

MCIBSE Engineering Practice Report
CIBSE Membership Number: [REDACTED]

July 2016

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Sponsor's Declaration

[REDACTED]

1. Work Experience

1.1. Employment Listing

2009: ██████████ – 3 month summer mechanical engineering internship in the Research and Development department in the ██████████ civil aerospace team.

2010: ██████████ – 3 month mechanical engineering summer internship at a product design company testing and analysing product designs.

2011: ██████████ - 3 month summer internship in the software development team. Completing software tests in a repeatable, accountable manner and coordinating in a wider team.

2012-2013: ██████████ – Mechanical engineer working in the obsolescence team. Based in ██████████, working with the team in ██████████ (central office) and train depots across ██████████. Developing a strategy to mitigate the risk due to parts on trains becoming obsolete and then failing and depots being unable to purchase a replacement part. Also leading a series of workshops on innovation, bringing together experts from across the business to develop the train of the future.

2013- Present: ██████████ - Mechanical Building Services engineer. Completed the three year graduate scheme, now working in both ██████████ and ██████████ offices on a range of projects undertaking Building Services and Project Management roles. Experience on bids and in a project controls team.

1.2. Summary of Key Projects

Showing approximate start date/month of starting, project name and a brief description. The below projects list the main activity, often engineering but most projects I took on some project management if not fully leading the project.

██████████
September 2012 - Working to reduce obsolescence risk

September 2012 - Leading a series of innovation workshops

██████████ Plc.
January 2013 - Gatwick airport Hanger Lane building - IES thermal modelling

March 2013 - Harpenden free school - Mechanical engineering/HVAC design

April 2013 - Abbey Road mixed-use development - IES thermal modelling

May 2013-2014 - Confidential client building - Mechanical building services/HVAC design

Oct 2014 - Crossrail 2 bid - Project coordinator and lead on app development

Nov 2014 - Bond Street station upgrade - Commercial project coordinator

Jan 2015 - ██████████ - Mechanical building services/HVAC design

Feb 2015 - Heathrow airport - IES thermal modelling

Feb 2015 - Confidential client training facility- Mechanical/HVAC design

Mar 2015 - Southall mixed-use development energy strategy - Mechanical engineer

May 2015 - Richmond College - Mechanical/HVAC design and project management

Oct 2015-2016 - Sizewell relocated facilities - Mechanical/HVAC design

April 2016 - Educational Funding Agency (EFA) technical guide re-write- Building Services engineer

June 2016- Confidential client building – Mechanical engineer

July 2016- Stag Lane School- MEP site visit for extension work

Extra-Curricular

Sep 2013 - Project Manager for charity fundraising for the Prince's Trust

Sep 2013 - Present - Visiting schools, promoting STEM and volunteer work

Sep 2013 - Present - Promoting engineering / building services at universities

May 2014 - Mechanical engineering for the Bootstrap charity

Sep 2013 - Present- Assisting the department with graduate recruitment and interviews

May 2015 - Present - Work experience student support in the department

Jan 2015 - Enterprise Advantage (project management software) - department champion and running workshops

Nov 2015 - 2016 - Lead on development of Building Services Network website

Jan 2016 - Employee Engagement Forum

June 2016 – Global CEO project: How [REDACTED] can differentiate itself using Technology- working with senior leaders in the company to gain client insight into a new technology

2. Engineering Practice Report

2.1. Introduction

While at [REDACTED] studying Mechanical Engineering I completed three summer placements; one at [REDACTED] and two at [REDACTED] - a product design company. All of the summer internships gave me experience and perspective of the engineering industry and developed my maturity and professional skills.

In 2012 I graduated from the [REDACTED] with a Masters Degree in Mechanical Engineering. Although the Mechanical Engineering course covered a wide range of mechanical topics, I have found the thermodynamics and fluid dynamics modules particularly useful in my role as a Building Services engineer. As an accredited course, the course also included modules on engineering with ethics, environment and innovation.

After graduation I began work in [REDACTED] for [REDACTED] working to establish the risk from obsolescence of parts used on trains on long term maintenance contracts. Here I further developed my professional and personal skills in the engineering environment. While at [REDACTED] I also lead a series of innovation workshops, bringing together experts in a wide range of fields to develop the next generation train.

In 2013 I started work in the [REDACTED] Building Services team in [REDACTED]. Whilst at [REDACTED] I have worked on a wide range of projects, from small scale shorter projects, to longer detailed projects. I have completed a number of IES thermal model assessments as well as completing the Heating, Ventilation and Air Conditioning (HVAC) designs.

I have established a good relationship with my department in [REDACTED] as well as the Building Services team in [REDACTED]. I have worked well with other teams within [REDACTED] such as the [REDACTED] architects, civil and structural engineers as well as architects and contractors external to [REDACTED].

While at [REDACTED] I have taken on and pursued many opportunities to develop my leadership, professional and project management skills. I have supported the department in work experience, recruitment and in helping develop the use of the company project management software.


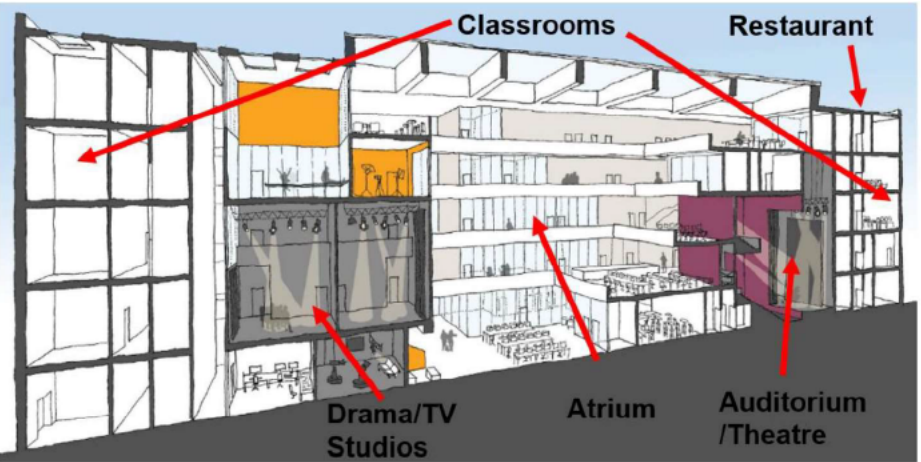
During the last year, I have taken on more responsibility on projects and have had a greater client interaction. I lead the development of other young engineers through project work and informal mentoring.

I have always sought to learn and increase my knowledge and have enjoyed attending many CPD talks and events. I have enjoyed the process of developing into a responsible, competent, well rounded and professional engineer and look forward to many more years learning and developing in the industry.

2.2. Referred Episodes

The below table outlines which of the projects I will cover in more detail in my engineering practice report in the next section. The table provides a brief introduction to each project, I explain my role and how I meet the Engineering Council's competencies in the next section.

Career Episode	Description
<p>Obsolescence Planning- 2012</p>	<p>██████████ is an international rail company. As well as designing new trains, ██████████ have a number of lengthy maintenance contracts for trains currently in use in the UK.</p> <p>Due to the 30 year lifespan of the trains, there is a risk to ██████████ where Commercially Off The Shelf (COTS) parts have been used and are no longer available to purchase. When these become obsolete in the IT industry and the parts are no longer available. If that part breaks on the train, the depot cannot simply buy a new component. This project was started in order to reduce the risk to ██████████ from COTS parts becoming obsolete.</p> <div data-bbox="496 757 1428 1220" data-label="Diagram"> <pre> graph TD A[Train In-Use] --> B[Train Does Not Require Parts or Maintenance] A --> C[Train Requiring Maintenance or Part] C --> D[Part Required is Custom Part Designed and Manufactured by ██████████] C --> E[Commercially Off The Shelf part] E --> F[Produce New Part and Install] E --> G[Buy Part and Install] E --> H[Part is No Longer Manufactured or Available: Part Has Become Obsolete] I[Obsolescence Planning Project to Mitigate the Risk to Trains due to this situation] --> H H --> J[Unable to Fix Train: Delay Caused] </pre> </div> <p><i>Obsolescence Planning Project to Mitigate the Risk to Trains due to this situation</i></p> <p>Unable to Fix Train: Delay Caused</p> <div data-bbox="683 1294 1251 1624" data-label="Image"> </div> <p>██████████ trains in use</p>
<p>Confidential Client – Facility 2013-2014</p>	<p>This project involved the design of a large scale building with industrial process areas, offices and other support areas. It was an ongoing project that was at RIBA Stage E.</p> <p>There were a number of significant changes to an already largely complete design which meant revising calculations, drawings and documents and coordinating with other disciplines.</p>

<p>2015 –Southall Energy Strategy</p>	<p>The client wanted to turn a piece of derelict land in Southall, West London into a new housing and mixed-use development with 6000 homes. The project scope included completing an Energy Strategy by evaluating the energy demand for electricity and heat (space and domestic hot water) and providing a recommendation to meet this demand, while meeting the London Plan and national building regulations.</p> <p>This work followed the GLA guidance/methodology to show a reduction of 35% beyond Building Regulations Part L 2013 in carbon emissions to meet the London Plan requirements.</p>  <p><i>Southall area showing all new proposed buildings</i></p>
<p>2015- Richmond upon Thames College</p>	<p>The scope of this project included the design of the main further education building on the campus for RIBA Stage 2 and 3. This included a mix of traditional teaching classrooms for languages, mathematics and other A-levels as well as vocational learning spaces for drama, music, commercial catering and beauty.</p>  <p><i>Sectional View of the Main Richmond Upon Thames College Building</i></p>
<p>2015-2016 Sizewell Relocated facilities</p>	<p>Sizewell C is a new power station to be built adjacent to the Sizewell B site (see image). Currently some office accommodation and Portakabins used to support Sizewell B are located to the North of the Sizewell B site, on the land which will be used to build the Sizewell C power station.</p> <p>This project scope included the design of 7 new buildings within the Sizewell B site boundaries to accommodate the relocated office and support facilities. This would then allow the Sizewell C site buildings to commence construction. The main challenge of this project was the constraints of the Sizewell B site since it was already highly congested with buildings.</p>

Proposed location of relocated Sizewell B office buildings

Location of existing Sizewell B office buildings

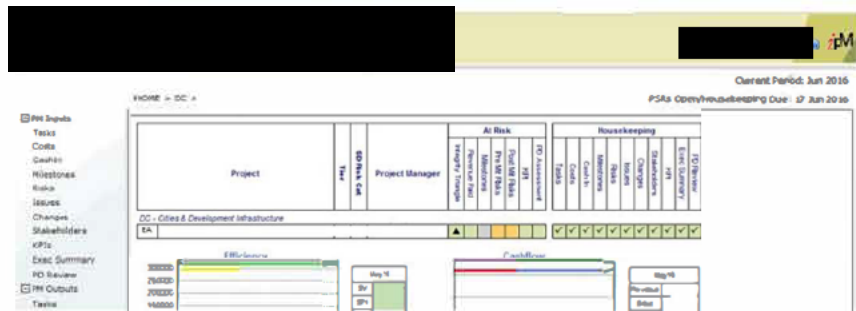


Sizewell B and the new proposed Sizewell C Power station. (Image from EDF.com)

2016 –Enterprise Advantage Champion

██████████ has a custom project management tool called Enterprise Advantage (EA). The software is designed to help Project Managers better manage projects, tracking the cash in, cash out, tasks, milestones and risks.

The software was not very well understood or utilised in the department so this project was developed to support Project Managers in understanding the software to gain the most benefit from the tool.

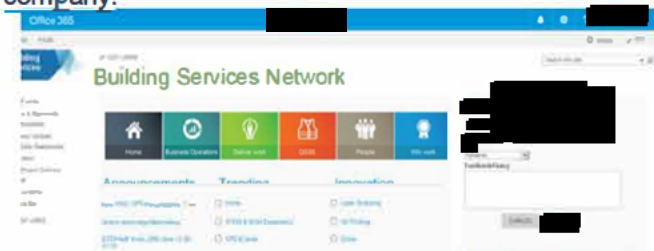


Screen Image of the Enterprise Advantage Tool

2016- Building Services Network

This project scope included the development and launch of a new web-based network for the company Building Services engineers.

Previously there was an internal network but it was only run by two offices rather than company-wide and it was out of date. Microsoft had produced a new version of the software that is used to host the website which provided a good opportunity to start with a new site for all the Building Services engineers across the global company.



**2016- Education
Funding Agency
Technical Guidance
Review**

The Education Funding Agency (EFA) is a government body set up to allocate money to manage and maintain schools. The EFA have produced a number of guides and regulations (including Building Bulletins) to ensure that new and refurbished schools are built to a high standard in a cost-effective manner. The standards will assist the tender stages of construction and ensure that contractors provide a suitable level of building services in the schools.

The project scope included re-writing, writing or updating a group of guidance documents including Technical Annexes to the Generic Design Brief. These Technical Annexes will become Building Bulletins in their own right at the next review stage.

2.3. Practice Report

This section details my role on a selection of the projects I have completed (listed in the *Summary of Key Projects*) and how I have demonstrated the Engineering Council's competencies. For an introduction to the projects, please see the previous section on *Referred Episodes*.

Obsolescence Planning- 2012

The main elements of my role were:

- Establish the extent of the obsolescence issue, particularly the effect of using commercially available IT parts on trains
- Identify key components causing greatest risk
- Develop a tool, method or strategy to manage obsolescence, included collaborating to evaluate other tools

As I was new to the rail industry I sought to increase my knowledge through reading internal literature, reading external information on the rail industry (including who the operators are and where they run and under which contracts), attending evening seminars at IMechE and talking to colleagues. I particularly found talks on new innovations and technologies in the rail industry interesting. (A1)

I worked as the representative for the [REDACTED] region depots. I saw the opportunity to learn from their experiences and improve the way the company addressed obsolescence by working closely with depot staff to establish their needs and priorities for the new technology I was developing. The maintenance contracts the company operated under meant there were large fines for each day a train was out of action, therefore maintenance time was the depot staff's main priority. (B1, A2, B2)

To visit the train depots I completed the two-day Track Safety Course to learn how to be responsible for myself and safe around trains. I put this knowledge into use when I visited several depots. (E2)

I visited Cranfield University to collaborate, evaluate and discuss a PhD project of an Excel based tool designed to evaluate and quantify the risk from obsolescence. I also discussed and compared it to another tool created by a helicopter company. I presented my own Excel tool and participated in discussions on how to best improve the method of managing obsolescence. (B3, D2, D3)

I researched and evaluated the extent of historic issues due to obsolescence and how the issues had been overcome in the past, including buying/stockpiling or paying to take over the rights to manufacture parts. I developed relationships and established the stakeholders' opinions and concerns, including time to manage the obsolescence and time to solve a fault. (B3, D3, A2)

I developed an Excel based tool to take a bill of materials for a train and rate the parts for severity, criticality and complexity. The tool gave visibility of how the parts should be prioritised for monitoring to ensure the supply chain remained consistent. The tool was also useful to analyse the parts on a train to foresee possible weaknesses due to obsolescence which the depots could proactively manage by modifying the trains to remove the part/use an alternative (before obsolescence issues occur). The downfall of the tool was the risk factor; probability (which required complex mathematical calculations) and chance (since the IT industry is very unpredictable). (B2)

Confidential Client –Facility 2013-2014

I worked as a mechanical Building Services engineer within a large multi-disciplinary team. I completed calculations for heating (such as heat loss calculations for sizing heating) and ventilation (such as ventilation rate and duct sizing) and design work, establishing and agreeing my calculation methods. (B2)

I wrote and updated the associated documents including drawings and layouts, schematics (including heating pipework, ventilation ductwork), equipment schedules, calculation sheets and reports. (D1)

I used software (Cymap) to calculate the pressure drop through the ductwork then evaluated and compared my results with previously calculated pressure drops for similar systems, discussing the results with colleagues. I refined the ductwork system to reduce the pressure drop so that the system used less energy by reducing duct lengths and complexity, which would permit good Specific Fan Powers (SFPs) and therefore reduce carbon emissions. (B2, B3, E3)

Where I needed to develop my knowledge I spoke to colleagues and read manufacturers' literature and industry guides such as The Green Book by Waterloo – a guide to louvres and grilles. (A1, B3)

I met with a manufacturer (Wozair) who brought in an industrial fire damper for the team and another manufacturer (Nuair) who brought in a Fan Coil Unit (FCU). This helped me gain perspective on the size of the units and constraints, such as the fire damper being very heavy, and benefits, such as the FCU being very slim. I also gained an understanding of the quality of the manufacture, as this is difficult to tell from information on the internet. (B3)

I attended weekly multi-disciplinary team meetings with the project managers, architects and other engineering disciplines. I represented the mechanical engineers, presenting information from my team or relaying it back. (A2, D3)

The large, multi-disciplinary nature of this project combined with its complexity were one of its prominent features. It was a highly complex project and coordination was a key element. I used a 3D model (Navis software) to coordinate the services, allowing me to walk around the facility and foresee potential problems. It also allowed me to work with the other teams to produce a high quality, coordinated, detailed design. (B2)

The second feature of this project was the high requirement for checking and audit involved because of the complex multi-disciplinary nature. I have learnt good habits and practices from working on this project which I have used to continuously improve quality on other projects. I led the check process for the mechanical team, making sure the single discipline check and then interdisciplinary checks were completed. To ensure a smooth document issue I liaised with the document control team. After the issue I scanned and saved a copy of all the checked and marked up documents and signed sheets. This process along with lessons learnt discussions improved quality on the project. (C4)

Throughout the design I ensured the systems satisfied health, safety and welfare issues such as the safety of the installation, maintenance and removal teams. I designed the services to have at least the minimum recommended space for access and maintenance. (E2)

I gained my Construction Skills Certification Scheme (CSCS) *Trainee, Supervisory and Management* (red) card in summer 2013 (and the *Academically Qualified Person* (white) card in February 2016). This provided me with an insight into health and safety during site visits. I completed the company online safety procedure before the trip and the site induction on arrival. I used my knowledge gained from the CSCS qualification to remain safe during the site visit, knowing what to look for and how to behave, ensuring I contributed to the health and safety of the site. (E2, E4)

2015 – Southall Energy Strategy

I modelled the annual heating (space and domestic hot water) and electricity demand for 6000 homes on the development based on the established assumptions (e.g. number of each flat size and orientation). I then combined this with the demand from the commercial units. (B2)

I read technical literature and researched how to use the software (JPA) to complete the SAP assessment; SAP stands for 'Standard Assessment Procedure' and is the only official, government approved system for assessing the energy rating for a new home, the assessment also gives the predicted energy demand for heating and electricity for a given home. This exercise enabled me to draw a monthly and annual energy demand profile and hence identify (A1, B2)

the base load to size the CHP equipment and calculate the modelled carbon savings (see below for the GLA methodology).

I participated in team meetings and identified the constraints of the work such as the time available and resources. I evaluated the clients' needs; to provide information on how to provide the heating and electricity demand while meeting the London Plan planning regulations. (A2)

I evaluated my own outcomes such as the monthly and annual heating and electricity demand for each flat/unit size and then aggregated for all the domestic units across all phases and the commercial data from my colleague. I presented and discussed my methodology and assumptions, such as averaging flats for each orientation of the building, as well as my results to our reviewers. (B3, D2)

I collated, combined and analysed the data in an Excel sheet and annotated the sheet so it was easy to understand and check. I made sure the Excel sheets and calculations were reviewed to maintain and continuously improve quality and recorded the review by scanning the comments and saving them in the project Quality Assurance (QA) folder. (C4)

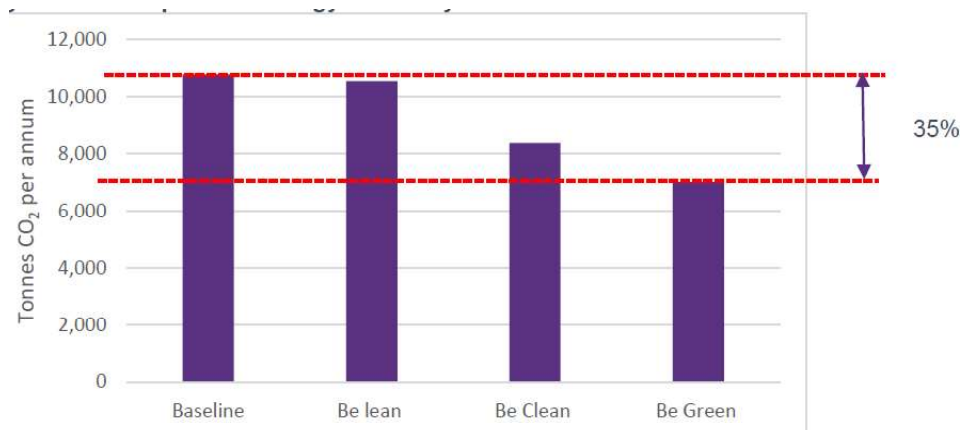
I researched new technologies and completed a Low and Zero Carbon (LZC) technology assessment. I wrote a summary note to explain to the client which technologies would be appropriate which was included in the Appendix of the final report. (A1, D1)

I read extensively on the London Plan and the Greater London Authority GLA guidance. The GLA guidance outlined the specific method I should follow to demonstrate a carbon saving; calculating the site annual carbon emissions for:

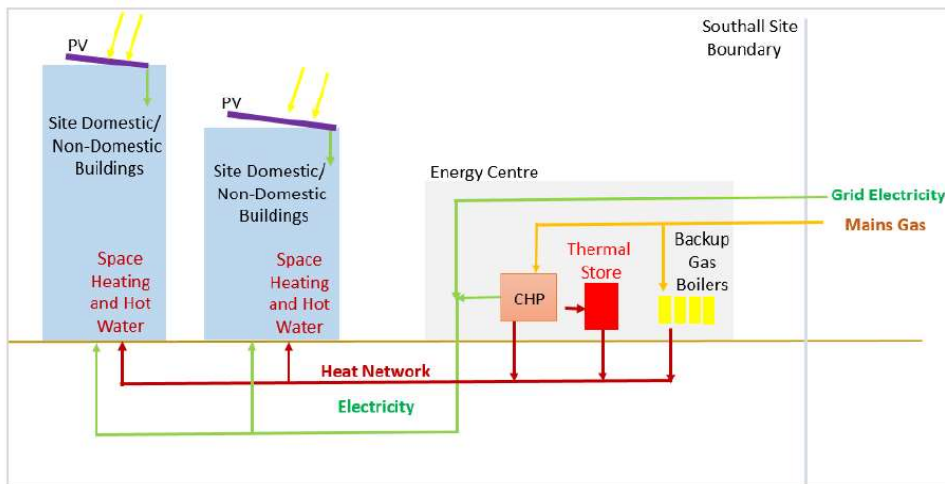
- Baseline case: compliant with Building Regulations Part L (2013)
- Lean (passive measures)
- Clean (CHP/energy networks)
- Green (Low and Zero Carbon technology)

Lean measures used on the site were minimal since I did not want to constrain the design at such an early stage by dictating particularly onerous U-values or adding shading (good constructions were already being used in the baseline case). The Clean carbon savings were derived from using a CHP unit in a central energy centre. The Green savings were met by PV panels. The development needed to meet The London Plan which dictated the development must show a 35% reduction in tonnes CO₂ per annum beyond Building Regulations Part L levels, as demonstrated in the image below. (B2, E3, A2, A1)

I wrote sections of the Energy Strategy report and the appendix including the renewable energy technology assessment. The report made three recommendations to the client to meet the energy demand using CHP, PV and biomass in different variations. An example summary of one option is shown below. (D1)



	CO ₂ Emissions (Tonnes CO ₂ per Annum)		% improvement on the BER/DER over the Target CO ₂ Emissions Rate (TER) for Regulated
	Regulated	Un-regulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development	10,797	18,168	-
After energy demand reduction	10,547	18,168	2.3%
After CHP	8,369	18,168	22.5%
After Renewable Technology	7,018	18,168	35 %



One of three options offered to the client on how to meet the energy demand while meeting the London Plan reduction in CO₂

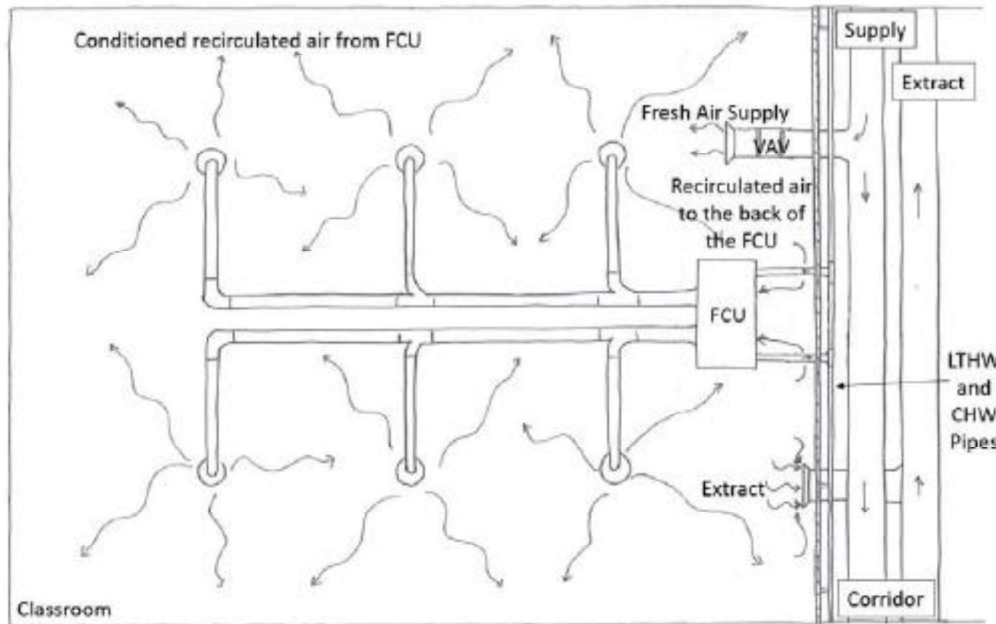
2015- Richmond upon Thames College

My role involved both project management and mechanical building services design.

The key features of this project were its many vocational learning areas such as a beauty salon and catering kitchens (as seen in the image in *Referred Episodes*). The vocational areas introduced challenges for the building services due to the varying demands and constraints such as high heat loads and changing occupancy levels. I participated in early client meetings to establish their needs including flexibility in the teaching spaces and therefore fast responding services systems. (A2, B2)

The building was located in West London where noise and pollution from a road and aeroplanes meant openable windows were not appropriate. With no natural ventilation from openable windows, there was a greater challenge to fit in the ductwork, plant and equipment throughout the building as well as reducing operational energy for the mechanical ventilation system. I read manufacturers' literature (e.g. on Fan Coil Units) for slim/small designs and coordinated with the architects on systems that would fit in the available space. (A2, B2)

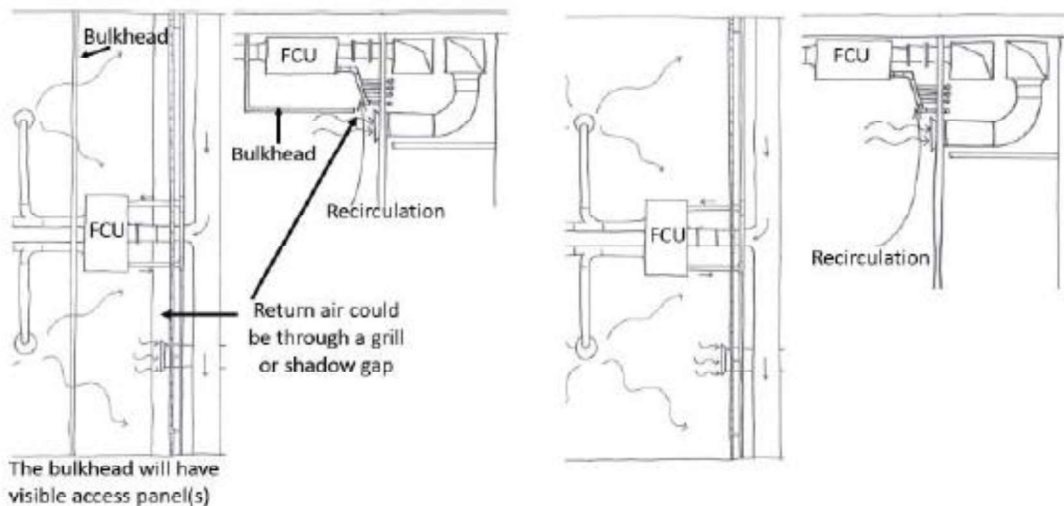
In the images below I have sketched the FCU configuration in a typical classroom, with the ducts and pipes entering from the corridor on the right hand side. I participated in significant coordination, particularly with lighting engineers. The lighting engineers specified lighting in the form of suspended lighting rafts (manufactured by Whitecroft) with integrated acoustic panels, fire alarms and detection. Since the rafts are produced in 2.2m lengths, 800mm wide it was important that I located the mechanical services around the lighting since I had more flexibility. (B2, B3)



Sketch showing FCU layout in a typical classroom. (window on the left, corridor on the right)

There was an option to have the FCU within a bulkhead (seen in the left in the below image) or without a bulkhead (seen on the right below). I coordinated with the architects on the aesthetic requirements of a bulkhead and any grilles and louvres used and I coordinated with the acoustic engineer to see what effect the bulkhead would have and how much acoustic material would be required in a classroom with an exposed soffit. My recommendation was to use a bulkhead since it reduced the noise impact of having the FCU in the classroom.

(B2, B3)



Sketch showing FCU within the bulkhead on the left and without a bulkhead on the right.

I collaborated with the architects to reduce or eliminate the cooling needed and reduce the energy consumption of the building, and to mitigate its high heat gains from high occupancy, solar gain and room use.

(B2, E3)

I evaluated a variety of cooling solutions, based on control, environmental factors and cost estimates for installation, running and maintenance. I compared technologies such as chilled beams, Termodeck (see below) and Fan Coil Units (FCUs). I researched many technologies by reading manufactures' literature (such as Frenger) and guides (such as CIBSE Knowledge Series KS3: Sustainable low energy cooling).

(A1, B3)

I organised for Termodeck to speak to the team. Termodeck manufacture prefabricated hollow core concrete slabs, the conditioned supply air is then supplied through the holes in the concrete slab, pre-heating or cooling the thermal mass of the building. Termodeck would provide good low-energy cooling particularly since the college was designed with exposed soffits which would work well with Termodeck. There would however, be poor control where one Air Handling Unit provided fresh air to a number of classes, each class would be provided with the same temperature air, requiring re-heat or cooling on a local level depending on the room use. I evaluated Termodeck against other cooling technologies and did not propose Termodeck as my preferred solution since it was not easily controlled. (B3, A1)

I wanted to recommend and design a cooling solution that would be low energy to run such as chilled beams, however the build budget dictated that they could not afford chilled beams so Fan Coil Units were selected in their place. Fan Coil Units have very good responsive control but have high running and maintenance costs. (B2)

I designed the systems to be safe to maintain, install and remove –it was important all services could be maintained away from the large drop in the atrium wherever possible. If at later stages, services were installed above the atrium, a Mobile Elevating Work Platform (MEWP) and associated access would be required. (E2)

I participated in a meeting at Richmond College with teachers, heads of departments, a catering specialist and external Project Manager to establish the user's needs for the commercial style teaching kitchens. The college wanted a commercial restaurant to operate on the top floor of the college where students would work in the restaurant, kitchens and bar. It was a significant challenge to provide a restaurant similar to a commercial restaurant within the space constraints, cost and teaching since the staff wanted additional space to teach the students above what a normal kitchen would have. (A2)

As Project Manager for Mechanical, Electrical and Public Health (MEP) I agreed the deliverables and programme. I planned the time each member could spend on the project based on the fee and time scale. I made sure the MEP team understood the deliverables, time scales and I fed up/down information needed by taking and distributing minutes, following up with face-to-face meetings and distributing deliverables lists and programmes. (C1, C2)

I attended weekly multi-disciplinary meetings as the MEP representative with the other leads and an external Project Manager who represented the client. During the meetings I presented my teams' findings and designs such as the cooling solutions described above. I discussed the meeting outcomes with my team afterwards and organised and lead the work. (C2, A2, D2)

I managed an apprentice engineer, agreeing her objectives. I gave her work such as calculating the ventilation rate in the classrooms and checked her results, giving feedback. (C3)

2015-2016 Sizewell Relocated Facilities

I worked as a mechanical engineer within the multi-disciplinary team. I worked with in-house civil, structural, electrical and fire engineers as well as external architects. I attended multi-disciplinary team meetings at the architects' offices, presenting my work and participating in discussions and workshops. (D3, D2, A2)

Of the 5 buildings delivered I managed one fully and the majority of another two. I organised resources to ensure the deliverables would be completed by the deadlines. I attended progress meetings to speak to the Project Manager and I managed my time as well as the public health and CAD engineer's. (C1, C2)

Once completed, I ensured the stage reports and drawings were checked in line with the company quality policy and coordinated with the other engineering disciplines. (C4)

I completed the mechanical design work including manual and computer calculations, agreeing the ventilation, cooling and heating solutions and presenting my designs. I completed ventilation rate calculations, ductwork sizing, Air Handling Unit selection, heat loss/gain calculations, VRF unit selections and other HVAC design elements. I planned the duct routes and coordinated with the architects and structural engineers. I presented my designs in the form of sketches and drawings or PowerPoint slides to the architects and other engineering disciplines during project design workshops. (B2)

I learnt about technologies such as an Air Handling Units (AHU) with integrated heat pumps to provide cooling without requiring chilled water or any outdoor space. I learnt through talking to my colleagues, reading manufactures' literature and arranging for manufacturers (EcoAirbox who manufacture a packaged Air Handling Unit with heat pump) to visit the office. (A1, B3)

I designed the engineering systems to minimise energy consumption and carbon emissions through optimising pressure drop, reducing heat loss/gain and using efficient equipment wherever possible. (E3)

I designed the services, in particular in the plantroom, to be safe to install, maintain and remove and to have enough space around them to be easily maintained. I wrote in the stage report about how to safely maintain, install and remove the equipment so that at later stages these features are retained and remembered. (E2)

I discussed and evaluated the mechanical solutions in other buildings as well as those I was leading. I had extensive discussions with colleagues and the architects to ensure the designs were appropriate to meet the user's needs. (B3)

The first challenge for this project was the client changing the scope. Originally the project started as 7 buildings, once the designs were completed, the client decided to combine two buildings into the remaining buildings on cost grounds. The buildings needed significant or complete redesign, however, I learnt important lessons during the first design (such as coordination) and the equipment selections only needed small modifications. (B2)

The second significant challenge of this project was that the architects specified fabricated cellular beams with holes for services for all the buildings, leaving no clear service zone. This meant I needed to complete extra work (for example sizing all ductwork and planning all duct routes) in order to coordinate the services through the beam penetrations. I conducted a lot of coordination, particularly with the architects and structural engineers to ensure an appropriate solution. (B2)

2016 –Enterprise Advantage (EA)

I saw an opportunity to benefit the department and proposed the programme of workshops to help staff gain the most benefit from the software. As the Enterprise Advantage champion for the department I help Project Managers and Directors gain the most benefit from the software and therefore benefit the projects and department. (B1)

I wrote and presented a number of workshops with the team to help teach specific topics, for example how to baseline and how the EA software interacts with the company's other accounting package. (D2)

I attended a training course to learn how to use the software and I learnt a lot from colleagues and the EA trainer about the business. I learnt about Project Management principles from wider reading and I attended a Project Management course; *ARM Introduction to Project Management*, for which I passed the exam to gain the certificate. (E4)

For the workshops I organised my time and the EA trainer's, agreed the programme and deliverables and desired outcomes. I monitored progress throughout the course of workshops and adjusted the programme, attendee list, workshop structure and length to provide the

department and staff with the best outcome. The workshops have been successful, I have received positive feedback from the Project Managers and Project Directors who attended my sessions. (C1, C2)

I led the project between myself and the trainer, agreed our outcomes and completed feedback for her and received feedback. (C3)

2016- Building Services Network

I saw a big potential opportunity for the business to share knowledge and best practice through the use of a Building Services Network site. Since the business is so large, its many employees hold a lot of experience and expertise and the site would allow people to connect and collaborate with specialists and colleagues in other offices. (B1)

I project managed and led the group, identifying practice managers from across the UK and strategic individuals who had special interests in business policy, for example Health and Safety. I wrote the scope of work, deliverables and programme. I ensured there were necessary people involved to complete the work on time. (C1)

As the project manager I organised meetings, wrote agendas and meeting minutes. I chaired regular meetings between senior staff from across the UK. I worked closely with the website developer and communicated his needs to the wider project group. (D1, C2)

I planned to launch the site at the start of April, however, I tested the site with a group of volunteers and the feedback was that there wasn't enough content on the site. I took the decision to delay the launch until more content was ready. I had to defend my decision to the senior staff and some did not agree with me but I am confident I made the right decision to delay and launch a better site. (C1, D1)

I launched the site 3 weeks later with a lot more content. I set up a team to maintain the site on an ongoing basis and to keep the site content up to date. For the launch I wrote an email in the office company communications style to all Building Services staff and followed this by presenting an introduction over Skype to the staff in the UK. Across two skype sessions I had an attendance of approximately 120 staff which was approximately 25% of the UK Building Services staff which was a huge achievement. (C1, D1, D2)

Through my work on developing this site, it will enable engineers working in different offices to work in a more consistent manner. On the site are document templates to create a more consistent approach and maintain quality across the offices and departments. I wrote a template for a RIBA Stage 3 design report to help guide engineers and maintain a high, consistent standard in all reports produced in our offices across the UK. (C4, D1)

The web developer I worked with extensively on this project was an apprentice/junior engineer. I led his work and gave him feedback. I agreed realistic deadlines and checked his work. (C3)

2016- Education Funding Agency Technical Guidance Review

My role on this project was to write guidance documents to outline what the contractor must provide in a new school funded by the Education Funding Agency (EFA).

I researched, developed and wrote a Technical Annexe on controls in schools and the majority of the mechanical section of another Technical Annex on Building Services in schools. The Building Services Technical Annex included Mechanical (heating, ventilation and cooling), Electrical and Public Health sections. I worked independently as well as collaborating with engineers from other disciplines such as electrical, public health and lighting. (D1)

As part of the project I have collaborated, discussed and presented to colleagues and EFA staff to evaluate our work and their needs in workshops and meetings both one-to-one and at the EFA offices. (A2, D2, D3)

I provided guidance and leadership to a more junior member of the team, for example on a summary table for internal conditions for different school room types. I discussed his work, gave feedback and provided him with references for further reading and information. (C3)

I wrote about safe systems of work, to ensure schools' services can be installed, maintained and removed safely and with adequate space in the future. (E2)

I included information where relevant, on environmental considerations such as including heat recovery and reducing heat loss/gain to reduce the running cost and environmental impact of the school. (E3)

I was mindful of the CIBSE code of conduct and wrote guidelines allowing for a fair tender process. (E1)

2012-2016 CPD: Competency E4

I have enjoyed many training courses, lunchtime talks and evening events since I have left university. I regularly attend lunchtime talks hosted by my company. In the evenings I enjoy attending talks organised by CIBSE and its subgroups such as YEN as well as talks at IMechE and the IET. (E4)

At work I have assisted in the running of CPD lunchtime sessions; booking manufacturers, organising the talks, circulating invites, welcoming the speaker and distributing certificates.

I regularly review my progress towards my goals and set new goals to maintain a focus on learning and developing my own personal, professional and engineering skills.

I have also assisted my colleagues in their development through making recommendations on training and events and encouraging participation.

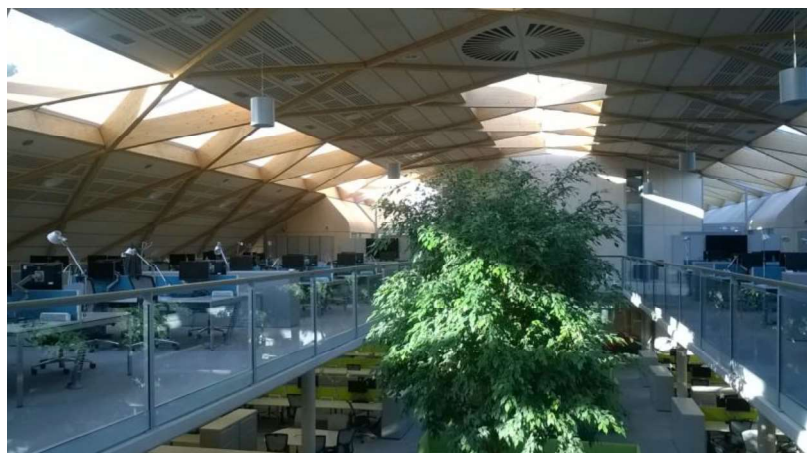
I think it's my responsibility as an engineer to continue to learn and approach the world with a curious mind. I have greatly enjoyed attending site tours and site visits predominantly out of work.

Notable visits attended:

- The BREEAM Outstanding WWF office in Woking (CIBSE tour)
- Kew Gardens –Building Services tour (IMechE tour)
- Thomas Clarkson Academy (Breathing Buildings tour)

Self-guided HVAC visits:

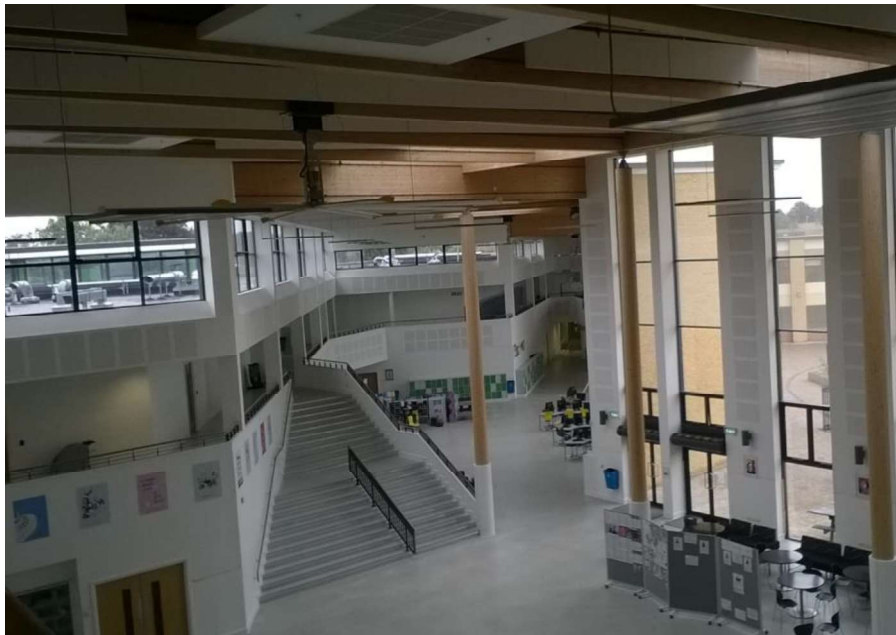
- [REDACTED] Sports Centre/tennis pavilion
- Ecobuild conference and The Crystal building



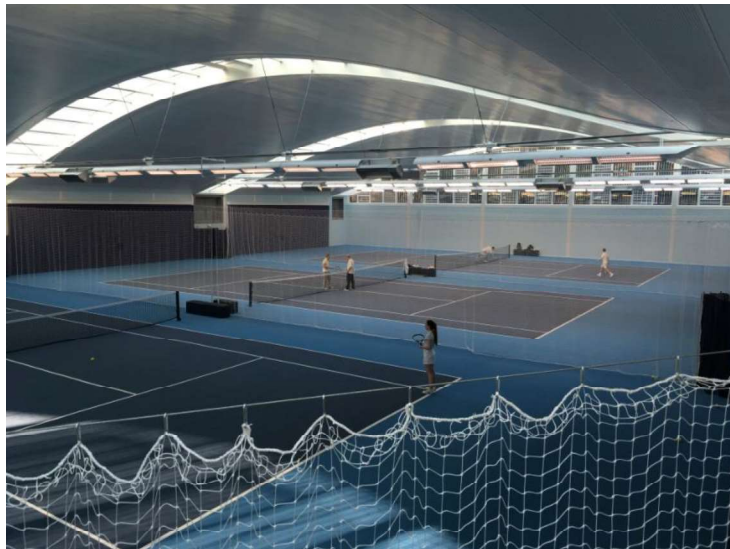
WWF Office in Woking



Kew Gardens roof plant space on the science teaching building- a very congested area due to many duct exhausts from fume cupboards



Thomas Clarkson Academy main atrium



Tennis Pavilion

On these visits I learnt a great deal about the engineering industry, engineering institutions, building services systems (both what works well and not) and lessons learnt both from the tour, (A1, D3) the tour guides (invariably very knowledgeable) and from other engineers on the tours.

I am interested in maintaining my knowledge and keeping up to date with recent innovations. I enjoy discussing lessons learnt and evaluating the designs with the tour guides. (E4, B3)

On the tours I maintained a high safety standard and listened to the guidance of the tour leader, especially when visiting areas not usually accessed by the public. (E2)

I regularly participate, organise and take part in activities that promote engineering and building services to children and adults. I am proud to be an engineer and feel it is important to represent the industry as a professional as well as promoting engineering, especially to school children. I visit schools and speak to the students, both self-organised presentations ([REDACTED] several times and my old school [REDACTED]) as well as taking part in school-organised events such as bridge building and careers evenings. I saw the opportunity in the way we introduce Building Services and so I developed and led a programme of Building Services talks at universities to introduce students to the industry. The programme was so successful that the department have continued to run the talks each year. (D3, E1, E4, B1)

I was short-listed as the CIBSE-ASHRAE graduate of the year in [REDACTED]. As a short-listed candidate I presented in the IMechE headquarters to the presidents of CIBSE and ASHRAE and prominent members of industry, the public and my company. I presented on the topic of "How has technology changed the way we as engineers work". It was a great privilege and a fantastic opportunity to present to this audience. I learnt a lot from participating in the awards and I think these awards help raise awareness of the work we do as engineers and enthuse and encourage younger engineers. (D2, D3)

2012-2016 Ethics: E5 and Code of Conduct: E1

I have read and understood the CIBSE Code of Conduct and I understand as a professional it is important to only operate within my own knowledge and work in an ethical manner. I have completed my company's Code of Conduct training course and I also learnt about relevant aspects on the Contract Law training course. (E1, E5)

(4719 words)

2.4. CPD

The below table details the continued professional development I have taken part in including training and talks, both internal and external.

Date	Name	Type
01/09/2012	IMechE evening talk on Rail industry	External talks
01/10/2012	IMechE evening talk on downsizing car engines	External talks
01/11/2012	Personal Track Safety course (2 day)	External Training
01/01/2013	Data centre design	Internal Talk
01/01/2013	BIM educational webinar	Internal Training
01/02/2013	IES thermal modelling software	Internal Talk
01/03/2013	Daylight design	Internal Talk
01/04/2013	BSRIA - introduction to mechanical building services course	External Training
01/04/2013	Schools of tomorrow talk	Internal Talk
22/04/2013	Midtherm - engineering natural ventilation system design	External CPD Talk
29/04/2013	Honeywell - BMS open protocol	External CPD Talk
02/05/2013	LG Electronics - VRF design	External CPD Talk
09/05/2013	Biddle - climate solutions on FCUs and noise	External CPD Talk
22/05/2013	Finning (UK) Ltd - flywheel UPS	External CPD Talk
01/06/2013	Work on listed buildings; Midlands bank refurbishment	Internal Talk
01/06/2013	Secure Document handling course	Internal Training
01/07/2013	CIBSE evening talk on BIM and Softlandings	External talks
01/07/2013	Summer Graduate event- Birmingham university	Internal Training
01/07/2013	Navis software	Internal Training
31/07/2013	TA Hydronics - mastering variable flow systems	External CPD Talk
06/09/2013	Application of natural ventilation at Birmingham New Street	Internal Talk
17/09/2013	First graduate event- Heathrow (2 day)	Internal Training
23/09/2013	Camfill Farr - cleanroom and containment applications	External CPD Talk
01/10/2013	Advanced Air - FCUs with demo	External CPD Talk
07/10/2013	Victaulic - re-usable pipe connections	External CPD Talk
10/10/2013	Ergro - absorption heat pumps and chillers	External CPD Talk
16/10/2013	IET - smart Cities of the future at the RE, London	External talks
21/10/2013	Condensation in a cavity wall in Heathrow, modelled in IES	Internal Talk
25/10/2013	BIM/CAD training session	Internal Training
31/10/2013	Action Air	External CPD Talk
09/11/2013	BIM/CAD training session	Internal Training
11/11/2013	BIM/CAD training session	Internal Training
12/11/2013	Second graduate event - ██████████ (2 day)	Internal Training
08/01/2014	CIBSE Women in Building Services Engineering (WIBSE) mentoring	Other
24/01/2014	UK Green Building Council	External CPD Talk
19/02/2014	CIBSE HCSW: Climate Based Daylight Modelling	External talks
19/03/2014	GE - energy management	External CPD Talk

27/03/2014	Presentation skills course (2 days)	Internal Training
02/04/2014	Hydrotec (UK) Ltd - bacteria control	External CPD Talk
23/04/2014	Introduction to BSRIA BG/6	Internal Talk
24/04/2014	Contract course	Internal Training
28/04/2014	AFP Air Technologies - stair pressurisation systems	External CPD Talk
30/04/2014	Lledo Group - high performance prismatic daylighting	External CPD Talk
01/05/2014	CIBSE evening talk on the new Part L regulations –RBS, London	External talks
03/06/2014	Project finance course	Internal Training
04/06/2014	Exhausto	External CPD Talk
11/06/2014	IMechE talk on passivhaus design – at Kingston University, London	External talks
12/06/2014	CIBSE evening technical talk on generators in Holborn, London	External talks
18/06/2014	CIBSE YEN evening talk - refrigeration design – South Bank Uni.	External talks
27/06/2014	Office 2013 training session	Internal Talk
07/07/2014	Company secretariat presentation on their role at [REDACTED]	Internal Talk
08/07/2014	[REDACTED] safety talk	Internal Talk
21/07/2014	Innovation Hub	Internal Talk
23/07/2014	Part L changes that affect the new [REDACTED] office	Internal Talk
02/09/2014	MEP Services Strategy talk on Tall Buildings in the Middle East	Internal Talk
29/09/2014	Ventilux - British Standards for Emergency Lighting	External CPD Talk
25/10/2014	CIBSE YEN National Ball- Bristol Marriot Hotel	Other
25/11/2014	IES Training course (3 day)	External Training
12/01/2015	KE Fibertec - Textile ventilation	External CPD Talk
14/01/2015	Hilti - Easy construct joints and parts	External CPD Talk
26/01/2015	Euro-Diesel (UK) Ltd - DRUPS & GENSET Solutions	External CPD Talk
05/02/2015	Panasonic - VRF Refirgerant Pumpdown Technology	External CPD Talk
09/02/2015	Warmup - Underfloor heating	External CPD Talk
10/02/2015	CIBSE Performance Awards-invited in recognition for my contribution	Other
25/02/2015	RIDI - Lighting	External CPD Talk
09/03/2015	Schnider - Electrical building analytics	External CPD Talk
11/03/2015	Third graduate training event (2 days)	Internal Training
19/03/2015	Innovation webinar	Internal Talk
29/04/2015	Effective writing for Consultants and Engineers Training Course	Internal Training
11/05/2015	Condair - Humidification & Psychometrics	External CPD Talk
27/05/2015	security clearances	Internal Talk
28/05/2015	Evinox - Modern Communal Heating Installations	External CPD Talk
01/06/2015	Carlo Gavazzi - Metering Systems L2 and MID	External CPD Talk
06/06/2015	BAXI - CHP	External CPD Talk
08/06/2015	Danfoss - Network Connected Control of Variable Flow Systems	External CPD Talk

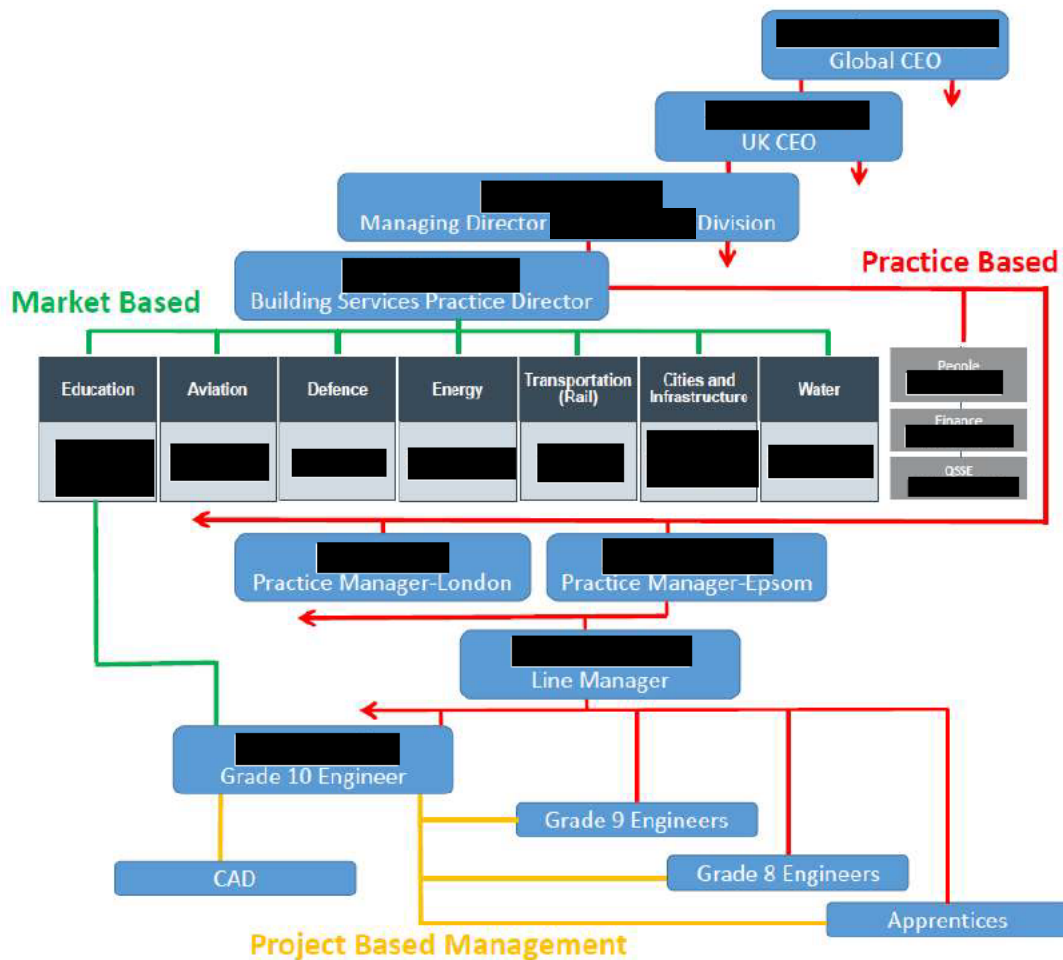
09/06/2015	CIBSE evening talk - membership and registration - CIBSE HQ	External talks
11/06/2015	Osram - Lighting Controls and Bespoke Solutions for Artwork	External CPD Talk
15/06/2015	Schools design and EFA Facilities Output Specification	Internal Talk
18/06/2015	Ener-G - CHP	External CPD Talk
23/06/2015	Arup - Women in engineering day talk	External talks
24/06/2015	Durapipe - Plastic piping	External CPD Talk
01/07/2015	BAC - Ice chillers thermal storage	External CPD Talk
07/07/2015	Dubai opera house building services design	Internal Talk
28/07/2015	BSRIA - Health and safety in building services	External Training
29/07/2015	Enterprise advantage- [REDACTED] software for project management	Internal Training
03/08/2015	JS - Air Curtains	External CPD Talk
23/09/2015	UKGBC - Smart cities evening talk- Canary Warf	External talks
24/09/2015	UKGBC - Sustainable schools talk - Buro Happold	External talks
24/09/2015	IES - Different types of models and lessons learnt	External talks
30/09/2015	Day 1 [REDACTED] Professional Development Course	Internal Training
14/10/2015	Day 2 [REDACTED] Professional Development Course	Internal Training
27/10/2015	I presented at Nottingham University on Building Services careers	Other
29/10/2015	I spoke at Bath University on Building Services Careers	Other
03/11/2015	I presented at [REDACTED] on STEM subjects	Other
05/11/2015	Carbon Critical buildings webinar	Internal Talk
12/11/2015	WISE conference and awards ceremony	Other
18/11/2015	Day 3 and 4 of [REDACTED] Professional Development course	Internal Training
03/12/2015	STEM careers fair at Greys School, Richmond	Other
07/12/2015	Micronics - flow and energy meters	External CPD Talk
16/12/2015	CIBSE membership presentation at [REDACTED]	External CPD Talk
11/01/2016	Unitrunk	External CPD Talk
25/01/2016	Kingspan	External CPD Talk
01/02/2016	Ability Projects	External CPD Talk
03/02/2016	Post Occupancy Evaluation and Health & Wellbeing	Internal Talk
11/02/2016	CSCS card exam passed	External Training
22/02/2016	Xicato - LED and getting colour right	External CPD Talk
09/03/2016	Ecobuild exhibition and UKGBC after 'party at the Crystal	Other
24/03/2016	APM: Project Fundamentals Qualification (2 day) course and exam	Internal Training
05/04/2016	Fuel cells	External CPD Talk
15/04/2016	CIBSE - Design of heating and chilled water pipe systems	External Training
25/04/2016	ICS - Cool Energy	External CPD Talk
28/04/2016	Green Sky /thinking Week - Wellness in the office -Buro Happold	External talks
04/05/2016	CIBSE Carbon Bites: Post Occupancy Evaluation	External talks
25/05/2016	PhotonStar - LED Group	External CPD Talk

15/06/2016	Breathing Buildings	External CPD Talk
15/06/2016	Talk on NBS Create specification software	Internal Talk
20/06/2016	STEMnet - talk on speaking to girls about engineering	External CPD Talk
21/06/2016	BSRIA - webinar on thermal comfort	External CPD Talk
07/07/2016	Fourth Graduate event : summer event (2 days)	Internal Training

3. Organisation Chart

The diagram below shows my position within the company.

The company is split both by management structure (red) but also by market (green). Although I have and do work on a range on projects, in a range of markets, I am currently working within the education market. My line management is through [redacted] but I also work closely with the team based in [redacted]. Depending on the size and nature of the project, I typically manage one or more members of the CAD team and one or more apprentices and graduates (in yellow on the diagram).



4. Development Action Plan

Short Term (1-3 Years)

In the short term I would aim to meet the following goals:

- Gain Member grade (CIBSE) and gain chartered status with the Engineering Council
- Continue to take on more responsibility and the Project Manage larger projects
- Continue to build on my experience in client interaction
- Continue to learn with an enquiring mind and attend tours, talks and CPD seminars
- Mentor and develop younger engineers in the company

Medium Term (3-7 Years)

In the medium term I aim to develop my skills in line with the following:

- Broaden my knowledge of other disciplines, in particular electrical and public health engineering
- Work on a variety of projects to gain a broader understanding of engineering systems and solutions
- Continue to attend external talks and seminars by industry leaders to keep up to date with new innovation and developments in legislation and industry

Long Term (7-10+ Years)

My long term goals that I would like to achieve are:

- Progress to a more senior position
- Develop and mentor young engineers in their career towards them gaining chartered engineer status
- Continue to learn and develop my technical and professional skills
- Gain a wider understanding of roles in the Building Services industry and in the company
- Make a difference to improving the technical standards within the industry and within my company