How many engineers does it take to make a tin of baked beans?
A lot of people eat baked beans...

The Heinz factory in Wigan makes over 1.5 million cans a day!

From field to plate, engineers are needed every step of the way...

1. First of all, you need the beans themselves. Engineers help make sure they’re fed, watered and harvested properly.

2. Because of the British weather, most of our baked beans are grown overseas, so engineers keep the ships and aeroplanes running that bring them here. Then they’re unloaded and transported to the factory to be mixed with other ingredients like tomatoes, sugar and salt.

Manufacturing systems engineers, process engineers, software engineers, materials engineers, control engineers, food engineers
The **ingredients** all have to arrive exactly when they’re needed, **fresh** and ready to be used.

Engineers oversee every step of the process to make sure nothing goes to waste.

Then when they’re baked and canned, they’re loaded onto lorries. They’re driven over roads, bridges and through tunnels - built by engineers - to the supermarket.

They are stored in the supermarket ready and waiting for you to pick them up; take them to the checkout and pay.
Then all you have to do is take them home, open the tin and heat them up.

This involves another few thousand engineers who provide the essential gas or electricity to your home to do that!

On the following pages you can read about people who are engineers and think about how they might have helped the baked bean on its journey...

You can see all the different things they did before they became engineers.

Let's meet them...
As a Field Engineer for Cable and Wireless worldwide, Natasha installs communication networks at business sites which allows employees access to super-fast internet. In 2011, she won Special Recognition at the Institute of Engineering and Technology’s Young Woman Engineer of the Year award.
Catering was Alex’s best subject at school, but she wanted to become an engineer after she visited a building site with her Dad. Alex is now a Trainee Civil Engineer at Hyder Consulting, a large engineering consultancy working on projects like the Sydney Harbour Bridge.

“Being an engineer means you get to make a difference and the learning enables you to benefit your whole career.”

2012
- GCSEs: including Maths, Sciences and Catering

2012
- Started BTEC in Construction and the Built Environment at Shooters Hill College

2013
- Left college after 10 months when offered an apprenticeship with Hyder Consulting

2013
- First job as a Trainee Civil Engineer with Hyder Consulting

2013
- Visited old school to encourage girls to work in construction industry

2014
- Studying for BTEC at the College of North West London
Umair Imran

An ex-goalkeeper who took science ‘A’ levels with the intention of studying medicine, but changed his mind and studied engineering instead. Now Umair is studying at University of Manchester and working for STEMNET and The Social Mobility Foundation.

“I am the first person to hear about, see and feel the newest tools, gadgets and aircraft engines”
SUSTAINABILITY
CHEERLEADER

Jo Carris

Dancer and cheerleader who was interested in engineering and the environment from a young age. Jo now works as a Senior Sustainability Consultant on the environmental sustainability of events such as the Olympic Games and Football World Cup in Brazil.

“"There are lots of exciting, varied and rewarding careers related to engineering"”

2001
GCSEs: including Sciences, Maths, French & Geography

2001
Performed at Sadler’s Wells and the London Palladium as a Street Jazz Dancer

2003
Cheerleader and coach of her university cheerleading team

2006
Studied at University of Birmingham then on to an MSc in Environmental Technology and Energy Policy at Imperial College London

2011
Senior Sustainability Consultant, Useful Simple Projects

2013
Women in Science and Engineering (WISE) Excellence Award Winner

The Olympic Velodrome, which is energy and water efficient, and built with environmentally friendly materials.
JOINING THE JET SET

Simon Pickering

Father of three and voluntary police officer, who once played in the FA Cup and worked as a plumber. Simon now works on jet engines at Rolls-Royce.

"Engineering isn’t just a career, it becomes an engrained passion and a way of life."

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<tr>
<th>Year</th>
<th>Details</th>
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<tbody>
<tr>
<td>1997</td>
<td>Worked on a paper round and washing cars</td>
</tr>
<tr>
<td>2002</td>
<td>GCSEs: including Maths, PE, Sciences &amp; ICT</td>
</tr>
<tr>
<td>2003</td>
<td>Plumbing and heating apprenticeship, becoming Corgi registered</td>
</tr>
<tr>
<td>2004</td>
<td>Played in the FA Cup for Matlock Town</td>
</tr>
<tr>
<td>2004</td>
<td>Became a Dad and worked as a plumber</td>
</tr>
<tr>
<td>2010</td>
<td>Concession Engineer with Rolls-Royce</td>
</tr>
</tbody>
</table>
EVERY ENGINEER HELPS

Bukky Bird

As the Director of Engineering and Sustainability for Tesco, Bukky uses her engineering skills to give Tesco customers the best shopping experience, while minimising the company’s impact on the environment.

A mind map demonstrating the thinking and processes involved in engineering

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<tbody>
<tr>
<td>A-levels in Maths, Physics and Classical Civilisation</td>
<td>Bachelor’s degree in Mechanical Engineering from University College London</td>
<td>Master’s degree in Built Environment: Environmental Design and Engineering from University College London</td>
<td>Associate Director at WSP Energy and Environmental</td>
<td>Head of Sustainability at Tesco</td>
<td>Director of Engineering and Sustainability at Tesco</td>
</tr>
</tbody>
</table>
A keen sportsman who was more athletic than academic at school, Craig changed career and moved into engineering after 5 years working in a bank.

"Every day in an engineering environment is different, and that opportunity for variety in my work is something I really enjoy."

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<tbody>
<tr>
<td>GCSEs: including Biology, French, Maths and PE</td>
<td>Joined Santander Bank and worked his way up to the role of Mortgage Consultant</td>
<td>Got a job at Rolls-Royce doing a 3 year apprenticeship in Manufacturing Engineering</td>
<td>Became a Dad</td>
<td>Awarded Apprentice of the Year</td>
<td>Studying for an MSc in Engineering Business Management at Warwick University</td>
</tr>
</tbody>
</table>
Chi Onwurah MP

Chi is the MP for Newcastle Central and ex-Head of Telecoms Technology for Ofcom - the organisation that oversees the British communications industry. Before that she designed a brand new type of double sided surface mounted printed circuit board.
BREAKING THINGS DOWN

Luke Dandy

As a Doctoral Researcher of Chemical Engineering at the University of Birmingham, Luke comes up with ways to break down things like waste materials so they can be recycled and reused.

A high pressure reactor used daily in the laboratory

2001 - 2005
Weapons Technician
- RAF

2002 - 2005
BTEC in Aeronautical Engineering

2005 - 2006
Engineering Foundation
- Aston University

2006 - 2011
Master's degree in Chemical Engineering and Applied Chemistry

2011 - present
PhD in Supercritical Fluids and their application to Polymer Synthesis and Processing
CLEANING UP

Keisha Ann-Marie Smith

Keisha grew up in Barbados, but now lives in Britain where she brings wasteland back to life for the local community as a Principal Engineer for CGL (Card Geotechnics Ltd).

“\‘It’s great finding a job that combines my love of sciences and the environment\’”

2000
Caribbean GCSEs: including Physics, History, Maths & Spanish

2002
Played for the school hockey team

2002 - 2005
BSc in Civil Engineering & work experience, including helping environmental engineers with visits & data collection

2005
Moved to the UK and began studying a MSc in Environmental Engineering at the University of Nottingham

2006
Started work investigating contaminated sites and recommending clean up strategies straight from university

2012
Principal Engineer & Chartered Environmentalist (CEnv) at CGL, leading multi-million pound brownfield schemes
Jamal Jules

Jamal worked in a supermarket while doing work experience in banking and insurance. Now he works as a Technician Apprentice on underground railways for one of the world's largest engineering firms.

“I don’t just like engineering, I love the creative input”

2011

- GCSEs: including Art, Maths, Sciences & Psychology
- Worked part time at Iceland Frozen Foods
- Work experience for Barclays Bank and Aviva Insurance

2012

- Passed football coaching Level 1
- Represented students as part of the school council
- Work experience as Civil Engineer Technician Apprentice, Mott MacDonald
As Associate Structural Engineer for international engineering consultancy WSP, Roma Agrawal helped engineer Western Europe’s tallest building - the Shard.

Roma Agrawal

Western Europe’s tallest building - the Shard

A-levels in Maths, Further Maths, Physics and Design and Technology
Bachelor's degree in Physics from University of Oxford
Master's in General Structural Engineering from Imperial College London
Associate Structural Engineer at WSP
Awarded Young Structural Engineer of the Year 2011 (IstructE)
Finalist for Young Woman Engineer of the Year 2012 (IET)
A part-time DJ and keen football player. Ray spends his days underground in 42kms of new tunnels being dug underneath London by Crossrail.

“Maths and Sciences are important. It’s hard to think where you can use what you study outside of school but Engineering is just that”
MAKING THE WORLD GREENER

Yewande Akinola

As an Environmental Services Engineer for international engineering consultancy ARUP, Yewande has developed sustainable water supply systems using rainwater and solar thermal energy for buildings around the world.

Solar thermal evacuated tubes created for sustainable building engineering

2001
A-levels in Maths, Physics, and Geometric and Mechanical Drawing

2003
Bachelor’s degree in Engineering Design and Appropriate Technology from the University of Warwick

2005 - 2006
Industrial placement at Thames Water

2011
MSc Innovation and Design for Sustainability at Cranfield University

2012
Winner, IET Young Woman Engineer of the Year 2012

2007 - present
Environmental Services Engineer at ARUP
Regina Tumblepot

Regina worked at Debenhams and as a bartender before becoming a Civil Engineering Technician Apprentice with Morgan Sindall on Crossrail, the largest construction project in Europe.

“You’ll be in a career where your curiosity and inventiveness will be key to finding solutions to problems.”

2000
GCSEs: including Maths, Music & Religious Studies

2004
Worked as bartender and waiting staff

2004
BTEC in Manufacturing and Mechanical Engineering at Preston College

2009
Worked as a sales assistant at Debenhams and as an insurance advisor

2011
Became Civil Engineering Technician Apprentice, Morgan Sindall

2012
Awarded Crossrail Trade Apprentice of the Year
Chimay now lives in the USA, after studying engineering in Nigeria and the UK. As Professor and Head of the Department of Architectural Engineering at Pennsylvania State University, he looks after over 500 engineering students.

**1984**
Bachelor’s Degree in Building from the University of Jos, Nigeria

**1989**
PhD in Civil Engineering (specialising in Computer-Aided Engineering) from the University of Leeds

**1991**
Chartered Builder (FCIOB)

**1992**
Chartered Engineer (CEng, FICE, FIstructE)

**2007**
Honorary Doctorate (Dr.h.c.) from Delft University of Technology in the Netherlands
HAVE A BREAK

Sara-Jayne Barker

A multi-lingual Craft Apprentice working for Nestlé in York. Sara-Jayne helps improve the way the company makes confectionary products like its famous KITKAT bars.

“Science, maths, IT and English will be more relevant than you imagine”

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<tbody>
<tr>
<td>Played in school netball team for 5 years</td>
<td>Work experience as a nursery nurse</td>
<td>GCSEs: including Maths, Sciences, Spanish &amp; Fine Art</td>
<td>Studied AS level Engineering at York College</td>
<td>Started work at Nestlé as a Craft Apprentice studying mechanical and electrical engineering</td>
<td>Finalist for the WISE (Women in Science and Engineering) Female Apprentice of the Year awards</td>
</tr>
</tbody>
</table>
THE TUBE’S TOP ENGINEER

David Waboso FREng

As London Underground’s Director of Capital Programmes, David leads the team responsible for delivering The Tube Upgrades.

A London Underground tube train

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>1980</td>
<td>Taught at inner city school</td>
</tr>
<tr>
<td>1982</td>
<td>Worked as engineer building bridges on the M25</td>
</tr>
<tr>
<td>1986</td>
<td>Management of a water supply scheme in Africa</td>
</tr>
<tr>
<td>1995</td>
<td>UK Project manager of the year &amp; joined London Underground</td>
</tr>
<tr>
<td>2005</td>
<td>London Underground Director of Engineering</td>
</tr>
<tr>
<td>2009</td>
<td>Capital Programmes Director</td>
</tr>
</tbody>
</table>
AFBE-UK
CHAIRPERSON

Dr Nike Folayan

Nike is the Chairperson of AFBE-UK, which aims to promote, encourage and support engineers from all backgrounds.

As a Systems Integration Consultant, she allows people working at rail, road and aviation sites to communicate easily with one another.

<table>
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<tr>
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<tbody>
<tr>
<td>1997</td>
<td>A-levels in Maths, Physics, Chemistry and Further Maths</td>
</tr>
<tr>
<td>2003</td>
<td>BEng and MSc (Electronics Engineering)</td>
</tr>
<tr>
<td>2007</td>
<td>PhD in Electronics Engineering - Antenna Technology and electromagnetics</td>
</tr>
<tr>
<td>2008</td>
<td>Winner of Inspiring Leader in the workplace award, AFBE-UK Chairperson</td>
</tr>
<tr>
<td>2012</td>
<td>Chartered Engineer - Institution of Engineering and Technology and Senior Comms Engineer at Mott MacDonald</td>
</tr>
<tr>
<td>2013</td>
<td>Systems Integration Consultant</td>
</tr>
</tbody>
</table>
MAKING TUNNELS SAFE

Yomi Ajileye

Yomi was involved with the tunnel ventilation system at the Hindhead tunnel, making sure traffic fumes don't build up, as a graduate engineer for Mott MacDonald.

<table>
<thead>
<tr>
<th>2003 - 2005</th>
<th>2005 - 2010</th>
<th>2010 - present</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-levels in Maths, Physics, Chemistry</td>
<td>Master’s degree in Aerospace Engineering from the University of Surrey</td>
<td>Graduate Engineer at Mott MacDonald</td>
</tr>
</tbody>
</table>
Becoming an Engineer

There is no right or wrong way to become an engineer

There are many different routes into engineering (as you’ll have seen from the role models in this booklet)...

Maths and Science, especially Physics, are important GCSE subjects at school, after which you can take:

- An apprenticeship/advanced apprenticeship which involves working and studying at the same time
- Vocational qualifications, such as BTECs, NVQs, SVQs or equivalent
- Academic qualifications, such as ‘A’ levels, IB, Higher Education qualifications or equivalent
- Or a combination of academic /vocational qualifications and on-the-job training

Whichever route you decide to take, you could move on to a university degree, an advanced apprenticeship, a higher apprenticeship (which often incorporates a degree), training or employment.

With a little work you could gain professional engineering qualifications that are recognised around the world. These letters after your name will demonstrate your expertise, skills and commitment to your chosen career:

- Engineering or ICT Technician (EngTech or ICTTech)
- Incorporated Engineer (IEng)
- Chartered Engineer (CEng)

The UK needs more engineers...

Engineers really are in demand - both here in the UK and around the world.

In the UK, engineering accounts for almost a quarter of the turnover of all UK businesses. That’s three times more than the shopping and retail market.

It’s growing too... Engineering companies are expected to have nearly 3 million job openings from 2010-2020.

That means in the UK we need double the number of engineering apprentices and people with engineering qualifications than we currently have to meet demand.

It is an old-fashioned stereotype that engineers are white and male. As you can see from this booklet, there are many female engineers and engineers from a range of different backgrounds. Anyone with an interest in creativity and problem-solving can get a good job in engineering and enjoy a rewarding career.
At every level, engineers consistently earn more than people in other industries.

Engineering technicians earn approximately £6,000 per year above the national average and Registered Engineering Technicians (EngTech) earn up to £25,000 per year above than the national average.

Graduate engineers can earn up to 30% more over their whole careers.

Across the board, on average, professional engineers can expect to earn between £25,000 and £40,000 per year more than the national average salary.

It’s such a diverse industry, with so many different jobs to be done.

Whether you’re starting an apprenticeship after your GCSEs or looking for a graduate position after finishing your studies at university, there is a career in engineering waiting for you.

We hope you are inspired to think more about the fascinating world of engineering!

Why not find out more by using the links on the right?

Useful links

Tomorrow’s Engineers
www.tomorrowsengineers.org.uk

Designed to Inspire YouTube Video
tinyurl.com/designedtoinspire

National Apprenticeship Service
www.apprenticeships.org.uk

Apprenticeships in Scotland
www.myworldofwork.co.uk/modernapprenticeships

Wales
www.careerswales.com/en

Northern Ireland
www.delni.gov.uk/apprenticeshipsni

Engineering Technicians
www.engtechnow.com

National Careers Service
nationalcareersservice.direct.gov.uk

UK Higher Education (UCAS)
www.ucas.com

icould careers videos
icould.com

WISE promoting female talent in science, technology, engineering and maths
www.wisecampaign.org.uk