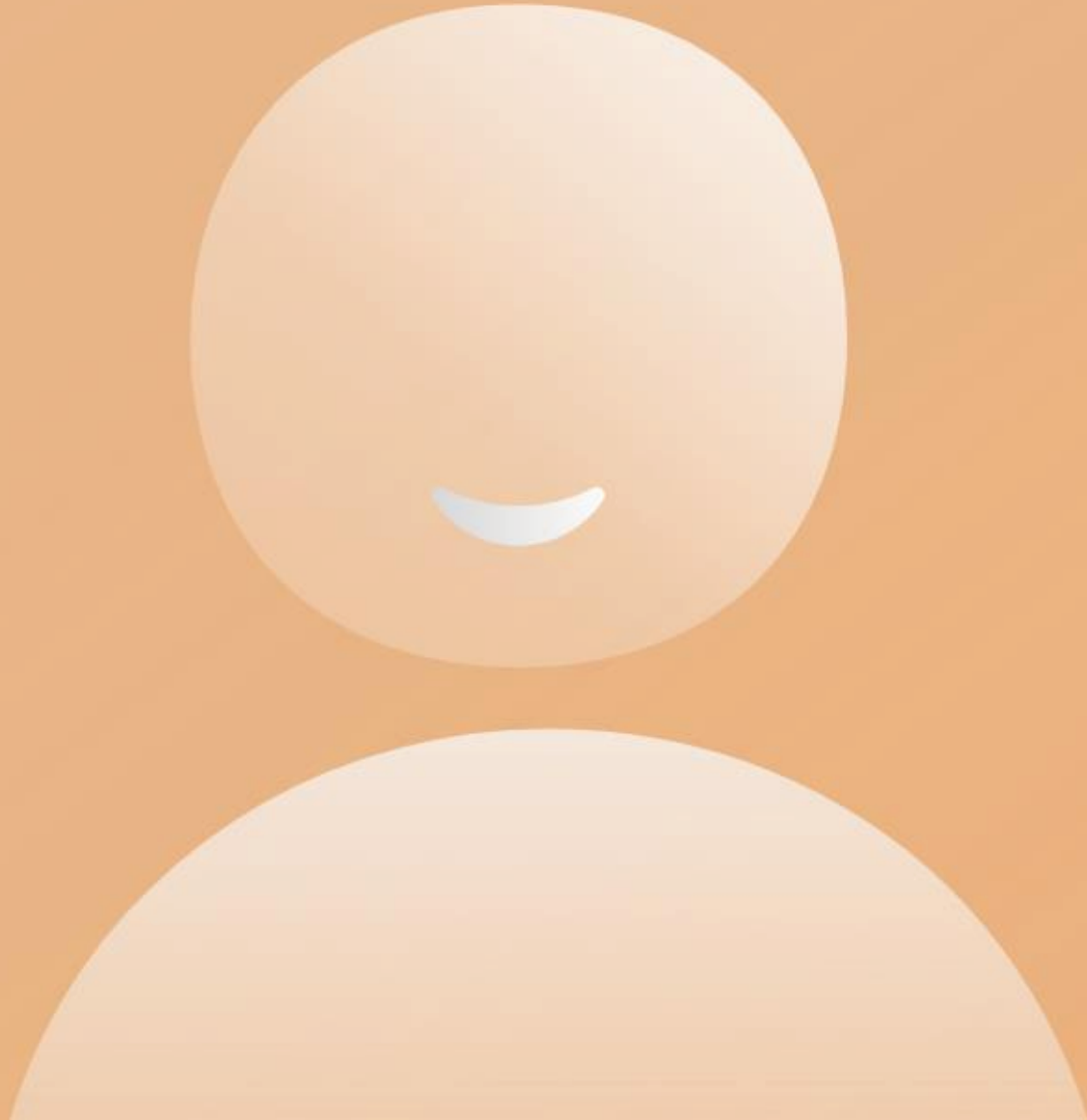
Think about...

- cost
- profit
- jobs
- trade
- tourism

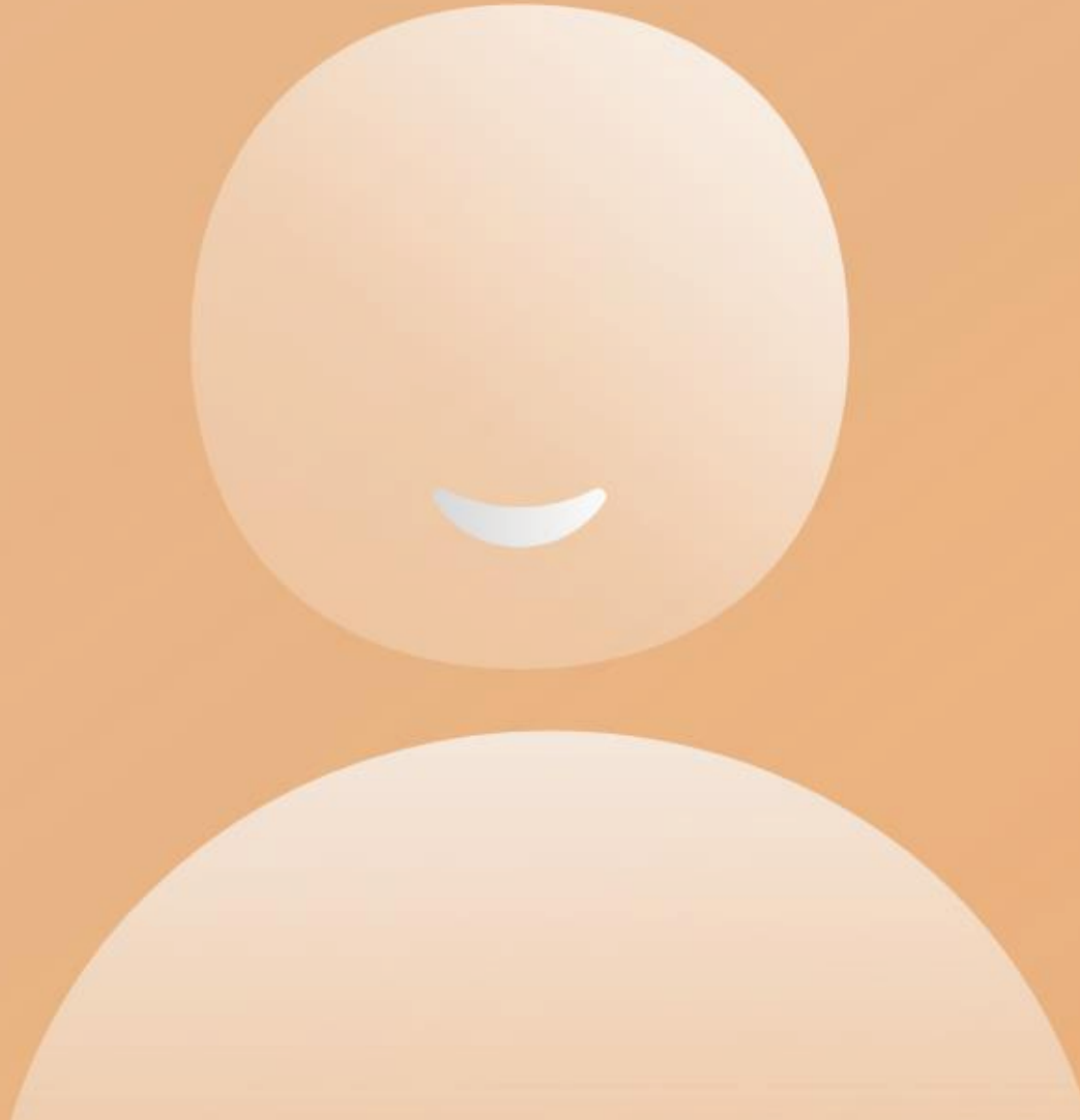
Examples

- a new sports centre may create jobs
- a shopping area may bring more customers
- a project may cost a lot to build

Task 8 – New leisure centre – Booklet p. 19



Task 9 – Self-checkout machines – Booklet p. 20



Pause – check your understanding

What does an economic impact affect?

Give a positive economic impact of a new sports centre.

Give a negative economic impact of self-checkouts.

Prove your I can... statements

1 Define an economic impact.

SC1

2 Give one **positive** economic impact of a **leisure centre**.

SC2

3 Give one **negative** economic impact of a new **shopping area**.

SC3

4 Who might **lose money** when **self-checkouts** replace cashiers?

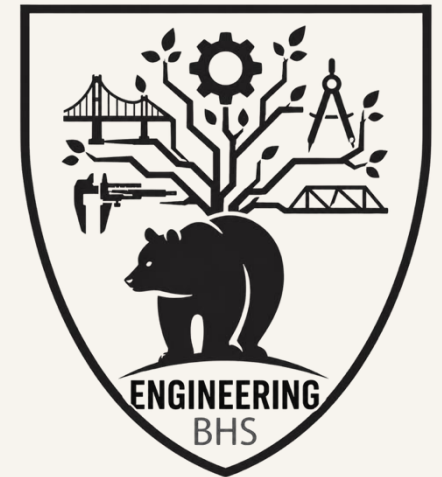
SC4

5 Use **what + why** to explain **ONE** economic impact of any project.

SC5

LESSON 7

Environmental Effects of engineering on the natural world. impacts

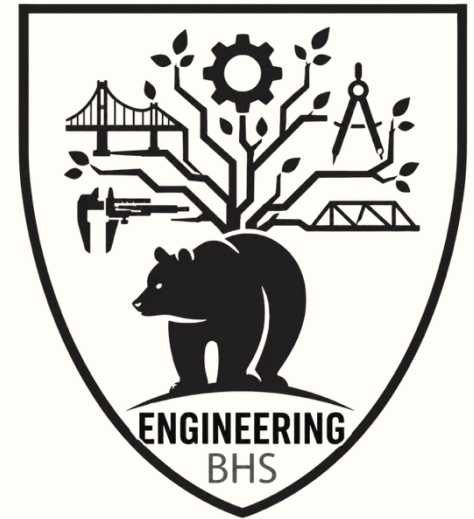


Recap from Lesson 6

- 1 What does an **economic impact** affect?
- 2 Give one **positive** economic impact of a **leisure centre**.
- 3 Give one **negative** economic impact of a new **shopping area**.
- 4 Name one social impact of **online gaming**.
- 5 What two parts should a good answer include?

Today we are learning...

That environmental impacts are how engineering changes the natural world.



By the end of this lesson...

☐ I can **say** what an **environmental impact** is.

☐ I can **give positive** environmental impacts.

☐ I can **give negative** environmental impacts.

☐ I can **use** real examples from real projects.

☐ I can **answer** using **what + why**.

What is an environmental impact?

Environmental impacts are about the natural world.

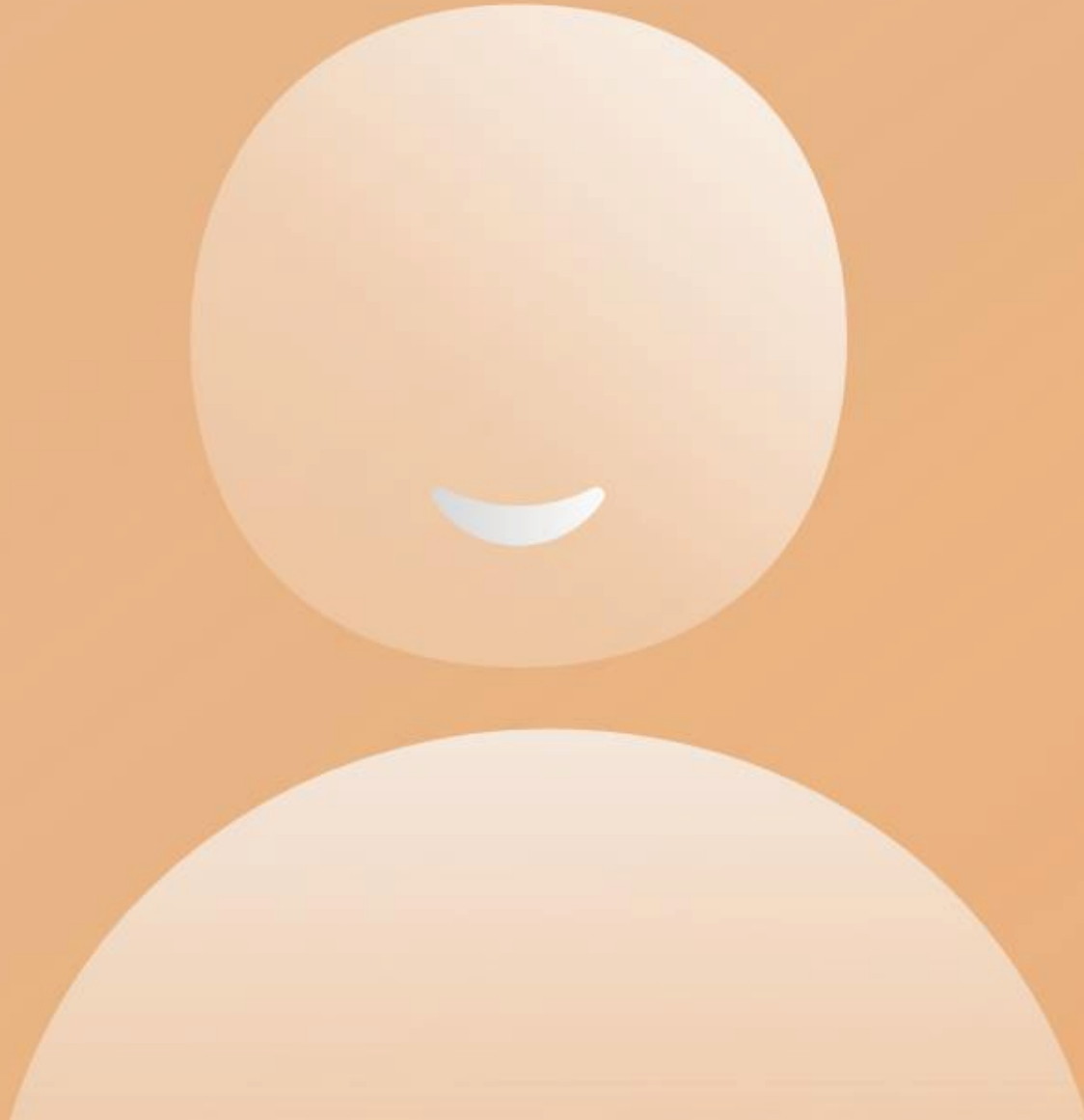
Think about...

- pollution
- habitats
- carbon emissions
- waste
- energy use

Examples

- solar panels reduce fossil fuel use
- building work may damage habitats
- electric vehicles reduce air pollution

Task 10 – Wind farm – Booklet p. 21



Practical – Sort the Impacts

Practise sorting five examples into the correct impact type.

Equipment

- Booklet p. 22
- pencil

Aim

- Read each example
- Decide if it is **social, economic or environmental**
- Discuss any that fit **more than one type**

How to do it

Work with a partner. Take turns.

Steps

- Read the five examples on Booklet p. 22
- Decide which type each is
- Compare with your

Record

- Write social / economic / environmental beside each item
- Be ready to share one example with the class

Pause – check your understanding

What does an environmental impact affect?

Give one positive AND one negative environmental impact of a wind farm.

Why are electric vehicles seen as a positive environmental impact?

Prove your I can... statements

- 1 Define an environmental impact.
- 2 Give one **positive** environmental impact of a wind farm.
- 3 Give one **negative** environmental impact of a wind farm.
- 4 Why is **solar energy** a positive environmental impact?
- 5 Use **what + why** to explain ONE environmental impact.

SC1

SC2

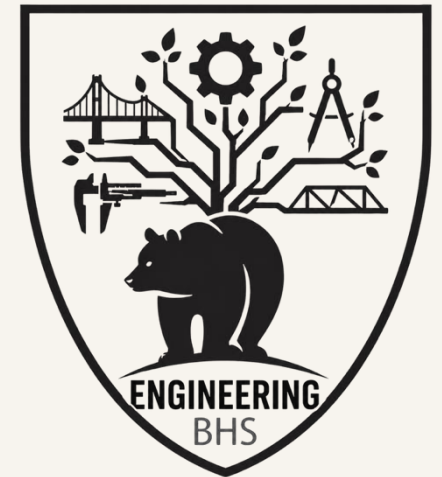
SC3

SC4

SC5

LESSON 8

Case study & end of topic self-check. topic

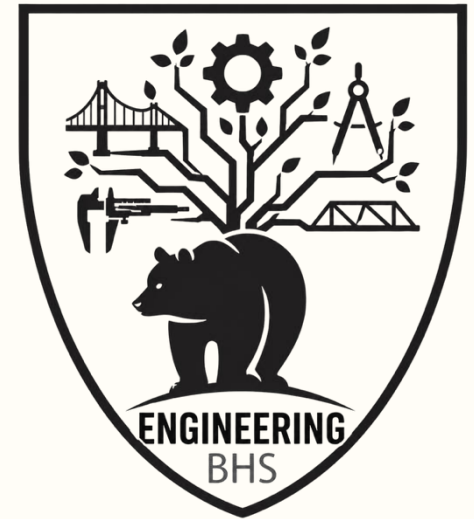


Recap of the whole booklet

- 1 Name the four main types of engineer.
- 2 What is a **system**?
- 3 Name the three types of impact.
- 4 Give one **positive social impact** of any project.
- 5 Give one **negative environmental impact** of any project.

Today we are learning...

**Apply everything
we've learned to a
real engineering
project.**



By the end of this lesson...

- ☐ I can **research** a real engineering project.
- ☐ I can **explain** who it helps.
- ☐ I can **describe TWO positive** impacts (any type).
- ☐ I can **describe TWO negative** impacts (any type).
- ☐ I can **answer in what + why** sentences using real examples.

Practical – Case Study Research

Research one engineering project and record what you find.

Equipment

- iPad / laptop
- Booklet p. 23
- pencil

Aim

- Use a **trusted source**
- Find a project
(Edinburgh Trams,
ScotRail, wind farm,
etc.)
- Record **positive** and

How to do it

Pick a project. Find out **what** it is and **why** it is being built.

Questions to answer

- What is the project?
- Why** is it being built?
- What **materials / technology** are used?
- Who does it help?

And finally...

- What are the **positive impacts**?
- What are the **negative impacts**?
- Cite your **source**.

Record your findings

Fill in the case study table on Booklet p. 23.

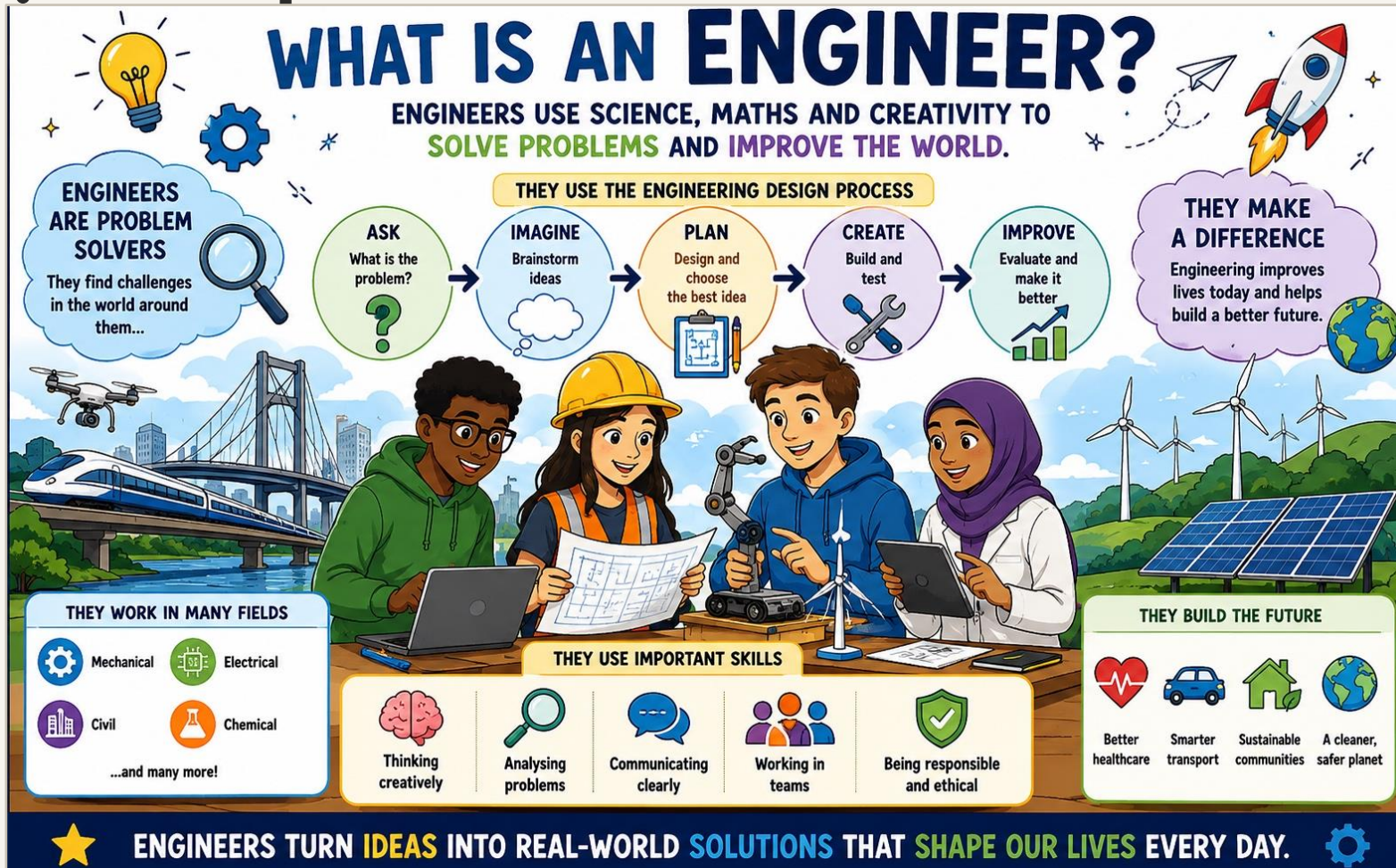
Top tips

- Stay on task
- Use trusted websites only
- Note materials and technology

Be ready to share

- Pick one positive and one negative impact
- Use what + why sentences

Knowledge organiser – engineers, systems,



Engineering = solving real problems with science, maths, technology and

reliable
efficient
fit for purpose
impact

Systems have

Answering questions: what + why

A strong answer should explain **WHAT** the effect is and **WHY** it matters.

Top tips

- use real examples
- use a **key word** from the booklet
- explain **WHY** in your own words

Key words

- **reliable** — works again and again
- **efficient** — does the job with little waste
- **fit for purpose** — suitable for the job

Pause – check your understanding

Name the four engineers and what each one mainly works on.

Define social, economic and environmental impact.

Give one what + why answer about any engineering project.

Prove your I can... statements

- | | | |
|---|---|-----|
| 1 | Name the four main types of engineer studied in this topic. | SC1 |
| 2 | What is a system ? Use input, process and output . | SC2 |
| 3 | Choose ONE engineer and describe ONE job they might do. | SC3 |
| 4 | What is the difference between a social and an economic impact ? | SC4 |
| 5 | Give ONE positive or negative impact of any project — explain why . | SC5 |