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TQUK Level 3 Certificate in

DESIGN, ENGINEER, CONSTRUCT!
THE DIGITAL BUILT ENVIRONMENT (RQF)
QAN: 603/2052/7

TQUK Level 3 Diploma in

DESIGN, ENGINEER, CONSTRUCT!
THE DIGITAL BUILT ENVIRONMENT (RQF)
QAN: 603/1993/8

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Contents

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BIM Model: Adelaide Oval
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UNIT 1: Defining a Sustainable Construction Project
12 credits (60 GLH) - A/615/8835

1. The candidate will research and convey the project remit.

I can:

1.1 identify a significant construction project for in-depth study

Candidates will identify sources which will provide the basis for a construction project.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will select an appropriate project either through an existing genuine architectural competition, or by identifying a building which they believe is needed in their own town.

1.2 communicate the vision for the project

Candidates will write a vision statement for their project and communicate it to relevant third parties.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates should articulate their high level, aspirational ambitions for their project; what it will achieve when it is completed in the context of the people who will use it, the environment in which it sits and the sustainable objectives it will realise.

1.3 set the scene for the project in the context of the existing environment

Candidates will provide a descriptive study of the local area where their project will be constructed.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates should discuss the existing built environment and infrastructure, describe the current social, economic and environment situation and the general aesthetics and 'feel' of the area, what it means to the people who live and work, and indeed what it means to them personally. Candidates can provide a range of evidence to support their findings by devising appropriate questionnaires for on street surveys and interviewing diverse groups of the immediate local community eg. local businesses, shoppers, the elderly, young people and students etc. They can find information through, for example, local authority, civic society, chamber of commerce and the office of national statistics' websites.

1.4 set the scene for the project in the context of the end user

Candidates will describe the prospective end user.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will provide a profile of the end user of their building project, detailing anticipated wishes and demands. They may choose to research end users in similar facilities both physically and operationally.

1.5 write a mission statement for the project

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will determine clear values, objectives and outcomes for their project, ideally working as a team to identify key themes, for example purpose, environmental impact, design excellence, sustainability, economic contribution. Candidates might gain inspiration by exploring the mission statements of leading architecture, engineering and construction companies.

2. The candidate will set standards for sustainability in a construction project.

I can:

2.1 define commitments to positively impact on the local community and the local environment

Candidates will produce a community and environmental statement.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will produce a statement which outlines their commitment to positively impact the local community and the local environment not only in terms of the building itself and its entire lifecycle, but also through the ethos, behaviour and passion of the entire project team in caring for the community and protecting the environment in the immediate vicinity of the project. This should be based on referenced research evidence. A series of Construction Commitments devised by the Strategic Forum for Construction provides valuable guidance:
http://www.strategicforum.org.uk/download/downloads/Construction%20Commitments%202012.pdf.
Also see guidance from the Considerate Constructors Scheme:
https://www.ccscheme.org.uk/site-registration/site-code-of-practice-site-reg/

2.2 define commitments to energy and water efficiency and reduction of carbon emissions

Candidates will produce an energy, water and carbon statement based on research.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will produce a statement which outlines their commitment to energy and water efficiency, and to reduce carbon emissions throughout the entire lifecycle of the building, and also through the ethos, behaviour and passion of the entire project team. This should be based on referenced research evidence. A series of Construction Commitments devised by the Strategic Forum for Construction provides valuable guidance: http://www.strategicforum.org.uk/download/downloads/Construction%20Commitments%202012.pdf and the Green Building Council resource: http://www.greenconstructionboard.org/otherdocs/CO2%20Construction%20sites%20master.pdf. The Green Building Council also produced guidance for water use in construction: http://www.greenconstructionboard.org/otherdocs/SCTG09-WaterActionPlanFinalCopy.pdf - a water use and activity summary can be found from page 21-24, and offers best practice example links.

2.3 define commitments to minimise construction waste

Candidates will produce a waste statement based on research.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will produce a statement which outlines their commitment to waste minimisation throughout the entire lifecycle of the building, and also through the ethos, behaviour and passion of the entire project team. This should be based on referenced research evidence. A series of Construction Commitments devised by the Strategic Forum for Construction provides valuable guidance: http://www.strategicforum.org.uk/download/downloads/Construction%20Commitments%202012.pdf and the Green Building Council resource: http://www.greenconstructionboard.org/otherdocs/CO2%20Construction%20sites%20master.pdf. The Green Building Council also produced guidance for water use in construction: http://www.greenconstructionboard.org/otherdocs/SCTG09-WaterActionPlanFinalCopy.pdf - a water use and activity summary can be found from page 21-24, and offers best practice example links.

2.4 define commitments to ethical sourcing of materials and responsible procurement

Candidates will produce a procurement statement based on research and their personal ethics.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will produce a statement which outlines their commitment to ethical sourcing and responsible procurement throughout the entire lifecycle of the building, and also through the ethos, behaviour and passion of the entire project team. This statement should be based on referenced research including information from the Strategic Forum for Construction. A series of Construction Commitments devised by the Strategic Forum for Construction provides valuable guidance: http://www.strategicforum.org.uk/download/downloads/Construction%20Commitments%202012.pdf and the Green Building Council resource: http://www.greenconstructionboard.org/otherdocs/CO2%20Construction%20sites%20master.pdf. The Green Building Council also produced guidance for water use in construction: http://www.greenconstructionboard.org/otherdocs/SCTG09-WaterActionPlanFinalCopy.pdf - a water use and activity summary can be found from page 21-24, and offers best practice example links.

2.5 define sustainability monitoring and reporting procedures for the lifecycle of the project

Candidates will define their methods for monitoring and reporting their commitments to sustainability throughout the entire lifecycle of the project.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates should explore existing industry procedures to produce a methodology. Valuable guidance can be found by registering with BREEAM, an internationally recognised measure and mark of a building's sustainable qualities, and certified buildings are immediately identifiable as having been planned, designed, constructed and operated in accordance with best practice sustainability principles. Click on the Resources tab at: http://www.breeam.org/

3. The candidate will be able to define site information required at pre-design phase.

I can:

3.1 identify the importance of site analysis and the roles of professional consultants at pre-design phase

Candidates will produce an overview of site analysis requirements and the professionals involved at pre-design stage.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will understand the importance of an adequate site investigation and describe who and what is involved, and why it is carried out. They will outline the risks involved in gathering insufficient or inadequate data.

3.2 determine what topographical information is required and appropriate, effective ways to collect accurate data for a particular site

Candidates can explain the need for an accurate topographical survey and can suggest and validate an appropriate survey method.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will understand the role of the topographical surveyor in providing accurate survey data. They will explore the limitations of everyday mapping information (eg. conventional ordnance survey maps) in providing accurate geotechnical data and how technology has advanced the methods of surveying. Candidates will compare methodologies and technologies and will determine appropriate above ground survey methods for their project including laser scanning, satellite based positioning systems (GPS/GNSS), electronic distance measurement (total station), Geographical Information Systems (GIS) and ground penetrating radar (GPR) for below ground utility mapping.

Candidates will define appropriate vertical/horizontal accuracy and understand the need for precision to establish boundaries, elevation for flood plain data, positioning of trees, water courses and other natural features, existing buildings and manmade features, and also the need to discover existing utilities running through and adjacent to the site. They will explore the limitations of surveying tools, for example GPS requires good satellite geometry and visibility. Tree canopies and dense, built up areas can render GPS methods ineffective. Total Stations can produce unreliable data when used in highly reflective environment and laser scanning can produce poor results on low-reflectance surfaces (eg. anything painted black), specular surfaces (eg. shiny metal and mirrors), and transparent or translucent surfaces (eg. windows). All methods require professional expertise and varying degrees of time to process collected data and candidates will understand the process of translating collected data to a useable, manageable format, and the data outputs produced by different methods (eg. laser scan point clouds, GPS/EDM raw data).

3.3 identify information required to produce a geotechnical report and relate to the specified project

Candidates can identify the geotechnical data required to produce a report.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will understand the role of the geotechnical surveyor in providing accurate ground condition information regarding soil and geologic conditions on and below the surface. They will understand the process of site analysis through desk study, survey and reporting.

3.4 identify information required to produce an ecological study and relate to the specified project

Candidates can identify the ecological data required to produce a report.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will understand the role of the ecology professional in providing accurate information regarding vegetation and wildlife and their habitats in the local area. They will understand the process of site analysis through desk study, survey and reporting.

3.5 identify information required to produce a hydrology study and relate to the specified project

Candidates can identify the hydrological data required to produce a report

Evidence: Portfolios of evidence, internal testing

Additional information and guidance: Candidates will understand the role of the hydrology professional in providing accurate information regarding the quality, position and flow of watercourses in the local area. They will understand the process of site analysis through desk study, survey and reporting.

UNIT 2: Developing a Sustainable Construction Project. 10 credits (60 GLH) - F/615/8836

1. prepare a design brief and take steps to appoint an effective design team.

I can:

1.1 describe the role and responsibility of the client in a construction project

Candidates will describe the role and responsibility of the client in a construction project.

Evidence: Portfolios of evidence.

Additional information and guidance: The Client plays a major role in any construction project and has a wide range of responsibilities including ensuring that all appointees are competent and that suitable managers are appointed to oversee the project. He is also responsible for providing pre construction information, and ensuring that someone coordinates health and safety. Guidance can be found at: http://webarchive.nationalarchives.gov.uk/20110118095356/, http://www.cabe.org.uk/buildings/client-role/description

1.2 prepare the design brief for a specific construction project and receive critical feedback for client sign off

Candidates will prepare a design brief and present to a critical audience.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will prepare an effective, jargon-free design brief which conveys a client's vision, their goals and their priorities and provides an accurate account of the project's deliverables. The brief should refer to a budget estimate and realistic timeline and should confirm the main point of contact and decision maker(s). Operational management must be a key part of the brief. Candidates will present to an audience which will act as client in the development. The candidate must present with conviction and confidence and make appropriate adjustments on receiving critical feedback.

1.3 formalise the appointment of an integrated Project Team

Candidates will describe the formal appointment of an integrated Project Team.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates should describe the engagement of an efficient, multidisciplinary team focusing on their ability to work together in a collaborative design environment driven by the benefits of Building Information Modelling. In addition to standard contracts

(see http://www.jctltd.co.uk/), candidates should highlight the BIM Protocol, BIM Employer's Information Requirements (EIR) and PAS1192:2 specification. Information regarding this can be found via the Government BIM Task Group website: http://www.bimtaskgroup.org/bim-protocol/

1.4 produce an organogram outlining professionals and their roles at each phase of the project

Candidates will produce an organogram outlining professionals and their roles at each phase of the project.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will outline key members of the Project Team with specific reference to the role of the Information Manager: http://cic.org.uk/download.php?f=outline-scope-of-services-for-the-role-of-info rmation-managment.pdf. They will draft a Project Programme outlining tasks and deliverables at each stage. The Royal Institute of British Architecture has produced a Plan of Work which offers clear guidance: http://www.architecture.com/Files/RIBAProfessionalServices/Practice/RIBAPlanofWork2013Overview.pdf

1.5 devise an effective communication strategy to promote collaboration between all parties

Candidates will produce an effective internal and external communication strategy

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will explain what they will need to communicate and how they will use BIM to support the communication process, through collaboration, integration and improving awareness, understanding and decision-making through a 3D model. They must ensure the project is on target at each stage to meet the client's aims and objectives including quality and budget. Candidates may also consider the use of social media to assist stakeholders in keeping up to date with the project.

2. use building information modelling techniques for concept design.

I can:

2.1 create preliminary concept designs based on design brief

Candidates will create a concept design based on the agreed design brief.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will produce a number of concept design options extracting key information from the design brief. They will understand the benefits of conceptual modelling as a critical stage of building design such as enabling the communication of ideas and supporting early stage analysis for building life cycle sustainability and cost.

2.2 assess concept designs for space requirements, circulation and accessibility

Candidates will assess concept designs for space requirements, circulation and accessibility.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will determine how their concept design maximises efficient and effective space use for those who will use it and how it facilitates the safe, convenient movement of people, both able bodied and disabled. They should define spatial requirements for a range of occupant activities and equipment and consider how the positioning of elements such as corridors, lifts, escalators, and staircases contribute to the optimisation of the flow of people through a building. They should be encouraged to explore the size of rooms and areas with specific purpose and it is useful to visit a building with a similar purpose to establish what works and what doesn't, interviewing existing end users where possible. Candidates should consider building operations and maintenance activities and the potential need for flexibility to accommodate changes in future use and technologies. They should understand the project's relationship with, and effective use, of the landscape in which it sits. Furthermore they should pay specific attention to statutory regulations concerning size, function, access etc.

2.3 assess concept design to produce preliminary cost and lifecycle cost prediction

Candidates will assess concept design to produce preliminary cost and lifecycle cost prediction.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will produce high level estimates based on number of occupants and area or volume on a standard £/m2 and £/m3 basis according to the type of project they have designed. Whilst this is a function that can be quickly carried out using industry software, candidates should understand the methodology behind calculation, the risks involved in estimation, and the impact of lifecycle costing on sustainability.

2.4 perform energy analysis relative to form, orientation, weather, surfaces and glazing

Candidates will perform energy analysis relative to form, orientation, weather, surfaces and glazing.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will produce a high level analysis of overall energy use. They will provide a solar study taking into account the shading effects of surrounding buildings where applicable and recommending ways to maximise solar gain. They will explore the effects of making changes to form and orientation to maximise energy efficiency and make comparisons. Whilst this is a function that can be quickly carried out using industry software, candidates should understand the methodology behind calculation, the risks involved in estimation, and the impact of analysis on sustainability.

2.5 present information for whole project lifecycle and provide validation for chosen model

Candidates will present a final concept model and provide whole project lifecycle validation.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will present an effective, efficient concept model which is most aligned to the project design brief, life cycle objectives and vision.

3. prepare information and resources needed to support a planning application.

I can:

3.1 explain the planning process for a specific construction project

Candidates will identify the sources of information which will provide a basis for a construction project.

Evidence: Portfolios of evidence.

Additional information and guidance: The 'National Planning Policy Framework' (see http://www.communities.gov.uk/publications/planningandbuilding/nppf) sets out planning policies for England and how they are expected to be applied. It provides guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications (see http://www.planningportal.gov.uk/planning/planningsystem/localplans#nppf). It is important that candidates understand the need to involve the wider community in the process and the introduction of the 'Localism Act' and the new 'Neighbourhood Planning' framework empowers communities to have their say regarding development in their neighbourhoods. A guide to the Act and the powers of communities can be found here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/5959/1896534.pdf. If a construction project is classed as a 'major development' it is crucial that the community is involved at an early stage. There may be more evidence required, in particular an environmental impact assessment, a transport study which outlines the impact the site entry and exit will have on existing roads and traffic volumes, and a design & access statement, which outlines the suitability of the design for the particular site, and how users will access it. Large scale developments often include a commitment from the developer to provide community services such as providing a park for local children. This is called a Section 106 agreement and is a powerful, legally binding agreement between a local council and developer to improve the local area. Major developments can include:

- Housing developments of more than 10 dwellings
- Housing development on a site of 0.5 hectares or more
- Any other development with a floor area of 1000 m2
- Any other development on a site of 1 hectare or more
- Waste development or mineral working
- A planning authority will facilitate community consultation by notifying neighbouring properties about an application, and in some cases they planning applications will also be advertised in the local press and a site notice.

3.2 make use of current legislation and guidance

Candidates will identify the sources of information which will provide a basis for a planning application.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will align significant legislation to their specific project. Guidance can be found via the government planning website: https://www.planningportal.co.uk/ and a number of key points are noted below. Candidates should be aware of a number of Acts and codes of practice from Level 2 including Tree Preservation Orders (TPOs) and the Wildlife and Countryside Act 1981. The Disabled Persons Act 1981 ensures that the needs of disabled persons are provided for in any development schemes. The Equality Act 2010 ensures that local planning policies need to take into account the particular needs of women, young people and children, older people, ethnic minorities, children and disabled people. The Party Wall Act 1996 prevents and resolves disputes in relation to party walls (walls of adjoining dwellings eg. semi detached houses and terraces), boundary walls and excavations near neighbouring buildings. Right to Light - a private, legally enforceable easement or right to a minimum level of natural illumination through a 'defined aperture', usually a window opening. Planning applications must also be decided in accordance with the Local Development Framework (LDF), and information regarding this can be found at:
http://www.planningportal.gov.uk/planning/planningsystem/localplans. Candidates should consider location specific policy - is the site situated in a green belt, or conservation area? It may be close to listed buildings (or indeed is the proposed project a refurbishment of a listed building?) or be situated in a Site of Special Scientific Interest (SSSI) which gives legal protection to local wildlife and specific geological formations. There are also a number of local Waste Management policies which should be adhered to. Building Regulations approval sets out design standards that focus on issues of health, safety, energy efficiency and disability access. It may also be necessary to notify the Health and Safety Executive (HSE) and may have other duties as well under the Construction Design and Management Regulations 2015 (CDM 2015). Candidates will use BIM to model Health and Safety requirements. BREEAM sets a standard for best practice in sustainable building design, construction and operation. The measures used represent a broad range of categories and criteria and include aspects related to energy and water use, the internal environment (health and well-being), pollution, transport, materials, waste, ecology and management processes. Much of this criteria is covered in DEC! at Level 1 and 2. More information about BREEAM can be found at: http://www.breeam.org/about.jsp?id=66

3.3 prepare a planning feasibility study for a specific construction project

Candidates will prepare a planning feasibility study for a specific construction project.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will create a feasibility study outlining how their proposal will conform and respond to particular areas of policy and legislation.

3.4 describe what is meant by the term 'undesirable precedent' in planning decisions and provide an example of such

Candidates will identify and describe the impact of 'undesirable precedent'.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will explain the term 'undesirable precedent' in the context of building design and impact on planning law/codes of practice. A large number of case studies can be found on the internet and candidates should provide an appropriate example aligned to their own project.

3.5 formulate justification and present evidence for the approval of a specific project

Candidates will formulate justification and present evidence for the approval of a specific project.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will include significant facts and provide appropriate evidence (eg. site plans and design drawings (elevations, floor plans, sections). Planning authorities will focus on material considerations when deciding a planning which include:

- Overlooking/loss of privacy
- Loss of light or overshadowing
- Parking
- Highway safety
- Traffic
- Noise
- Effect on listed building and conservation area
- Layout and density of building
- Design, appearance and materials
- Government policy
- Disabled persons' access
- Proposals in the Development Plan
- Previous planning decisions (including appeal decisions)
- Nature conservation

Further information is available on the UK website: http://www.planningportal.gov.uk/

UNIT 3: Investigate Design, Structural and Services Aspects of a Sustainable Construction Project. 10 credits (60 GLH) - R/616/9176

1. gather and analyse information to develop the design.

I can:

1.1 analyse relevant architectural precedents.

Candidates will identify and analyse precedents to inform their proposals.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will identify relevant precedents in terms of function and location, and analyse to highlight features that could inspire and inform the architecture of their proposals.

1.2 explore specific materials and their properties and justify material choices.

Candidates will justify their choice of building materials.

Evidence: Portfolios of evidence.

Additional information and guidance: Materials should be selected in terms of their aesthetics, sustainability, cost and performance. Candidates will create a table that compares the materials and presents the data. Compare U values, cost and aesthetics.

1.3 gather information using charts and tables to inform the sizes of rooms and spaces.

Candidates will determine the internal spacial requirements of their building design.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will refine the function and occupancy of each space, and use data from guidelines to calculate the area and height of spaces and rooms using correct units. Candidates can measure the sizes of comparable rooms within the school building and use these to inform their own designs.

1.4 generate schedules of accommodation.

Candidates will determine schedules of accommodation.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will produce a schedule of accommodation that can be used to inform and test the architectural model.

1.5 analyse the information and justify choices.

Candidates will analyse and justify spatial arrangements within their building design.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will explain how their building meets their design brief.

2. gather and analyse information to develop the structural elements.

I can:

2.1 explore different structures within the built environment: frame, shell, mass.

Candidates will identify common types of building structures.

Evidence: Portfolios of evidence.

Additional advice and guidance: This criteria presents students with the ideal opportunity to meet with their industry partners to explore buildings in the real world, where different structural forms have been used.

2.2 explore how forces affect structural elements: tension, compression, shear, torsion and bending.

Candidates will understand structural forces.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will create a simple structural model (spaghetti and marshmallows work well) and record what happens when different loads are applied.

2.3 gather information about different structural materials and compare their properties.

Candidates will identify structural materials and their properties.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will compare the properties of reinforced concrete, steel, aluminium, brick and modern manufactured materials e.g. SIPs. Candidates will compare their structural properties, e.g. concrete is strong in compression, steel is strong in tension.

2.4 use charts and tables to define loading scenarios.

Candidates will understand the impact of load on structures.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will research the dead loads of different materials and the imposed loads of different activities that will take place in your building. These are available in the 'Architects Pocket Handbook' and the 'Structural Engineers Handbook' or from websites such as: https://theconstructor.org/structural-engg/types-of-loads-on-structure/1698/

2.5 analyse the information and make choices as to the type of structure and which materials are most suitable for the building.

Candidates will make informed choices regarding building structure.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will use the research to make choices about the type of structure they think is most appropriate, and which materials they would use for the different elements.

3. gather and analyse information to develop the building services elements.

I can:

3.1 explore what is meant by occupant comfort and how it can be measured.

Candidates will define and understand the measurement of comfort within a building.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will research the different aspects of occupant comfort; thermal, visual, air quality and acoustic. Candidates will explain how they can be measured (metrics) and achieved through the provision of building services.
https://sustainabilityworkshop.autodesk.com/buildings/occupant-comfort

3.2 gather information from case studies related to aspects of buildings services heating, ventilation and lighting.

Candidates will explore best practice in hearing ventilation and lighting.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will research best practice in building services and identify strategies and technologies that could be applied. http://www.bullittcenter.org/ https://www.breeam.com/case-studies/

3.3 use tables and charts to define lighting levels, temperatures and air exchange rates.

Candidates will use appropriate measurements for heating, ventilation and lighting.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will collect data to define the recommended lighting levels (lux), temperatures and air exchange rates for the building types. The values are available in CIBSE Guide A: Environmental Design Table 1.5 recommended comfort criteria and in other guidance.

3.4 apply science and maths and use industry standard software to calculate the need for different building services.

Candidates will use scientific and mathematical concepts to determine building services needs.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will benefit from real life examples presented by industry partners, this could include:

- Heat loss calculations using U Values
- Lighting calculation using free software such as Dialux
- Water consumption using on-line software
- Fire exits using information from building regulations Part B

3.5 analyse the information and make choices as to the appropriate technologies to use.

Candidates will make informed choices for building services within their building designs.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will use the research to explain choices that will improve occupant comfort and be energy efficient.

UNIT 4: Deliver Design, Structural and Services Aspects of a Sustainable Construction Project. 10 credits (60 GLH) - D/616/9178

1. use building information modelling techniques to develop the design

I can:

1.1 generate a 3D model using material and component libraries.

Candidates will generate a 3D model of their building design.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will create a 3D model of the building using Autodesk Revit (or other). Level of required detail: External and internal walls (with materials), doors and windows, floors and roof; rooms and spaces should be identified to allow schedules to be generated; furniture and other components can be added to demonstrate the scale and organisation of spaces.

1.2 generate floor plans and schedules.

Candidates will generate floor plans and schedules from their building model

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will use sheets tool in Autodesk Revit (or other 2D CAD package) to produce floor plans and room/space schedules.

1.3 communicate the design using 3D views and renders.

Candidates will communicate the design of their building model, using appropriate techniques.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will create different 3D views of the building (external and internal) to show the design of the building and particular features.

1.4 present the model to critical experts.

Candidates will present their building models for critical feedback.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will create a presentation to explain how the building evolved, the accommodation it provides and the materials used. Candidates will present the building to critical experts, these could be your industry link, ambassadors from local universities or colleges, or your client. Candidates will record any feedback (see section 1.5).

1.5 address errors, clashes and omissions and make modifications as a result of feedback.

Candidates will reflect and implement critical feedback in their building model.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will record the feedback from their presentation and update the model. Candidates will explain the changes that have been made.

2. use building information modelling techniques to develop structural elements of a building project.

I can:

2.1 generate a structural plan or grid that identifies the main structural elements: foundations, structural walls, slabs, beams and columns.

Candidates will generate a structural plan.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will use 3D modelling software to annotate floor plans to create a structural grid. The grid should show column spacings and locations.

2.2 create a 3D structural model using component libraries.

Candidates will create a structural model.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will use 3D modelling software to create a structural model. If the building design is too complex, a simpler example could be included, or a single part of the proposal could be modelled.

2.3 apply science and maths and use industry standard software to calculate elements of the structure.

Candidates will use scientific and mathematical concepts to calculate structural elements.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will benefit from real life examples presented by industry partners, this could include scientific and mathematical concepts relating to bending moments, cantilevers, forces and loads.

2.4 present the model to critical experts.

Candidates will present their building models for critical feedback.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will create a presentation to explain their choices of structure and materials. They may also want to include the loading data so that a Structural Engineer could then perform more detailed analysis. Candidates will present the building to critical experts, these could be your industry link, ambassadors from local universities or colleges, or your client. Record any feedback (see section 2.5).

2.5 address errors, clashes and omissions and make modifications as a result of feedback.

Candidates will reflect and implement critical feedback in their building model.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will record the feedback from their presentation and update the model. Candidates will explain the changes that have been made.

3. use building information modelling techniques to develop building services elements of a building project.

I can:

3.1 generate annotated floor plans that define recommended levels for lighting ventilation and heating.

Candidates will produce floor plans to illustrate building services within their building design.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will create annotated floor plans with a key to illustrate the different lighting, temperature and ventilation recommendations

3.2 model and test aspects of building services to demonstrate how recommendations for services can be met.

Candidates will test building services recommendations.

Evidence: Portfolios of evidence.

Additional information and guidance: Software (e.g. Autodesk Revit) libraries can be used to add plumbing, lighting, ventilation etc to the model. It is not necessary to include all services. Alternatively other specialist software such as Dialux for lighting could be used to model and test.

3.3 use energy software to test the energy efficiency and recommend improvements.

Candidates will assess energy efficiency recommendations.

Evidence: Portfolios of evidence.

Additional information and guidance: Energy Analysis in Autodesk Revit, through Green Building Studio, can be used to model the energy use. The energy insight can be particularly useful to test different improvements and measure the impact.

3.4 present the model to critical experts.

Candidates will present their building models for critical feedback.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will create a presentation to explain their choices for heating, lighting and ventilating their building. They may also want to include the recommended levels so that a Building Services Engineer could then perform more detailed analysis. Candidates will present the building to critical experts, these could be your industry link, ambassadors from local universities or colleges, or your client. Record any feedback (see section 2.5).

3.5 address errors, clashes and omissions and make modifications as a result of feedback.

Candidates will reflect and implement critical feedback in their building model.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will record the feedback from their presentation and update the model. Candidates will explain the changes that have been made.

UNIT 5: Lifecycle and Financial planning for a Sustainable Construction Project. 10 credits (60 GLH) - L/615/8838

1. use building information modelling techniques to support the operational management of a building.

I can:

1.1 explain the role of BIM in the operation, management and maintenance of a sustainable building project throughout its lifecycle

Candidates will explain the role of BIM in the context of whole life facilities management.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will describe the benefits of developing and maintaining lifecycle data to support the effective, efficient operation, management and maintenance of a building. Data defines the precise location and condition of systems, equipment and objects found in a building (for example lighting, air conditioning, electrical and plumbing systems, fire protection, IT, furniture), and relationships between one component and another. They should understand how information is created and updated throughout the design and construction phase, and how it can be monitored and constantly refreshed throughout the building's lifetime to provide an up to date, real time 'as built' model. This model can be used to reduce energy usage, monitor life cycle costs, reduce the amount of time required for modification/repair/replacement/ renewal of objects/systems and critically provide a clear picture of how effectively an end user is using the building. Candidates should be able to provide examples of efficiencies and suggest how ongoing data evaluation can impact the future of building design.

1.2 devise an appropriate handover process from the construction team to the end user

Candidates will devise an appropriate handover process from the construction team to the end user.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will further develop knowledge gained in Level 1 and 2 qualifications regarding effective end user behaviour, and should devise an effective strategy for end user handover to promote the optimum operational performance of a building. The strategy should include an end user training programme designed to educate users and operators in how they should use the building to support lifecycle efficiencies and positive social, economic and environmental outcomes. Candidates should also devise a strategy to monitor, evaluate and report outcomes. The UK Government's 'Soft Landings' concept provides further guidance on effective handover (see http://www.bimtaskgroup.org/gsl/)

1.3 set targets for whole life energy performance, water consumption, waste reduction, operation and maintenance costs

Candidates will set targets for building lifecycle efficiency.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will produce and validate a clear set of targets for their building focusing on energy use, water consumption, waste reduction and operation and maintenance costs. Candidates should consider local, national and global policies and protocols, and research existing local case studies to determine how targets are set, measured and reported, and their effectiveness over time.

1.4 analyse the impact of post occupancy behaviour on the lifecycle of a building

Candidates will understand the impact of post occupancy evaluation on building lifecycle.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates should discuss quantitative and qualitative end user/operator data and how this information can provide a measurement of the success (or failure) of a building project. Candidates should discuss the analysis of data to inform the design process and real life building performance prediction.

1.5 describe the benefits of early engagement of the Facilities Manager and the client/end user in the design process

Candidates can describe the benefits of early engagement of the Facilities Manager and the client/end user in the design process.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will discuss the role of the Facilities Manager and the client/end user in early stage building design in contributing key knowledge and experience in the use, operation and maintenance of a building.

2. understand cost analysis and financial control.

I can:

2.1 explain the role of BIM in the financial management of a building project

Candidates will understand the role of BIM in the financial management of a building project.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will understand the role and effectiveness of BIM in producing accurate building project cost information including cost plans, bills of quantities and estimates. They should discuss accuracy, time and cost savings, financial transparency, and also the ability to update cost information automatically when making modifications to the building model.

2.2 produce a cost model based on the project timeline

Candidates will produce a cost model based on the project timeline.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will generate a detailed cost plan from their building model in line with original budget and timeline objectives.

2.3 identify points of accountability for keeping the project to budget

Candidates will identify points of accountability for keeping the project to budget.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will identify key project stages and associated cost centres and the roles responsible for their impact on the budget and final project cost.

2.4 explain the consequences of weaknesses in financial control

Candidates will explain the consequences of weaknesses in financial control.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will understand the impact of poor financial management and reporting and should discuss the bank account and reconciliation, assets and liabilities, cashflow, invoicing, supply chain management, resolution of errors, resource prediction and allocation.

2.5 devise policies for sustainable procurement to establish audit trails

Candidates will devise policies for sustainable procurement to establish audit trails.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will establish procedures for sustainable procurement which provides a clear audit trail and promotes responsible sourcing based on whole life costing principles. They should consider social, economic and environmental impact and compliance with environmental legislation and regulation.

3. produce a budget for a complex building project.

I can:

3.1 compile an accurate list of capital costs

Candidates will compile an accurate list of capital costs.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will provide a definition of capital costs for a construction project and compile a list referenced to their building project. Capital costs include expenses related to the initial establishment of a building and include land purchase, planning and feasibility studies, architectural and engineering design, construction (including materials, equipment and labour), construction management, insurance, tax, inspections and testing, equipment and furnishings not including in the building (eg. site office furniture and IT).

3.2 provide an annual projection for recurrent fixed costs

Candidates will provide an annual projection for recurrent fixed costs.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will provide a definition of fixed costs for a construction project and provide an annual projection for recurrent fixed costs referenced to their building project. Recurrent fixed costs are regular, anticipated costs and are independent of the output or activity level. They include permanent office utilities, permanent staff wages, bank interest, leasing costs.

3.3 provide an annual projection for recurrent variable costs

Candidates will provide an accurate annual projection for variable costs.

Evidence: Portfolios of evidence, internal testing.

Additional information and guidance: Candidates will provide a definition of variable costs for a construction project and provide an annual projection for recurrent variable costs referenced to their building project. Recurrent variable costs are irregular, often unanticipated costs that change during the project's lifecycle. They include temporary site labour, subcontractors, materials and equipment and fuel.

3.4 provide a sensitivity analysis based on possible variations in costs

Candidates will provide a sensitivity analysis based on possible variations in costs.

Evidence: Portfolios of evidence.

Additional information and guidance: With an emphasis on sustainability and energy efficiency, candidates will carry out a sensitivity analysis, testing the cost effective potential of a building project throughout its lifecycle by modifying a number of design objects within the model.

3.5 present and negotiate variations to the design within budget constraints

Candidates will present and negotiate variations to the design within budget constraints.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will present and validate design recommendations to a professional audience. They will use the outcomes of the dialogue to make variations that optimise their designs within the constraints of the budget.

Unit 6: Evaluating and Documenting a Sustainable Construction Project. 10 credits (60 GLH) - R/615/8839

1. make objective comparisons between construction methods.

I can:

1.1 compare construction methods on the basis of aesthetics and appropriateness to design intent

Candidates will produce a construction method evaluation on the basis of aesthetics and appropriateness to design intent.

Evidence: Portfolios of evidence.

Additional information and guidance: Candidates will consider a range of construction techniques and make comparisons based on aesthetics. The end user and/or client will have a personal view on what is aesthetically pleasing (i.e. is a delightful/beautiful building) and perhaps here the candidate could collaborate with peers or seek the comments of a professional visitor. Design intent was established in the formulation of a design brief in Unit 1, and again, candidates should conform to the brief when evaluating construction methods. Candidates should present evaluations in a written report. They will come to specific conclusions and present these as judgements that are supported by the evidence.

1.2 compare construction methods on the basis of cost

Candidates will produce a construction method evaluation on the basis of cost

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report in their portfolios that presents the evidence and comparisons in a clearly understandable format. They will come to specific conclusions and and present these as judgements that are supported by the evidence.

1.3 compare construction methods on the basis of sustainability

Candidates will compare construction methods on the basis of sustainability.

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report in their portfolios that presents the evidence and comparisons in a clearly understandable format. They will come to specific conclusions and and present these as judgements that are supported by the evidence.

1.4 compare construction methods on the basis of endurance and reliability

Candidates will compare construction methods on the basis of endurance and reliability.

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report in their portfolios that presents the evidence and comparisons in a clearly understandable format. They will come to specific conclusions and and present these as judgements that are supported by the evidence.

1.5 compare construction methods on the basis of reduction of operating costs

Candidates will compare construction methods on the basis of reduction of operating costs.

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report in their portfolios that presents the evidence and comparisons in a clearly understandable format. They will come to specific conclusions and and present these as judgements that are supported by the evidence.

2. Communicate outcomes from professional perspectives.

I can:

2.1 explain the strengths and weaknesses of the design from a facilities management perspective

Candidates will produce an evaluation of the building in the role of a facilities manager.

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional.

2.2 explain the strengths and weaknesses of the design from an architectural perspective

Candidates will produce an evaluation of the building in the role of an architect.

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional.

2.3 explain the strengths and weaknesses of the design from a structural engineering perspective

Candidates will produce an evaluation of the building in the role of a structural engineer.

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional.

2.4 explain the strengths and weaknesses of the design from a building services engineering perspective

Candidates will produce an evaluation of the building in the role of a building services engineer.

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional.

2.5 explain the strengths and weaknesses of the design from an end user perspective

Candidates will produce an evaluation of the building in the role of an end user.

Evidence: Portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional. Candidates are particularly encouraged to present their design to a group of end users who operate in a similar existing facility.

3. make a presentation of a summary report to a critical audience.

I can:

3.1 support a presentation with appropriate digital technologies

Candidates will present their project using appropriate digital technology.

Evidence: Portfolios of evidence, assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should provide an assessment (and make recommendations where appropriate) of the selected technology they have adopted in terms of functionality, ease of use, reliability, flexibility,

accuracy, responsiveness, availability of appropriate tools, how realistic, visualisation capability, speed, collaboration opportunity, interoperability, import/export functionality, compatibility with existing hardware."

3.2 compare the client brief to the finished project and communicate to a professional audience

Evidence: Portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should focus on key elements of the design brief and provide an honest evaluation of their ability to adhere to the brief.

3.3 compare social, economic and environmental outcomes with planned intentions

Candidates will compare sustainable outcomes to planned intentions.

Evidence: Portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should focus on key elements of their commitments to sustainability outlined in Unit 1 and provide an honest evaluation of their ability to confirm to these commitments.

3.4 assess and validate the project's major strengths and weaknesses with supporting evidence

Candidates will present an evaluation of strengths and weaknesses.

Evidence: Portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should focus on key strengths and weaknesses and provide an honest evaluation. Strengths could focus in a number of areas, for example a candidate might comment on a particular sustainable feature, or an ability to demonstrate innovate design solutions for a particular purpose. Conversely a candidate may feel his/her technical ability restricted creativity or they lacked confidence to present their project in an articulate, informed manner.

3.5 make clear judgements about the success of the project and lessons learned for the future

Candidates will present an evaluation of the project.

Evidence: Portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should focus on providing an honest evaluation of their experience, their aptitude for

certain skills and the lessons they have learned, or still need to learn, for the next project they undertake. They should comment on their aspirations for the future, and how they see their place in the industry.