ROLE PROFILE
AIRPORT ENGINEER

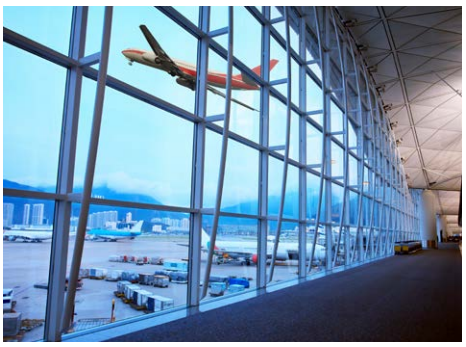
Institution of Civil Engineers

Airport Engineering

What does a civil engineer in the Airport sector do?

A civil engineer in the airports sector will specialise in the design, tendering, contracting and supervision services in connection with runways, taxiways, aprons and landside access facilities.

The civil engineer must consider issues such as drainage, airside layout, landside access design and passenger flow characteristics.



What is enjoyable about the role?

A civil engineer specialising in airports infrastructure can enjoy a well-travelled and varied career involving many different projects. Engineers may tweak a system to improve its performance, for instance by upgrading a runway, while seeking to minimise disruption to the airport. Larger projects could involve the planning and design of new runways and terminal buildings.

You will meet a variety of different people, and each project will be unique with its own challenges and priorities. Engineers in the sector work closely with clients, decision makers, industry stakeholders and consultants and will necessitate the development and approval of robust design solutions through collaborative working, trust and proactive management of client demands.

How do I become an Airport Engineer?

A Bachelor's degree in Engineering is required, such as Civil Engineering or Civil Engineering Technology. Graduates will join a team and learn the basic concepts of airport engineering so they can apply their skills to one field.

Those interested in entering the sector should have:

- A strong interest in airports
- Spatial awareness and conceptualisation
- Analytical and problem-solving skills.

Future projects

To symbolise the growing relationship between Hong Kong and China, the world's largest rail network is being built to connect Hong Kong and Beijing. Contractors have made extensive use of Building Information Modelling (BIM) throughout the project's lifecycle. A key element of the station will be a dramatic steel and glass roof structure. This should become a prominent feature of the Kowloon skyline. The station will also connect to others close by via a series of pedestrian bridges and underpasses. These include Austin Station, Kowloon Station and Airport Express.

Get in touch

Dean Lenton
Learning Development Manager

e: dean.lenton@ice.org.uk
t: + 44 (0)20 7665 2243
w: ice.org.uk
twitter: @ICE_engineers

About ICE

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ROLE PROFILE
HIGHWAY ENGINEER

Highway Engineering

What does a civil engineer in the Highways sector do?

A Highways Engineer is a civil engineer who specialises in the design and construction of roads and highway projects. Highway engineers must take into account future traffic flows, design of highway intersections/interchanges, geometric alignment and design. They must also consider highway pavement materials and design, and structural design of pavement thickness to deliver improved whole life costs and reflect budget pressures.

What is enjoyable about the role?

You will be involved in many different projects from minor proposals right the way through to complex high profile major developments of national or regional importance. One particularly rewarding aspect is seeing designs you have worked on being built and operating successfully for years to come.

What has changed in the sector in recent years?

Standards of highway engineering are continuously improved. Highway engineers must take into account future traffic flows, design of highway intersections/ interchanges, geometric alignment and design, highway pavement materials and design, and structural design of pavement thickness to deliver improved whole life costs and reflect budget pressures.

The operation and management of the highway network has changed in recent times, and continues to evolve. For example, the Highways Agency, in England, has now become a public company, 'Highways England'.

Future career potential and projects

£11 billion will be invested into England's motorway and A roads network in the next 5 years, adding 1,300 miles of new lanes. This programme of modernisation will include:

- Smart motorways and expressways: Over the coming years, a national spine of smart motorways will add more than 400 miles of extra capacity to our highways. A new standard for A roads, known as 'expressways' will be introduced: with modernised junctions, refuge areas and specialist technology to quickly detect incidents and get traffic moving again.
- Unblocking bottlenecks: congestion hotspots will be tackled across the country, ranging from improving the A14, to progressing plans for a new lower Thames crossing.
- Safer roads: England's roads are already some of the safest in the world. However, they need to become even safer by improving road design.
- Greener roads: A national effort to manage carbon emissions, including the creation of a network that is open to all, and which boosts facilities for people that cycle or walk (Highways England, 2015).

Roles within Highway Engineering include:

- Topographical survey
- Geological analysis
- Soils and rock design
- Highway materials design
- Highway drainage design
- Traffic analysis
- Lighting and signing
- Highway network management
- Contract management
- Health and safety
- Environmental assessments

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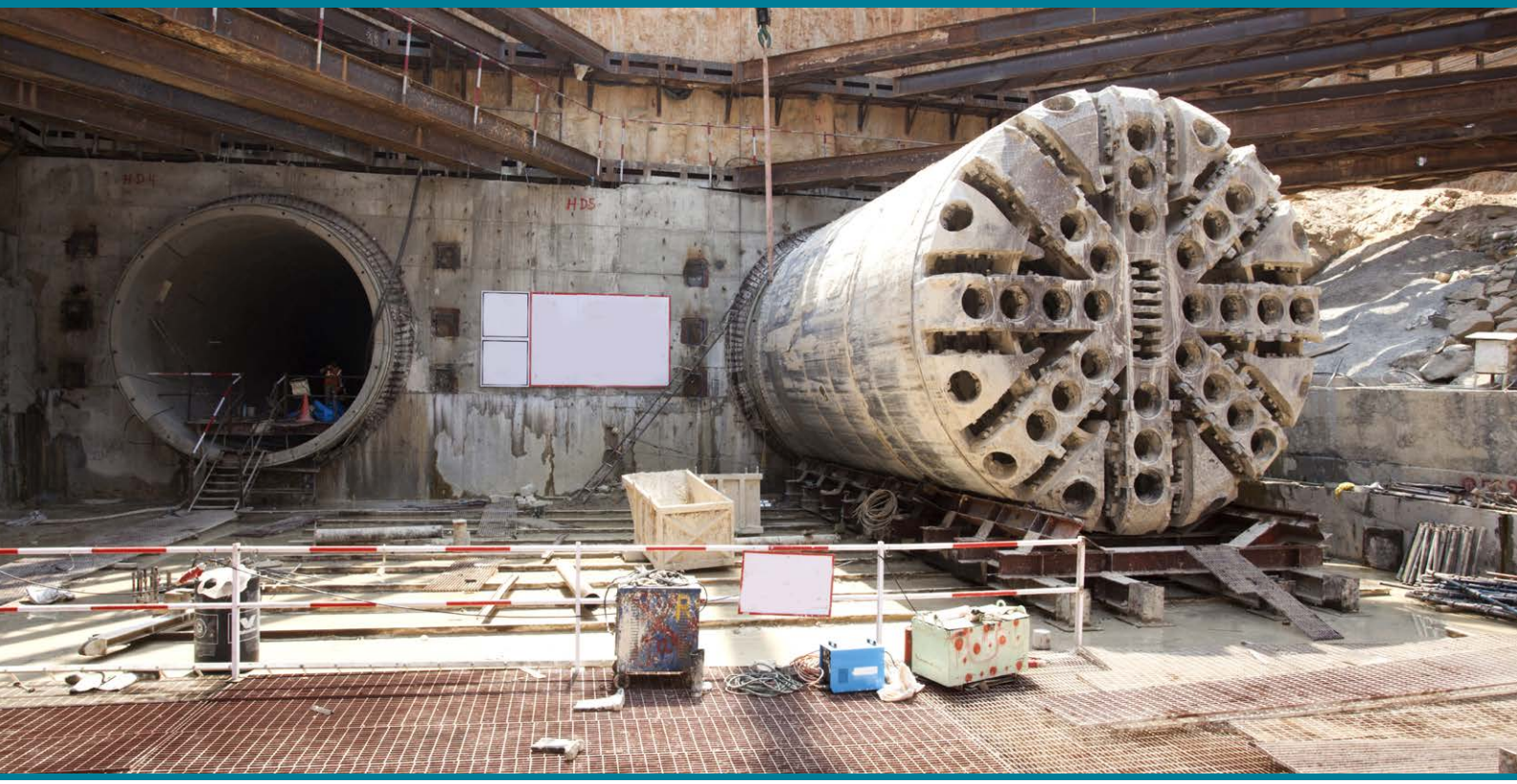
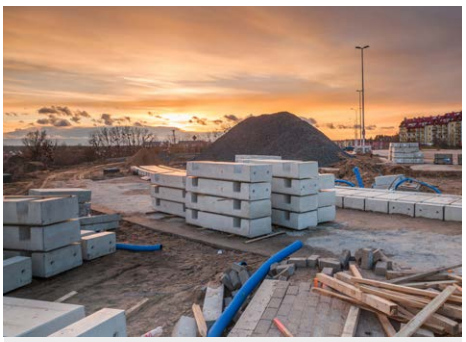
ROLE PROFILE
RAILWAY ENGINEER

Railway Engineering



What does a Civil Engineer in the Rail sector do?

A railway civil engineer specialises in the design, construction and operation of all types of railway systems, which may include main line, metro, light rail or high-speed rail. A career often encompasses, or works closely with a wide range of disciplines, including civil engineering, electrification, track, power, signalling, as well as train specialists in train operations. There are specialists in rail plant, railway systems and new technologies, working in the public or private sector of global industry which is worth billions of pounds.



What is enjoyable about the role?

You could make a great contribution to transform Britain's rail infrastructure and work on some of Britain's most impressive projects, like HS2 or Crossrail – currently Europe's largest civil engineering project. The work is varied, but you will seldom find yourself working alone, so enjoying being part of a team is very important. You may find yourself in small teams of designers or in large project teams with other engineers, contractors and specialists.

What has changed in the sector in recent years?

Although the UK's rail networks have existed since the 19th century, and you will be following in famous footsteps, the sector is continually innovating and adopting new standards and techniques. Remote monitoring of equipment and the use of software simulation to solve reliability and design challenges are commonplace and the sector exports its knowledge all around the world.

There is always a business need for improved performance in the rail sector. Engineers are encouraged to create solutions that embrace technology, and to find ways in which the railway network can be maintained, renewed and expanded, whilst ensuring that a safe and reliable service is always available to passenger and freight customers. Whether high-speed, metro, light rail or main line, there are many, diverse career opportunities in railway civil engineering.

Future career potential and projects

As part of a major investment programme, there is now unprecedented demand for the engineering skills that are required in the UK over the next decade. The sector plans to double the number of people with engineering qualifications.

The rail engineering sector will be responsible for some of the UK's largest and most vital infrastructure projects in the coming years including HS2, Crossrail and Crossrail 2.

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Learning Development Manager

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t: + 44 (0)20 7665 2243
w: ice.org.uk
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ROLE PROFILE
TRAFFIC ENGINEER

Institution of Civil Engineers

Traffic Engineering

What does a Civil Engineer in the Traffic sector do?

A Traffic Engineer is a civil engineer who provides a safe, convenient, comfortable, attractive, sustainable and economic environment for the movement of people and goods through the planning, design, and operations of the following: networks of roads, streets and highways; parking facilities and relationships with other modes of transport; and land use developments.

Traffic engineers may work as part of project teams developing concept, feasibility, preliminary and detailed designs for highway engineering schemes, public realm schemes and public transport improvements. They will have detailed knowledge of the needs and characteristics of all types of traffic including pedestrians, cycle traffic, private car traffic, public transport and goods vehicle traffic.

What is enjoyable about the role?

This job is particularly rewarding for those who like to deal with complex problems and to examine and identify solutions. An important part of being a traffic engineer will be your ability to analyse traffic flow problems and the environmental impact of transport engineering projects.

Future career potential and projects

With increased devolution of transport planning and policy, as well as the increased adoption of intelligent transportation systems (ITS), there will be no shortage of work for this sector.

Areas include:

- Smart motorways
- Urban traffic management
- Signal control schemes
- Modelling of demand and routeing
- Shared space
- Safety and accident investigation
- Traffic calming
- Public transport priority
- Cycle traffic networks
- Developer schemes and development control

What has changed in the sector?

In recent years, the industry has evolved. The evolution of the dynamic elements of traffic management, particularly relating to ITS applications, will ensure traffic and transport engineering maintains an important role long into the future.

Innovation, efficiency and economic conditions mean these sectors are growing and changing at a high rate. British transport consultancies have a global reach and many smaller specialist consultancies have emerged as strong contributors to the field in recent years.

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Learning Development Manager

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ROLE PROFILE
WATER RESOURCES ENGINEER

Institution of Civil Engineers

Water Resources Engineering

What does a civil engineer do in the Water Resources sector?

Water resource engineers are employed by organisations right across the water industry. Water suppliers abstract water from the environment, treat it to the required standard and distribute it to household and non-household customers. In the UK, the industry is regulated by the Environment Agency, the Water Services Regulation Authority (Ofwat) and the Drinking Water Inspectorate (DWI). Engineering and hydrological consultancies and research bodies offer services to assist other organisations in planning and managing water resources.

In the broader field, water resource engineers advise on sustainable use of resources by conserving water, building dams and conveying water to users. Their planning ensures holistic, integrated management of water which balances the needs of nature with those of users.

What is enjoyable about the role?

The work you do as a water resources engineer is vital, making a real difference to people's lives and to the environment, whether you are working in the UK or further afield. Your work impacts on hundreds of thousands of people, sourcing water and supplying it to homes, farmland and other businesses. This can be extremely rewarding, especially in developing countries where reliable sources of water may be scarce.

The water resources industry is filled with opportunities to work across the globe due to its universal reach. Major world issues such as climate change and urbanisation are presenting greater challenges than ever – from providing irrigation water to farmers in the developing world to building resilience into water and wastewater networks, in some of the most advanced water systems ever constructed.

Future career potential and projects

Experienced water resource engineers may go into consultancy work or progress to senior roles within water companies, regulatory bodies and other organisations. While the engineering aspects of major water infrastructure projects may grab the headlines, they must be underpinned by well-argued and presented long-term strategic plans that are robust to public scrutiny and possible challenge.

In the UK, recent statutory plans combined with long-term horizon scanning suggest that major new water resource infrastructure will be required to provide the resilience now being sought by politicians and the public alike. Water resource engineers will play fundamental roles in developing the plans for new infrastructure and taking them through the planning and approval stages, to procurement, construction, commissioning and operation.

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Learning Development Manager

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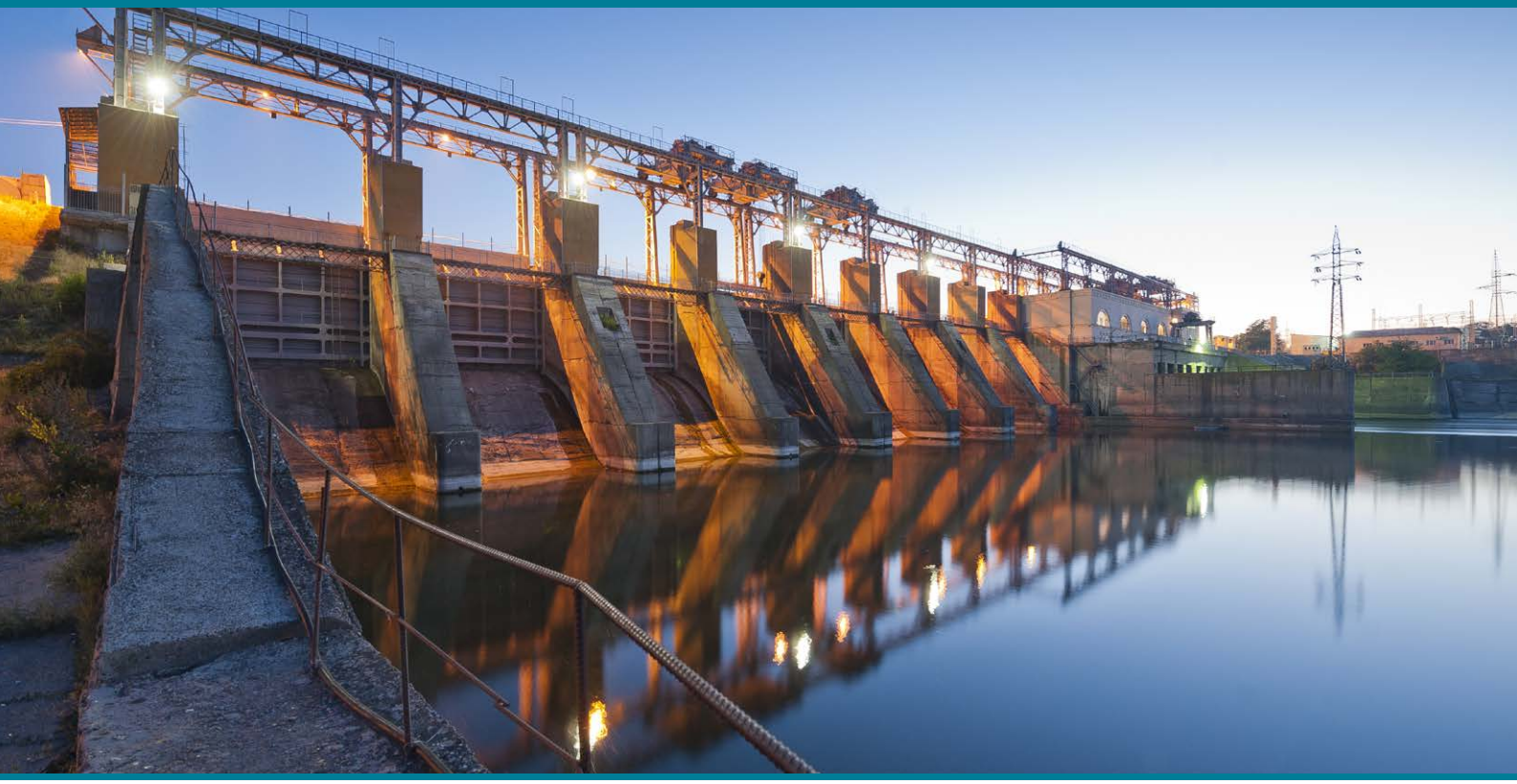
ROLE PROFILE
FLOOD RISK MANAGEMENT ENGINEER

Institution of Civil Engineers

Flood Risk Management Engineering



What does a civil engineer in the Flood Risk Management sector do?

Civil engineers play a vital role in protecting communities from the impacts of flooding, which can happen at the coast caused by the sea, or inland caused by rivers, waterways or excesses of water in the local drainage network, or from surface water or groundwater.

Flood risk management is achieved by extensive research and planning as well as the actual infrastructure that controls water levels. Civil engineers are involved with detailed analysis methods, which inform projects delivered by national agencies and other authorities with responsibility. Increasingly, local communities are implementing their own measures and often employ specialist flood risk management engineers to assist with projects.

What is enjoyable about the role?

'The flood risk management engineer makes a real difference to people's lives. Extreme weather may be on the increase due to climate change, bringing increased risk of flood events, especially to homes built on floodplains and towns and cities at the coast. The work helps to safeguard lives and the property and livelihoods of thousands of people and the benefits will last for many years into the future.

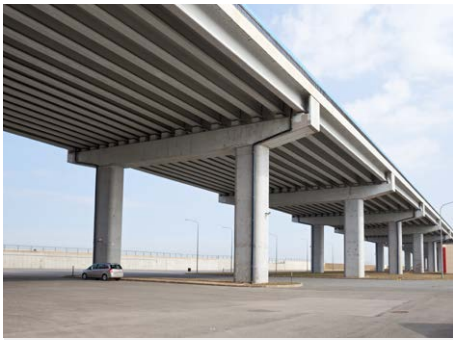
As part of your work you will meet a variety of people, including clients, contractors and consultants, all of whom work closely in the planning and delivery of flood risk management projects. You will also engage with other key stakeholders such as local authorities, landowners, regulatory bodies and members of the public. You will work as part of a multi-disciplinary team and will work in partnership with other engineers and specialists to deliver projects.

Future career potential and projects

Flood risk management continues to be a hot topic in the public domain and at a government level so it is expected that the industry will continue to grow. However, with budgetary pressures, the focus is on efficiency and innovation – the challenge being how to achieve the same outcomes but at a lower cost to the public purse.

What has changed in the sector?

From a policy perspective, the concept of "flood risk management" has now become the preferred underlying approach (rather than "flood defence") and underpins the strategies of the agencies and authorities tasked with protecting against floods. The requirements of the Water Framework Directive (WFD) have created additional considerations. Civil engineers have to consider the interaction between the land and water and their designs and construction must seek to improve the water quality in watercourses.



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Learning Development Manager

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ROLE PROFILE
RENEWABLE ENERGY ENGINEER

Institution of Civil Engineers

Renewable Energy

What does a civil engineer in the Renewable Energy sector do?'

Civil Engineers that work in the renewable energy sector specialise in the design and construction of a variety of renewable energy technologies. Their duties include carrying out site inspections and energy surveys and combining renewable energy production with existing power systems. They also prepare detailed schedules of work, feasibility studies and cost estimates. They also check site and ground conditions for the installation of renewable technologies, such as wind turbines.

What is enjoyable about the role?

A career as a renewable energy engineer can be rewarding in a number of ways. There are a wide variety of renewable energy technologies. Some are well established, others are at the cutting edge of innovation, giving the opportunity to research and develop new energy generation methods.

You will be working alongside electrical and mechanical engineers, providing construction support and advice on strategy and best practice. You will also liaise with clients and operation departments to ensure safety, cost efficiency and sustainability of construction and development. You will need to keep up to date with legislation and environmental standards in order to make sure systems and processes comply. In doing so you will be helping to reduce carbon emissions, mitigating the risk of climate change and ensuring that carbon reduction targets of 2050, are met.

What has changed in the sector in recent years?

Both the volume and scale of renewable energy projects has increased significantly in recent years. Whilst this has undoubtedly provided fantastic opportunities for those working in the renewables sector it has provided increased technical challenges. This is perhaps most evident in the offshore wind sector with the Round 3 offshore wind farm projects increasing in size significantly and moving further into deeper water. As a result the foundation design has become increasingly complex with civil engineers now looking at XL mono-piles, jacket and gravity base foundations.

The other development that has had a major impact on the whole renewables sector relates to the shift to a competitive subsidy regime (Contracts for Difference) under the Electricity Market Reform (EMR). This has meant that civil engineers have had to look for increasingly innovative solutions as a means of driving the costs down.

Future career potential and projects

The long term growth prospects for the renewable energy sector remain very positive. With significant volumes of existing coal and gas powered generation due to come off line over the next decade the UK energy industry needs to rise to the challenge of providing sufficient additional generation to keep the lights on whilst meeting the needs of the 'energy trillema': supply that is affordable, low carbon and secure. Renewable Energy generators such as wind, solar, biomass and tidal power are all well placed to play a key role as part of the future energy mix.

The 2009 Renewable Energy Directive sets a target for the UK to achieve 15% of its primary energy consumption (which includes heat and transport) from renewable sources by 2020. Looking at the electricity sector alone, this would require an increase in electricity supplied by renewable energy sources to rise from current levels (about 14-15% in 2014) to over 30% by 2020. Meeting this increase in supply will require significant increases in the installed capacity of the three main renewable energy generators: onshore wind, offshore wind and solar PV, but most projections also predict greater diversity of energy sources including biomass, energy from waste and marine technologies. Alongside the more established renewable energy technologies there are exciting developments in other areas such as tidal power (notably the Swansea Bay tidal lagoon project) and energy storage both of which potentially offer exciting opportunities for civil engineers.

How do I become a renewable energy engineer?

A Bachelor's degree in Engineering is required, such as Civil Engineering or Civil Engineering Technology. Foundations in particular are a key focus area for most renewable energy projects.

Salary

Starting salaries for energy engineers are around **£20,000 to £28,000.**

With experience, salaries of **£28,000 to £40,000.**

Senior levels salaries of more than **£60,000.**

Get in touch

Dean Lenton
Learning Development Manager

e: dean.lenton@ice.org.uk
t: + 44 (0)20 7665 2243
w: ice.org.uk
twitter: @ICE_engineers

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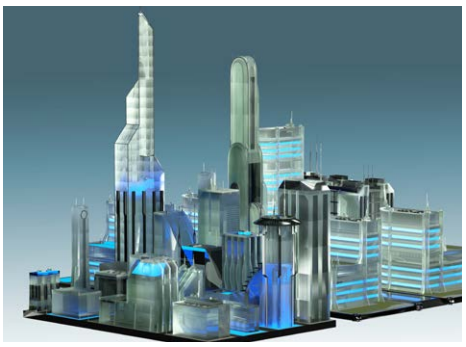
ROLE PROFILE
BIM MANAGER

Institution of Civil Engineers

BIM Management

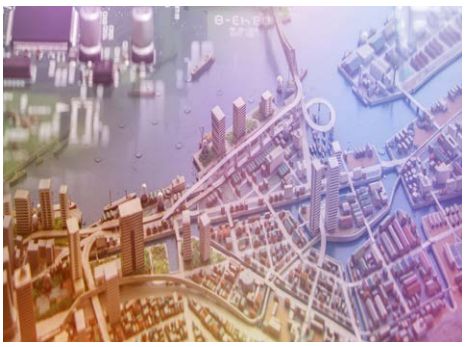
What does a BIM Manager do?

A BIM Manager is a civil engineer who is responsible for the implementation of Building Information Modelling and the Digital Construction procedures at the design, construction and handover stages of a project. A BIM Manager's role and responsibilities may vary depending on whether the individual is working for the client, contractor or designer.



What is enjoyable about the role?

A BIM Manager has a unique opportunity to have a wide and varied exposure to all elements of the construction process. On a day to day basis a BIM Manager may work with Quantity Surveyors, Designers, Planners and Engineers to assist in the manipulation and extraction of information from data-rich models. There is a common misconception about the simplicity of BIM, some people believe it's just 3D models and "Hollywood Style" visualisations. In actual fact BIM is a process-driven discipline which results in "Better Information Management", achieving a more effective and collaborative workplace.



What has changed in the sector?

The government is enforcing the use of BIM Level 2 on all government procured projects as of 6th April 2016. To win these tenders, companies must be BIM compliant. A BIM toolkit was published in 2015 and you can access all the latest material from the **ICE Website**.

How do I become a BIM Manager?

While there is not currently a recognised route to the BIM Manager job role there are certain minimum requirements expressed by a large number of employers.

A BIM Manager is often expected to have academic qualifications of HNC/HND (or higher) in a construction-based subject such as Civil Engineering. Additionally they should have at least 5 years' experience in an architectural, engineering or construction-based role. It is common for individuals with CAD, document control or engineering backgrounds to make the transition into a BIM-based role.

Key Competencies

While a BIM manager will not have any design responsibilities, they should have a basic understanding of the modelling process. BIM Managers are expected to have above average IT skills and the ability to use multiple software disciplines as they will be expected to "drive" the model during meetings. Good written and verbal communication skills are a must as BIM Managers are expected to work collaboratively with all members of the supply chain. A sound knowledge of quality and document management processes is extremely useful as BIM Managers may be expected to assist with the creation and maintenance of Common Data Environments (CDE's).

Did you know…

Some people mistakenly conflate BIM with simply 3D modelling. BIM is the larger conversation around the use of 3D models and data drops; it is the deciding of who needs to know what and when, to make the best decisions (about the project or about the operation of the asset). The purpose of this conversation is to make sure you only create information that is useful, and that there is no duplication of effort, or wasted, useless information created. In essence it is collaborating to decide what information will be needed, and then making sure everyone necessary is involved in creating that information, so it is the best it can be.

In addition to the UK, Governments around the world are now realising the benefits of BIM, especially for large construction funded with public money, and are beginning to mandate the use of BIM for these projects.

BIM is not just 3D modelling; it's the conversation.

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Learning Development Manager

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ROLE PROFILE
BRIDGE ENGINEER

Institution of Civil Engineers

Bridge Engineering

What does a Bridge Engineer do?

A Bridge Engineer is a civil engineer who specialises in the design and construction of bridges. Some design new structures, while others inspect and plan the rehabilitation of older ones.

They work as project managers overseeing the actual bridge construction process. Typically, these engineers are employed by heavy construction and highway construction companies, design and consulting firms and government transportation agencies. Strong maths, science and spatial skills are important for this job, and good communication skills are helpful in working with clients, construction crews and others.

Engineers must sometimes spend significant amounts of time away from home or commuting long distances. Computer and software experience also is important, since these individuals often use bridge design software in their work.

What's enjoyable about the role?

A career as a Bridge Engineer can be rewarding in a number of ways. You will help build a variety of bridges, including cable, truss, arch and suspension bridges.

Engineers will prepare plans, specifications and cost estimates and, during planning and design, will consider what type of bridge will best meet the needs of the area and how the selected building site will support it. Engineers perform load rating and stress analysis calculations to ensure that the structure can stand up to the weight it will bear and the environmental stresses of the site. This engineer also must take into account local and regional building codes and requirements.

Those in project management roles are tasked with overseeing bridge construction and ensuring that projects stay on schedule and on budget. They are often on hand at building sites to manage and monitor building progress. They ensure that all aspects of bridge development run smoothly, and resolve any problems encountered during building. These engineers work with construction crews, subcontractors, suppliers and others to ensure that construction is completed safely and successfully.

How do I become a Bridge Engineer?

A minimum of a bachelor's degree is required to become a bridge engineer, although many have more advanced degrees. Civil engineering or structural engineering are the most common fields of study. Engineers who conduct bridge inspections usually have additional inspection training or certification.

Future projects

The two current Forth rail bridges represent the state of the art in the structural engineering of their day. A third structure, the Queensferry Crossing will be built, a 1.7-mile structure which will be the longest three-tower cable-stayed bridge in the world.

Great Bridges - Millau Viaduct, France

Built as a solution to holiday traffic between Paris and Spain, the Millau Viaduct spans the River Tarn valley and is ranked as one of the greatest feats of engineering. It received an Outstanding Structure Award for its work.

I do not have a degree in civil engineering. What next?

If you do not have a civil engineering degree, or would prefer to take a vocational route into the profession, how about becoming a civil engineering technician. Civil engineering technicians are at the cutting edge of designing, constructing and maintaining everything from bridges to sewage systems. ICE even offers a recognised engineering technician qualification. Many ICE members have followed this path.

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Learning Development Manager

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ROLE PROFILE
COASTAL ENGINEER

Coastal Engineering

What does a Civil Engineer in Coastal Engineering & Management do?

Coastal engineering and management involves a range of disciplines related to the interaction of the sea with the land. In changing the way that we manage the shoreline, we must take heed of the natural processes at work in order to maximise the desired outcome at the project site and further afield. Coastal engineering and management not only involves construction in coastal areas and the project stages leading up to that, but ever increasingly it involves understanding the implications of letting nature take its course.

Coastal engineers are usually qualified in civil engineering, and must also understand the principles of oceanography, geology and other aspects of the marine environment.

What's enjoyable about the role?

Many communities in the UK have suffered severe impacts from flooding in recent years and the work of coastal engineers has been vital in safeguarding those most at risk. The benefits of your work are long lasting and your designs will be used and operated for many years into the future.

The projects you work on also make a real difference to the environment. Development at the coast can have huge impacts on coastal habitats, so effective planning and management, with the environment in mind, is crucial.

The role and projects themselves can be so variable that no day is the same. New challenges arise with each project, providing a stimulating work environment. Frequent visits to the coast are also a bonus!

How do I become an Coastal Engineer?

A keen interest in the coastal environment is essential. A large number of coastal engineers have a Bachelor of Science in Civil Engineering, although other environmental or scientific backgrounds feature heavily and are often complimented with relevant postgraduate studies.

Graduates can then join coastal engineering firms to develop specialist skills and understand the sector through on the job training. Further study can also be pursued e.g. an MSc in Coastal Engineering.

Future projects

The Environment Agency has a continuing programme of works to improve and upgrade coastal defences in England and Wales. The dynamic nature of the coast means that change is always happening and therefore engineered intervention is often required to manage that change. As we battle with legacy of the aging hard defences constructed after the 1953 North Sea storm surge, there is a growing trend towards building "softer" structures that are more adaptable to future change. Innovations in this area are being tested within the often-aggressive coastal environment.

Did you know…

In parallel with on-going efforts to defend the coast, there are also an increasing number of managed realignment schemes – a trend that is likely to continue for the foreseeable future and will become more challenging to deliver.

Salary

Typical Starting Salary
£21 - £27k

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twitter: @ICE_engineers

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Established in 1818 and with over 90,000 members worldwide, ICE is the independent voice of infrastructure and the leading source of expertise in infrastructure and engineering policy. Under our Royal Charter, ICE has a public duty to provide advice to all political parties and work with industry to ensure that civil engineering remains at the forefront of society.

ROLE PROFILE
COASTAL AND OFFSHORE ENGINEER

Coastal and Offshore Engineering

What does a Civil Engineer do in the offshore sector?

Civil engineers are involved in the design, construction, installation and maintenance of the platforms, infield pipelines and other subsea infrastructure. The design of platforms involves core structural, hydrodynamic and geotechnical aspects of civil engineering within a wide range of challenging environmental conditions. This can involve working with extreme water depths, waves, hurricanes and sea ice found in the seas and oceans of the world. The installation, maintenance/modification and ultimately removal of offshore platforms therefore often require the use of huge heavy lift and pipe-lay vessels with enormous capacities.

Renewable energy generation from waves, tidal currents and wind is also an ever-growing part of offshore engineering. To date the greatest development has been the harvesting of wind through wind farms which are growing ever larger in size and employ turbine generators of increasing capacity. Developments in wind energy are occurring around the world as part of the drive for low-carbon energy generation schemes to mitigate the impacts of climate change.

Tidal and wave schemes also fall within the offshore sphere. Although still in the development stages it is expected that commercial schemes for these methods of energy generation will be active within the near future. Civil engineers are closely involved in the planning, design, installation, maintenance and ultimately removal of turbine foundations and offshore infrastructure.

What's enjoyable about the role?

There is a great opportunity to innovate and resources are available to develop worthwhile new ideas. Projects continually pose new challenges for engineers as the hydrocarbon industry seeks to drill in ever deeper water or move into new environments such as the Arctic. There is a great opportunity to travel to most parts of the world, wherever there are seas and oceans with hydrocarbon reserves.

In the renewable energy sector, significant challenges exist as developers pursue larger wind farms in deeper waters and bring new generation technologies to market.

Did you know...

The resources available to the engineer are immense. Equipment used often dwarfs that seen onshore. For example a new heavy lift vessel that has just entered service for platform removal is able to lift 46,000 tonnes in a single lift.

How do I become a Coastal and Offshore Engineer?

A degree in engineering and an appropriate science or mathematics qualification is normally required. Joining an organisation operating within the industry will allow the development of the specialist skills and an understanding of the industry. Many organisations offer training schemes that ensure graduates get the appropriate breadth of industry and engineering experience and mentoring.

Future projects

Gas is often seen as a cleaner fuel than most other fossil fuels and therefore its extraction from offshore reservoirs will continue for some time. While some predict a decline in oil as an energy source, oil still provides the feedstock for the chemical and pharmaceutical industries on which our society depends.

The search for clean energy will push the development of offshore renewable energy forward in the coming years. As the technical challenges are addressed, offshore renewable energy will become a major part of the world's energy supply.

Did you know...

As resources in shallower water have declined, the push has been into deeper water with oil now being recovered in water depths up to 3000m. In addition, the development of technologies to extract the enormous oil resources in the Arctic is accelerating.

Most wind farms currently use large diameter monopiles up to 6m in diameter, but plans are well advanced for monopiles as large as 11m.

Salary

Typical Starting Salary
£21 - £27k

Get in touch

Dean Lenton
Learning Development Manager

e: dean.lenton@ice.org.uk
t: + 44 (0)20 7665 2243
w: ice.org.uk
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ROLE PROFILE
GEOSPATIAL ENGINEER

Geospatial engineering

What does a Geospatial Engineer do?

The Geospatial Engineer is a civil engineer who specialises in managing the spatial aspects as well as the construction processes of built environment projects, throughout the lifecycle of the project. The processes of design, construction, maintenance and demolition or preservation of structures includes the measurement and representation of physical and manmade features. This may take the form of Digital Terrain Models, Digital Surface Models, Othophotos, Building Information Models, digital terrestrial, space and airborne data, precise positioning, and the monitoring of inland and offshore structures.

What's enjoyable about the role?

As a Geospatial Engineer, you will face the challenge of managing and combining huge volumes of geospatial data from various measurement techniques of differing precision and at differing times.

A Geospatial Engineer's tasks encompass the entire data lifecycle. They capture data from satellite imagery and aerial photography, digitised information from existing maps and plans, and they collect data in the field. They manage the data, conduct data processing and informed analysis, and map or model the data to create two-dimensional and three-dimensional visualisations.

How do I become a Geospatial Engineer?

A Bachelor's degree in Engineering is required, such as Civil Engineering or Civil Engineering Technology. Many universities also offer degrees in Geospatial Engineering and related topics, such as land-management, mapping sciences, geomatics, hydrography and land surveying. A number of universities offer MSc in geospatial engineering (MSc surveying and mapping, geo-informatics, engineering surveying, GIS, GNSS and Navigation Science, Hydrographic Surveying, etc). Most of these courses are non-cognate programmes. The entry requirement could be a degree from other disciplines.

What does the future hold for geospatial engineering?

With the recent advances in geospatial engineering, much new technology is now available for extensive surveys of the built environment in general, and for civil engineering in particular. These technologies include laser scanning, digital terrestrial photogrammetry, Remote Sensing Satellites (Lidar), Unmanned Aerial Vehicles (UAV) digital aerial photogrammetry, and Global Positioning Systems (GPS), in addition to Robotic Total Stations and other geospatial technology.

Did you know...

Geospatial engineers play pivotal roles in all sectors of economy including major infrastructure projects such as railways, roads, airports, building projects, building services, channels, tunnels, waterways, offshore projects, town and cities regeneration and development.

Salary

Typical Starting Salary
£21 - £27k

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ROLE PROFILE
GEOTECHNICAL ENGINEER

ice
Institution of Civil Engineers

Geotechnical Engineering

What does a Geotechnical Engineer do?

Geotechnical engineering has a multitude of facets but the following definition is a good starting point:

"Geotechnical engineering is the application of sciences of soil and rock mechanics and engineering geology, building, civil engineering construction, and the protection of the environment (HD 22/08)."

A Geotechnical Engineer is someone who deals with all aspects of the ground and specifically it's engineering properties. Geotechnical engineers may decide to work for a consultant or a contractor, depending on their preference for the design or construction of geotechnical elements.

What is enjoyable about the role?

A career as a Geotechnical Engineer can be rewarding in a number of ways. Many people choose geotechnical engineering because of the variety of projects in the field and unpredictability of the material: soil is rarely the same even within the same location!

It is important for Geotechnical Engineers to understand first principles when working with soil, whether in design or construction. An analytical, evidence based approach to problem solving is essential.

The fundamental principles of geotechnical engineering are well established; however, design codes and methods of analysis using computers evolve continuously but generally gradually. Equipment and technologies used in construction are also developing to become more sophisticated, safer, more efficient and environmentally friendly.

Future career potential and projects

Geotechnical engineering is literally the basis of all civil engineering projects. The sheer diversity of assignments that geotechnical engineers can work on, from railways, to flood defences to underground tunnelling, to offshore-engineering and more, make it a challenging, diverse and rewarding profession with numerous possibilities both in the UK and overseas.

How do I become a Geotechnical Engineer?

There are many opportunities for someone to become a Geotechnical Engineer. The following routes are common:

- BEng/MEng in Civil Engineering
- MSc in Soil Mechanics, Rock Mechanics, Geotechnical Engineering, Engineering Geology, Geophysics, Hydrogeology, or other ground related disciplines.

This would be followed by Chartership with the ICE.

Did you know...

Geotechnical engineering is an ancient science. Examples of early geotechnical engineering and slope erosion control can be found as far back as 2000 BC, when ancient Mesopotamia and Egypt started employing construction practices to irrigate crops, create dams and dykes and even dig canals.

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ROLE PROFILE
MUNICIPAL ENGINEER

Municipal Engineering

What does a Municipal Engineer do?

The Municipal Engineer works to make the city a civilised place to live, work and play. They do this through the management of a wide range of infrastructure and are the link between the citizen and politicians to ensure that everyone understands the options available to ensure that public funds are spent wisely.

In the past, municipal engineers were employed by councils but are now, more often, employed by consulting engineers, contractors and partnerships. The traditional work of highways and bridges, traffic and lighting still forms a major part of the workload, but is increasingly supplemented by a range of schemes that can embrace everything that makes a city function properly. This includes design, planning, maintenance and management of streets, public spaces, leisure facilities and public buildings. As well as water supply, drainage and waste recycling. The list is as long as the facilities that people need around them.

What is enjoyable about the role?

A career as a Municipal Engineer can be rewarding in many ways. You will be involved in a variety of urban infrastructure projects, and will use your engineering skills to develop and present solutions that have a direct impact upon the quality of everyday life.

Municipal engineers also play an important role in the checking of structures for compliance with building regulations. Similarly, work is carried out in the public realm, improving the streetscape in conjunction with landscape specialists and architects. In coastal areas there is a significant workload both in renewing sea defences and in the on-going maintenance of these structures.

How do I become a Municipal Engineer?

Municipal Engineers are qualified in the identical way to every other civil engineer, with an educational base that spans NVQ through to a masters degree and onto chartership with the ICE.

Employers

While consulting civil engineers are employed mainly by civil engineering consultancies, employers may also include:

- Civil engineering contractors;
- Local authorities;
- Water companies;
- Property developers;
- The Environment Agency (EA);
- Transport infrastructure companies;
- Government agencies and departments

Did you know…

New disciplines are increasingly being embraced by municipal practitioners. Specialism's such as 3D modelling, geo-spatial and big-data specialists are included within the team to apply these techniques into city management.

Salary

Average graduate starting salary is around **£23,500**.

Typical salary of graduates aged 25 and with under two years' experience is **£26,500**.

Those with up to five years' experience earn an approximate average of **£30,000**.

The average basic salary for members of Institution of Civil Engineers (ICE) is **£49,793**.

The average basic salary of ICE fellows is **£81,447**.

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Dean Lenton
Learning Development Manager

e: dean.lenton@ice.org.uk
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ROLE PROFILE
RISK MANAGER

Institution of Civil Engineers

Risk Management

What does a Risk Manager do?

Managing civil engineering projects requires dealing with uncertainty – events that could impact project delivery. With increasing project complexity, specialist "risk" roles (Risk Manager / Risk Engineer / Risk Analyst) are increasing - some as part-time advisors, others full-time in the project team.

A Risk Manager is someone who builds a risk-aware culture so the different groups delivering the project recognise the risks and develop plans to manage them. This means communicating a clear process and actively engaging with the wide range of participants.

Risk Managers focus the project teams attention to identify risks, assess which are most critical, and put in place plans to mitigate them. Establishing the risk register is important but equally so is following through to see mitigation plans are effective in reducing risks. Risks change during the project and the risk management process must be dynamic, closing mitigated risks, identifying new ones, and communicating the status across the project team.

What are the key skills of a Risk Manager and where can it take me?

Key skills are diligence and being methodical in assessing the risks involved and their consequences. The design and construction experience is invaluable in investigating risks, ensuring risks are consistently ranked so the most severe are addressed, and that appropriate risk mitigations are developed.

Risk Manager opportunities extend beyond projects into business roles. Operator companies require risk assessments to make capital investment decisions. Risk management is an essential part of executive management to manage the wider range of corporate risks (financial, strategic, operational, reputational, etc.).

What is enjoyable about the role?

A career as a Risk Manager entails a lot of creativity and problem solving. Risk investigations range from in-depth investigation into technically challenging work, to wide-ranging external factors and diverse stakeholders. It provides the opportunity to work with the broad range of project participants. This is a mentally stimulating role that leads to a "big-picture" project view.

This is a fast growing area, with lots of varying roles within it. Risk management is a key business discipline that supports business operations and growth. If risk managers fail, the whole organisation may fail, so it's very important.

How has the role moved on?

Risk management is both becoming more of a discipline it its own right with organisations such as the Institute of Risk Management and processes such as ISO 31000, and its application in Infrastructure is becoming better defined with the RAMP methodology developed by the ICE and Institution of Actuaries.

How do I become a Risk Manager?

To become a Risk Manager, a Bachelor's degree in Engineering is most common, such as Civil Engineering or Civil Engineering Technology. However, it is possible to come in via a business degree, then go into planning/cost engineering, building up around 8 years' experience as a 'project control engineer'.

Civil Engineering or Civil Engineering Technology degree	Business degree
2-3 years discipline engineer	8 years' experience as a 'project control engineer'
5 years project engineering	

Training

Basic risk management training can be obtained through short courses from ICE and other organisations.

Intermediate training in project risk management qualifications can be obtained through study with the Association for Project Management, and for general risk management through the Institution of Risk Management. The Institution of Risk Management has a diploma for advanced risk management.

Salary

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ROLE PROFILE
STRUCTURAL ENGINEER

Institution of Civil Engineers

Structural Engineering

What does a Structural Engineer do?

Structural engineering is generally considered a specialty discipline within civil engineering. A structural engineer works alongside other construction professionals to create all kinds of structures from bridges, hospitals and skyscrapers to more specialist structures such as oil digging platforms and temporary structures. Their role is to ensure a building is structurally sound, taking into consideration load, material characteristics and stresses, ground conditions and climate variations. Using skills in maths and physics, sketching and computer modelling a structural engineer finds creative solutions to realise the architect's/ designer's visions for a structure. A structural engineer will innovate, design and plan, collaborate and support a multi-disciplinary team towards a common goal- a performing and safe structure.

What's enjoyable about the role?

Structural engineering can provide a fulfilling and stimulating career that makes an important and tangible difference to peoples' lives, impacting on most of the built environment we all live in. The different challenges faced that require creative thinking make the role interesting and seeing a design idea realized can be hugely rewarding. The work can often involve working as part of a larger team, travelling and developing new skills. Advancements is technology and materials mean you never stop learning or searching for the most innovative way of fulfilling a project.

How do I become a Structural Engineer?

A minimum of a bachelor's degree is required to become a structural engineer. Civil engineering or structural engineering are the most common fields of study. BEng or BSc, followed by an MEng or MSc and eventually Chartership with ICE.

Future projects

Structural engineers are currently in great demand due to playing an integral part in major projects such as Crossrail, HS2 and Thames Tideway.

Our experts discuss

Current industry hot topics: How to golden thread important issues such as carbon lifecycle and sustainability through everything they do. Other topics to consider include Eurocodes, flooding and nuclear energy.

Great structures

Currently the tallest man-made structure ever built, the Burj Khalifa measures 2,717 feet (828 metres). The tower's chief structural engineer was Bill Baker. The tower has a Y-shaped design, to maximize outward views and inward natural light. The base structure consists of three elements arranged around a central core. For better stability, setbacks occur as the tower reaches toward the sky, creating 27 terraces. The core element emerges into a 4,000 tonnes steel spire, which also houses communications equipment.

Salary

Salaries for new graduate trainees typically range from **£22,000 to £28,000.**

Structural engineers with one to three years' experience usually earn between **£27,000 to 35,000**.

Salaries at senior level/for those with significant experience range from **£40,000 to £70,000**. The higher end of the scale is reached by those who have chartered status.

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ROLE PROFILE
TUNNEL ENGINEER

Institution of Civil Engineers

Tunnel Engineering

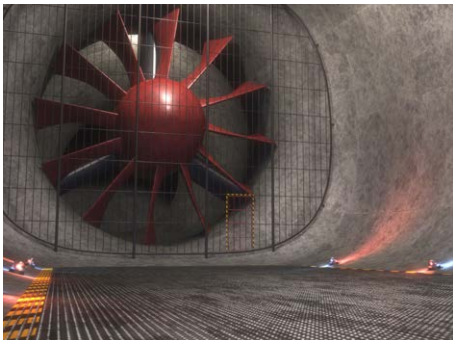
What does a Tunnelling Engineer do?

There are many methods of tunnel construction, each requiring specialist skills and equipment. These include techniques such as bored tunnels using Tunnel Boring Machines (TBMs), sprayed concrete lined tunnels, tunnels constructed by blasting with explosives, and tunnels constructed by pipejacking, piperamming, or thrustboring. This large variety means the tunnelling world and the skills it needs are constantly varied and challenging.

There are many reasons why tunnels or other underground excavations are required, and many methods for their construction. What they all have in common is the need to provide a conduit or space under or through an obstacle, be it a mass transit system under a busy city centre, a high-speed rail line underneath a mountain range or sea, a road link underneath a river, an oil, gas or elctricity pipeline, or a water supply or sewer tunnel for a city. The method employed for the construction of a tunnel depends on the length and size, but most importantly on the ground and groundwater conditions through which the tunnel is built.

What is enjoyable about the role?

Tunnel engineering stems from the wider field of Geotechnical engineering. Many are attracted to engineering tunnels, by the problem solving aspect of this field of civil engineering. Engineers must take a scientific and analytical approach, which often return to the first principles of engineering. So, if you like to be challenged, this is a fantastic area to ply your trade.



Future projects

Tunnel construction in the UK has been increasing over the last few years, with a range of major projects currently underway and in the pipeline, and there has never been a better time to embark or return to a career in tunnelling. These projects include HS2, Crossrail, Thames Tideway Tunnel to name but three!

What if I don't have a civil engineering degree?

Qualified Civil Engineers from almost any discipline can enter the industry, but there is a variety of industry standard specifications . If you do not have a civil engineering degree, or would prefer to take a vocational route into the profession, how about becoming a civil engineering technician. Civil engineering technicians are at the cutting edge of designing, constructing and maintaining everything from airports to sewage systems.

Did you know...

The longest undersea tunnel in the world (as of 2010) is the Seikan Tunnel in Japan. Connecting the Japanese islands of Honshu and Hokkaido, the tunnel is 53.85 kilometres (33.46 miles) in length.

As well as being built for human use, tunnels can also be built for the safety and convenience of animals. More than 600 tunnels have been built under roads in the Netherlands to help increase the population numbers of endangered animals such as the European Badger.

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ROLE PROFILE
WASTE MANAGER

Waste Management

What does a Civil Engineer in the Waste & Resource Management sector do?

A civil engineer in the waste and resource management engineering sector specialises in the key engineering and technical aspects of waste. This includes the management, treatment, disposal and recycling options for solid wastes and the role resource efficiency plays in conserving resources and contributing to a low carbon economy.

The civil engineer could be involved in many aspects of the sector including the procurement, planning, design, construction, operation and logistics of new waste and resource management facilities. This could also include:

- devising strategies for reducing construction waste, through better design,
- improved recovery and re-use; or,
- more efficient resource management.

As more materials are recovered from the waste stream, the performance of these recovered materials will also become increasingly important through the proper specification for secondary usage.

What is enjoyable about the role?

A career as a civil engineer in the waste and resource management sector has a heavy focus on sustainability and resource efficiency with consideration for how

materials flow through the economy, steps towards designing out waste and maximising the value of outputs from waste treatment processes. Engineers in the sector have a direct impact upon how we make greater use of our natural and manufactured resources, and create a more resource efficient and sustainable society.

Future career potential and projects

The UK must ensure it has a waste and resource management infrastructure that can adapt to changing demands. These changing demands will require engineers who can build and maintain infrastructure projects, and Defra is investing some £3 billion of grant funding in a number of waste infrastructure projects.

- **Energy from Waste Projects:** for example - the Grundon/Viridor Energy from Waste plant located at Colnbrook, Heathrow. This plant uses moving hearth grate technology to process c.425,000tpa of residual waste and generates electricity which is supplied to the National Grid.
- **Municipal Solid Waste Projects:** for example - the Shanks East London Mechanical Biological Treatment (MBT) facility located at Frog Island, Dagenham, London. This plant is one of two similar plants located in East London which process c. 360,000tpa of residual MSW and produces a variety of outputs including RDF/SRF (Refuse Derived Fuel/Solid Recovered Fuel) used both in the UK and exported as a fuel to mainland Europe.
- **Anaerobic Digestion projects:** for example the Biffa Anaerobic Digestion (AD) facility at Poplars, West Midlands. This plant is the largest AD facility in the UK and processes c. 150,000tpa of waste food which it turns into methane gas and then electricity which is supplied to Sainsbury supermarkets and also exported to the National Grid.
- **Commercial & Industrial Waste projects:** for example the Powerday Material Recovery Facility (MRF) at Willesden Junction, North London. This plant processes c. 500,000tpa of residual I&C waste and recovers a range of recyclates (for recycling) and RDF/SRF for use both in the UK and Europe.

Did you know…

The waste management industry is undergoing a change in strategy as a result of the introduction of increasingly arduous legislation, tougher enforcement, and better educated consumers making demands about the environment. (Department for Environment, Food and Rural Affairs – DEFRA, 2006 and 2011; Energy and utility skills, 2010). This is stimulating considerable investment by the waste industry in alternative technologies to reduce and reuse waste, rather than rely on simple landfill. This sector therefore has an urgent requirement for well qualified staff with management expertise who can meet the challenges of this future sustainable agenda.

This is the Cardiff anaerobic digestion plant. It will receive around 35000 tonnes of household food waste a year from the city, which the anaerobic digestion process will convert into heat and power to the local area.

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