

Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment



Specification

First teaching from September 2017

First certification from 2018

Issue 8

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About Pearson

We are the world's leading learning company operating in countries all around the world. We provide content, assessment and digital services to schools, colleges and universities, as well as professional and vocational education to learners to help increase their skills and lifelong employability prospects. We believe that wherever learning flourishes so do people.

This specification is Issue 8. We will inform centres of any changes to this issue. The latest issue can be found on our website.

References to third-party material made in this specification are made in good faith. We do not endorse, approve or accept responsibility for the content of materials, which may be subject to change, or any opinions expressed therein. (Material may include textbooks, journals, magazines and other publications and websites.)

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Welcome

With a track record built over 30 years of learner success, BTEC Nationals are widely recognised by industry and higher education as the signature vocational qualification at Level 3. They provide progression to the workplace either directly or via study at a higher level. Proof comes from YouGov research, which shows that 62% of large companies have recruited employees with BTEC qualifications. What's more, well over 100,000 BTEC students apply to UK universities every year and their BTEC Nationals are accepted by over 150 UK universities and higher education institutes for relevant degree programmes either on their own or in combination with A Levels.

Why are BTECs so successful?

BTECs embody a fundamentally learner-centred approach to the curriculum, with a flexible, unit-based structure and knowledge applied in project-based assessments. They focus on the holistic development of the practical, interpersonal and thinking skills required to be able to succeed in employment and higher education.

When creating the BTEC Nationals in this suite, we worked with many employers, higher education providers, colleges and schools to ensure that their needs are met. Employers are looking for recruits with a thorough grounding in the latest industry requirements and work-ready skills such as teamwork. Higher education needs students who have experience of research, extended writing and meeting deadlines.

We have addressed these requirements with:

- a range of BTEC sizes, each with a clear purpose, so there is something to suit each learner's choice of study programme and progression plans
- refreshed content that is closely aligned with employers' and higher education needs for a skilled future workforce
- assessments and projects chosen to help learners progress to the next stage. This means some are set by you to meet local needs, while others are set and marked by Pearson so that there is a core of skills and understanding that is common to all learners. For example, a written test can be used to check that learners are confident in using technical knowledge to carry out a certain job.

We are providing a wealth of support, both resources and people, to ensure that learners and their teachers have the best possible experience during their course. See *Section 10* for details of the support we offer.

A word to learners

Today's BTEC Nationals are demanding, as you would expect of the most respected applied learning qualification in the UK. You will have to choose and complete a range of units, be organised, take some assessments that we will set and mark, and keep a portfolio of your assignments. But you can feel proud to achieve a BTEC because, whatever your plans in life – whether you decide to study further, go on to work or an apprenticeship, or set up your own business – your BTEC National will be your passport to success in the next stage of your life.

Good luck, and we hope you enjoy your course.

Collaborative development

Students completing their BTEC Nationals in Construction and the Built Environment will be aiming to go on to employment, often via the stepping stone of higher education. It was, therefore, essential that we developed these qualifications in close collaboration with experts from professional bodies, businesses and universities, and with the providers who will be delivering the qualifications. To ensure that the content meets providers' needs and provides high-quality preparation for progression, we engaged experts. We are very grateful to all the university and further education lecturers, teachers, employers, professional body representatives and other individuals who have generously shared their time and expertise to help us develop these new qualifications.

Professional bodies and businesses have provided letters of support confirming that these qualifications meet their entry requirements. These letters can be viewed on our website.

Summary of Pearson BTEC Level 3 National in Foundation Diploma in Construction and the Built Environment specification Issue 8 changes

Summary of changes made between the previous issue and this current issue	Page number
Change made to <i>Structures of the qualifications at a glance</i> section to remove incorrect indication that <i>Unit 3: Tendering and Estimating</i> is a mandatory unit in the Diploma (720 GLH) in Civil Engineering.	Page 6

Summary of Pearson BTEC Level 3 National in Foundation Diploma in Construction and the Built Environment specification Issue 7 changes

Summary of changes made between Issue 6 and Issue 7	Page number
The number of mandatory units for the Extended Diploma in Construction and the Built Environment and the Extended Diploma in Building Services Engineering in the <i>Qualification, sizes and purpose at a glance</i> section has been corrected to 15.	Page 5
Changes made to <i>Unit 1: Construction Principles Essential content</i> under A2 and A3 for clarity.	Pages 25 and 26
Changes made to <i>Unit 2: Construction Design Essential content</i> under A1, A2, B1, B4 and C1 for clarity.	Pages 37-41
Removal of references to MyBTEC, as that service is retiring.	Pages 158, 163, 168, 183, 184

If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com/en/support/contact-us.html.

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Introduction to BTEC National qualifications for the construction and the built environment sector

This specification contains the information you need to deliver the Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment. The specification signposts you to additional handbooks and policies. It includes all the units for this qualification.

This qualification is part of the suite of Construction and the Built Environment qualifications offered by Pearson. In the suite there are qualifications that focus on different progression routes, allowing learners to choose the one best suited to their aspirations.

All qualifications in the suite share some common units and assessments, allowing learners some flexibility in moving between qualifications where they wish to select a more specific progression route. The qualification titles are given below.

Within this suite are BTEC National qualifications for post-16 learners wishing to specialise in a specific industry, occupation or occupational group. The qualifications give learners specialist knowledge and technical skills, enabling entry to an Apprenticeship or other employment, or progression to related higher education courses. Learners taking these qualifications must have a significant level of employer involvement in their programmes.

In the construction and the built environment sector these are:

Pearson BTEC Level 3 National Extended Certificate in Construction and the Built Environment (603/0862/X)

Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment (603/0863/1)

Pearson BTEC Level 3 National Diploma in Construction and the Built Environment (603/0864/3)

Pearson BTEC Level 3 National Diploma in Building Services Engineering (603/1218/X)

Pearson BTEC Level 3 National Diploma in Civil Engineering (603/1217/8)

Pearson BTEC Level 3 National Extended Diploma in Construction and the Built Environment (603/0861/8)

Pearson BTEC Level 3 National Extended Diploma in Building Services Engineering (603/1219/1)

Pearson BTEC Level 3 National Extended Diploma in Civil Engineering (603/1216/6).

Other BTEC National qualifications in this sector provide a broad introduction that gives learners transferable knowledge and skills. These qualifications are for post-16 learners who want to continue their education through applied learning. The qualifications prepare learners for a range of higher education courses either by meeting entry requirements in their own right or by being accepted alongside other qualifications at the same level and adding value to them. Learners may progress to one of the qualifications in this specification having completed a smaller qualification that provides suitable fundamental knowledge and skills.

This specification signposts all the other essential documents and support that you need as a centre in order to deliver, assess and administer the qualification, including the staff development required. A summary of all essential documents is given in *Section 7*. Information on how we can support you with this qualification is given in *Section 10*.

The information in this specification is correct at the time of publication.

Total Qualification Time

For all regulated qualifications, Pearson specifies a total number of hours that it is estimated learners will require to complete and show achievement for the qualification: this is the Total Qualification Time (TQT). Within TQT, Pearson identifies the number of Guided Learning Hours (GLH) that we estimate a centre delivering the qualification might provide. Guided learning means activities, such as lessons, tutorials, online instruction, supervised study and giving feedback on performance, that directly involve teachers and assessors in teaching, supervising and invigilating learners. Guided learning includes the time required for learners to complete external assessment under examination or supervised conditions.

In addition to guided learning, other required learning directed by teachers or assessors will include private study, preparation for assessment and undertaking assessment when not under supervision, such as preparatory reading, revision and independent research.

BTEC Nationals have been designed around the number of hours of guided learning expected. Each unit in the qualification has a GLH value of 60, 90 or 120. There is then a total GLH value for the qualification.

Each qualification has a TQT value. This may vary within sectors and across the suite depending on the nature of the units in each qualification and the expected time for other required learning.

The following table show all the qualifications in this sector and their GLH and TQT values.

Qualifications, sizes and purposes at a glance

Title	Size and structure	Summary purpose
Pearson BTEC Level 3 National Extended Certificate in Construction and the Built Environment	360 GLH (490 TQT) Equivalent in size to one A Level. 4 units of which 4 are mandatory and 2 are external. Mandatory content (100%). External assessment (66%).	The Extended Certificate is for learners who are interested in learning about the construction sector alongside other fields of study, with a view to progressing to a wide range of higher education courses, not necessarily in construction-related subjects. It is designed to be taken as part of a programme of study that includes other appropriate BTEC Nationals or A Levels.
Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment	540 GLH (725 TQT) Equivalent in size to 1.5 A Levels. 7 units of which 4 are mandatory and 2 are external. Mandatory content (66%). External assessment (44%).	The Foundation Diploma is for learners looking to study construction as a one-year, full-time course, or for those wishing to take it alongside another area of contrasting or complementary study, as part of a two-year, full-time study programme. It supports progression to higher education, if taken as part of a programme of study that includes other BTEC Nationals or A Levels. It also supports progression to an Apprenticeship in the construction sector or to a further year of study at Level 3.
Pearson BTEC Level 3 National Diploma in Construction and the Built Environment	720 GLH (985 TQT) Equivalent in size to two A Levels. 10 units of which 7 are mandatory and 2 are external. Mandatory content (75%) External assessment (33%).	The Diploma is designed to be the substantive part of a 16–19 study programme for learners who want a strong core of sector study. This programme may include other BTEC Nationals or A Levels to support progression to higher education courses in construction areas before entering employment. The additional qualification(s) studied allow learners either to give breadth to their study programme by choosing a contrasting subject, or to give it more focus by choosing a complementary subject. This qualification can also be used to progress to Higher Apprenticeships.

Title	Size and structure	Summary purpose
<p>Pearson BTEC Level 3 National Diploma in Building Services Engineering</p>	<p>720 GLH (990 TQT) Equivalent in size to two A Levels. 10 units of which 6 are mandatory and 2 are external. Mandatory content (66%) External assessment (33%).</p>	<p>The Diploma is designed to be the substantive part of a 16–19 study programme for learners who want a strong core of sector study.</p> <p>This programme may include other BTEC Nationals or A Levels to support progression to higher education courses in construction areas before entering employment. The qualification is intended to meet the educational base for registration as a technician.</p> <p>The additional qualification(s) studied allow learners either to give breadth to their study programme by choosing a contrasting subject, or to give it more focus by choosing a complementary subject.</p> <p>This qualification can also be used, when studied part time, as part of an advanced technician Apprenticeship in building services engineering, or for progression to a Higher Apprenticeship in building services engineering.</p>
<p>Pearson BTEC Level 3 National Diploma in Civil Engineering</p>	<p>720 GLH (975 TQT) Equivalent in size to two A Levels. 10 units of which 7 are mandatory and 2 are external. Mandatory content (75%) External assessment (33%).</p>	<p>The Diploma is designed to be the substantive part of a 16–19 study programme for learners who want a strong core of sector study.</p> <p>This programme may include other BTEC Nationals or A Levels to support progression to higher education courses in construction areas before entering employment. The qualification is intended to meet the educational base for registration as a technician.</p> <p>The additional qualification(s) studied allow learners either to give breadth to their study programme by choosing a contrasting subject, or to give it more focus by choosing a complementary subject.</p> <p>This qualification can also be used, when studied part time, as part of an advanced technician Apprenticeship in civil engineering, or for progression to a Higher Apprenticeship in civil engineering.</p>

Title	Size and structure	Summary purpose
Pearson BTEC Level 3 National Extended Diploma in Construction and the Built Environment	1080 GLH (1465 TQT) Equivalent in size to three A Levels. 15 units of which 9 are mandatory and 3 are external. Mandatory content (66%) External assessment (33%).	<p>The Extended Diploma is a two-year, full-time course that meets entry requirements in its own right for learners who want to progress to higher education courses in construction areas before entering employment.</p> <p>It can also support learners who want to progress directly to employment in job roles in construction or a professional construction role and Higher Apprenticeships in the construction sector.</p>
Pearson BTEC Level 3 National Extended Diploma in Building Services Engineering	1080 GLH (1480 TQT) Equivalent in size to three A Levels. 15 units of which 7 are mandatory and 3 are external. Mandatory content (55%) External assessment (33%).	<p>The Extended Diploma is a two-year, full-time course that meets entry requirements in its own right for learners who want to progress to higher education courses in building services areas before entering employment. The qualification is intended to meet the educational base for registration as a technician.</p> <p>It supports learners who want to progress directly to employment in roles in building services engineering as technicians, or to a professional construction role and advanced/Higher Apprenticeships in building services engineering.</p>
Pearson BTEC Level 3 National Extended Diploma in Civil Engineering	1080 GLH (1450 TQT) Equivalent in size to three A Levels. 15 units of which 8 are mandatory and 3 are external. Mandatory content (66%) External assessment (33%).	<p>The Extended Diploma is a two-year, full-time course that meets entry requirements in its own right for learners who want to progress to higher education courses in civil engineering areas before entering employment. The qualification is intended to meet the educational base for registration as a technician.</p> <p>It supports learners who want to progress directly to employment in roles in civil engineering as technicians, or to a professional construction role and advanced/Higher Apprenticeships in civil engineering.</p>

Structures of the qualifications at a glance

This table shows all the units and the qualifications to which they contribute. The full structure for this Pearson BTEC Level 3 National in Construction and the Built Environment is shown in *Section 2*. **You must refer to the full structure to select units and plan your programme.**

Key

Unit assessed externally	M	Mandatory units	O	Optional units
CBE	Construction and the Built Environment		CE	Civil Engineering
			BSE	Building Services Engineering

Unit (number and title)	Unit size (GLH)	Extended Certificate (360 GLH)	Foundation Diploma (540 GLH)	Diploma (720 GLH)			Extended Diploma (1080 GLH)		
				CBE	CE	BSE	CBE	CE	BSE
1 Construction Principles	120	M	M	M	M	M	M	M	M
2 Construction Design	120	M	M	M	M	M	M	M	M
3 Tendering and Estimating	120						M	M	M
4 Construction Technology	60	M	M	M	M	M	M	M	M
5 Health and Safety in Construction	60	M	M	M	M	M	M	M	M
6 Surveying in Construction	60		O	M	O		M	O	
7 Graphical Detailing in Construction	60		O	M	O	O	M	O	O
8 Building Regulations and Control in Construction	60		O	M			M	O	
9 Management of a Construction Project	60		O	O	O	O	M	O	O
10 Building Surveying in Construction	60		O	O			O	O	
11 Site Engineering for Construction	60		O	O	M		O	M	
12 Low Temperature Hot Water Systems in Building Services	60			O		O	O		O
13 Measurement Techniques in Construction	60		O	O	O		O	O	
14 Provision of Primary Services in Construction	60		O	O		M	O		M
15 Further Mathematics for Construction	60				M	O	O	M	O
16 Work Experience in the Construction Sector	60						O	O	O
17 Projects in Construction	60			O	O	O	O	O	O
18 Building Information Modelling	60			O	O	O	O	O	O

continued overleaf

Unit (number and title)	Unit size (GLH)	Extended Certificate (360 GLH)	Foundation Diploma (540 GLH)	Diploma (720 GLH)			Extended Diploma (1080 GLH)		
				CBE	CE	BSE	CBE	CE	BSE
19 Quantity Surveying	60		O	O		O	O		O
20 Quality Control Management in Construction	60			O			O	O	O
21 Building Services Science	60					M	O		M
22 Economics and Finance in Construction	60						O		
23 Construction in Civil Engineering	60				M		O	M	
24 Planning Application Procedures in Construction	60						O		
25 Property Law	60						O		
26 Conversion, Adaptation and Maintenance of Buildings	60						O		
27 Building Services Control Systems	60					O			O
28 Heating, Ventilation and Air Conditioning Design	60					O			O
29 Use of Static and Dynamic Fluids in Building Services Engineering	60					O			O
30 Plumbing Technology in Building Services Engineering	60					O			O
31 Electrical Principles in Building Services Engineering	60					O			O
32 Electrical Installation Standards, Components and Design	60					O			O
33 Quantity Surveying Measurement Techniques in Building Services Engineering	60					O			O
34 Building Regulations and Control in Building Services Engineering	60					O			O
35 Principles and Applications of Structural Mechanics	60				O			O	
36 Public Health Engineering	60				O			O	
37 Specialist Civil Engineering Techniques	60				O			O	
38 Highway Construction and Maintenance in Civil Engineering	60				O			O	

Unit (number and title)	Unit size (GLH)	Extended Certificate (360 GLH)	Foundation Diploma (540 GLH)	Diploma (720 GLH)			Extended Diploma (1080 GLH)		
				CBE	CE	BSE	CBE	CE	BSE
39 Housing Design Project	60			0			0		
40 Offsite and Onsite Alternative Construction Methods	60			0			0		
41 Renewable Energy for Housing	60			0			0		
42 The Housing Industry	60			0			0		

Qualification and unit content

Pearson has developed the content of the new BTEC Nationals in collaboration with employers and representatives from higher education and relevant professional bodies. In this way, we have ensured that content is up to date and that it includes the knowledge, understanding, skills and attributes required in the sector.

Each qualification in the suite has its own purpose. The mandatory content provides a balance of breadth and depth ensuring that all learners have a strong basis for developing technical skills required in the sector. Learners are then offered the opportunity to develop a range of technical skills and attributes expected by employers, with some opportunity to select between optional units where a degree of choice for individual learners to study content relevant to their own progression choices is appropriate. It is expected that learners will apply their learning in relevant employment and sector contexts during delivery and have opportunities to engage meaningfully with employers.

The proportion of mandatory content ensures that all learners are following a coherent programme of study and acquiring the knowledge, understanding and skills that will be recognised and valued. Learners are expected to show achievement across mandatory units as detailed in *Section 2*.

BTEC Nationals have always required applied learning that brings together knowledge and understanding (the cognitive domain) with practical and technical skills (the psychomotor domain). This is achieved through learners performing vocational tasks that encourage the development of appropriate vocational behaviours (the affective domain) and transferable skills. Transferable skills are those such as communication, teamwork, planning and completing tasks to high standards, which are valued in both the workplace and in higher education.

Our approach provides rigour and balance, and promotes the ability to apply learning immediately in new contexts. Further details can be found in *Section 2*.

Centres should ensure that delivery of content is kept up to date. Some of the units within the specification may contain references to legislation, policies, regulations and organisations, which may not be applicable in the country you deliver this qualification in (if teaching outside of England), or which may have gone out-of-date during the lifespan of the specification. In these instances, it is possible to substitute such references with ones that are current and applicable in the country you deliver subject to confirmation by your Standards Verifier.

Assessment

Assessment is specifically designed to fit the purpose and objective of the qualification. It includes a range of assessment types and styles suited to vocational qualifications in the sector. There are three main forms of assessment that you need to be aware of: external, internal and synoptic.

Externally-assessed units

Each external assessment for a BTEC National is linked to a specific unit. All of the units developed for external assessment are of 120 GLH to allow learners to demonstrate breadth and depth of achievement. Each assessment is taken under specified conditions, then marked by Pearson and a grade awarded. Learners are permitted to resit external assessments during their programme. You should refer to our website for current policy information on permitted retakes.

The styles of external assessment used for qualifications in the Construction and the Built Environment suite are:

- examinations – all learners take the same assessment at the same time, normally with a written outcome
- set tasks – learners take the assessment during a defined window and demonstrate understanding through completion of a vocational task.

Some external assessments include a period of preparation using set information. External assessments are available once or twice a year. For detailed information on the external assessments please see the table in *Section 2*. For further information on preparing for external assessment see *Section 5*.

Internally-assessed units

Most units in the sector are internally assessed and subject to external standards verification. This means that you set and assess the assignments that provide the final summative assessment of each unit, using the examples and support that Pearson provides. Before you assess you will need to become an approved centre, if you are not one already. You will need to prepare to assess using the guidance in *Section 6*.

In line with the requirements and guidance for internal assessment, you select the most appropriate assessment styles according to the learning set out in the unit. This ensures that learners are assessed using a variety of styles to help them develop a broad range of transferable skills. Learners could be given opportunities to:

- demonstrate practical and technical skills using appropriate (tools/processes etc.)
- complete realistic tasks to meet specific briefs or particular purposes
- write up the findings of their own research
- use case studies to explore complex or unfamiliar situations
- carry out projects for which they have choice over the direction and outcomes.

You will make grading decisions based on the requirements and supporting guidance given in the units. Learners may not make repeated submissions of assignment evidence. For further information see *Section 6*.

Synoptic assessment

Synoptic assessment requires learners to demonstrate that they can identify and use effectively, in an integrated way, an appropriate selection of skills, techniques, concepts, theories and knowledge from across the whole sector as relevant to a key task. BTEC learning has always encouraged learners to apply their learning in realistic contexts using scenarios and realistic activities that will permit learners to draw on and apply their learning. For these qualifications we have formally identified units which contain a synoptic assessment task. Synoptic assessment must take place after the teaching and learning of other mandatory units in order for learners to be able to draw from the full range of content. The synoptic assessment gives learners an opportunity to independently select and apply learning from across their programmes in the completion of a vocational task. Synoptic tasks may be in internally or externally assessed units. The particular unit that contains the synoptic tasks for this qualification is shown in the structure in *Section 2*.

Language of assessment

Assessment of the internal and external units for these qualifications will be available in English. All learner work must be in English. A learner taking the qualifications may be assessed in British or Irish Sign Language where it is permitted for the purpose of reasonable adjustment. For information on reasonable adjustments see *Section 7*.

Grading for units and qualifications

Achievement in the qualification requires a demonstration of depth of study in each unit, assured acquisition of a range of practical skills required for employment or progression to higher education, and successful development of transferable skills. Learners achieving a qualification will have achieved across mandatory units, including external and synoptic assessment.

Units are assessed using a grading scale of Distinction (D), Merit (M), Pass (P), Near Pass (N) and Unclassified (U). The grade of Near Pass is used for externally-assessed units only. All mandatory and optional units contribute proportionately to the overall qualification grade, for example a unit of 120 GLH will contribute double that of a 60 GLH unit.

Qualifications in the suite are graded using a scale of P to D*, **or** PP to D*D*, **or** PPP to D*D*D*. Please see *Section 9* for more details. The relationship between qualification grading scales and unit grades will be subject to regular review as part of Pearson's standards monitoring processes on the basis of learner performance and in consultation with key users of the qualification.

UCAS Tariff points

The BTEC Nationals attract UCAS points. Please go to the UCAS website for full details of the points allocated.

1 Qualification purpose

Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment

In this section you will find information on the purpose of this qualification and how its design meets that purpose through the qualification objective and structure. We publish a full 'Statement of Purpose' for each qualification on our website. These statements are designed to guide you and potential learners to make the most appropriate choice about the size of qualification suitable at recruitment.

The construction sector

Construction is a very important global industry and is worth £90 billion annually to the UK economy. At technician level and beyond, there is a diverse range of career pathways, with established professional entry and development routes in civil engineering, building services engineering, design/architecture and construction supervision/management. Currently, qualified construction technicians, managers and professionals are highly sought after in the UK industry, with demand for a greater number of professionals to implement and lead low-carbon and sustainable building projects in an efficient, cost-effective way.

Who is this qualification for?

The Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment is intended as a Tech Level qualification, equivalent in size to 1.5 A Levels. It is designed to meet the Tech Bacc measure when studied alongside Level 3 mathematics and the Extended Project Qualification (EPQ). Outside the Tech Bacc, it will normally be the main qualification in a one-year study programme, particularly for those looking for a full-time course specialising in the construction sector, and who intend to progress to employment in one of the wide variety of roles available.

As well as direct entry to employment, this qualification will prepare learners for higher study of a specialist degree, or a BTEC Higher National Certificate/Diploma. This route gives learners the opportunity to enter the sector at a higher level, or in a more specialist role.

No prior study of the sector is needed but learners should normally have a range of achievement at Level 2, in GCSEs or equivalent qualifications, including English, mathematics and science.

What does the qualification cover?

The content of this qualification has been developed in consultation with employers and professional bodies to ensure that it is appropriate for those interested in working in the sector. In addition, higher education representatives have been involved to ensure that it fully supports entry to the relevant range of specialist degrees.

The qualification provides the essential knowledge, understanding and skills that will prepare learners to work as a trainee or for further study.

There are four mandatory units, which cover the following aspects of construction:

- construction principles
- construction design
- health and safety in construction
- construction technology.

The mandatory units will introduce learners to personal responsibilities for health, safety and welfare, the industry and legislative requirements for health and safety, and the application of organisational processes and risk management to ensure compliance.

Learners will be able to choose three optional units focusing on their areas of preferred specialism. These units have been designed to support learners' progression to a range of employment opportunities in the construction sector and will allow them a choice of covering principles across one or more of the following disciplines:

- construction and the built environment
- building services engineering
- civil engineering.

Additional technical optional units cover areas such as:

- graphical detailing in construction
- mechanical and electrical services
- measurement techniques
- building surveying in construction
- site engineering for construction
- low temperature hot water in building services.

Learners will be required to engage with sector employers as part of your course.

What could this qualification lead to?

This qualification will prepare learners for direct employment in the construction and built environment sector, and is ideal if they wish to enter a particular specialist area of work, such as:

- trainee site engineer
- trainee construction project technician
- trainee mechanical/electrical services technician
- trainee technician estimator/buyer/planner
- trainee construction design technician.

Learners may use this qualification as a foundation for a further year of study to achieve a Pearson BTEC Level 3 National Extended Diploma in Construction and the Built Environment. The core units studied in this qualification can allow for progression to the second year of the Extended Diploma.

There are many roles in this sector where recruitment is at graduate level. Learners can study additional qualifications alongside this qualification, such as an AS Level and A Level. The qualification carries UCAS points and is recognised by higher education providers as meeting admission requirements to many relevant courses, for example:

- BSc (Hons) in Construction Management, if taken in combination with subjects such as business and mathematics
- BSc (Hons) in Property Management (Building Surveying), if taken in combination with subjects such as science and mathematics
- BSc (Hons) in Architecture, if taken in combination with subjects such as science and art
- BSc (Hons) in Civil Engineering, if taken in combination with subjects such as science and mathematics
- HNC/D in Civil Engineering, if taken in combination with subjects such as science and mathematics
- HNC/D in Building Services Engineering, if taken in combination with subjects such as mathematics and physics
- HND in Construction and the Built Environment, if taken in combination with subjects such as science and mathematics.

Learners should always check the entry requirements for degree programmes with specific higher education providers. After this qualification, learners can also progress directly into employment, however it is likely that many will do so via higher study. Areas of employment include specialist roles, such as trainee site engineer, trainee construction project technician, trainee mechanical/electrical services technician, trainee technician estimator/buyer/planner, trainee construction design technician.

As part of their higher study choices, learners may also choose to progress to a BTEC Higher National (HN) qualification. HNs are widely supported by higher education and industry as the principal vocational qualifications at Levels 4 and 5 and are designed to reflect the increasing need for high quality professional and technical education at Levels 4 and 5. They provide learners with a clear line of sight to employment and to a degree at Level 6 if they choose. The Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment meets the admission requirements for:

- Pearson BTEC Level 4 Higher National Certificate in Construction and the Built Environment
- Pearson BTEC Level 5 Higher National Diploma in Construction and the Built Environment.

How does the qualification provide employability and technical skills?

In the BTEC National units there are opportunities during the teaching and learning phase to give learners practice in developing employability skills. Where employability skills are referred to in this specification, we are generally referring to skills in the following three main categories:

- **cognitive and problem-solving skills:** use critical thinking, approach non-routine problems applying expert and creative solutions, use systems and technology
- **intrapersonal skills:** communicating, working collaboratively, negotiating and influencing, self-presentation
- **interpersonal skills:** self-management, adaptability and resilience, self-monitoring and development.

There are also specific requirements in some units for assessment of these skills where relevant. For example, where learners are required to undertake real or simulated activities.

Many of the mandatory and specified optional units encourage learners to develop the specific practical skills that employers are looking for.

How does the qualification provide transferable knowledge and skills for higher education?

All BTEC Nationals provide transferable knowledge and skills that prepare learners for progression to university or other higher study either immediately or for career progression. The transferable skills that universities value include:

- the ability to learn independently
- the ability to research actively and methodically
- being able to give presentations and being active group members.

BTEC learners can also benefit from opportunities for deep learning where they are able to make connections among units and select areas of interest for detailed study. BTEC Nationals provide a vocational context in which learners can become prepared for life-long learning through:

- reading technical texts
- analytical skills.

2 Structure

Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment

Mandatory units

There are four mandatory units, two internal and two external. Learners must complete and achieve at Near Pass grade or above in all mandatory external units in group A. Learners must complete all units in group B.

Optional units

Learners must complete at least three optional units.

Pearson BTEC Level 3 National Foundation Diploma in Construction and the Built Environment				
Unit number	Unit title	GLH	Type	How assessed
Mandatory units group A – learners complete and achieve all units				
1	Construction Principles	120	Mandatory	External
2	Construction Design	120	Mandatory and Synoptic	External
Mandatory units group B – learners complete all units				
4	Construction Technology	60	Mandatory	Internal
5	Health and Safety in Construction	60	Mandatory	Internal
Optional units – learners complete 3 units				
6	Surveying in Construction	60	Optional	Internal
7	Graphical Detailing in Construction	60	Optional	Internal
8	Building Regulations and Control in Construction	60	Optional	Internal
9	Management of a Construction Project	60	Optional	Internal
10	Building Surveying in Construction	60	Optional	Internal
11	Site Engineering for Construction	60	Optional	Internal
13	Measurement Techniques in Construction	60	Optional	Internal
14	Provision of Primary Services in Buildings	60	Optional	Internal
19	Quantity Surveying	60	Optional	Internal

External assessment

This is a summary of the type and availability of external assessment, which is of units making up 44% of the total qualification GLH. See *Section 5* and the units and sample assessment materials for more information.

Unit	Type	Availability
Unit 1: Construction Principles	<ul style="list-style-type: none">• Written exam.• 1 hour 30 minutes.• Written submission.• 75 marks.	Jan and May/June First assessment May/June 2018
Unit 2: Construction Design	<ul style="list-style-type: none">• A task set and marked by Pearson and completed under supervised conditions.• Before the supervised assessment, learners will be given information to research in approximately three hours in a two-week period timetabled by Pearson.• The supervised assessment is 12 hours in a two-week period timetabled by Pearson.• Written submission of evidence.• 63 marks.	May/June First assessment May/June 2018

Synoptic assessment

The mandatory synoptic assessment requires learners to apply learning from across the qualification to the completion of a defined vocational task. Within the assessment for *Unit 2: Construction Design* learners complete a task to demonstrate the application of skills involved in the design and construction of low- and medium-rise buildings and structures, evaluating the effectiveness of a design solution against client requirements and external constraints. This draws together underpinning knowledge of how to go through clear design processes, along with practical knowledge of how to use different manual and computer-aided methods. Learners complete the task using knowledge and understanding from their studies of the sector and apply both transferable and specialist knowledge and skills.

In delivering the unit you need to encourage learners to draw on their broader learning so they will be prepared for the assessment.

Employer involvement in assessment and delivery

You need to ensure that learners on this qualification have a significant level of employer involvement in programme delivery or assessment. See *Section 4* for more information.

3 Units

Understanding your units

The units in this specification set out our expectations of assessment in a way that helps you to prepare your learners for assessment. The units help you to undertake assessment and quality assurance effectively.

Each unit in the specification is set out in a similar way. There are two types of unit format:

- internal units
- external units.

This section explains how the units work. It is important that all teachers, assessors, internal verifiers and other staff responsible for the programme review this section.

Internal units

Section	Explanation
Unit number	The number is in a sequence in the sector. Numbers may not be sequential for an individual qualification.
Unit title	This is the formal title that we always use and it appears on certificates.
Level	All units are at Level 3 on the national framework.
Unit type	This shows if the unit is internal or external only. See structure information in <i>Section 2</i> for full details.
GLH	Units may have a GLH value of 120, 90 or 60 GLH. This indicates the numbers of hours of teaching, directed activity and assessment expected. It also shows the weighting of the unit in the final qualification grade.
Unit in brief	A brief formal statement on the content of the unit that is helpful in understanding its role in the qualification. You can use this in summary documents, brochures etc.
Unit introduction	This is designed with learners in mind. It indicates why the unit is important, how learning is structured, and how learning might be applied when progressing to employment or higher education.
Learning aims	These help to define the scope, style and depth of learning of the unit. You can see where learners should be learning standard requirements ('understand') or where they should be actively researching ('investigate'). You can find out more about the verbs we use in learning aims in <i>Appendix 2</i> .
Summary of unit	This new section helps teachers to see at a glance the main content areas against the learning aims and the structure of the assessment. The content areas and structure of assessment are required. The forms of evidence given are suitable to fulfil the requirements.
Content	This section sets out the required teaching content of the unit. Content is compulsory except when shown as 'e.g.'. Learners should be asked to complete summative assessment only after the teaching content for the unit or learning aim(s) has been covered.

Section	Explanation
Assessment criteria	<p>Each learning aim has Pass and Merit criteria. Each assignment has at least one Distinction criterion.</p> <p>A full glossary of terms used is given in <i>Appendix 2</i>. All assessors need to understand our expectations of the terms used.</p> <p>Distinction criteria represent outstanding performance in the unit. Some criteria require learners to draw together learning from across the learning aims.</p>
Essential information for assignments	<p>This shows the maximum number of assignments that may be used for the unit to allow for effective summative assessment, and how the assessment criteria should be used to assess performance.</p>
Further information for teachers and assessors	<p>The section gives you information to support the implementation of assessment. It is important that this is used carefully alongside the assessment criteria.</p>
Resource requirements	<p>Any specific resources that you need to be able to teach and assess are listed in this section. For information on support resources see <i>Section 10</i>.</p>
Essential information for assessment decisions	<p>This information gives guidance for each learning aim or assignment of the expectations for Pass, Merit and Distinction standard. This section contains examples and essential clarification.</p>
Links to other units	<p>This section shows you the main relationship among units. This section can help you to structure your programme and make best use of materials and resources.</p>
Employer involvement	<p>This section gives you information on the units that can be used to give learners involvement with employers. It will help you to identify the kind of involvement that is likely to be successful.</p>

External units

Section	Explanation
Unit number	The number is in a sequence in the sector. Numbers may not be sequential for an individual qualification.
Unit title	This is the formal title that we always use and it appears on certificates.
Level	All units are at Level 3 on the national framework.
Unit type	This shows if the unit is internal or external only. See structure information in <i>Section 2</i> for full details.
GLH	Units may have a GLH value of 120, 90 or 60 GLH. This indicates the numbers of hours of teaching, directed activity and assessment expected. It also shows the weighting of the unit in the final qualification grade.
Unit in brief	A brief formal statement on the content of the unit.
Unit introduction	This is designed with learners in mind. It indicates why the unit is important, how learning is structured, and how learning might be applied when progressing to employment or higher education.
Summary of assessment	This sets out the type of external assessment used and the way in which it is used to assess achievement.
Assessment outcomes	These show the hierarchy of knowledge, understanding, skills and behaviours that are assessed. Includes information on how this hierarchy relates to command terms in sample assessment materials (SAMs).
Essential content	For external units all the content is obligatory, the depth of content is indicated in the assessment outcomes and sample assessment materials (SAMs). The content will be sampled through the external assessment over time, using the variety of questions or tasks shown.
Grade descriptors	We use grading descriptors when making judgements on grade boundaries. You can use them to understand what we expect to see from learners at particular grades.
Key terms typically used in assessment	These definitions will help you analyse requirements and prepare learners for assessment.
Resources	Any specific resources that you need to be able to teach and assess are listed in this section. For information on support resources see <i>Section 10</i> .
Links to other units	This section shows the main relationship among units. This section can help you to structure your programme and make best use of materials and resources.
Employer involvement	This section gives you information on the units that can be used to give learners involvement with employers. It will help you to identify the kind of involvement that is likely to be successful.

Index of units

This section contains all the units developed for this qualification. Please refer to *pages 4–5* to check which units are available in all qualifications in the Construction and the Built Environment sector.

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Unit 1: Construction Principles

Level: **3**

Unit type: **External**

Guided learning hours: **120**

Unit in brief

Learners demonstrate an understanding of the underlying principles used in the design, construction and refurbishments of buildings and infrastructure.

Unit introduction

Roles in the construction and built environment industry require the application of knowledge and understanding related to the design of structures and infrastructure, selection and use of construction materials, and the provision of human comfort in buildings. Whether you want to become a site manager, designer, engineer or surveyor, you will apply the knowledge and skills to ensure that materials are fit for purpose and that specified quantities are ordered and used on a construction project.

In this unit, you will develop the skills needed to solve a variety of practical construction problems by applying scientific knowledge and carrying out mathematical and statistical techniques. You will learn about the science underpinning the manufacture, properties and degradation of construction materials. You will apply mathematical principles and techniques to carry out calculations that determine how materials behave under the action of forces or loads when used as structural members, and draw conclusions regarding whether a material is fit for purpose. You will understand scientific principles and apply them to heat loss, sound reduction and lighting levels to provide human comfort during structure design, build and refurbishment.

This unit gives a foundation to help you progress to a wide range of construction-related higher education qualifications, and will support you in a variety of construction roles such as technician, and Higher Level Apprenticeships.

Summary of assessment

This unit is assessed through a written examination set and marked by Pearson.

The examination is 1 hour and 30 minutes. During the supervised assessment period, learners will be assessed on their knowledge of construction materials and their properties, application of mathematics in construction contexts, and the provision of human comfort in buildings. The number of marks for the paper is 75.

The assessment availability is January and May/June each year. The first assessment availability is May/June 2018.

Sample assessment materials will be available to help centres prepare learners for assessment.

Assessment outcomes

AO1 Demonstrate knowledge of construction terms, standards, concepts, methods and processes

Command words: calculate, describe, explain, identify, state/give

Marks: ranges from 1 to 4 marks

AO2 Demonstrate understanding of construction standards, concepts, methods and processes in context, in order to find solutions to real-life construction problems

Command words: calculate, describe, discuss, draw, explain, find

Marks: ranges from 1 to 8 marks

AO3 Analyse and evaluate information in order to recommend and justify the use of technologies and methodologies to solve construction problems in context

Command words: analyse, discuss, evaluate

Marks: ranges from 6 to 12 marks

AO4 Make connections between information, technologies and methodologies to resolve construction problems

Command words: analyse, discuss, evaluate

Marks: ranges from 8 to 12 marks

Essential content

The essential content is set out under content areas. Learners must cover all specified content before the assessment.

A Construction materials

The use of materials in construction, including their manufacture, the properties of materials linked to their use, the degradation of materials, the effects of temperature change on materials and the behaviour of materials under different loading conditions.

A1 Properties of materials

Material properties, terminology and use in construction:

- mass and density
- strength – tensile, compressive, shear, bending
- hardness
- toughness
- malleability
- workability
- stiffness
- fatigue and creep
- fire resistance
- electrical conductivity and conductance
- thermal conductivity and conductance
- resistance to moisture penetration
- resistance to vapour penetration
- resistance to degradation
- embedded energy
- recycling potential.

A2 Properties of construction materials

Key properties of construction materials, how they work together to provide composite performance and properties, how they impact on performance in use and on the specification of materials for different scenarios and levels of exposure to the elements.

- Bricks – facings, Class A engineering, Class B engineering, commons.
- Concrete – prescribed mixes, design mixes, new mixes using additives, smart concrete, hempcrete, mixes by ratio of volume, mixes by ratio of weight, screed mixes.
- Concrete blocks – aerated, high density, insulated.
- Mortar mixes – cement mortar, lime mortar, cement lime mortar, coloured mortar.
- Sand – building, sharp, silver.
- Plasterboard.
- Glass and glass finishes – structural, smart, laminated, tempered, float, clear, obscured.
- Insulation materials – fibreglass, expanded polystyrene, Celotex, mineral wool, cellulose, straw, polyurethane.
- Plastics used for polythene damp-proof membranes (DPM), damp-proof courses (DPC).
- Plastics used for doors and window frames, soffits, bargeboards, fascia, guttering, Polyvinylchloride (PVC), unplasticised Polyvinylchloride (uPVC).
- Timber and manufactured boards – hardwoods, softwoods, plywood, chipboard, particle board, medium-density fibreboard (MDF).
- Roofing materials – slate, concrete, pantile, roofing felt, thatch, ridge, lead flashing, green/living roofs, smart roofing materials, coverings with built-in PV cells.
- Engineered timber – SIPS (Structural Insulated Panels), glulam beams, engineered joists.
- Steel – mild, stainless, high strength.
- Aluminium alloys.

A3 Manufacturing and processing of construction materials

The manufacturing, processing and technology of construction materials and how this impacts on properties and fitness for purpose.

- Materials:
 - cements – ordinary Portland and sulphate-resisting cement
 - steels – mild and stainless
 - concrete – including modern concretes, fedcrete, hempcrete, admixtures, FEB
 - bricks – engineering and facing bricks
 - concrete blocks – aerated, high density, insulated
 - aluminium alloys
 - glass – laminated, tempered, float, smart and structural glass.
- Technologies:
 - 3D printing
 - CNC to manufacture structural elements
 - on-site robotics to perform repetitive tasks in construction.

A4 Degradation of construction materials

The impact of the environment on building materials for various scenarios, degradation methods and types, preventive and reduction measures, and impact of failure of a single material in a composite element.

- Sources of degradation and their cause:
 - natural agents – ageing, ultraviolet (UV) radiation
 - timber infestation – insect attack, fungal
 - timber decay – wet rot, dry rot, lichens and mosses
 - moisture movement – capillary action, shrinkage
 - exposure conditions – weathering, freeze-thaw, thermal ageing, creep, humidity, loadings
 - chemical degradation – acid rain, sulphate, alkalis, leaching
 - corrosion in metals – oxidation.
- Remedial measures to prevent and reduce degradation and their benefits and drawbacks:
 - use of special paints
 - protective coatings.
- Material failure:
 - concrete and reinforced concrete
 - brickwork
 - timber – external and internal applications
 - steel
 - mortars.

A5 Effects of temperature changes on construction materials

- Types of heat: latent, sensible.
- The effect of temperature change on the properties of materials:
 - changes of state
 - evaporation
 - expansion and contraction.

A6 Behaviour of structural members under load

- Types of structural members:
 - beams, lintels
 - columns, walls and frames
 - struts and ties.

- The effect of different loading conditions and potential failure of beams, lintels, columns, walls, frames, struts and ties in the following materials:
 - concrete
 - reinforced concrete
 - timber
 - steel.
- Types, configuration and effect of loads:
 - dead and live load
 - imposed and wind loads
 - point and distributed loads.
- Characteristics, properties and use of types of supports – pinned, roller, hinged and fixed.
- Effects of structural failure on structural members.

B Solving practical construction problems

B1 Application of mathematical and statistical methods and techniques used in practical construction contexts

Recall, perform procedures, demonstrate an understanding of and analyse information in a variety of construction contexts by applying mathematical and statistical techniques, including the following.

- Algebraic techniques:
 - linear equations of the form $y = mx + c$
 - pair of simultaneous linear equations in two unknowns
 - factorisation and quadratics:
 - multiply expressions in brackets by a number, symbol or by another expression in a bracket
 - by extraction of a common factor $a(x + y)$, $a(x + 2) + b(x + 2)$
 - by grouping $ax - ay + bx - by$
 - quadratic expressions $a^2 + 2ab + b^2$
 - roots of an equation, including quadratic equations with real roots by factorisation, use of quadratic formula, completing the square
 - rearranging formulae to change subject of formulae, complex formulae involving exponents, roots and trigonometric identities
 - substituting values into and evaluating formulae.
- Accuracy of calculations:
 - use of significant figures
 - use of approximation to check a calculation
 - effects of rounding-off errors.
- Trigonometric techniques:
 - trigonometric functions: sine, cosine, tangent ratios
 - application of trigonometry to determine dimensions in 2D and 3D:
 - in surveying
 - in setting out
 - other practical contexts.
- Circular measure:
 - radian measure
 - conversion of degree measure to radian measure and vice versa
 - arc length $s = r\theta$
 - area of sector $A = \frac{1}{2}r^2\theta$
- Geometric techniques:
 - properties of points, lines, angles, circles
 - Pythagoras' theorem.

- Graphical techniques:
 - Cartesian coordinates
 - intersections of graph lines with axes
 - gradients of straight lines
 - equations of graphs: straight line
 - areas under graphs: straight line
 - interpolation and extrapolation.
- Mensuration techniques for quantity surveying and buying:
 - calculation of perimeters, centre lines, areas, surface areas and volumes of:
 - rectangles, squares, triangles, circles, trapeziums
 - prisms, spheres, pyramids, cones, cylinders
 - compound and irregular shapes and objects.
- Statistical techniques:
 - types of data: discrete data, continuous data, ungrouped data, grouped data
 - methods of visual presentation of statistics and data, interpretation and production of: line graphs, bar charts, scatter diagrams, pie charts, histograms, distribution curve, Venn diagrams, tables
 - processing large groups of data to achieve mean, median, mode
 - statistical methods to present data and make decisions based on them
 - interpretation of climate maps.
- Application of mathematical techniques used in structural analysis:
 - concurrent and non-concurrent coplanar forces
 - relationship between force (load), mass and acceleration due to gravity
 - forces: tension, compression, shear
 - application of Hooke's law $F = -kx$ and $F = kx$
 - stress, strain and modulus of elasticity
 - loading as the result of gravitational attraction
 - shear force and bending moment in a beam and its effect on the beam cross section
 - equilibrium conditions to ensure stability of a beam
 - determination of support reactions for simply supported beams with point and distributed loads.
- Application of mathematical techniques involving the human comfort effect of temperature on construction materials while in situ:
 - calculating the effect of temperature change on materials
 - coefficients of thermal expansion application and its significance for selecting fit-for-purpose construction materials and details
 - calculation of U -value
 - calculating required insulation thickness
 - calculation of structural temperature profiles
 - calculation of dew-point temperature profiles.
- Calculation of sound absorption coefficients, reverberation, actual and optimum reverberation times.
- Application of mathematical techniques to determine lighting requirements:
 - inverse square law of illumination:

$$E = \frac{I}{r^2}$$
 - cosine law of illumination:

$$E = \frac{I}{d^2} \cos \theta$$
 - lumen method of design
 - daylight factor.
- Application of the desktop method to determine daylight factor.

C Human comfort

The impact of heat, light and sound on human comfort in the built environment.

C1 Heat

The impact of the natural and built environment on human comfort and the provision of comfortable living and working environments.

- Scientific principles and their application in the built environment:
 - air temperature
 - mean radiant temperature
 - relative humidity
 - air movement
 - dry and wet bulb temperatures
 - mechanisms of heat transfer:
 - conduction
 - convection
 - radiation.
- Measurement instruments and their application in heat in determining human comfort conditions:
 - thermometer
 - globe thermometer
 - hygrometer
 - anemometer
 - electronic control systems
 - thermostats
 - remote monitoring systems, e.g. smartphone applications to monitor and control temperature.
- Acceptable thermal comfort parameters according to:
 - current building regulations
 - combination of personal factors and thermal comfort requirements:
 - age
 - gender
 - clothing
 - state of health
 - level of activity
 - metabolic rate.
- Principles of heat losses and gains in buildings and methods to control them to provide human comfort in buildings:
 - how heat is lost in a building:
 - fabric heat losses
 - ventilation heat losses
 - thermal bridges and their impact on heat losses
 - contribution of air changes to heat losses
 - factors contributing to heat gains and losses:
 - insulation of building
 - surface area of the external shell
 - exposure and impact of local climatic conditions on a building
 - temperature difference between inside and outside
 - air change rate
 - building use
 - thermal conductivity and thermal resistance
 - significance of the insulating material and its thickness
 - determination of fabric and ventilation heat losses.

- Heat loss control methods (alternative: methods for controlling heat loss from buildings):
 - roof, wall and floor insulation
 - double/triple glazing, low emissivity glass
 - secondary glazing
 - draught reduction
 - insulated building materials
 - location and type of heating installations in a building.
- The source and causes of condensation, the consequences of its occurrence and potential impact on the building fabric and methods of control to provide human comfort in buildings:
 - sources of water vapour in buildings
 - causes and effects of condensation in buildings
 - impact of structural temperature profiles
 - impact of dew-point temperature profiles
 - prediction and prevention of condensation
 - interstitial condensation
 - methods for controlling condensation in buildings:
 - air conditioning
 - heating and ventilation
 - dehumidification
 - extractor fans.

C2 Acoustics

Scientific principles of sound, its relation to human comfort and the acoustic fitness for purpose of the area relative to its intended use.

- Scientific principles:
 - difference between sound and noise
 - frequency of sound
 - standard units
 - addition and averaging of decibel levels
 - sound reduction indices
 - reverberation times.
- Acceptable acoustic comfort parameters of an area relative to its intended use:
 - current building regulations
 - noise criteria indices
 - personal factors:
 - age
 - previous exposure to noise
 - state of health
 - activity.
- Measurement of sound levels.
- Difference between sound insulation and sound absorption.
- Difference between airborne and impact sound.
- Issues associated with flanking transmission.
- Reasons why sound insulation and sound reduction is required.
- Understanding and application of sound insulation approaches:
 - source-path-receiver approach
 - improving structural elements
 - controlling flanking sound
 - use of appropriate materials to reduce sound.

C3 Lighting

Scientific principles and the provision of appropriate lighting levels and type for various activities in the built environment.

- Scientific principles:
 - differences between natural and artificial light
 - illuminance levels
 - daylight factors
 - glare indices
 - direct and reflected light
 - power of a light source
 - flow of light energy
 - illumination of surface.
- Standard units of measurement:
 - candela – power of a light source
 - lumen – flow of light energy
 - lux – illumination on surface.
- Acceptable illuminance levels for different activities and building use.
- Variation of daylight factors in a room.
- Principal components of daylight factor:
 - sky component (SC)
 - externally reflected component (ERC)
 - internally reflected component (IRC).
- Artificial lighting sources:
 - incandescent lamps
 - compact fluorescent lamps (CFLs)
 - fluorescent tubes
 - discharge lamps
 - halogen lamps
 - ballast lamps
 - light-emitting diodes (LEDs).

Grade descriptors

To achieve a grade learners are expected to demonstrate these attributes across the essential content of the unit. The principle of best fit will apply in awarding grades.

Level 3 Pass

Learners will be able to apply their understanding of construction principles to develop a solution to given situations and information in context. Learners are able to use and apply basic construction, human factors and mathematics to solve simple and familiar construction problems directly.

They can provide responses showing understanding and analysis of basic and familiar construction problems. They can interpret and analyse drawings, diagrams, graphical information and meteorological information, and use their knowledge and understanding to solve basic and familiar problems. They are able to use their knowledge of construction to deconstruct given scenarios to produce solutions with interpretation. They often use appropriate construction and human comfort terminology in their responses. Learners will apply their knowledge and understanding of basic construction, human comfort and applied mathematical principles to make recommendations and propose evolutionary or analytical solutions to construction problems.

Level 3 Distinction

Learners will be able to use and apply advanced construction, human factors and mathematical principles to solve complex and unfamiliar construction problems directly, indirectly and synoptically. They can provide balanced responses showing developed understanding and evaluation of complex familiar and unfamiliar construction problems. They can interpret and evaluate drawings, diagrams, graphical information and meteorological information, and use their knowledge and understanding to solve complex, familiar and unfamiliar problems. They use appropriate and technically accurate construction and human factors terminology consistently. They are able to synthesise knowledge and understanding of construction to deconstruct given scenarios, drawing on various sources of information to develop effective solutions with justification. Learners can propose justified synoptic solutions to problems, drawing on their knowledge and understanding of construction, human comfort and applied mathematical principles to make recommendations and propose evolutionary or analytical solutions to construction problems. Learners are able to evaluate the effectiveness of solutions to make justified recommendations on their development and future actions that can be taken.

Key words typically used in assessment

The following table shows the key words that will be used consistently by Pearson in our assessments to ensure learners are rewarded for demonstrating the necessary skills.

Please note: the list below will not necessarily be used in every paper/session and is provided for guidance only.

Command or term	Definition
Analyse	Learners examine in detail a scenario or problem to discover its meaning or essential features. Learners will break down the problem into its parts and show how they interrelate. This may include the analysis of graphs to solve construction problems. There is no requirement for any conclusion.
Calculate	Learners apply some form of mathematical process to give an answer. Learners judge the number or amount of something by using the information they already have and add, subtract, multiply, or divide numbers, and apply formula to solve mathematical problems.
Describe	Learners give a clear, objective account in their own words, or highlight a number of key features of a given topic to show recall and/or application of relevant features and information about a subject.
Discuss	Learners investigate a problem or scenario, showing reasoning or argument. There is no requirement for any conclusion.
Draw	Learners produce hand-drawn graphical information or a drawing to show their understanding of and/or solve a construction problem.
Evaluate	Learners review and synthesise information to provide a supported judgement about the topic or problem. Typically a conclusion will be required.
Explain	Learners make a series of linked points and/or justify or expand on an identified point.
Find	Learners discover the facts or truth about something, typically from information contained in a diagram, graph or chart.
Identify	Learners assess factual information, typically when making use of given stimuli. Requires a single word or short-sentence answer.
State/Give	Learners assess factual information. Learners declare definitely or specifically in a single word or short-sentence answer.

Links to other units

This unit has links to all other units in the qualification.

Employer involvement

Centres can involve employers in the delivery of this unit if there are local opportunities to do so. There is no specific guidance related to this unit.

Unit 2: Construction Design

Level: **3**

Unit type: **External**

Guided learning hours: **120**

Unit in brief

Learners will apply the principles and practice of design and construction for low- and medium-rise buildings and structures.

Unit introduction

Almost all human activity takes place in and around buildings and structures that are, for example, places of shelter, work, worship, culture and sport, and these places have a strong influence on our quality of life. Buildings are deceptively complex and expensive to build and maintain, so their design requires careful consideration to ensure that they are fit for purpose and meet user requirements. Creating buildings and structures is a unique process that requires input from a team of built environment professionals, who take into consideration a wide variety of factors to resolve problems and meet client requirements.

In this unit, you will learn the principles and practice involved in the design and construction of low- and medium-rise buildings and structures, and gain an understanding of how design is influenced by client requirements and external constraints. You will consider the stages involved in the design and construction process and gain an understanding of the use of design techniques, including sketching and computer-aided design (CAD) to provide efficient methods of designing, constructing and maintaining structures over their life cycle. To complete the assessment task within this unit, you will need to draw on your learning from across your programme.

This unit will give you the knowledge and understanding of design and construction that will support your progression to employment as an apprentice or trainee construction professional, or entry to a construction-related higher education programme.

Summary of assessment

This unit is assessed under supervised conditions. Learners will be given a scenario two weeks before a supervised assessment period in order to carry out research.

The supervised assessment period is a maximum of 12 hours and can be arranged over a number of sessions. During the supervised assessment period, learners will be given a set task that will assess their ability to produce designs to meet client requirements. Pearson sets and marks the task.

The number of marks for the unit is 63.

The assessment availability is May/June each year. The first assessment availability is May/June 2018.

Sample assessment materials will be available to help centres prepare learners for assessment.

Assessment outcomes

AO1 Demonstrate knowledge and understanding of construction design and build concepts and processes

AO2 Apply knowledge and understanding of construction design and build concepts and processes to design a building to meet an initial project brief

AO3 Analyse site, client and construction information to make decisions in order to produce a building design to meet an initial project brief

AO4 Be able to develop a reasoned design solution for a building to meet an initial project brief

Essential content

The essential content is set out under content areas. Learners must cover all specified content before the assessment.

A The construction design process

A1 Stages and tasks involved in the design process

The application of Stages 1-7 of the Royal Institute of British Architects (RIBA) Plan of Work 2020 to the tasks associated with the design of low- and medium-rise domestic, commercial and industrial buildings.

- Preparation and brief.
- Concept Design including information modeling and coding.
- Developed design.
- Technical design.

A2 Factors that influence the design process

Requirements and constraints and their impact on the initial project brief and design process for combinations of rural, urban, greenfield and brownfield settings.

- Client requirements for the project outcomes:
 - building use:
 - to include domestic, industrial, commercial, retail, health, cultural and recreation
 - how the building operates within its defined use
 - the project spatial requirements – building size, layout, circulation space, number of floors, number and use of rooms
 - flexibility and remodelling potential
 - future extension potential to meet residential needs and business expansion
 - external and internal aesthetics, types and use of materials
 - sustainability, energy efficiency, alternate types of energy sources
 - age demographic of the building user(s)
 - target market sector
 - needs of different building users
 - security requirements for the building and client operations
 - corporate image and branding requirements.
- Site information and constraints:
 - site features – location, size, configuration, orientation, access, topography
 - borehole report used to provide information on geotechnical and ground conditions
 - ground contamination
 - building services availability
 - existing buildings, structures
 - interaction and compatibility between traditional and modern materials for retrofit
 - neighboring structures and the need for temporary and permanent support
 - existing underground services
 - trees
 - rights of way
 - underground transport.

- Planning constraints:
 - planning consent/approval
 - local plan requirements
 - design sympathetic to local environment
 - planning objections and pressure groups
 - listed building consent
 - protection of greenbelt land
 - conservation areas, Areas of Outstanding Natural Beauty (AONB), Site of Special Scientific Interest (SSSI)
 - tree preservation orders (TPO), contaminated land, flood risk areas.
- Statutory constraints and their requirements, including subsequent updates:
 - Construction (Design and Management) Regulations 2015
 - building regulations approval
 - Party Wall etc. Act 1996
 - Disability Discrimination Acts 1995 and 2005
 - Equality Act 2010
 - Landlord and Tenant Act 1985
 - restrictive covenants on land and property
 - legislation and restrictions relating to outcomes of the Hackitt report, including restrictions on the architect on specifying cladding.
- Environmental constraints:
 - avoidance of air, water and noise pollution
 - National Planning Policy Framework (NPPF) 2012 with reference to:
 - Part 6 Delivering a wide choice of high quality homes
 - Part 7 Requiring good design
 - Part 9 Protecting Green Belt land
 - Part 10 Meeting the challenge of climate change, flooding and coastal change
 - Part 11 Conserving and enhancing the natural environment
 - Part 12 Conserving and enhancing the historic environment
 - Part 1 of the Wildlife and Countryside Act 1981, with reference to protected species and habitat conservation
 - the findings of Environmental Impact Assessments (EIAs) and their use in developing designs for a project.
- Social constraints:
 - neighbour's rights
 - local community objections
 - green space requirements
 - environmental requirements
 - mixed and balanced development.
- Project budget and economic constraints:
 - cost planning
 - available funds
 - source of additional funding for business premises – grants, government incentives, European funding
 - local land prices
 - first-time buyer residential accommodation – borrowing potential, shared-ownership schemes, Help to Buy scheme, government incentives for developers
 - life cycle costs.
- Design for Manufacture and Assembly:
 - logistics for offsite including just in time concepts and transport from factory to site
 - site preparation including the ability to receive prefabricated products
 - the importance of communications and accuracy of data
 - site personnel and roles required.

B Project information and building design production

B1 Project information

Information used in the production of building designs.

- Information requirements of offsite construction.
- Client requirements.
- Site constraints.
- Planning constraints.
- Statutory constraints.
- Environmental constraints.
- Social constraints.
- Economic constraints.

B2 Initial project brief

- The initial project brief's purpose and its application.
- Content of an initial project brief:
 - spatial requirements
 - desired project outcomes
 - site information
 - budget requirements.
- Use of an initial project brief to generate and develop design ideas and specifications.
- Completion of an initial project brief: use of appropriate tone and technical language for target audience.

B3 Design production

Production of creative and innovative outline solutions and designs to meet initial project brief requirements and their presentation requirements for client and design team use.

- Production of designs for low- and medium-rise domestic, commercial and industrial buildings.
- Outline solution – to communicate use of space and appropriate form of construction.
- 2D and 3D sketches of initial ideas, to include internal and external views, plans and elevations:
 - freehand sketched
 - single-point perspective
 - two-point perspective
 - planometric views
 - isometric views
 - use of line thickness to convey a 3D effect
 - use of shade and light direction
 - freehand rendering techniques.
- Clear communication using technical annotations.
- Clear communication of key features, to include external fabric, roof type, service access, circulation space, windows, doors etc.

B4 Digital design competencies

- Use of Digital Design software, including CAD, to produce virtual models and interiors.
- Setting up CAD projects:
 - number of floors
 - floor levels
 - linking elements, to include top and bottom anchors
 - building footprint
 - component libraries
 - saving in an appropriate format.

- Use of basic CAD methodologies:
 - dimensional control, sizing and scale
 - detail levels, to include appropriate level for drawing use and audience:
 - fine
 - medium
 - coarse
 - use of 'hidden element' features
 - setting up and drawing composite elements:
 - walls
 - floors
 - roofs
 - standard opening components, placing and positioning:
 - doors, to include external, internal, garage and industrial
 - windows
 - inclusion and placing of fixtures and fittings:
 - stairs
 - fitted units and fitted furniture
 - plumbing and sanitary ware fixtures
 - light fittings
 - furnishing and lighting for selected internal area.
- External site area:
 - setting up ground area
 - surface effects, to include natural and built environment
 - contours, relief and topography
 - inclusion of features, to include street furniture, cars, etc.
 - inclusion of landscaping and planting features.
- Use and manipulation of Digital Technologies to produce virtual models:
 - New technologies:
 - BIM software
 - coding
 - coordination
 - VR, AR, holoLens
 - 3D digital project information:
 - 3D views
 - 3D perspective effects
 - surface detailing and effects
 - 2D digital project information, to include appropriate scale and level of detail:
 - plans
 - elevations
 - sections.
- 3D manipulation:
 - orientation and rotation of images
 - zooming
 - detail level.

- Rendered images:
 - camera views, to include camera position, angle of coverage, shadow effects
 - setting up rendered views:
 - internal lighting effects
 - external lighting effects
 - weather effects
 - seasonal effects
 - sun position
 - lighting/sun on or off
 - detail level
 - processing, saving and printing of rendered images.
- Extraction of 2D and 3D drawings:
 - plans
 - elevations
 - cross sections
 - 3D models.
- Drawing output:
 - setting up borders and title block
 - orthographic drawing conventions, to include third angle
 - scale and placement of images
 - printer and screen outputs.

C Construction methods and techniques

Construction methods and techniques used in the design and construction of low- and medium-rise domestic, commercial and industrial buildings.

C1 Forms of low- and medium-rise structures

- Functional requirements of key primary and secondary elements.
- Types, characteristics and application of construction techniques and methods for:
 - offsite manufacturing, including panels, pods, volumetric with services/with finishes
 - traditional construction
 - timber frame construction
 - steel frame construction
 - light steel frame construction
 - concrete frame construction
 - modern methods of construction (MMC)
 - Passivhaus construction.

C2 Sub-structure construction

- Types, purpose and use of methods of site investigation and analysis:
 - site surveys – desk, walk-over, measured, survey reports
 - soil investigation – bore holes, trial pits, auger, test data/results/reports
 - soil assessment – classification, particle size distribution, compressive/tensile/shear strength
 - groundwater – water table, contaminates, dewatering techniques/control.
- Factors and principles affecting foundation design:
 - structural requirements – building type, loading types, load transmission
 - ground load bearing capacity – soil type/condition
 - differential settlement and ground heave – made up ground, subsidence, underground features/mining, shrinkable clay, frost, trees, hard standings.

- Purpose, types, sizing, construction methods/techniques and details of foundations:
 - strip – traditional, deep, narrow, wide, stepped, reinforced
 - raft –edge thickening, edge beam, reinforced
 - pad – isolated, combined, reinforced
 - pile – replacement, displacement, end bearing, friction, pile caps, edge beams, reinforced.

C3 Superstructure construction

The construction requirements and detailing of the superstructure and external envelope, and their suitability for use in different scenarios.

- External walls:
 - solid masonry, cavity walls, curtain walls, infill walling, rain screen, panel, cladding, profiled sheets, rammed earth, straw bale
 - formation of openings, heads, sills, jambs/reveals, thresholds
 - weather tightness
 - thermal and acoustic insulation
 - finishes.
- Internal walls:
 - separating/party, partition/compartment
 - loadbearing, non-loadbearing
 - finishes.
- Structural frames:
 - steel, reinforced concrete, timber, structural insulated panels, light gauge steel
 - fire protection.
- Ground floors:
 - solid and suspended
 - in-situ concrete, beam and block, timber
 - thermal insulation
 - damp proofing
 - finishes
 - upper floors – composite concrete/profiled steel, pre-cast concrete slabs, in-situ concrete, beam and block, timber/engineered timber
 - fire protection.
- Roofs:
 - flat/pitched forms and terminology
 - traditional, trussed rafter, profiled decking, lattice frame, portal frame
 - weather protection, coverings.
- Stairs and landings:
 - stair and landing terminology/regulations
 - timber, in-situ concrete, precast concrete, steel.
- Doors and windows:
 - types, construction
 - uses in fire compartmentalization and escape.

C4 Sustainability

Sustainability methods and techniques used in the design of modern construction projects and in the refurbishment, remodelling and extension of existing buildings to reduce pollution, the impact on the environment and the carbon footprint of the building.

- Passive solar gain.
- Passive stack ventilation.
- Water use reduction methods:
 - grey water systems
 - rainwater harvesting
 - water efficiency measures and fittings.
- Waste reduction measures:
 - segregation of waste
 - recycling.
- Use of alternative energy sources:
 - ground source – ground source heat pump (horizontal and vertical)
 - air source – air source heat pump (indoor heat exchanger, outdoor heat exchanger, air to air, air to water)
 - wind – micro wind generator (horizontal axis; vertical axis)
 - solar – solar photovoltaic (PV) panels, solar panel (thermal).
- Energy-efficient electrical and mechanical services installations.
- Sustainable and low embodied energy materials.
- Insulation methods:
 - floors
 - walls
 - roofs.
- Sustainable urban drainage systems.
- Sustainable landscape design.
- Building Research Establishment Environmental Assessment Method (BREEAM):
 - benefits of
 - ratings and percentage of UK buildings in each category.

Grade descriptors

To achieve a grade learners are expected to demonstrate these attributes across the essential content of the unit. The principle of best fit will apply in awarding grades.

Level 3 Pass

Learners will demonstrate knowledge and understanding of the factors that influence design and development, with some consideration of how these impact on construction details. They will make some use of appropriate technical vocabulary in their work. They will be able to select, use and interpret relevant information in the context of a scenario to produce an initial project brief. They will be able to consider the spatial requirements of a project and consider suitable forms of construction to produce a design that communicates design intentions with clarity and addresses aspects of the initial project brief, with some use of annotations. They can produce a virtual model that addresses some aspects of the scenario requirements and provide printouts of 3D rendered views.

Level 3 Distinction

Learners will demonstrate a comprehensive knowledge and understanding of the factors that influence design and development, and consider in depth how these impact on construction details. They will make use of developed technical vocabulary in their work. They will be able to select, use and interpret most of the relevant information in the context of a scenario, showing a balanced consideration of this information to produce an initial project brief with minimal errors or omissions. They will be able to analyse the spatial requirements of a project and provide detailed consideration of suitable forms of construction to produce a design that communicates design intentions with clarity and comprehensively addresses the initial project brief. Learners use annotations that clearly explain the key features and operation of the design. They can produce an accurate and complete virtual model that appropriately addresses the scenario requirements and provide printouts of 3D rendered views.

Key words typically used in assessment

The following table shows the key words that will be used consistently by Pearson in our assessments to ensure learners are rewarded for demonstrating the necessary skills.

Please note: the list below will not necessarily be used in every paper/session and is provided for guidance only.

Command or term	Definition
Borehole report	A report that provides information on the soil types and depths within the various strata underneath the surface of the site.
Client details	Information about the client and their requirements.
External envelope	The walls and roof forming the external surfaces of a building, including features such as the windows and external doors.
Ground conditions	Soil type, composition, contamination, level of compaction, water table level, level of saturation.
Ground water table	The depth below ground level of water contained in the ground.
Initial project brief	A document providing information relating to the spatial requirements, desired project outcomes, context of the site and budget.
Internal views	3D internal views of the building.
Medium rise	A building of three- to eight storeys in height.
Sketch	A freehand drawing/hand drawn with annotations, using pens and pencils.
Specification	Details of the building fabric that will achieve the required outcomes.
Sub-soil	The soil below the topsoil.
Virtual model	A 3D computer-generated image of a CAD design that can be rotated and viewed from any angle and can be used to generate rendered images of a project.

Links to other units

The assessment for this unit should draw on knowledge, understanding and skills developed from:

- Unit 1: Construction Principles
- Unit 4: Construction Technology
- Unit 5: Health and Safety in Construction
- Unit 6: Surveying in Construction
- Unit 7: Graphical Detailing in Construction
- Unit 8: Building Regulations in Construction
- Unit 11: Site Engineering for Construction
- Unit 14: Provision of Primary Services in Construction
- Unit 15: Further Mathematics for Construction
- Unit 21: Building Services Science
- Unit 23: Construction in Civil Engineering.

This unit would relate to the teaching of:

- Unit 19: Quantity Surveying.

Employer involvement

Centres can involve employers in the delivery of this unit if there are local opportunities to do so. There is no specific guidance related to this unit.

Unit 4: Construction Technology

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners examine the underlying principles and construction methods used in the construction of new buildings and their associated external works.

Unit introduction

The construction industry provides the population of the UK, and the world, with the built environment needed to sustain all aspects of life as we know it. Today's buildings can use combinations of modern and traditional techniques and materials in their construction, and this unit will give you an understanding of the technology used in the design and construction of low-rise domestic and commercial buildings.

In this unit, you will examine various forms of low-rise construction and consider the most appropriate forms for differing site conditions and client requirements. You will gain an understanding of the different types of foundation that could be used on a project and the factors that influence its selection. You will investigate superstructure, external works design and construction, considering the most appropriate specifications and details for given scenarios.

This unit will give you the underlying knowledge and understanding of construction technology that supports a wide range of other units in this qualification. A sound knowledge of construction technology is an essential aspect of many roles, including architect, site manager, quantity surveyor, planner, buyer, estimator, etc.

Learning aims

In this unit you will:

- A** Understand common forms of low-rise construction
- B** Examine foundation design and construction
- C** Examine superstructure design and construction
- D** Examine external works associated with construction projects.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Understand common forms of low-rise construction	A1 Forms of low-rise construction	A report to a client that covers the use of different structural forms for the proposed project, considering the effectiveness of each structural form.
B Examine foundation design and construction	B1 Subsoil investigation B2 Subsoil improvement B3 Design principles B4 Types of foundation	A report for a given project scenario that covers the foundation design and different methods that can be used for the design and construction of the foundations, superstructures and external works.
C Examine superstructure design and construction	C1 Walls C2 Floors C3 Roofs C4 Internal finishes	
D Examine external works associated with construction projects	D1 Foul and surface water drainage D2 Utility services D3 Roads and footpaths D4 Sustainable urban drainage systems	A report for a given project scenario that covers the design and construction of the external works, including the incorporation of sustainable drainage systems.

Content

Learning aim A: Understand common forms of low-rise construction

A1 Forms of low-rise construction

The application, characteristics, use, methods of load transfer, differences in construction methods, advantages and limitations of the following forms of low-rise construction.

- Framed structures:
 - skeleton, rectangular frame:
 - steel
 - in-situ reinforced concrete
 - prefabricated concrete
 - portal frame:
 - steel
 - laminated timber
 - prefabricated concrete
 - timber frame:
 - prefabricated platform frames
 - open panel systems
 - closed panel systems
 - structural insulated panels (SIPs).
- Traditional construction:
 - cavity wall
 - masonry wall
 - cut rafter roofing
 - timber floors
 - in-situ methods.
- Modular construction:
 - four-sided modules
 - open-sided modules
 - partially open sided
 - corner supported modules
 - stair modules
 - lift modules
 - non-loadbearing modules.

Learning aim B: Examine foundation design and construction

B1 Subsoil investigation

Subsoil investigation methods to obtain data and information for foundation design and their advantages and disadvantages.

- Investigation methods:
 - desk study
 - walkover survey
 - trial pits
 - auger holes
 - percussion drilling and window sampling
 - plate bearing test.
- Information used for foundation design:
 - bearing capacity
 - subsoil classification
 - groundwater levels
 - chemical analysis of soil samples and presence of sulphates
 - presence of obstructions – naturally occurring and from previous development.

B2 Subsoil improvement

Awareness of techniques of how to improve the bearing capacity of the ground before construction work commencing on site:

- vibroflotation, including vibro replacement
- grouting
- land drainage.

B3 Design principles

Foundation design considerations, including the relationship between building load and ground bearing capacity, the foundation footprint and transfer of loads to a suitable bearing strata.

- Factors used during design to minimise settlement:
 - building load
 - soil bearing capacity and type
 - foundation depth
 - groundwater.
- Design to minimise other movement:
 - soil shrinkage
 - ground heave
 - differential settlement
 - effects of tree growth and tree removal.
- The Building Regulations 2010, Part A – use to determine the minimum:
 - width of strip foundations
 - thickness of strip foundations
 - overlap where foundations are stepped.

B4 Types of foundation

The application, characteristics, substructure detailing, advantages and disadvantages and factors affecting choice of the following foundation types for different loadings and ground bearing capacities.

- Strip.
- Trench fill.
- Raft.
- Pad.
- Pile:
 - replacement piles
 - displacement piles
 - pile caps
 - ground beams.

Learning aim C: Examine superstructure design and construction**C1 Walls**

Construction methods and techniques, materials used, stability, detailing, external finishes, performance requirements, advantages and disadvantages of the following wall elements.

- External cavity walls:
 - traditional brickwork and blockwork
 - blockwork with external skin rendered.
- Solid wall with rainscreen cladding.
- Internal walls and partitions:
 - blockwork partitions
 - timber stud partitions
 - metal stud partitions
 - demountable partitions.

- Prefabricated timber frame construction:
 - external wall details
 - cladding options, including brickwork
 - internal wall details.
- Openings in walls:
 - head detailing, including methods of supporting the wall above the opening
 - jamb detailing
 - sill and threshold detailing
 - windows
 - doors.

C2 Floors

Construction methods and techniques, materials used, support, detailing, finishes, performance requirements, advantages and disadvantages of the following floor types and elements.

- Ground floors:
 - solid concrete
 - beam and block
 - prestressed concrete
 - suspended timber.
- Intermediate floors:
 - beam and block
 - prestressed concrete
 - timber
 - platform floors in timber frame construction.
- Openings and stairs:
 - forming openings
 - timber stairs
 - precast concrete stairs.

C3 Roofs

Construction methods and techniques, materials and components used, support (including bracing and lateral restraint), detailing (at eaves, verge, abutments and ridge), finishes, performance requirements, advantages and disadvantages of the following roof types.

- Pitched, including mono pitch, double pitch, gable ended and hipped:
 - trussed rafter construction
 - traditional timber roofing.
- Flat:
 - warm deck
 - cold deck
 - method of achieving required falls:
 - firrings
 - laser-cut tapered insulation
 - screed.

C4 Internal finishes

Application, characteristics, properties, advantages and disadvantages of the following finishes.

- Wall finishes:
 - traditional two-coat plasterwork
 - dry lining
 - ceramic tiling
 - wood paneling
 - decorating:
 - paint
 - wallpaper.

- Ceiling finishes:
 - plasterboard and skim
 - suspended ceilings
 - UPVC ceiling cladding
 - timber-boarded ceilings.
- Floor finishes:
 - natural timber
 - laminates
 - carpets
 - ceramic tiling
 - sheet materials.

Learning aim D: Examine external works associated with construction projects

D1 Foul and surface water drainage

The layout, falls, access, advantages and disadvantages of the following methods of disposal for foul and surface water.

- Combined drainage.
- Separate drainage.

D2 Utility services

The depth, colour coding of ducts, positioning, typical layout and building entry of the following utility services.

- Water.
- Gas.
- Electricity.
- Telecommunications.

D3 Roads and footpaths

Construction methods and techniques, materials used, edge details, performance requirements, specifications, finishes, advantages and disadvantages of the following paving types.

- Tarmacadam to footpaths.
- Tarmacadam to vehicular areas and roads.
- Block paving.
- In-situ concrete.
- Precast concrete paving.

D4 Sustainable urban drainage systems

The methods, use, characteristics, advantages and disadvantages of sustainable urban drainage systems.

- Methods of temporary storage of excess surface water:
 - swales
 - infiltration basins
 - extended detention basins
 - wet ponds
 - infiltration systems.
- Methods allowing natural percolation to groundwater:
 - filter strips
 - porous surfaces:
 - porous block paving
 - permeable tarmacadam
 - porous concrete
 - gravel.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand common forms of low-rise construction		A.D1 Evaluate the effectiveness of different structural forms for use with a given low-rise buildings project scenario.
A.P1 Explain the different structural forms used in the construction of low-rise buildings.	A.M1 Discuss the use of different structural forms for use with a given low-rise buildings project scenario.	
Learning aim B: Examine foundation design and construction		BC.D2 Evaluate the construction of new low-rise buildings.
B.P2 Explain the different types of investigation used to provide information required for the design of foundations for low-rise buildings.	B.M2 Discuss the principles of foundation design and how they impact on the choice of foundation type for low-rise buildings.	
B.P3 Explain the different types of foundation used for low-rise buildings.		
B.P4 Describe the principles of foundation design and how they impact on the choice of foundation type for low-rise buildings.		
Learning aim C: Examine superstructure design and construction		
C.P5 Explain the construction details used in the construction of walls, floors and roofs on new construction projects.	C.M3 Analyse the different details and finishes used in the construction of new construction projects.	
C.P6 Summarise the use of internal finishes for floors, walls and ceilings on new construction projects.		
Learning aim D: Examine external works associated with construction projects		D.D3 Analyse the design and construction of external works for new construction projects, including the incorporation of a sustainable urban drainage system.
D.P7 Summarise the design and construction of external works on new construction projects.	D.M4 Discuss the design and construction of external works for new construction projects, including the incorporation of a sustainable urban drainage system.	
D.P8 Explain the use of sustainable urban drainage systems in new construction projects.		

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of three summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.M1, A.D1)

Learning aims: B and C (B.P2, B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, BC.D2)

Learning aim: D (D.P7, D.P8, D.M4, D.D3)

Further information for teachers and assessors

Resource requirements

There are no specific additional resource requirements for this unit.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will demonstrate sound knowledge and understanding of the specific advantages and disadvantages of framed structures, traditional construction and modular construction methods when considered for use in the given project scenario. Learners will critically review the different forms of construction in the context of the scenario and will bring together key considerations to form a supported conclusion, drawing on information relevant to the given scenario.

For merit standard, learners will provide a coherent, logical and mostly balanced discussion that considers the application, characteristics, use, methods of load transfer, advantages and limitations of the different structural forms that could be considered for the given project scenario. They will demonstrate some understanding of the specific advantages and limitations of framed structures, traditional construction and modular construction methods when considered for use in the given project scenario.

For pass standard, learners will provide a clear explanation of different structural forms that are used in the construction of low-rise buildings. They will cover a minimum of two structural forms. Learners' work will demonstrate some knowledge of how the application, characteristics, advantages and limitations of each type of structural form affects the selection. Illustrations and/or sketches with annotations may be used, alongside written submissions, to help convey knowledge and understanding of the different structural forms.

Learning aims B and C

For distinction standard, learners will evaluate the effectiveness of the different foundation types, potential superstructure construction details and finishes to cover the basic proposals and site information for a low-rise construction scenario. Learners will demonstrate sound knowledge and understanding of the specific application, advantages and disadvantages of different foundation types, including strip, trench fill, raft, pad and various types of pile foundation, and the methods and performance requirements for the various elements of superstructure when considered for use in the given project scenario. Learners will review the different methods and details in the context of the scenario and will bring together key considerations to form a supported conclusion, including alternative specifications where appropriate, drawing on information relevant to the given scenario.

For merit standard, learners will provide a coherent, logical and mostly balanced discussion that considers the relationship between building load, ground bearing capacity, the foundation footprint, transfer of loads to a suitable bearing strata and the appropriate foundation types to cover the basic proposals and site information for a low-rise construction scenario. They will demonstrate a sound approach and competent analysis of typical details and finishes used in the construction of walls, floors and roofs. Learners must cover two details for each of the identified elements.

For pass standard, learners will provide a clear explanation of methods for determining soil type and properties, foundation types and principles of foundation design used in the construction of low-rise domestic buildings. Their explanation will cover a minimum of three different site investigation methods and foundation types, although the explanation will be generic and may only have limited focus to cover the basic proposals and site information for a low-rise construction scenario. Learners' work will cover an explanation of superstructure construction details, including walls, floors and roofs but this will be generic and not focused on the scenario. Details of internal finishes will be outlined, covering walls, ceilings and floors. Illustrations and/or sketches with annotations may be used, alongside written submissions, to help convey knowledge and understanding of the different principles and details.

Learning aim D

For distinction standard, learners will evaluate the effectiveness of external works, including sustainable urban drainage systems, to cover the basic proposals and site information for a low-rise construction scenario. Learners will demonstrate sound knowledge and understanding of the specific application, advantages and disadvantages of external works and sustainable urban drainage systems, when considered for use in the given project scenario. Learners will review the different methods and details in the context of the scenario and will bring together key considerations to form a supported conclusion, including alternative specifications where appropriate, drawing on information relevant to the given scenario.

For merit standard, learners will provide a coherent, logical and mostly balanced discussion in their work that covers how the design and construction of external works is suitable for the new construction project, including how external works are affected by the incorporation of a sustainable urban drainage system. This should include consideration of methods that delay and/or minimise the discharge of excess surface water, methods that provide for localised infiltration to groundwater and how all three approaches can be combined into a single effective system.

For pass standard, learners will demonstrate knowledge and understanding in their work of external works that incorporate sustainable drainage systems, including methods of temporary storage and methods allowing percolation to groundwater. Learners will demonstrate an awareness of the various external works requirements to cover the basic proposals and site information for a low-rise scenario. Illustrations and/or sketches with annotations may be used, alongside written submissions, to help convey knowledge and understanding of the different principles and details.

Links to other units

This unit links to:

- Unit 1: Construction Principles
- Unit 2: Construction Design
- Unit 5: Health and Safety in Construction
- Unit 7: Graphical Detailing in Construction
- Unit 10: Building Surveying in Construction
- Unit 11: Site Engineering for Construction
- Unit 12: Low Temperature Hot Water Systems in Building Services
- Unit 13: Measurement Techniques in Construction
- Unit 14: Provision of Primary Services in Buildings.

Employer involvement

This unit would benefit from employer involvement in the form of:

- guest speakers
- participation in audience assessment of presentations
- design/ideas to contribute to unit assignment/case study/project materials
- work experience
- employer's business materials as exemplars
- support from local business staff as mentors.

Unit 5: Health and Safety in Construction

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners will carry out a safe system of work and investigate the significance of safety system reviews, understanding the responsibilities of employees and employers with regard to health and safety in construction operations.

Unit introduction

Health and safety in construction operations is essential so that workers can carry out practical activities in a safe environment that is free from hazards and risks. Safety starts in the office, with planning safe systems of work, assessing the risks in construction operations and applying control measures to reduce the risks to an acceptable level. Companies aspire to achieve the target of zero accidents in the workplace, promoting their reputation as safe constructors.

In this unit, you will examine the responsibilities of employees and employers with regard to UK legislation and regulations and the procedures used to control hazards and risks for construction operations across a range of activities. You will use relevant policies and procedures to design a safe system of work that could be instigated and maintained in a construction context. You will also investigate how all aspects of health and safety are monitored to ensure they are kept up to date, employers and employees are well informed and any changes are evaluated and controlled.

This unit can help you progress to health and safety management and supervision in the construction sector as a contracts manager or site manager, or to specialist health and safety qualifications such as the National Examination Board in Occupational Safety and Health (NEBOSH) Certificate and Diploma qualifications or Higher Nationals in Construction and degrees in construction specialisms.

Learning aims

In this unit you will:

- A** Understand how health and safety legislation is applied to construction operations
- B** Carry out the development of a safe system of work for construction operations
- C** Understand the need for the review of safety systems for construction operations.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Understand how health and safety legislation is applied to construction operations	<p>A1 Health and Safety at Work etc. Act 1974</p> <p>A2 Construction (Design and Management) Regulations 2015</p> <p>A3 Management of Health and Safety at Work Regulations 1999</p> <p>A4 Work at Height Regulations 2005</p> <p>A5 Control of Substances Hazardous to Health (COSHH) Regulations 2002</p> <p>A6 Training and education</p>	Presentations, explanatory leaflets or a formal report that references case studies, showing the impact of how legislation and regulations uphold and improve health and safety on construction sites. Reference to statistics could provide justification of legislation and regulation effectiveness.
B Carry out the development of a safe system of work for construction operations	<p>B1 Health and safety preparation</p> <p>B2 Construction phase health and safety</p> <p>B3 Health and safety file</p>	A safety survey with completed documentation, including the production of a risk assessment and method statement.
C Understand the need for the review of safety systems for construction operations	<p>C1 Accident reporting procedures</p> <p>C2 Reviewing safety systems</p> <p>C3 Changes to systems and procedures</p> <p>C4 Skills, knowledge and behaviours</p>	A report evaluating how safe systems can be improved following the reporting of accidents, utilising review procedures.

Content

Learning aim A: Understand how health and safety legislation is applied to construction operations

Current legislation and regulations, including any updates, and their application in construction operations.

A1 Health and Safety at Work etc. Act 1974

- The duties defined in each section of the act. The duties of:
 - employers
 - employees and self-employed
 - designers and manufacturers
 - Health and Safety Executive (HSE):
 - powers of the HSE when visiting a site or investigating an accident
 - notices for improvements and prohibition, differences between the two types.
- Penalties for non-compliance:
 - enforcement, sanctions, loss of reputation, loss of work, corporate manslaughter
 - fines, magistrates and crown court penalties, level of fines
 - imprisonment, length of detainment.

A2 Construction (Design and Management) Regulations 2015

The content of the regulations and what aspects have to be carried out in order to comply with them during the design and construction of a building project.

- Phases to be followed:
 - pre-construction information – client’s health and safety file, site survey, desktop research
 - construction phase safety plan – contents required for compliance with regulations
 - content of the health and safety file:
 - meet the requirements of the regulations
 - duty holders’ participation, to include designer, client, main contractor, contractors.
- Duties of parties to the contract, to include:
 - principal designer and designers
 - client
 - principal contractor.
- General requirements for all construction sites:
 - welfare facilities – Schedule 2 in the appendix to the regulations
 - general principles of prevention to be employed on site.

A3 Management of Health and Safety at Work Regulations 1999

Aspects of the regulations relevant to construction.

- Duties, to include those defined in the following sections of the regulations:
 - risk assessment requirements under Regulation 3 of the legislation
 - health and safety arrangements and assistance provided by the employer
 - cooperation and co-ordination between all parties
 - capabilities and training of all operatives
 - specific duties of employees under this regulation.

A4 Work at Height Regulations 2005

Duties, to include:

- organisation and planning required before working at height is commenced
- avoiding risks from working at height by establishing an alternative method
- work equipment requirements for operatives
- duties of persons at work with regard to safety under this regulation
- requirements for any working platform used to gain access to working at height
- requirements for personal fall protection to be provided for employees
- the use of ladders and the regulations and duties concerning this use.

A5 Control of Substances Hazardous to Health (COSHH) Regulations 2002

Relevant aspects regarding the use of substances and chemicals during construction activities on site.

- Employer's duties, to include provision of:
 - risk assessment of all substances used in the workplace – highlighting precautionary methods to be employed before and during use
 - control measures, use, maintenance, examination and testing – reducing the risk to an acceptable level
 - monitoring and health surveillance of employees using substances at work
 - information, instruction and training of employees.

A6 Training and education

- On-site safety training, e.g. tool box talks.
- Construction Skills Certification Scheme (CSCS) card – classification and the different types of cards available, qualifying for a card, process, validity.
- Client Contractor National Safety Group (CCNSG) Safety Passport – requirements and use.
- Fire safety.
- Off-site training requirements and links to control measures, e.g. for working at height, COSHH, noise, confined spaces.
- Training associated with equipment.
- Provision and Use of Work Equipment Regulations (PUWER) 1998.
- Purpose and provision of safety notice boards and signage.

Learning aim B: Carry out the development of a safe system of work for construction operations

Relevant administration and management tasks must be carried out to ensure that a construction site is a safe place of work.

B1 Health and safety preparation

- Notifications to HSE, the completion of the F10 documentation.
- Health and safety construction phase plan, contents and safe systems of work (SSW).
- Site induction content to be prepared, inclusions, method of delivery.
- Preparation of the site waste management plan, its content and specific requirements under the regulations for waste management.
- Safety poster provision, gate and entrance signage and notices, formal gate notifications.

B2 Construction phase health and safety

- Delivery of site inductions and retaining records of inductions.
- Identifying hazards by various methods – direct observation, checklists, audits, tool box talks, safety committees.
- Writing risk assessments and evaluating control measures – risk ratings, acceptable levels.
- Writing method statements, sequencing of statements, resources to be used.
- Delivering tool box talks – method, timing, what to cover in talk, who should be present.

- Issuing care and maintenance of personal protective equipment (PPE) and first-aid facilities.
- Preparing temporary fire and evacuation procedures.
- Instructing on waste disposal, segregation, good housekeeping.
- Managing subcontractors' safety information, site meetings.

B3 Health and safety file

- Preparing file contents in accordance with the requirements of the Construction (Design and Management) Regulations 2015:
 - a brief description of the work carried out
 - any residual hazards that remain and how they have been dealt with, e.g. information concerning asbestos, contaminated land, buried services, etc.
 - key structural information, e.g. bracing, sources of substantial stored energy – including pre- or post-tensioned members, etc.
 - safe working loads for floors and roofs, particularly where these may prohibit placing scaffolding or heavy machinery
 - hazardous materials used, to include manufacturer's data sheets, e.g. pesticides, special coatings that should not be burnt off, etc.
 - information regarding the removal or dismantling of installed plant and equipment, e.g. any special arrangements for lifting, special instructions for dismantling, etc.
 - health and safety information about equipment provided for cleaning or maintaining the structure
 - the nature, location and markings of significant services, including underground cables; gas supply equipment; fire-fighting services, etc.
 - information and as-built drawings of the structure, its plant and equipment, e.g. the means of safe access to and from service voids, fire doors and compartmentalization, etc.
- Reviewing documentation.
- File distribution.

Learning aim C: Understand the need for the review of safety systems for construction operations

Reviewing to close the safety cycle and analysing systems for any changes to processes, procedures or operations.

C1 Accident reporting procedures

- Definition of the following in accordance with reporting procedures and classification:
 - accident
 - near miss
 - minor
 - major.
- Procedures on discovering an accident:
 - first-aid actions, call for help, first aider, emergency services, individual responsibilities
 - reporting to supervisor, procedures, accident book, internal reports
 - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013, over-three-day lost time injuries, reporting of a fatality
 - internal accident investigation procedures
 - fatalities and HSE investigations, documentation to produce.

C2 Reviewing safety systems

Using data to establish where unplanned events occur and to reduce incidents.

- Analysis of accident information:
 - trends in near misses and types of accidents
 - comparison with UK national averages
 - discussion with workforce, site safety meetings, interviews, safety committees
 - suggestions and recommendations for improvements, justified by statistical analysis.
- Benefits of undertaking safety reviews:
 - reduction in costs – direct and indirect
 - reputation of the company, marketing materials
 - worker morale, a better and safer place to work
 - improved performance in terms of production
 - client estimating pre-contract enquiries and getting onto employer tender lists.

C3 Changes to systems and procedures

Closing the safety cycle to ensure that any changes are reviewed, checked for compliance and monitored for effectiveness.

- Reviewing control measures, ensuring lowest possible risk achieved with reasonably practical measures, signing and dating reviews.
- Revising risk assessments in light of changes to processes, operatives and materials.
- Evaluating revised risk ratings.
- Reviewing changes and recommendations, communication to all.

C4 Skills, knowledge and behaviours

Demonstrating appropriate behaviour and its impact on outcomes, to include professionalism, etiquette, working to deadlines, accountability and individual responsibility.

- Evaluating outcomes on hazards and risks to help inform high-quality justified recommendations and decisions.
- Media and communication skills, including:
 - the ability to convey intended meaning, e.g. written (risk assessment documentation, recording documentation, reports, visual aids for presentation use), verbal communication requirements (one-to-one and group, informal and formal situations)
 - use of tone and language for verbal and written communications to convey intended meaning and make a positive and constructive impact on audience, e.g. positive and engaging tone, technical/vocational language suitable for intended audience.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand how health and safety legislation is applied to construction operations		A.D1 Evaluate the effectiveness of health and safety related legislation, education and training in controlling health and safety in construction.
A.P1 Explain the legislative duties of employers and employees in the current legislation.	A.M1 Discuss the impact of health and safety related legislation, education and training in controlling health and safety in construction.	
A.P2 Explain how the application of health and safety related legislation controls health and safety in construction.		
A.P3 Explain how education and training improves standards of health and safety.		
Learning aim B: Carry out the development of a safe system of work for construction operations		B.D2 Justify the optimised safe system of work for a construction operation.
B.P4 Explain methods used to identify hazards and assess risks.	B.M2 Optimise the safe system of work for a construction operation.	
B.P5 Produce a safe system of work for a given construction operation, and a risk assessment to include a method statement with effective control measures.		
Learning aim C: Understand the need for the review of safety systems for construction operations		C.D3 Evaluate how safety systems are improved following the reporting of accidents and review of procedures.
C.P6 Explain how safe systems of work are reviewed.	C.M3 Discuss how safety systems are improved following the reporting of accidents and review of procedures.	
C.P7 Explain the procedures that follow an accident to improve future safety.		

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of three summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.P3, A.M1, A.D1)

Learning aim: B (B.P4, B.P5, B.M2, B.D2)

Learning aim C (C.P6, C.P7, C.M3, C.D3)

Further information for teachers and assessors

Resource requirements

There are no specific additional resource requirements for this unit.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners must thoroughly evaluate, in terms of advantages and disadvantages, the effectiveness of health and safety legislation and regulations in controlling risks on a construction site. Learners will make specific, relevant references to the role of safety education and training to produce a logical, coherent response. Learners' research must lead to a supported, convincing judgement of the impact of risk reduction, considering fatalities and major and minor accidents in order to come to a robust conclusion. Learners' research can also include the contribution of legislation and regulations in reducing 'near misses'. This can include making reasoned judgements where legislation and regulations have not reduced accident rates or incidents on construction sites.

For merit standard, learners must produce a clear, balanced discussion of the impact of how legislation and regulations, and associated training and education, control safety on a construction site. This should be in terms of what has to be provided legally, for example safety information and welfare facilities and how these are provided, depending on the choice of two other regulations in addition to the Health and Safety at Work etc. Act 1974. Learners will consider the impact in terms of relevant preliminary items and temporary features provided on site, for example mobile elevated platforms for gaining access at height, the training of operatives to use harnesses to restrain falls from height, etc.

For pass standard, learners need to explain the Health and Safety at Work etc. Act 1974 in terms of the duties placed on an employer and employee under this legislation. Learners will give mostly relevant examples of the types of provision, giving accurate details and reasons for their importance in a construction working environment. Two other regulations must be explored by learners in explaining how each controls health and safety in a construction context. Examples of on-site requirements must be provided against each regulation. Learners will also provide a realistic explanation of how education and training improves standards of health and safety.

Learning aim B

For distinction standard, learners must thoroughly evaluate how hazard identification, risk assessment and method statements support a safe system of work for a given construction operation. They must consider the strengths and potential weaknesses of the safe system of work while examining risk assessments, method statements and control measures. This will result in a reasoned conclusion with justifications supporting the effectiveness of the optimised safe system of work. Learners must demonstrate that they have developed a robust, comprehensive understanding of the methods used to ensure that construction operations can be carried out in a safe manner with minimal risk of accident, injury or near miss.

For merit standard, learners must produce an optimised safe system of work. In doing so, they must analyse how hazard identification, risk assessment and method statements support a safe system of work for a given construction operation. They must conduct a methodical and detailed examination that considers the various facets of the safe system of work, while examining risk assessments, method statements and control measures and how these can be improved. Learners must demonstrate that they fully comprehend the methods used to ensure that construction operations can be carried out in a safe manner with minimal risk of accident, injury or near miss.

For pass standard, learners must produce a realistic, appropriate explanation of the methods used to identify hazards and assess risks. Learners will produce a realistic risk assessment and method statement with effective control measures that supports a safe system of work for a given construction operation. Learners must demonstrate that they have a good understanding of the methods used to ensure that construction operations can be carried out in a safe manner with minimal risk of accident, injury or near miss.

Learning aim C

For distinction standard, learners must consider an accident report and then thoroughly evaluate how safe systems of work can be improved, utilising review procedures following the reporting of accidents. They must consider both the strengths and potential weaknesses of the safe systems of work in relation to the scenario, and arrive at a logical conclusion with accurate justifications supporting the effectiveness of the safe system of work that they are proposing. Learners must demonstrate that they have developed a robust, in-depth understanding of the methods used to review safe systems of work following the reporting of an accident.

For merit standard, learners will adopt a balanced approach in considering an accident report and discussing how safe systems of work can be improved, utilising review procedures following the reporting of accidents. Learners will provide a relevant, balanced discussion of how different aspects of safe systems of work interrelate, in relation to the scenario. Learners must demonstrate that they fully comprehend the methods used to review safe systems of work following the reporting of an accident.

For pass standard, learners must explain how safe systems of work are reviewed, and the procedures that follow an accident to facilitate safety improvements in the future. Learners' explanations will be realistic and mostly relevant. Learners must demonstrate that they have a good understanding of the methods used to review safe systems of work following the reporting of an accident.

Links to other units

This unit links to:

- Unit 4: Construction Technology
- Unit 11: Site Engineering for Construction
- Unit 13: Measurement Techniques in Construction
- Unit 14: Provision of Primary Services in Buildings.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local construction organisations with expertise in a range of specialist areas
- contribution of ideas to unit assignments, for individual learner projects and contribution of project materials
- guest speakers from a related health and safety background
- participation in audience assessment of presentations for discussion elements
- work experience on a construction site
- employer's business materials as exemplars
- support from local business staff as mentors
- employer's health and safety policies and procedural documentation.

Unit 6: Surveying in Construction

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners develop the skills to carry out linear, levelling and land surveys, understanding the methods and technologies needed for this work.

Unit introduction

The surveying of land is concerned with the measurement of existing features of the natural and built environment, and the presentation of data in a format suitable for architects and engineers to use when designing construction projects. It plays an important role in the early stages of the design process and links with the setting out phase of construction projects.

In this unit, you will become familiar with basic surveying techniques, carry out surveying tasks and present fieldwork data in a suitable format. You will consider the nature of survey measurements, the instruments used and the errors inherent in the measurement systems, including the best ways to reduce or eliminate them.

Understanding how to carry out surveying in construction to produce suitable and accurate drawings will prepare you for employment or further study in land surveying, site supervision, civil engineering and other branches of construction. The skills you gain from this unit will help you progress to employment in a range of areas in the construction industry, including site supervision, setting out, land surveying, quantity surveying, civil engineering and other branches of construction.

Learning aims

In this unit you will:

- A** Understand the methods and technologies that underpin surveys
- B** Undertake fieldwork surveys to collect data for drawings
- C** Develop drawings from completed fieldwork surveys.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
<p>A Understand the methods and technologies that underpin surveys</p>	<p>A1 Linear, levelling and angular measurement</p> <p>A2 Equipment used to perform fieldwork surveys</p> <p>A3 Sources of systematic errors</p>	<p>A report on the techniques and instruments used to record survey data, including potential sources of systematic errors and their minimisation to produce accurate data for plan and section details production.</p>
<p>B Undertake fieldwork surveys to collect data for drawings</p>	<p>B1 Linear surveys</p> <p>B2 Levelling surveys</p> <p>B3 Read and record horizontal angles of a closed traverse</p> <p>B4 Basic arithmetic operations</p> <p>B5 Application of applied mathematical techniques</p>	<p>Linear survey and level booking sheets to demonstrate accurate recording of surveying measurements.</p> <p>Teacher observation sheets confirming individual understanding and contribution to the practical tasks carried out during fieldwork tasks with others.</p>
<p>C Develop drawings from completed fieldwork surveys</p>	<p>C1 Conventions used in survey drawings</p> <p>C2 Production of survey drawings</p> <p>C3 Corrected closed traverse drawing</p>	<p>A report:</p> <ul style="list-style-type: none"> • evaluating the methods used to take levelling and angular measurements in terms of accuracy • including linear survey and level booking sheets of reduced levels and check calculations • including coordinates, calculations and corrections. <p>A series of plan and section scaled detail drawings, to include a:</p> <ul style="list-style-type: none"> • linear survey line plotted accurately to scale • contoured plan of a surveyed area of land • long section detail of one surveyed line indicating rise and fall of ground between survey stations • plot of a corrected closed traverse. <p>The drawings/details can be produced using manual or computer-aided design (CAD) drawing techniques.</p>

Content

This unit is an introductory unit to surveying. Learners are expected to use basic surveying equipment and linear surveys that are small in nature. In this way, learners do not have to complete a full linear survey and in B.P4 this is limited to a small survey line. The overall focus of the unit is to allow learners to use modern technology to produce accurate horizontal and vertical surveys.

Learning aim A: Understand the methods and technologies that underpin surveys

A1 Linear, levelling and angular measurement

Surveying terminology principles, their application to fieldwork activity and use of surveying technology to complete fieldwork activities.

- Framework.
- Measuring horizontal and slope distances.
- Chainage:
 - running measurements
 - perpendicular offsets.
- Survey line:
 - baseline
 - check lines.
- Reading levels:
 - backsight
 - intermediate sight
 - foresight.
- Datum terminology:
 - Ordnance Survey Bench Mark (OSBM)
 - Temporary Bench Mark (TBM)
 - reduced level.
- Height of collimation.
- Rise and fall.
- Fly levelling.
- Whole circle bearings.
- Horizontal angles.
- Traverse types:
 - open
 - closed
 - fixed between points
 - rectangular coordinates
 - survey stations.

A2 Equipment used to perform fieldwork surveys

Surveying equipment, their advantages and disadvantages, and use in completing fieldwork activities.

- Tapes.
- Bands.
- Ranging poles.
- Levels:
 - automatic
 - tilting
 - dumpy and builder
 - laser.
- Digital theodolites.
- Electronic distance measurement (EDM) devices.
- Total stations, including Global Positioning Systems (GPS).

A3 Sources of systematic errors

How errors impact on the accuracy of fieldwork surveys.

- Plastic tapes – stretching.
- Levels – calibration errors.
- Theodolites:
 - bubble and electronic plummets off-centre errors
 - horizontal collimation errors
 - vertical collimation errors.
- Electronic distance measurement:
 - scale and index errors.
- Performance of systematic checks on surveying instruments:
 - tapes – calibration against standardised steel tapes
 - levels – two-peg test.
- Theodolites:
 - vertical axis check
 - transit axis check
 - spire check.

Learning aim B: Undertake fieldwork surveys to collect data for drawings

Methodologies used in the production of accurate surveys, including systematic checking, instrument adjustment and accuracy of calculations.

B1 Linear surveys

Application of techniques and processes to perform a linear survey.

- Establishing survey stations for a given location.
- Using chainage, offsets, tie lines to record measurements.
- Using correct booking techniques to survey in between survey stations.

B2 Levelling surveys

Application of techniques and processes to perform levelling surveys.

- Using TBM or OSBM datum to commence exercises.
- Recording readings using correct booking techniques:
 - height of collimation method
 - rise and fall method
 - flying levels.
- Completion of check calculations on the accuracy of levelling exercises undertaken.

B3 Read and record horizontal angles of a closed traverse

Application of techniques and processes for a closed traverse survey.

- Establishing survey stations for a closed traverse.
- Technique and recording requirements for the survey of a closed traverse.
- Recording horizontal angle readings using correct booking techniques.
- Detecting and correcting errors.

B4 Basic arithmetic operations

Application of arithmetic operations during fieldwork surveying tasks used to gather data for construction drawings.

- Calculations for levelling exercises and appropriate check calculations:
 - height of collimation method
 - rise and fall method
 - flying levels.
- Calculation of recorded horizontal angles using face left/face right techniques.
- Addition and subtraction of angles.

B5 Application of applied mathematical techniques

Application of applied mathematical techniques during fieldwork surveying tasks to gather data for construction drawings.

- Calculation of rectangular coordinates.
- Adjustment of simple traverse:
 - application of Bowditch to adjust a traverse
 - balancing in traverse
 - distribution of closure error.

Learning aim C: Develop drawings from completed fieldwork surveys

Techniques used to produce accurate construction drawings.

C1 Conventions used in survey drawings

- Conventions used in survey drawings.
- Appropriate scales for survey drawings.

C2 Production of survey drawings

Production of survey drawings to incorporate:

- levels survey plan
- plotting linear survey lines accurately to scale
- spot levels
- grid levels
- contours
- site cross section
- long section detail
- cut and fill cross section.

C3 Corrected closed traverse drawing

- Application of corrected traverse station coordinates to plot a closed traverse.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand the methods and technologies that underpin surveys		A.D1 Evaluate the methods and technologies underpinning linear, levelling and angular measurement and surveys.
A.P1 Explain the methods and technologies underpinning linear, levelling and angular measurement surveys. A.P2 Explain systematic errors in surveying measurements.	A.M1 Discuss the methods and technologies underpinning linear, levelling and angular measurement and surveys.	
Learning aim B: Undertake fieldwork surveys to collect data for drawings		B.D2 Evaluate the methods used to produce accurate fieldwork survey information for the development of accurate drawings. C.D3 Evaluate the production of drawings from completed fieldwork surveys.
B.P3 Perform systematic checks and adjustments to equipment and instruments appropriate for the fieldwork surveying activity. B.P4 Perform linear, levelling and angular measurement surveys using appropriate equipment and booking methods. B.P5 Perform correct calculations to support fieldwork activities.	B.M2 Justify the selection of equipment, methods used, the application of systematic checking, instrument adjustment and accuracy of calculations to provide accurate fieldwork survey information.	
Learning aim C: Develop drawings from completed fieldwork surveys		
C.P6 Produce plans of land and section detail drawings from completed fieldwork surveys.	C.M3 Produce plans of land and section detail drawings from completed fieldwork surveys to a high level of technical skill and accuracy.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, B.P5, C.P6, B.M2, C.M3, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to areas of land with a range of topographic and built features where surveying practical work can be carried out safely. Health, safety and welfare issues must be considered at all times and risk assessments carried out where necessary.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will evaluate the methods and technologies that underpin how to complete linear, levelling and angular measurement surveys. The evaluation must be supported with justified, detailed and well-presented examples of the relevant instruments to be used and appropriate booking procedures.

For merit standard, learners will discuss the methods and technologies that underpin how to complete linear, levelling and angular measurement surveys. The discussion must be supported with detailed and well-presented examples of the relevant instruments to be used and appropriate booking procedures.

For pass standard, learners will explain the characteristics that underpin how to complete linear, levelling and angular measurement surveys. The explanations must be supported with examples of the relevant instruments to be used and appropriate booking procedures to record measurements. Learners will explain the types of systematic errors in surveying measurements, which must include equipment used for linear, levelling and angular measurement fieldwork surveys.

Learning aims B and C

For distinction standard, learners will draw on and make supported judgements of the methodologies used to produce their accurate surveys. This will include their choices of equipment selected in comparison to alternate surveying instruments available to complete similar fieldwork measurements, and consideration of the accuracy of fieldwork readings and calculations completed.

For merit standard, learners will present a methodical and detailed justification of their selection of equipment and methods they have used to perform fieldwork exercises in order to provide accurate and reliable data for accurate drawings. This will include showing a clear understanding of the importance of the systematic checks and equipment/instrument adjustments that are conducted to minimise fieldwork measurements inaccuracies. Their calculations show their understanding of how to adjust a simple traverse network using a standard method of calculation.

Learners will provide accurate, well-presented scaled drawings and details of their surveys, to include a:

- linear plan detail of one surveyed line
- contoured plan of a section of the area surveyed
- section detail along one survey line
- corrected traverse plan detail.

It is acceptable for their drawings/details to be produced manually or by CAD.

Learners will produce drawings and details that meet all of the intended requirements, have the correct application of scale and are presented to a high level of technical skill and accuracy.

For pass standard, learners will participate in fieldwork activities to carry out their linear, levelling and angular surveys using appropriate equipment and recognised booking methods. Their survey measurements will be recorded using an appropriate booking method. Learners will produce evidence of how they completed systematic checks and adjusted equipment/instruments used to perform their fieldwork activities. Learners will produce reduced level calculations, using both the height of collimation and rise and fall methods. Learners will produce angular measurement calculations and record using the correct booking techniques. They will provide calculations for the coordinates of survey stations from data collected for a traverse survey. In this case, correct calculations will be seen as those that show understanding of methodologies. Learners must provide scaled drawings and details, to include a:

- linear plan detail of one surveyed line
- contoured plan of a section of the area surveyed
- section detail along one survey line
- corrected traverse plan detail.

It is acceptable for these drawings/details to be produced manually or by CAD.

Learners will produce drawings and details that meet the necessary requirements, however there will be some inaccuracies in the correct application of scale and in the presentation of the finished details.

Links to other units

This unit links to:

- Unit 1: Construction Principles
- Unit 2: Construction Design
- Unit 4: Construction Technology
- Unit 7: Graphical Detailing in Construction
- Unit 13: Measurement Techniques in Construction
- Unit 14: Provision of Primary Services in Buildings.

Employer involvement

This unit would benefit from employer involvement in the form of:

- guest speakers such as a surveyor from a local authority or building control department
- guest speakers from specialist surveying companies
- participation in audience assessment of presentations
- design/ideas to contribute to unit assignment/case study/project materials
- work experience
- own business materials as exemplars
- support from local business staff as mentors.

Unit 7: Graphical Detailing in Construction

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners develop knowledge and apply skills to produce graphical information by manual and computer-aided design (CAD) methods.

Unit introduction

The construction industry is heavily reliant on communicating through the use of graphical information. Whether you are a designer, builder or planner, an understanding of drawn information and the ability to produce it yourself is an essential part of your work. Information can be produced using manual or CAD methods. Although the industry is fast moving towards CAD, skills in the use of manual methods remain very important, especially those to make freehand sketches.

In this unit, you will develop an understanding of the range of media, equipment and techniques required to produce drawings manually, and you will learn about CAD techniques and requirements. You will produce a number of drawings following British Standards using manual and CAD methods. This unit will help you develop the skills to produce freehand sketches.

The knowledge and skills gained in this unit are essential to prepare you for progression to various roles in architectural and landscape design. An understanding of graphical representation is essential in other roles too, such as site management, site engineering, planning and quantity surveying. It will also help you progress to a higher education programme in construction and related disciplines.

Learning aims

In this unit you will:

- A** Understand the resources required to produce construction drawings
- B** Develop construction drawings for a given construction brief
- C** Undertake production of two-dimensional and three-dimensional freehand construction sketches.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Understand the resources required to produce construction drawings	A1 Manual methods A2 Computer-aided design (CAD) A3 Comparison of manual and CAD methods of drawing	An evaluative report or presentation supported with illustrations, images and sketches of the equipment and media that learners used in producing their construction drawings. Learners' construction drawings produced using manual and CAD methods, following standard conventions and practices in response to a given brief.
B Develop construction drawings for a given construction brief	B1 Construction drawings	
C Undertake production of two-dimensional and three-dimensional freehand construction sketches	C1 Principles, techniques and conventions C2 Freehand sketches C3 Skills, knowledge and behaviours	A portfolio of 2D and 3D freehand sketches. The portfolio should demonstrate the skills to use two- and three-point perspectives.

Content

Learning aim A: Understand the resources required to produce construction drawings

A1 Manual methods

Purpose, function, application and use of equipment and media for the production of construction drawings manually.

- Equipment required and its use in producing construction drawings manually:
 - hand drafting equipment, e.g. pens, pencils, scale rules, erasers, erasing shields, adjustable set squares, compasses, templates and flexible curves, stencils, parallel motion drawing boards, drafting tape.
- Media section and use to produce fit-for-purpose graphical information, to include:
 - grades of pencil (HB, H, 2H)
 - ink pens, e.g. 0.2, 0.25, 0.4, 0.5 mm thick
 - paper (detail paper, cartridge paper, tracing paper, A1, A2, A3 and A4 sizes)
 - reprographics.
- Manual drawing techniques, application and use, to include:
 - drawing lines and shapes
 - drawing to a scale
 - lettering and dimensioning
 - use of graphic conventions and standard symbols in accordance with British Standard BS 1192:2007.

A2 Computer-aided design (CAD)

Hardware and software specifications for a CAD system, CAD techniques and the comparison of the use of CAD with manual methods to produce construction drawings.

- Hardware requirements:
 - requirements to run the CAD software, e.g. graphics card, speed of processor, random-access memory (RAM) capacity, memory
 - storage, e.g. hard disk, solid state drive (SSD), USB stick, network drives, cloud
 - input devices, to include keyboard, mouse, other input devices, e.g. light pen, digitiser, joystick, thumbwheel
 - output devices, e.g. monitor, printer, plotter.
- Software requirements, to include:
 - operating systems available and their suitability for use with the chosen software package
 - CAD software packages and their advantages and limitations in use
 - minimum computing system requirements for the selected software package, e.g. hard disk space, memory required, processor, video card.
- CAD techniques, such as:
 - use of common commands and their application to produce designs, to include set-up, drawing, editing, zoom
 - plotting methods, to include vector plotting, colour plotting, black and white printing, greyscale printing, colour printing
 - setting up floor and external levels
 - drawing with composite elements, e.g. cavity wall
 - inserting standard components
 - using and applying layers in drawing production
 - using and applying line weights and their interpretation
 - selecting and applying appropriate drawing scale
 - producing a 3D virtual building model

- producing 2D views, to include plan views, elevation views, cross sections and site layout
- producing camera views and rendered images.

A3 Comparison of manual and CAD methods of drawing

Comparison of manual and CAD methods to produce construction drawings, to include:

- equipment requirements and costs
- accuracy and ease of making changes
- time and cost to produce drawings
- training and support required
- conversion from 3D to 2D
- production of rendered views
- transfer of information.

Learning aim B: Develop construction drawings for a given construction brief

B1 Construction drawings

Types and production of construction drawings following BS 1192:2007 standards and conventions using manual and CAD methods:

- BS 1192:2007 standards and conventions requirements and their application to the different types of construction drawing
- site plan requirements
- two-storey building plans
- elevations
- cross-section drawing
- component or detail drawing
- structural drawings showing general arrangements
- preliminary sketch drawing.

Learning aim C: Undertake production of two-dimensional and three-dimensional freehand construction sketches

C1 Principles, techniques and conventions

Application of principles and techniques used to draw freehand sketches, to include:

- concept of proportionality
- oblique projection
- draw what you see – perspective drawings
- identifying the horizon line, perspective line and vanishing point
- sketching with vanishing points, to include two- and three-point perspective.

C2 Freehand sketches

Two-dimensional and three-dimensional freehand sketch techniques and their application to:

- the interior of a building, to include room or space showing location of doors, windows, features and fixings
- the exterior of a building, to include the showing of spatial layout and important features
- marking requirements to indicate the clear location of vanishing point(s) on sketches
- the use and appropriate application of annotations to communicate details of materials, finishes, condition or any other relevant information in sketches.

C3 Skills, knowledge and behaviours

Demonstrate behaviour and its impact on outcomes, to include professionalism, etiquette, working to deadlines, accountability and individual responsibility.

- Evaluating outcomes to help inform high-quality justified decisions.
- Media and communication skills, including:
 - the ability to convey intended meaning, e.g. written (reports, visual aids for presentational use), verbal communication requirements (one-to-one and group, informal and formal situations)
 - use of tone and language for verbal and written communications to convey intended meaning and make a positive and constructive impact on the audience, e.g. positive and engaging tone, technical/vocational language suitable for intended audience.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand the resources required to produce construction drawings		
<p>A.P1 Explain the use of media and equipment to produce manual drawings for a given building.</p> <p>A.P2 Describe the resources required to produce CAD drawings for a given building.</p> <p>A.P3 Compare manual and CAD methods for the production of drawings in terms of their resource requirements, efficiency and cost.</p>	<p>A.M1 Analyse the use of manual and CAD methods to produce drawings for a given building in terms of their resource requirements, efficiency and cost.</p>	
Learning aim B: Develop construction drawings for a given construction brief		
<p>B.P4 Produce construction drawings for a two-storey building drawn to an appropriate scale, containing some technical information following BS 1192:2007 standards.</p>	<p>B.M2 Produce good-quality construction drawings for a two-storey building drawn accurately to an appropriate scale, containing appropriate technical information following BS 1192:2007 standards.</p>	
Learning aim C: Undertake production of two-dimensional and three-dimensional freehand construction sketches		
<p>C.P5 Produce annotated 2D and 3D freehand sketches, using appropriate conventions, for the interior of a building.</p> <p>C.P6 Produce annotated 2D and 3D freehand sketches, using appropriate conventions, for the exterior of a building.</p>	<p>C.M3 Produce good-quality, annotated 2D and 3D freehand sketches for the interior and exterior of a building with convergence to vanishing points.</p>	
		<p>A.D1 Evaluate the use of manual and CAD methods to produce drawings for a given building in terms of their resource requirements, efficiency and cost.</p> <p>B.D2 Produce high-quality, fully annotated construction drawings for a two-storey building drawn accurately to an appropriate scale, containing detailed technical information following BS 1192:2007 standards.</p> <p>C.D3 Produce high-quality, fully annotated 2D and 3D freehand sketches for the interior and exterior of a building with accurate convergence to vanishing points.</p>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, A.P3, B.P4, A.M1, B.M2, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to CAD and manual equipment for drawing and sketching.

Essential information for assessment decisions

Learning aims A and B

For distinction standard, learners evaluate manual and CAD methods to produce drawings. Learners will demonstrate a thorough understanding of the media and equipment required to produce manual and CAD drawings. They will produce a balanced evaluation of the methods used and take into account resource requirements, efficiency and cost.

Learners will produce a set of good-quality drawings using standards and conventions as laid down in BS 1192:2007 for a two-storey building. The drawings will contain correct technical information.

For merit standard, learners analyse manual and CAD methods to produce drawings. Learners will produce an analysis of the comparison of methods, which may lack balance but will take into account resource requirements, efficiency and cost.

Learners will produce a set of good-quality drawings using standards and conventions as laid down in BS 1192:2007 for a two-storey building. The drawings will include the use of both CAD and traditional drafting techniques (only one technique needs to be applied to each drawing produced) and drawings will contain appropriate technical information.

For pass standard, learners analyse manual and CAD methods to produce drawings. Learners will produce an analysis of the comparison of methods, which may lack balance but will take into account some elements of resource requirements, efficiency and cost.

Learners will produce a set of appropriately annotated drawings using standards and conventions as laid down in BS 1192:2007 for a two-storey building. This set of drawings must include the use of both CAD and traditional drafting techniques (only one technique needs to be applied to each drawing produced) and drawings will contain some technical information.

Learning aim C

For distinction standard, learners produce high-quality, fully annotated 2D and 3D freehand sketches. These will be produced using two- or three-point perspective drawing techniques for the interior and exterior of a building. Learners will demonstrate a thorough understanding of the concept of proportionality and vanishing points, although these may be outside the boundaries of the media at this level. Sketches will be fully annotated, providing details of materials, finishes, condition or any other relevant information and will show location of doors, windows, features, fixings and spatial layout.

For merit standard, learners produce good-quality, annotated 2D and 3D freehand sketches. These will be produced using two- or three-point perspective drawing techniques for the interior and exterior of a building. At this level, learners will show some understanding of proportionality and may have worked with vanishing points in the constraints of the media. Sketches will be annotated, providing details of most of the materials, finishes, condition or any other relevant information and will show location of doors, windows, features, fixings and spatial layout.

For pass standard, learners produce annotated 2D and 3D freehand sketches. At this level, learners will show some understanding of proportionality. Sketches will be annotated, providing details of some of the materials, finishes, condition or any other relevant information and will show location of doors, windows, features, fixings and spatial layout.

Links to other units

This unit links to:

- Unit 2: Construction Design
- Unit 4: Construction Technology
- Unit 11: Site Engineering for Construction
- Unit 13: Measurement Techniques in Construction
- Unit 14: Provision of Primary Services in Buildings.

Employer involvement

This unit would benefit from employer involvement in the form of:

- guest speakers
- technical workshops involving staff from local construction organisations
- contribution of ideas to unit assignment/project materials.

Unit 8: Building Regulations and Control in Construction

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners interpret and apply the requirements of the building regulations to existing and new-build schemes, including the application process and different methods of inspection and control.

Unit introduction

The Building Regulations are steeped in history, with many crediting their birth at the Great Fire of London in 1666, when the city was rebuilt with a view to fire prevention. However, building codes have been around even longer than this. Over the years, there have been many versions and variations of the building regulations as they have grown and evolved, leading to the documents we now use. Today's construction professionals need a wide and far-reaching knowledge to achieve compliance.

In this unit, you will learn how to apply for building regulations approval, which you will be able to use in professional practice in your future career. To enable you to do this, you will learn about the different options available, the documents required and the process of making an application. This unit is designed to be hands-on and practical and, on successful completion, you will have a good knowledge and understanding of the process.

The content of this unit will broaden your knowledge of one of the key legislative requirements in construction. It will prepare you for a range of roles in industry, ranging from the practical and production roles through to the professional and planning roles, such as building surveyors, architects, site supervisors, building inspectors and clerk of works. This unit will also prepare you for entry to higher-level courses in architecture or building construction.

Learning aims

In this unit you will:

- A** Understand the requirements of building regulations
- B** Examine the requirements of the building regulations
- C** Undertake a building regulations application.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Understand the requirements of building regulations	A1 The building regulations A2 Control and implementation of the Building Regulations	A written report and presentation to discuss the requirements of the Building Regulations and the different methods of control and of demonstrating compliance with the Building Regulations.
B Examine the requirements of the building regulations	B1 Approved documents B2 Alternative methods of achieving compliance	
C Undertake a building regulations application	C1 Types of application C2 Preparing a building notice application C3 Preparing a full plans application	Portfolio of evidence showing the preparation for a full plans building regulations application for a new-build domestic scheme.

Content

Learning aim A: Understand the requirements of building regulations

The specifics of the Building Act 1984 and the Building Regulations, and how to find and use the relevant information.

A1 The building regulations

- Application of the Building Act 1984.
- The requirements of the Building Act 1984:
 - definition of building work and the extent of the building regulations application
 - material alterations
 - exemptions to the regulations
 - dispensation or relaxation of the regulations.

A2 Control and implementation of the building regulations

- Application procedure and the correct use of each method:
 - full plans
 - building notice.
- Notification of commencement and certain stages of the works.
- Supervision of works and the powers of inspectors:
 - local authority
 - private inspectors
 - National House Building Council (NHBC).
- Testing and commissioning.
- Certification of the works.
- Self-certification schemes.
- Non-compliance and the consequences.

Learning aim B: Examine the requirements of the building regulations

Interpretation, application and compliance with the requirements of the Building Regulations 2010.

B1 Approved documents

Learners need to have a basic knowledge of the approved documents, how to use them and how to apply the requirements.

- Structure, covered in Approved Document A.
- Fire safety, covered in Approved Document B.
- Site preparation and resistance to contaminants and moisture, covered in Approved Document C.
- Toxic substances, covered in Approved Document D.
- Resistance to sound, covered in Approved Document E.
- Ventilation, covered in Approved Document F.
- Sanitation, hot water safety and water efficiency, covered in Approved Document G.
- Drainage and waste disposal, covered in Approved Document H.
- Combustion appliances and fuel storage systems, covered in Approved Document J.
- Protection from falling, collision and impact, covered in Approved Document K.
- Conservation of fuel and power, covered in Approved Document L.
- Access to and use of buildings, covered in Approved Document M.
- Electrical safety, covered in Approved Document P.
- Security in dwellings, covered in Approved Document Q.
- High-speed electronic communication networks, covered in Approved Document R.
- Materials and workmanship, covered in Approved Document 7.

B2 Alternative methods of achieving compliance

Methods of demonstrating compliance with building regulations for a variety of different project types, to include:

- British Standards
- European Standards
- NHBC Standards
- competent person/self-certification schemes.

Learning aim C: Undertake a building regulations application**C1 Types of application**

The type of work for which each application is used and the conditions of application and expiration.

- Full plans.
- Building notice.

C2 Preparing a building notice application

Learners need to be able to make a building notice application for a given scenario, including all the relevant documentation as stipulated in the building regulations.

- Statement of application.
- Description of the proposed works.
- Location of the building.
- Current and intended use of the building.
- For schemes with an extension or addition to the building:
 - details to show the size of the extension and the relationship to the adjoining boundaries
 - the boundaries of the existing curtilage, and the position and size of other buildings within the curtilage
 - location of the property in relation to the surrounding streets
 - a statement specifying the number of storeys
 - provisions made for drainage.
- Use of fee schedules to determine the correct fee for the application.

C3 Preparing a full plans application

Learners need to be able to make a full plans application for a given scenario, including all the relevant documentation as stipulated in the building regulations.

- Statement of application.
- Copies of the plans (multiple copies as specified by the regulating authority).
- Description of the proposed works.
- All other associated plans required to show compliance with the building regulations (which will include):
 - details to show the size of the extension and the relationship to the adjoining boundaries
 - the boundaries of the existing curtilage, and the position and size of other buildings within the curtilage
 - location of the property in relation to the surrounding streets
 - a statement specifying the number of storeys
 - provisions made for drainage
 - details of the works and materials
 - copies of relevant calculations and relevant supporting documentation.
- Statement in relation to Regulatory Reform (Fire Safety) Order 2005.
- Request for completion certificate.
- Determination of the appropriate fee.

Assessment criteria

Pass	Merit	Distinction	
Learning aim A: Understand the requirements of building regulations			
A.P1 Describe the requirements of the building regulations. A.P2 Explain the different methods of control and implementation for building regulation applications.	A.M1 Discuss the different methods of application and control for a building regulations application.		A.D1 Evaluate the different methods of control for a building regulations application on a variety of project types.
Learning aim B: Examine the requirements of the building regulations			B.D2 Evaluate the different methods of demonstrating compliance with building regulations on a variety of project types.
B.P3 Describe the different methods of achieving compliance with the building regulations. B.P4 Outline the requirements of the Approved Documents.	B.M2 Analyse the different methods of demonstrating compliance with the building regulations.		
Learning aim C: Undertake a building regulations application			
C.P5 Describe the method and process for a building notice application from application to completion. C.P6 Describe the method and process for a full plans application from application to completion. C.P7 Complete the application forms and produce outline plans for a building notice and a full plans application for a new-build residential project.	C.M3 Produce a detailed full plans building regulations application for a new-build residential project.		C.D3 Analyse the documentation produced for a full plans application in relation to the requirements of the building regulations.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.P7, C.M3, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of documents relating to the building regulations (online access optional)
- completed building regulation applications, drawings, forms and any other relevant supporting documentation.

Essential information for assessment decisions

Learning aims A and B

For distinction standard, learners will evaluate a number of different types of project (provided by the teacher) that use different methods of application and control, assessing the options for each scheme and coming to a conclusion about what they believe to be the most appropriate. Learners will validate their discussion and justify why they believe the chosen methods to be the most appropriate. If they can do so, they will demonstrate higher-level thinking, which is essential at distinction level and is more important than aligning with any preconceived thoughts held by the teacher.

For merit standard, learners will discuss in detail the different methods of application and control, considering when each method of application would be used, and when and why an applicant may choose to use an alternative method of control to that of the traditional local authority route. Their discussion will be considered and will describe the options available, without necessarily being evaluative of each one individually.

For pass standard, learners will describe the basic requirements of the building regulations and the different methods of control and implementation. They will also describe the range of methods available to demonstrate compliance and expand this specifically to take into account the Approved Documents. At this level there is no need for an in-depth analysis of each aspect, but there is a requirement to demonstrate a clear understanding of the whole process and how it works in the industry. Learners should make reference to the Building Act 1984 and to how the Building Regulations 2010 relate to this. They should discuss who is responsible for the implementation and regulation and the different ways in which the applicant can demonstrate compliance. There is no requirement to go into detail about the contents of each of the Approved Documents, but it is expected that they can name them all, as well as the broad areas they cover. Learners will select one as an example and describe in greater detail how the contents of the document will ensure compliance is achieved, for example using pertinent and succinct extracts from the Building Regulations 2010, alongside the relevant part of an Approved Document, to demonstrate a sound understanding.

Learning aim C

For distinction standard, learners will produce an analytical statement to support their application, choosing the form they feel to be most appropriate, for example a letter to the client explaining what all the various documents are, why they have produced them, and how they demonstrate compliance with the requirements of the regulations. Learners should be analytical and consider other options, and conclude why the methods selected were deemed the most appropriate.

For merit standard, learners will develop the form completed at pass level and produce the supporting documentation for a full plans application for a residential project, which should be modest in scope. Learners will produce the documents specific to the scheme, for example a new stand-alone development, or a reasonable-sized extension (at least an addition of 40% to the existing property and containing at least two storeys). Each option will present its own unique set of challenges and one is not considered easier than the other. Learners' work may tie in and support work in other modules, or be bespoke for this unit. It is acceptable to provide learners with blank plans and elevations so that they may annotate the drawings and produce the supplementary documents. Learners will provide sufficient information to be able to submit the application to the relevant body. They should clarify in the submission any assumptions made with regard to issues such as connection to the mains services.

For pass standard, learners will describe the process of making an application for both a building notice and full plans using a simple narrative or a flow chart. They will then complete an application form for a new-build residential scheme. Learners should be encouraged to obtain their own forms from the local authority in their area (typically available on the local authority website). It is expected that they include details of all the relevant supporting documents and a schedule of the key dates/stages for on-site inspection from the application stage through to final sign-off.

Links to other units

This unit links to:

- Unit 4: Construction Technology
- Unit 7: Graphical Detailing in Construction.

Employer involvement

Centres can involve employers in the delivery of this unit if there are local opportunities to do so. There is no specific guidance related to this unit.

Unit 9: Management of a Construction Project

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners gain an understanding of management principles and their application to the construction industry.

Unit introduction

Managing and delivering a project to a client on time and within budget is key to modern construction. With so many variables and potential unforeseen challenges, the job of the site or project manager is interesting, demanding and exacting. A satisfactory and rewarding conclusion to a project requires them to have the techniques to plan, programme, budget and manage the workforce, as well as have the skills to control these techniques in many and varied situations.

In this unit, you will examine the techniques needed to manage a project from start to completion. You will learn about the roles and responsibilities of the construction management team, which will include planning, forecasting, organising, buying, motivating and cost control. You will carry out planning and production control techniques and apply these skills to the design of building programmes.

This unit will help you to progress to a higher-level construction programme, such as the Higher National in Construction, or to a degree in project management. Additionally, the content of this unit will support progression to careers in site or project management, or to other professional roles in construction, such as architecture, quantity surveying, building services engineering and structural engineering.

Learning aims

In this unit you will:

- A** Understand the principles and application of management in construction
- B** Understand purchasing and cost management techniques
- C** Develop a programme of activities for construction works.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Understand the principles and application of management in construction	A1 Principles of management A2 Application of construction management techniques	A report about the management systems in use in the construction company.
B Understand purchasing and cost management techniques	B1 Application of purchasing methods B2 Cost management techniques	A training pack for trainee site managers joining a large national housing contractor.
C Develop a programme of activities for construction works	C1 Production control systems	A presentation in which learners consider the methods used to plan and control a programme of work for a housing development.

Content

Learning aim A: Understand the principles and application of management in construction

A1 Principles of management

Management principles and their application by the management team in the construction of low- to medium-rise buildings.

- Management style, methods and theories, to include Fayol, Maslow, McGregor.
- The roles, responsibilities and interaction of a construction project management team, to include the architect, quantity surveyor, construction manager, project manager, structural engineer, services engineer, site manager, buyer, planner.
- Planning and forecasting a project's needs, requirements and resources.
- On-site, short-term management for projects in progress:
 - pre-construction
 - site preparation
 - construction phase
 - handover.
- Claiming interim payments.
- Managing cash flow.
- Order and delivery of materials.
- Labour requirements.
- Training needs.
- Plant requirements.
- Quality assurance and control.
- Workforce supervision.
- Health and safety requirements.
- Decision making.
- Managing unforeseen events.
- Handover schedule.
- Completion.
- Managing the organisation's viable options:
 - national and local government policies, trends
 - labour requirements, recruitment, investment in skills and training
 - subcontract or direct employment
 - site management structure:
 - fully site based
 - head office based functions and support
 - plant and equipment hire, lease or purchase.
- Organising, procuring, co-ordinating and controlling:
 - materials, plant and equipment delivered to site on time
 - site storage facilities
 - site distribution methods
 - workforce requirements.
- Motivating the workforce:
 - incentives, including bonus payments
 - awards and rewards
 - job security, including contract renewal
 - training.

- Communication with the design and management team, the workforce, suppliers:
 - chains of command and management structures
 - team and site meetings
 - written forms of communication, their use and appropriateness, to include letters, architect's instructions, site instructions
 - telecommunications, to include telephones, mobiles and site radios
 - graphical and electronic forms of communication, e.g. emails, texts, instant messaging
 - information technologies, to include building information modelling (BIM).

A2 Application of construction management techniques

Site management responsibilities and the techniques used to manage a project/site to ensure an efficient build from commencement to completion, on programme and to budget.

- Standard planning techniques and how these are applied to control work on site:
 - production and use of master programmes
 - production and use of progress monitoring techniques:
 - Gantt charts, Critical Path Analysis, Line of Balance charts
 - production of daily activity sheets
 - production of site layout plan, to include access/exit points, materials storage, crane locations, site accommodation, temporary services, temporary site roads and hard standings
 - production and monitoring of delivery schedules
 - production of method statements and risk assessments for the various phases of construction work.
- The application of quality assurance and quality-control requirements:
 - document control
 - drawing registers
 - use of the specification
 - site testing
 - offsite testing
 - site inspection
 - dimensional quality control.
- Compliance with statutory liaison, building regulations, project materials specification requirements:
 - building regulation notices and inspection
 - National House Building Council (NHBC) inspections and standards.
- Application of on-site sampling and material testing techniques.
- Supervision and inspection of the quality of outcomes produced by the workforce.
- Management of direct workforce:
 - recruitment, training, competence requirements, including Construction Skills Certification Scheme (CSCS) requirements
 - monitoring of equal opportunities
 - leadership skills, including how to motivate individual and group members, creating productive team behaviours.
- Management of subcontractors:
 - communication methods, to include language use to instruct, persuade, motivate, discipline
 - checking of insurance and legal requirements and responsibility for compliance
 - retention of payment practice and its use
 - production of snagging lists of remedial works required.

Learning aim B: Understand purchasing and cost management techniques

B1 Application of purchasing methods

Use and application of purchasing techniques to facilitate the effective supply of materials to construction projects and the benefits and drawbacks of their use.

- List of selected suppliers:
 - area of operations
 - previous performance
 - capacity to supply
 - reputation of supplier
 - stock levels
 - ability to meet changes in demand.
- Materials and subcontract enquiries:
 - number of quotations required
 - scheduling materials or extracts from bills of quantities
 - use of correct or appropriate specifications
 - receipt of and checking quotations
 - gap analysis
 - negotiating skills.
- Planning links:
 - purchasing materials to meet the requirements of the construction programme
 - items with long lead times that might impact on construction planning
 - just-in-time deliveries to programme requirements when site storage is limited.
- Ethical purchasing and supply:
 - purchasing policy
 - sustainable and local sourcing
 - minimising transportation
 - use of sustainable materials
 - fair trade agreements
 - abuse of power
 - avoidance of corruption
 - social responsibility.
- Purchase orders:
 - terms and conditions
 - discounts
 - timing of orders
 - clarity of content.
- Benefits and drawbacks of serial and term contracts:
 - annual supply contracts
 - multiple project contracts
 - serial contracts.

B2 Cost management techniques

Recognition and knowledge of cost management techniques applied during a building project and an appreciation of how these assist the manager to plan and manage the budget.

- Analysis of interim claims, to include:
 - preliminary items
 - measured work by trade or element breakdown
 - nominated subcontract values
 - materials on site.

- Cost value comparisons, to include:
 - costs from management information systems
 - monthly valuations reconciled with project costs
 - profit and loss projections
 - cash flow forecasts.
- Managing costs:
 - selection and application of techniques available to break down, itemise and control the project cost, to include:
 - unit costing
 - element costing
 - marginal costing
 - variance analysis
 - selection and use of techniques to enable prices and budgets to be prepared and compared, to include:
 - estimated costs
 - variable costs
 - target costs
 - actual costs
 - identifying cost savings, to include:
 - labour
 - plant
 - materials
 - site set-up
 - site management structure
 - methodologies
 - programme acceleration or deceleration.
- Preparing and examining elemental and project comparison costs.

Learning aim C: Develop a programme of activities for construction works

C1 Production control systems

Understand the need, and techniques, to plan and control a project on site, both in terms of physical and financial progress, and to be able to communicate this information to site and management teams.

- Production of programmes of activities:
 - planning project organisation, to include:
 - method statements
 - site layout
 - site accommodation and storage
 - waste management
 - site traffic management
 - use of Gantt charts, bar charts, linked bar charts to show and monitor progress of the construction project
 - use of Critical Path Analysis, network analysis, Line of Balance, precedence diagrams, time change diagrams to show and monitor progress of the construction project:
 - manual and computer-based techniques on site.
- Measurement of progress:
 - physical progress on site, to include:
 - regular comparison of planned progress of work on site with actual progress
 - methods to overcome the consequences of running ahead or behind project schedule
 - causes and effects of delays, the consequences of rescheduling, implementing overtime payments, extensions of time applications
 - preparation of financial progress information, to include:
 - site returns
 - interim valuations and payments
 - claims and variations
 - reviewing events, predicted and unforeseen.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand the principles and application of management in construction		A.D1 Evaluate the different roles of the construction management team, their responsibilities and the techniques applied by a site manager to manage the project.
<p>A.P1 Explain the roles of the members of the construction management team and their individual responsibilities.</p> <p>A.P2 Explain the techniques applied by a site manager to manage the project.</p>	<p>A.M1 Discuss the roles of the members of the construction management team and how their individual responsibilities are applied.</p> <p>A.M2 Discuss the techniques applied by a site manager to manage the project.</p>	
Learning aim B: Understand purchasing and cost management techniques		B.D2 Evaluate the methods used to facilitate the ethical supply of appropriate materials to site, meeting programme requirements, and how these impact on the cost management and profitability of construction projects.
<p>B.P3 Explain the methods used by construction companies to facilitate the supply of appropriate materials to site.</p> <p>B.P4 Explain the cost management techniques used to monitor and control the cost and profitability of construction projects.</p>	<p>B.M3 Assess the methods used to facilitate the cost-effective supply of appropriate materials to site.</p> <p>B.M4 Analyse the cost management techniques used to effectively monitor and control the cost and profitability of construction projects.</p>	
Learning aim C: Develop a programme of activities for construction works		C.D3 Produce a comprehensive programme of activities, with graphical representations and highly detailed timings that show critical and non-critical elements for a given construction project, and consider the most appropriate method to monitor progress.
<p>C.P5 Produce a programme of activities with graphical representations for a given construction project.</p> <p>C.P6 Explain the methods used to monitor the progress of construction projects.</p>	<p>C.M5 Produce a detailed programme of activities, with graphical representations and appropriately detailed timings for a given construction project, and consider an appropriate method to monitor progress.</p>	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of three summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aim: B (B.P3, B.P4, B.M3, B.M4, B.D2)

Learning aim: C (C.P5, C.P6, C.M5, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners would benefit from access to project management planning software and case studies of real-world construction projects, of varying size and scope.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will evaluate the construction management team roles and responsibilities. They will demonstrate a thorough understanding of how the manager will plan, interact, communicate and motivate within their team and with the production workforce and subcontractors, and how their individual responsibilities are applied and impact on the successful construction of a building.

For merit standard, learners will discuss the different roles of the management team and how their individual responsibilities are applied in the planning and running of a building project. They will also discuss the techniques applied by a site manager to manage the project and coordinate the workforce, including the subcontractors, on site. They will consider the different aspects of site management, how they interrelate and the extent to which they are important.

For pass standard, learners will explain the roles and responsibilities of the members of the construction management team, including the roles relevant to the project scenario and their duties and involvement in the planning and implementation of a building project. They must describe the techniques applied to manage the project, including the supervision of the workforce and the subcontractors, as well as the coordination of their activities on site. In explaining, learners will demonstrate that they understand the functions and objectives of construction management techniques and their suitability for the given scenario.

Learning aim B

For distinction standard, learners will evaluate the methods used to facilitate the ethical supply of appropriate materials to site, meeting programme requirements, and how these impact on the cost management and profitability of construction projects. In doing so, they will consider the different aspects of the purchasing function and the cost management techniques used to monitor and control construction costs. When evaluating, learners will draw on their knowledge of purchasing and cost-control methodologies, as well as the concepts and principles applied to the scenario, considering their strengths and weaknesses, their interrelation, relevance or significance, leading to a justified conclusion.

For merit standard, learners will assess the methods used to facilitate the cost-effective supply of appropriate materials to site. They will analyse the cost management techniques used to effectively monitor and control the cost and profitability of construction projects. When discussing, learners will consider the different aspects of purchasing and cost control, their techniques and methodologies, how they interrelate, and the extent to which they are important.

For pass standard, learners will explain the methods used by construction companies to facilitate the supply of appropriate materials to site. They will also explain the cost management techniques used to monitor and control the cost and profitability of construction projects. In explaining, learners will demonstrate that they understand the functions and objectives of purchasing and cost-control techniques and their suitability for the given scenario.

Learning aim C

For distinction standard, learners will produce a comprehensive programme of activities, with graphical representations and highly detailed timings that show critical and non-critical elements for a given construction project. Learners will consider the most appropriate method to monitor progress and the shortest route to completion, with the placement of non-critical elements based on the identified float. The programme will be in an appropriate format with the correct sequence of activities and attention to detail. Learners will clearly explain the appropriate methods for monitoring progress on site.

For merit standard, learners will produce a detailed programme of activities, with graphical representations and appropriately detailed timings for a given construction project, and consider an appropriate method to monitor progress. Learners will clearly explain the appropriate methods for monitoring progress on site.

For pass standard, learners will produce a programme of activities with graphical representations for a given construction project. The programme will use one of the techniques noted in the specification. They will explain the methods used to monitor the progress of construction projects. In explaining, learners will demonstrate that they understand the functions and objectives of progress monitoring and the suitability of the methods for the given scenario.

Links to other units

This unit links to:

- Unit 4: Construction Technology
- Unit 5: Health and Safety in Construction
- Unit 6: Surveying in Construction
- Unit 8: Building Regulations and Control in Construction
- Unit 11: Site Engineering for Construction
- Unit 19: Quantity Surveying.

Employer involvement

This unit would benefit from employer involvement in the form of:

- guest speakers from specialist construction project management organisations
- participation in audience assessment of presentations
- design/ideas to contribute to unit assignment/case study/project materials
- work experience
- employer's business materials as exemplars
- support from local business staff as mentors.

Unit 10: Building Surveying in Construction

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners develop the skills needed to survey existing buildings, establish current condition and size, and enable detailed survey reports/plans that highlight defects and identify potential issues.

Unit introduction

If something goes wrong with a building, how do you know what the problem is and how to fix it? A building surveyor carries out surveys on existing properties and advises the owners on how to repair, alter or extend the building to meet new needs.

In this unit, you will learn how to carry out a buildings survey, identify defects and record findings in a format suitable for a range of end users. You will gain a good understanding of building defects, their causes and the remedies available. You will learn how to undertake a measured survey of an existing property to produce scale plans and elevations of the building.

The skills in this unit are essential for employment as a building surveyor, and other related construction roles in a range of areas such as construction management, site supervision, quantity surveying and architecture. This unit will give you a good foundation for studying construction-related subjects at a higher level, including degree-level programmes.

Learning aims

In this unit you will:

- A** Understand the impact of the methods used to construct existing buildings on current and future maintenance requirements
- B** Explore different defects and methods of repair for low-rise residential properties
- C** Undertake a building survey of a low-rise residential property.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Understand the impact of the methods used to construct existing buildings on current and future maintenance requirements	A1 Different styles and types of residential property A2 Traditional methods of construction A3 Modern methods of construction	Illustrated report or presentation and information booklet on different types and styles of residential properties, their common defects and methods of repair.
B Explore different defects and methods of repair for low-rise residential properties	B1 Defects to the external envelope B2 Internal defects B3 Methods of repair and remediation	Building and measured survey of a low-rise residential property. Production of survey report detailing the condition, defects, remedial works, plans and elevations.
C Undertake a building survey of a low-rise residential property	C1 Types of survey C2 Undertaking a building survey C3 Undertaking measured surveys C4 Skills, knowledge and behaviours	

Content

Learning aim A: Understand the impact of the methods used to construct existing buildings on current and future maintenance requirements

Different methods of construction, styles and periods of architecture.

A1 Different styles and types of residential property

The features and details of residential property types, periods and styles to inform maintenance requirements and remedial works.

- Types of property:
 - detached, semi-detached, terraced, end-terraced, bungalow, flat, duplex, maisonette, cottage, mansion, manor house, 'prefab'.
- Key periods and architectural styles of residential property:
 - Tudor, Elizabethan, Georgian, Victorian
 - pre-war (1900 to 1939), post-war (1945 to 1960)
 - modern, postmodern, contemporary.

A2 Traditional methods of construction

Recognition and knowledge of construction technologies found in low-rise residential properties and how material evolution and advancement impact on construction to facilitate decisions related to maintenance required and remedial works.

- Foundations:
 - strip foundations
 - raft foundations
 - spreader foundations/corbelled brickwork/masonry foundations
 - timber piles.
- Walls:
 - solid:
 - stone, brick, block
 - cavity:
 - brick and block, brick and brick, stone and block/brick, block/brick and metal cladding
 - framed:
 - cruck frame, box frame, post and beam, storey height panels.
- Roofs:
 - pitched, mono-pitched, mansard, dormer
 - traditional timber, timber truss, metal truss
 - slate, stone, clay tiles, thatch, metal sheet
 - flat:
 - timber, metal deck, concrete
 - lead, felt, asphalt.
- Floors:
 - concrete/ground-bearing slab
 - suspended timber (ground floor and upper floors).
- Internal walls:
 - concrete block
 - timber stud
 - solid plaster and plaster and lath finishes.
- Doors and windows:
 - timber, metal, single glazing, secondary glazing, leaded lights.

A3 Modern methods of construction

Recognition and knowledge of construction technologies found in low-rise residential properties and how material evolution and advancement impacts on construction to facilitate decisions related to maintenance required and remedial works.

- Foundations:
 - strip
 - trench fill
 - raft
 - short bored pile.
- Walls:
 - solid
 - thermal blocks, external insulation, internal insulation, external finishes (render, cladding)
 - rainscreen cladding
 - cavity:
 - brick and thermal block, block and block, insulated cavities, internal insulation, internal finishes (plaster, dry lining), external insulations, external finishes (render, cladding)
 - framed:
 - storey height panels, structured insulated panels (SIPs)
 - timber frame construction, platform frames
 - insulation.
- Roofs:
 - pitched and mono-pitched:
 - timber truss, metal truss, SIPs
 - slate, stone, clay tiles, thatch, metal sheet, green roof, polycarbonate, glass
 - flat:
 - timber, metal, concrete
 - felt, single ply membrane, Green Roof Professional (GRP)
 - insulation.
- Floors:
 - concrete:
 - ground-bearing slab, suspended concrete, insulation, screeds
 - suspended timber:
 - solid timber, engineered joists
 - insulation.
- Internal walls:
 - metal stud
 - timber stud
 - board and skim finishes.
- Doors and windows:
 - timber, PVCu, thermally broken metal, composite frames, composite doors, double and triple glazing, thermal coatings and gases.

Learning aim B: Explore different defects and methods of repair for low-rise residential properties

Consideration of the defects to the key elements of a building, focusing on those most commonly noted in the building survey.

B1 Defects to the external envelope

Recognition and knowledge of external building defects to facilitate decisions related to maintenance required and remedial works.

- Foundation defects:
 - settlement:
 - seasonal movement (frost, heave), mining, compression of substrata, landfill, trees
 - sulphate attack
 - overloading
 - bad design/poor construction methods.
- Wall defects:
 - bowing/bulging:
 - poor construction detailing, wall tie failure, lack of lateral support, overloading, roof thrust, alterations and changes to original structure
 - failure of arches, lintels, embedded timbers and structural elements
 - expansion of embedded steel and iron fixings
 - surface failure
 - frost, efflorescence, cracking, sulphate attack, poor specification, bad workmanship/detailing, failed pointing, incorrect pointing mixes, material failure, water ingress.
- Chimney defects:
 - tall and thin stacks with no support, failure of the internal structure, freeze thaw, sulphate attack, water ingress.
- Roof defects:
 - structural failure:
 - poor construction/detailing, lack of ties, lack of lateral restraint, change of covering, water ingress, alterations, rot/insect attack of timber, flashings (missing, sand : cement), no ventilation
 - covering failure:
 - poor construction, corrosion of mechanical fixings, delamination, efflorescence, pointing corrosion, thermal expansion, frost damage.
- Door and window defects:
 - rotten timber, putty failure, fixing failure, failure of hinges and handles, rusting to steel and iron fixings, swelling and poor operation.
- Failure of decoration.

B2 Internal defects

Recognition and knowledge of internal building defects to facilitate decisions related to maintenance required and remedial works.

- Ground floor:
 - concrete:
 - sulphate attack, membrane failure, damp ingress, poor detailing/construction, settlement, heave, screed failure, excessive spans for pre-cast
 - timber:
 - poor construction and detailing, lack of ventilation, damp ingress, excessive spans, lack of support/strutting, insect attack, fungal attack, joist ends built in with no DPC.
- Upper floors and ceilings:
 - floors:
 - poor construction and detailing, lack of support to the joist ends, lack of support and strutting causing sagging, alterations and service holes/notches, overloading, insect and fungal attack, joist ends built in with no DPC, failure of mechanical fixings

- ceilings:
 - poor construction and detailing, failure of fixings to plaster laths or boards causing debonding of surface finish, water leaks causing stains.
- Walls:
 - masonry:
 - overloading, alterations, poor detailing and construction, damp (rising and penetrating), lack of lateral support, lack of support below
 - timber:
 - overloading, alterations, poor detailing and construction, damp, lack of lateral support, lack of support below, lack of strutting, insect and fungal attack, service holes and notches.
- Stairs:
 - overloading, insect and fungal attack, poor detailing and design, loose spindles and handrails, loose tread and risers.
- Decoration:
 - damp staining, wallpaper peeling, paint finish imperfections.

B3 Methods of repair and remediation

Determining appropriate repairs from which options are selected.

- Repair:
 - minimal intervention to affected area only
 - repairs to the obvious damage but not necessarily the root cause (stitching cracks, sealing damp areas, redecoration to cover defects).
- Methods of repair for common defects:
 - damp, cracking, insect and fungal infestation.
- Replace/renew:
 - extensive repairing option to remove root cause and makes good to wider area
 - underpinning
 - taking down and rebuilding
 - complete removal of damaged area, rebuilding with new materials, e.g. structural timbers.

Learning aim C: Undertake a building survey of a low-rise residential property

Understanding of different survey types, their use and application, and the actual process of undertaking a survey.

C1 Types of survey

Survey types, purpose, essential content and use.

- Building survey.
- RICS Level 1 Condition Report.
- RICS Level 2 HomeBuyer Report.
- RICS Level 3 Building Survey.
- Mortgage valuation.
- Schedule of Dilapidations (Landlord and Tenant).
- Schedule of Condition (Landlord and Tenant).
- Maintenance survey.
- Alteration survey.
- Stock condition survey.
- Mortgage drawdown.
- Access audits.
- Elemental survey.
- Insurance reinstatement survey.
- Defect analysis survey.
- Health and safety survey.
- Measured survey.

C2 Undertaking a building survey

Surveying a building and recording findings to produce a building survey report.

- Pre-survey protocol:
 - confirmation of instruction, access arrangements, health and safety considerations.
- Property inspection requirements:
 - inspection of the building's main elements (walls, roof, floors, doors and windows)
 - recording inspection findings – element condition, defects
 - photographic record requirements, e.g. of the property, defects
 - measurement of defects, e.g. levels of damp, width of cracks, distance of deflection or movement.
- Survey report requirements and completion: general description of the property, details of condition and specific defects, photographic record of condition and defects.

C3 Undertaking measured surveys

Measured survey requirements to produce survey drawings.

- Pre-survey protocol:
 - confirmation of instruction, access arrangements, health and safety considerations.
- Property inspection requirements:
 - sketching the layout of floor plans and elevations
 - measurements and recording requirements to produce floor plans and elevations.
- Survey drawings:
 - production of scale plans
 - production of elevations.

C4 Skills, knowledge and behaviours

Demonstrate behaviour and its impact on outcomes, to include professionalism, etiquette, working to deadlines, accountability and individual responsibility.

- Evaluating outcomes to help inform high-quality, justified recommendations and decisions.
- Media and communication skills, including:
 - the ability to convey intended meaning, e.g. written (design documentation, recording documentation, reports, visual aids for presentation use), verbal communication requirements (one to one and group, informal and formal situations)
 - use of tone and language for verbal and written communications to convey intended meaning and make a positive and constructive impact on audience, e.g. positive and engaging tone, technical/vocational language suitable for intended audience.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand the impact of the methods used to construct existing buildings on current and future maintenance requirements		A.D1 Evaluate the different residential housing styles and types and how their construction methods are applied and their impact on the current and future requirements for repair and remedial work.
A.P1 Describe the different styles and types of residential housing. A.P2 Describe the different methods of traditional and modern construction used for residential housing and their impact on current and future repair and remedial work.	A.M1 Discuss the different residential housing styles and types and how their construction methods are applied and their impact on the current and future requirements for repair and remedial work.	
Learning aim B: Explore different defects and methods of repair for low-rise residential properties		BC.D2 Evaluate the repair and remedial work options for the defects identified in the building survey. BC.D3 Demonstrate individual responsibility, creativity and self-management when preparing for and undertaking the building survey and producing the survey report and drawings.
B.P3 Describe a range of external and internal defects commonly occurring in residential properties. B.P4 Explain different methods of repair and remediation to a range of internal and external defects of a residential property.	B.M2 Discuss appropriate repair and remedial measures for a range of external and internal defects for a residential property.	
Learning aim C: Undertake a building survey of a low-rise residential property		
C.P5 Perform a building survey, detailing the condition and defects with required remedial works for a residential property. C.P6 Record the findings of the survey in a survey report. C.P7 Perform a measured survey on a residential property. C.P8 Produce accurate scale plans and elevations for a residential property to standard conventions.	C.M3 Produce a comprehensive and detailed building survey, detailing the condition, defects and remedial works required, with plans and elevations for a residential property.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, C.P7, C.P8, B.M2, C.M3, BC.D2, BC.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must:

- have access to a suitable property to undertake a building survey and a measured survey (ideally of typical residential scale)
- be supervised during the survey
- have measures in place to ensure health and safety, including the provision of appropriate safety briefings and the use of appropriate safety equipment.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will evaluate the evolution and development of residential housing types and styles, methods of construction and the impact on the current and future requirements for repair and remedial work. Learners will demonstrate a thorough understanding of the changes in design and style and how different methods of construction have contributed to these changes. They will demonstrate how material evolution and advancement has allowed for changes in style. For example, learners can demonstrate how, through the use of engineered joists, layouts in modern houses do not need as many supporting walls. Similarly, they can explain how developments in concrete technology in the 1960s saw an increase in concrete structures, even on a domestic scale, and show how a lack of understanding led to problems with damp and condensation. Information will be well researched and presented in a clear and coherent manner for the intended audience, with clearly described examples and annotated visual elements.

For merit standard, learners will discuss the evolution and development of housing types, styles and construction methods and the impact on the current and future requirements for repair and remedial work. They may not necessarily make the links between changing styles and material development but will consider how different techniques can allow for different designs and styles. Learners' work will be clear and provide sufficient detail as to construction methods and how the elements fit together. Information will be technically correct and at an appropriate level for the intended audience.

For pass standard, learners will describe the different methods and styles of housing used in traditional and modern methods of construction and the impact on the current and future requirements for repair and remedial work. They will be technically accurate but will not make links between different styles and changes in materials. Learners will consider the three different architectural styles, and traditional and modern construction methods, and will demonstrate a good understanding of them.

Learning aims B and C

For distinction standard, learners will demonstrate a high level of technical knowledge, autonomy and self-reliance. They will also demonstrate a high level of skill in inspecting an existing property, recording the condition and analysing the defects found. They will develop a detailed schedule for the repair and remediation of the defects noted. This will typically be located in the recommendations section of the report they produce. The report will be to a very high standard, technically accurate and will contain very few errors or omissions.

Learners will take individual responsibility for their own work, for example identifying potential issues and resolving them, reviewing their work and making improvements, and keeping their work safe and secure. They will show their creativity, for example through taking modern approaches to the solving of building defects. Learners will refer to tangible evidence, such as survey records, to support their evaluation.

For merit standard, learners will produce a detailed, illustrated survey report in a standard format that identifies the condition of the property and the defects. The report must contain at least the same level of detail as a Level 2 survey type. During the survey, learners will exhibit awareness for health and safety and produce a detailed record of field observations.

For pass standard, learners will undertake a building and measured survey, and produce a survey report and a set of plans and elevations using standard formats and conventions. The report will be limited in detail but will record the condition of the property and identify the defects. They will show gaps in knowledge and the report may not contain appropriately annotated photographs. Field observations can be limited and another surveyor may struggle to use them. Learners will act in a timely fashion and will undertake the survey and produce the report in accordance with agreed timescales.

Links to other units

This unit links to:

- Unit 1: Construction Principles
- Unit 2: Construction Design
- Unit 5: Health and Safety in Construction
- Unit 6: Surveying in Construction
- Unit 7: Graphical Detailing in Construction.

Employer involvement

This unit would benefit from employer involvement in the form of:

- guest speakers
- ideas to contribute to unit delivery and assignments
- work experience in the construction settings where building surveying knowledge and skills are used.

Unit 11: Site Engineering for Construction

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners undertake site engineering processes used to set out construction and built environment projects.

Unit introduction

The skills required for setting out construction and civil engineering works involves a high degree of accuracy. This is essential in meeting the tolerances of the elements that form the substructure and the superstructure so that the building, and its components, fit into position correctly. For example, the specification for the installation of roads is often in terms of ± 3 mm in level. Also, as a site engineer, you will need to be able to read dimensions from drawings provided by the designer and produce calculations to assist in setting out the work. Building modern city landscapes requires the ability to control the verticality of multi-storey buildings to a high degree of accuracy from storey to storey.

In this unit, you will use a range of surveying equipment to set out construction work, including string lines, pegs and global positioning system (GPS) total stations to ensure that the completed structure meets the designer's specification in terms of appearance and accurate positioning.

This unit gives you the opportunity to progress to site-management, project-management and supervision roles in the construction sector as a site manager or site engineer, or to progress to specialist civil engineering qualifications such as Higher Nationals in civil engineering and degrees in construction and civil engineering specialisms.

Learning aims

In this unit, you will:

- A** Undertake the setting out of construction work on plan
- B** Undertake the setting out of infrastructure works
- C** Explore how to maintain horizontal and vertical control in setting out.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Undertake the setting out of construction work on plan	A1 Setting-out terminology A2 Basic setting-out processes A3 Interpreting drawn information to set out construction work A4 Site engineering equipment	A case study scenario where learners have to acquire all the information, equipment and data for a setting-out project. They will produce a method statement detailing all requirements, then set out a building on plan.
B Undertake the setting out of infrastructure works	B1 Setting out drainage B2 Setting out embankment and cutting profiles B3 Interpreting drawn information to set out roads	Fieldwork practical tasks to defined levels of accuracy. Learners will evaluate methodologies used in undertaking a series of practical setting-out tasks.
C Explore how to maintain horizontal and vertical control in setting out	C1 Vertical and horizontal control of structures C2 Vertical and horizontal control of excavation	

Content

Learning aim A: Undertake the setting out of construction work on plan

A1 Setting-out terminology

Setting-out terminology use and its application to associated equipment and methods.

- Base line as the starting point used to offset the grid lines on plan.
- Corner pegs are used to indicate the corner points of structures.
- Profile boards are used to indicate the inside, outside and centre lines of walls and indicate levels for depth and height control.
- A traveller is used between profile boards to indicate the extent of reduced-level excavation.
- The centre line follows a midpoint between the inside and the outside face of a wall.
- Coordinates are indicated by northings and eastings using GPS, polar or Cartesian systems.
- Grids are square arrangements of intersecting lines.
- String lines are drawn between two points to denote a grid, building element face or centre line.
- Diagonal measurement is taken across two opposing corners to confirm accuracy of setting out squares and rectangles.
- Offset measurement is taken perpendicular from a base line.

A2 Basic setting-out processes

Application of techniques used to establish basic setting-out points in the field.

- Construction of a right angle using the following methods:
 - Pythagoras' theorem
 - builder's square
 - optical square
 - base line and scribing equal arcs
 - theodolite
 - coordinates from a total station
 - calculation of diagonal from two sides
 - the three, four, five technique.
- Transferral of bench mark to establish a temporary bench mark (TBM) on site:
 - sourcing a bench mark
 - digital information reference to drawings and design levels
 - methods of recording on site and protecting TBM
 - use of storey tapes for vertical heights.

A3 Interpreting drawn information to set out construction work

Fieldwork in setting out buildings on plan for initial excavation and for external wall positions.

- Setting out buildings for initial excavation to reduced level of foundations:
 - interpretation of drawings for setting-out information and dimensions on site
 - square or rectangular shapes containing voids on plan for excavation using corner pegs to indicate centre of foundation trench.
- Setting out buildings for outlines of external walls:
 - the use of profile boards for a building's external walls, centre line, foundations and position of cavity.

A4 Site engineering equipment

- How and when traditional setting-out tools and equipment are used:
 - pegs, to include basic pegs, string lines, nails, saw cuts
 - tools, to include sledgehammer, claw hammer, lump hammer, saw
 - profile rails and boards, including use of saw cuts and pins
 - road pins and tape
 - markers, to include marker spray, paint, sand, lime
 - measuring, to include tape measures, steel and fibre, retractable steel tape measure
 - optical surveying equipment, to include level, tripod, theodolites, staff.
- How to use and the benefits of digital technology, to include:
 - total station with GPS
 - equipment using laser levelling
 - laser measuring devices.

Learning aim B: Undertake the setting out of infrastructure works

The use and application of methods employed in the field to set out the following types of construction and civil engineering work.

B1 Setting out drainage

- Calculating the gradient from invert levels taken from design drawings.
- Transferring TBM to drainage position on site.
- Positioning manholes.
- Calculating heights of profile rails.
- Setting up profile boards.
- Establishing profile rails and highlighting with spray paint.
- Calculating the length of traveller.
- Constructing traveller.
- Positioning cover level indicators.

B2 Setting out embankment and cutting profiles

- Positioning base of embankment on plan, using pegs.
- Calculating embankment gradient from road levels and ground levels.
- Positioning profile sight rails to gradient.
- Checking that rails are parallel.
- Calculating drainage ditch profile.
- Positioning profile.

B3 Interpreting drawn information to set out roads

- Establishing road curve points and all data from road design drawings.
- Selecting and applying the following methods to set out curves based on given information:
 - using the chord point method, how to:
 - establish intersection points
 - establish tangent points
 - calculate the deflection angle, radius of curvature, centre of curvature
 - establish setting-out data for a number of points on the curve
 - set out road kerb curve using pins
 - using the deflection angle method, how to:
 - establish deflection angle
 - establish tangent angles
 - establish chord lengths
 - set up theodolite over starting point
 - establish each tangential point by deflection angle and chord length.

Learning aim C: Explore how to maintain horizontal and vertical control in setting out

C1 Vertical and horizontal control of structures

Techniques used and their application to control vertical structures maintaining tolerances in accordance with specifications.

- Concrete works, to include:
 - positioning of kickers for in-situ concrete columns
 - checking verticality of column shuttering in two directions
 - confirming within tolerances
 - checking squareness and diagonals of shuttering profile on plan
 - checking cover to reinforcement.
- Structural steel works:
 - positioning holding down bolt boxes in line with grid
 - checking verticality of steel columns in two directions
 - confirming within tolerances
 - checking columns' profile lines in the grid.

C2 Vertical and horizontal control of excavation

Application of techniques to record data before setting out of construction work for secondary purposes.

- Establishing and recording a grid of ground levels before excavation, to include:
 - setting out a grid over the area of the excavation
 - taking flying levels over the area
 - plotting grid of levels to reduced level.
- Interim and final grid of levels from reduced excavation to establish volumes, to include:
 - setting out a grid over the area of the excavation
 - taking flying levels over the area
 - plotting grid of levels to excavation level
 - calculating of the formation level achieved and confirmation of depth
 - providing records for quantity surveying applications.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Undertake the setting out of construction work on plan		A.D1 Justify the selection of setting-out tools, equipment and processes for the accurate setting out of a given structure.
<p>A.P1 Explain the setting-out procedures using traditional tools, equipment and processes to a given level of accuracy.</p> <p>A.P2 Perform setting out a structure to define the centre line, and the external and internal faces of the enclosing wall to a given tolerance.</p>	<p>A.M1 Discuss the selection of setting-out tools, equipment and processes for the accurate setting out of a given structure.</p>	
Learning aim B: Undertake the setting out of infrastructure works		B.D2 Evaluate the setting-out methodologies used to accurately set out infrastructure works. C.D3 Evaluate the methods used to achieve accurate setting out and excavated volume calculation.
<p>B.P3 Perform setting out a drainage run to given tolerances.</p> <p>B.P4 Perform setting out the position of an embankment, cutting and profiles.</p> <p>B.P5 Perform setting out a complex road curve using appropriate methods.</p>	<p>B.M2 Analyse the setting-out methodologies used to accurately set out infrastructure works.</p>	
Learning aim C: Explore how to maintain horizontal and vertical control in setting out		
<p>C.P6 Produce a pre-excavation survey grid in a drawn format and calculate volumes.</p> <p>C.P7 Calculate the volumes of excavation using an appropriate method.</p> <p>C.P8 Explain how accuracy is achieved in setting out vertical and horizontal elements.</p>	<p>C.M3 Discuss the methods used to achieve accurate setting out and excavated volume calculation.</p>	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, B.P5, C.P6, C.P7, C.P8, B.M2, C.M3, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to a range of setting-out equipment to meet the needs of the practical assessment. This can be achieved using (traditional) optical equipment or digital technologies. One option could be to hire a total station, which would be an efficient way to allow learners to understand setting out from an uploaded computer-aided design (CAD) file. A suitable location that is safe to use for setting-out purposes will need to be established.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will justify the equipment used for specific setting-out tasks. This must be in terms of the accuracy that has to be achieved. Their justification will cover a range of setting-out equipment, tools and processes, and they will give reasons to support and confirm the appropriate methodologies used. Learners will perform the setting out of a structure and will refer to this during their justification.

For merit standard, learners will discuss the equipment used for specific setting-out tasks. This must be in terms of the accuracy that has to be achieved. Their discussion must cover a range of setting-out equipment, tools and processes, and they will consider the importance of elements of the process and how they interrelate. Learners will perform the setting out of a structure and will refer to this during their discussions.

For pass standard, learners will produce a report for the setting out of a rectangular structure to a given level of accuracy. Their setting out must include the positioning of profile boards or rails. The level of accuracy should reflect the application, for example excavation or external wall construction. Learners will set out a building or structure that includes profile boards or rails and establishes three grid lines. These will be completed to a given tolerance. Learners will explain the setting-out procedures, equipment and methodologies adopted to produce work to a given level of accuracy.

Learning aims B and C

For distinction standard, learners will evaluate the methods used to achieve accuracy in the setting out of infrastructure works, including horizontal and vertical elements and the production of a pre-excavation survey grid. They will complete the setting out of a drainage run, an embankment and a complex road curve that includes calculating the theoretical distances and angles using trigonometry, which is then used to compare the actual lengths and angles achieved in the setting-out exercises. They will also complete a pre-excavation survey grid. In a fieldwork book, learners can record the communication used in setting out so that a third party can understand the notes made. Communication needs to be clear and professional in its layout and methodology. In evaluating this, learners will draw on their knowledge to consider the strengths and weaknesses of each method and their relevance or significance, leading to supported judgements.

For merit standard, learners will discuss and analyse the methods used to achieve accuracy in the setting out of infrastructure works, including horizontal and vertical elements and the production of a pre-excavation survey grid. They will complete the setting out of a drainage run, an embankment and a complex road curve that includes calculating the theoretical distances and angles using trigonometry, which is then used to compare the actual lengths and angles achieved in the setting-out exercises. They will also complete a pre-excavation survey grid. In a fieldwork book, learners can record the communication used in setting out so that a third party can understand the notes made. Communication needs to be clear and professional in its layout and methodology. In discussing this, learners will draw on their knowledge to consider the different aspects of each method, how they interrelate and the extent to which they are important. Learners will consider the different aspects of the methodologies and how they interrelate, including their importance in terms of achieving accuracy.

For pass standard, learners will set out three items: a drainage run, including the excavation for a manhole, an embankment and cutting, and a complex road curve from two straight entries and exits. Their pre-excitation survey evidence needs to be a grid of reduced levels taken across sloping or uneven ground so a range of ground levels can be established. Their booking and drawing should be to a standard that a client would expect to be given. Their explanation of accuracy for vertical and horizontal control must evidence tolerances required for functions, for example the tolerances on holding-down bolts for steel stanchions. Learners must explain how accuracy is achieved when setting out vertical and horizontal elements.

Links to other units

This unit links to:

- Unit 1: Construction Principles
- Unit 4: Construction Technology
- Unit 6: Surveying in Construction
- Unit 10: Building Surveying in Construction.

Employer involvement

This unit would benefit from employer involvement in the form of:

- guest speakers from a specialist setting out firm, or a project management specialist
- participation in audience assessment of presentations
- design/ideas to contribute to unit assignment/case study/project materials
- work experience
- employer's business materials as exemplars
- support from local business staff as mentors
- site visits.

Unit 13: Measurement Techniques in Construction

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners undertake the quantity surveying techniques used to apply measurement rules in the production of a bill of quantities.

Unit introduction

Measurement is the first process that turns a construction design into a monetary value. Measurement quantifies the physical resources required for a project to be constructed. Each element is measured using a standard method of measurement. These quantities are then abstracted and entered into a bill of quantities, which is then used in the tendering process to obtain quotations from the main contractors, in the form of a written tender document. The total quantities can then be published in a bill that is used to rate and value the total sum for the project.

In this unit, you will examine the processes of taking off quantities for the production of bills of quantities that are used for the financial control of a client's project. You will learn how employers and client organisations use agreed methods of measurement for construction and civil engineering work. These standard methods set out clearly the rules for measuring quantities from the drawings and schedules created by architects and other members of the design team. You will use these methods to produce quantities for structural elements and then undertake the production of a bill of quantities.

This unit gives you the opportunity to progress to construction sector roles, including estimator, bid writer, buyer, quantity surveyor or costing surveyor. It can also give you the skills for progression to Higher Nationals in Construction and degrees in construction specialisms.

Learning aims

In this unit you will:

- A** Examine the measurement rules for building and civil engineering
- B** Undertake the production of quantities for substructure and superstructure elements
- C** Undertake the production of bills of quantities.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Examine the measurement rules for building and civil engineering	A1 Introduction to taking off quantities A2 Standard methods of measurements	A guidance document for new learners to comprehend the use of quantities in construction and the standard methods of measurement available in the construction industry.
B Undertake the production of quantities for substructure and superstructure elements	B1 Processes in the production of quantities B2 Production of substructure quantities for a building B3 Production of superstructure quantities for a building B4 Production of quantities for a civil engineering project	A set of quantities from teacher-provided drawings for a building, substructure, elements of a superstructure and elements of external works. Bills of quantities for a building, substructure, elements of superstructure and elements of external works.
C Undertake the production of bills of quantities	C1 Abstraction of quantities C2 The production of a bill of quantities for a building or civil engineering project	

Content

Learning aim A: Examine the measurement rules for building and civil engineering

A1 Introduction to taking off quantities

Reasons for producing both approximate and accurate quantities and their use for:

- the production of bills of quantities
- tendering and estimating
- budgets for feasibility studies during design stages
- cost comparison of different designs
- preparation of estimates
- estimation of a project's value
- final account measurements and variations
- ordering materials
- producing a quotation for a work element.

A2 Standard methods of measurement

The use of the Standard Methods of Measurement (SMM) rules in the production of quantities.

- Measurement rules:
 - the need for rules
 - origins of measurement rules
 - measurement initiative steering group
 - status of the Royal Institution of Chartered Surveyors (RICS) New Rules of Measurement (NRM)
 - status of the Institution of Civil Engineers (ICE) Civil Engineering Standard Method of Measurement (CESMM)
 - typical considerations:
 - units of measurement
 - deduction of voids
 - deemed to be included
 - item description
 - hierarchy of description
 - key content
 - preliminaries and measured work
 - guidance on the preparation of bills of quantities.
- The New Rules of Measurement (NRM):
 - NRM1 – order of cost estimating and cost planning for capital building works:
 - application of this to budgeting for projects
 - uses of NRM 1
 - NRM2 – detailed measurement for building works:
 - application of this to taking off quantities for projects
 - uses of NRM 2
 - NRM3 – order of cost estimating and cost planning for building maintenance works:
 - application of this to maintaining projects
 - uses of NRM 3.
- CESMM:
 - content and its application to civil engineering projects
 - differences against the NRM volumes.

Learning aim B: Undertake the production of quantities for substructure and superstructure elements

B1 Processes in the production of quantities

The use of dimension paper or direct billing paper and the techniques used to take off quantities.

- Preparation and planning, to include the compilation of a take-off list.
- The vocationally correct format and layout of quantities and calculations on dimension paper:
 - enumerated
 - linear
 - area
 - volumes
 - itemised
 - multiplying (including additional multipliers and 'dotting-on')
 - totalling dimensions
 - deductions and omission quantities
 - page numbering
 - carried-forward and brought-forward dimension totals
 - use of standard quantity surveyors' abbreviations
 - marking the extent of a calculation
 - waste calculations, to include centre lines.

B2 Production of substructure quantities for a building

- The substructure of a building, to include:
 - excavations for foundations
 - short-bored piles
 - mass concrete foundation works
 - formwork
 - earthwork support
 - substructure external and internal walls to damp-proof course (DPC) level
 - ground floor construction:
 - excavation
 - hardcore filling
 - sand blinding
 - damp-proof membrane (DPM)
 - insulation
 - concrete beds
 - finishes to concrete
 - floor finishes.

B3 Production of superstructure quantities for a building

- The superstructure of a building, to include:
 - external wall construction:
 - timber framed, to include sole plates, softwood stud frames, plywood coverings, insulation, DPM, head frames
 - masonry, to include skins of hollow walls, forming cavities, cavity insulation
 - windows, to include the formation of openings: lintels, reveals, sills, window boards
 - doors, to include the formation of openings: lintels, reveals, thresholds
 - intermediate floors, to include timber joists and precast concrete beam and block
 - roof construction, to include trussed rafter construction, traditional rafter roof construction
 - roofing, to include coverings, breather membranes, tile battens.

B4 Production of quantities for a civil engineering project

The taking off of quantities for a civil engineering project using CESMM:

- excavation works
- filling
- formwork
- reinforcement
- concreting works
- drainage, manholes.

Learning aim C: Undertake the production of bills of quantities

Abstraction from dimension sheets into item summaries.

C1 Abstraction of quantities

- Use of 'cut and shuffle' paper.
- Use of direct billing paper.
- Use of abstract paper:
 - assembly of quantities taken from dimension sheets
 - final item quantity calculations.

C2 The production of a bill of quantities for a building or civil engineering project

How the quantities and descriptions are summarised in a bill of quantities, to include:

- production of a bill of quantities for a building work section:
 - assembly of quantities taken from dimension sheets
 - writing bill items using the method of measurement for substructure and superstructure items
 - collections and summaries
 - final summary
 - format and layout of the document.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Examine the measurement rules for building and civil engineering		A.D1 Evaluate the use of recognised standard methods of measurement to ensure consistency when tendering and estimating for buildings and civil engineering projects.
<p>A.P1 Explain how approximate and accurate quantities are used for different applications by quantity surveyors.</p> <p>A.P2 Explain the reasons for the use of a recognised standard method of measurement.</p>	<p>A.M1 Discuss the benefits of using recognised standard methods of measurement for buildings and civil engineering projects.</p>	
Learning aim B: Undertake the production of quantities for substructure and superstructure elements		B.D2 Perform an accurate and comprehensive take-off of quantities for a project using a recognised standard method of measurement and a vocationally correct layout of dimensions and methodology. C.D3 Produce comprehensive bills of quantities for a construction project.
<p>B.P3 Perform a take-off of quantities for a project using a recognised standard method of measurement and an appropriate layout of dimensions.</p> <p>B.P4 Explain the difference between the production of quantities for building projects and the production of quantities for civil engineering projects.</p>	<p>B.M2 Perform an accurate take-off of quantities for a project using a recognised standard method of measurement and a vocationally correct layout of dimensions.</p>	
Learning aim C: Undertake the production of bills of quantities		
<p>C.P5 Produce bills of quantities for a construction project.</p> <p>C.P6 Explain the different methods used to convert the take-off into bills of quantities.</p>	<p>C.M3 Produce accurate bills of quantities for a construction project.</p>	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to copies of standard methods of measurement, to include NRM1, NRM2, NRM3 and the CESMM.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will evaluate the use of recognised standard methods of measurement to ensure consistency when tendering and estimating for buildings and civil engineering projects. They will consider how quantities are used for construction projects during the various stages of a project, and consider the benefits and drawbacks of the use of a recognised standard method of measurement. In their evaluation, learners will consider the strengths and weaknesses of standard methods of measurement and their significance in generating accurate and consistent tender outcomes across a range of tender bids. They will provide a conclusion relating to the use of an appropriate standard method of measurement.

For merit standard, learners will discuss the benefits of using recognised standard methods of measurement for buildings and civil engineering projects. They will consider how quantities are used for construction projects during the various stages of a project and consider the relevant use of a recognised standard method of measurement. In their discussion, learners will consider the different aspects of the standard methods of measurement and the extent of their importance.

For pass standard, learners will explain how approximate and accurate quantities are used for different applications by quantity surveyors. Additionally, learners will explain the reasons for the use of a recognised standard method of measurement. In their explanation, learners will show that they comprehend the origins, functions and objectives of standard methods of measurement and the quantities that they produce.

Learning aims B and C

For distinction standard, learners will perform an accurate and comprehensive take-off of quantities for a project using a recognised standard method of measurement and a vocationally correct layout of dimensions and methodology (for example, correct centre-line calculations, dimension layout, codification etc.). Their take-off will include a substructure, elements of superstructures and elements of external works. Learners will explain the difference between the production of quantities for building projects and for civil engineering projects. They will produce comprehensive bills of quantities for a construction project with clarity of language and layout, including vocationally correct layout, bill format, units of measurement, codification of items, ordering of sizes and use of headings. They will explain the different methods used to convert the take-off into bills of quantities. In their explanation, learners will show that they comprehend the origins, functions and objectives of methods of producing bills of quantities.

For merit standard, learners will perform an accurate take-off of quantities for a project using a recognised standard method of measurement and using a vocationally correct layout of dimensions. The take-off will include a substructure, elements of superstructures and elements of external works. Learners will explain the difference between the production of quantities for building projects and for civil engineering projects. They will produce accurate bills of quantities for a construction project with appropriate use of language and layout, including vocationally correct layout, bill format, units of measurement, ordering of sizes and use of headings. They will explain the different methods used to convert the take-off into bills of quantities. In their explanation, learners will show that they comprehend the origins, functions and objectives of methods of bills of quantities production.

For pass standard, learners will perform a take-off of quantities for a project using a recognised standard method of measurement and an appropriate layout of dimensions, allowing for some computational inaccuracy. The take-off will include a substructure, elements of superstructures and elements of external works. Learners will explain the difference between the production of quantities for building projects and for civil engineering projects. They will produce bills of quantities for a construction project with appropriate use of language and layout, including vocationally appropriate layout, units of measurement and use of headings. They will explain the different methods used to convert the take-off into bills of quantities production.

Links to other units

This unit links to:

- Unit 1: Construction Principles
- Unit 4: Construction Technology
- Unit 7: Graphical Detailing in Construction
- Unit 14: Provision of Primary Services in Buildings.

Employer involvement

Centres can involve employers in the delivery of this unit if there are local opportunities to do so. There is no specific guidance related to this unit.

Unit 14: Provision of Primary Services in Buildings

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners examine the four primary services to understand the installation, operation and integration of these services.

Unit introduction

The provision of high-quality building services differentiates modern buildings from those constructed in earlier times. There are four primary services that are essential for a building to be habitable: hot and cold water, drainage, electricity and gas. You must therefore develop a basic understanding of building services and construction methods so that you can contribute to their safe and effective integration. You also need to learn the installation, operation and maintenance of all the primary services.

In this unit, you will learn the principles and practices that underpin the design and installation of hot and cold water systems, above-ground and below-ground drainage, single-phase electrical systems and gas installations. You will examine the specification of building services systems in terms of the materials used, the appropriate dimensions, capacities and falls, and any health and safety issues. You will gain an understanding of the advantages and disadvantages of the different systems available to justify the selection of the systems used.

This unit will help you to progress to relevant higher-level programmes. Entry to higher-level building services programmes is also possible if supported by evidence of competence in mathematics and science. The unit will support progression to work in a variety of construction roles, both on site and off site, including trainee positions in architectural technology, site supervision, site engineering, estimating, buying, quantity surveying, building surveying, land surveying and town planning, among others.

Learning aims

In this unit, you will:

- A** Examine the practices associated with the provision of hot- and cold-water systems
- B** Examine the principles and approaches associated with the provision of above- and below-ground drainage systems
- C** Understand the principles of the provision of simple, single-phase electrical systems and domestic gas installations.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Examine the practices associated with the provision of hot- and cold-water systems	A1 Direct cold-water systems A2 Indirect cold-water systems A3 Direct hot-water systems A4 Indirect hot-water systems	Learners will be given construction drawings of a domestic building and associated external areas. They will be required to provide a report that includes details of an appropriate direct and indirect hot- and cold-water system.
B Examine the principles and approaches associated with the provision of above- and below-ground drainage systems	B1 Above-ground drainage principles B2 Above-ground drainage approaches B3 Below-ground drainage principles B4 Below-ground drainage approaches	
C Understand the principles of the provision of simple, single-phase electrical systems and domestic gas installations	C1 Electrical principles C2 Electrical components C3 Ring final circuits C4 Radial circuits C5 Gas installation principles C6 Gas installations	Learners will be given construction drawings of a domestic building. They will be required to provide a report that includes details of an appropriate layout of single-phase electrical systems to buildings, and the internal layouts of ring final circuits and radial circuits, including line drawings, materials and components.

Content

Learning aim A: Examine the practices associated with the provision of hot- and cold-water systems

The systems used to supply buildings with a supply of potable cold water for drinking, flushing toilets, bathing, laundry and to feed heating systems, including the provision of hot water, together with an understanding of the situations in which each system would be appropriate.

A1 Direct cold-water systems

- Distribution to buildings:
 - service pipe minimum of 750 mm below ground
 - pipe to pass through wall above foundations
 - pipe to be sealed at entrance to wall
 - first 600 mm of pipe to be insulated
 - stop valve
 - rising main to drinking water tap
 - storage cistern.
- Internal layout of system, to include:
 - direct supply to all outlets
 - requirement for low-capacity cistern to feed a hot-water storage cylinder if installed
 - annotated line diagram for the layout showing key components.
- Selection of materials used, dimensions and capacities:
 - externally – 22 mm diameter service pipe, generally plastic (blue polyethylene or uPVC), although copper is acceptable
 - internally – copper or plastic pipes (generally 15 mm diameter, 20 mm for baths), 115-litre feed cistern (with 22 mm diameter overflow and feed to copper hot-water storage cylinder if installed), cisterns made from polyethylene, polypropylene or polyvinyl chloride (galvanised steel in older systems).
- Situations where system is appropriate:
 - where water pressure is high (e.g. from a high-level reservoir) or where drinking water is required from all outlets; inappropriate when supply is cut off or reduced in periods of peak demand, or where there is a danger of back-siphonage.

A2 Indirect cold-water systems

- Internal layout of system, to include:
 - cold water supplied to all outlets (except the sink) from a cold-water storage cistern, sink connected directly to rising main for supply of potable water
 - annotated line diagram for the layout showing key components.
- Selection of materials used, dimensions and capacities, to include:
 - copper or plastic pipes (generally 15 mm diameter, 20 mm for bath), 115-litre feed cistern (with 22 mm diameter overflow and feed to minimum 140-litre copper hot-water storage cylinder if installed), 230-litre cisterns in polyethylene, polypropylene or polyvinyl chloride (galvanised steel in older systems)
 - situations where system is appropriate, to include where a reserve is required should supply be cut off or reduced, where there is a risk of back-siphonage.

A3 Direct hot-water systems

- Mains pressure systems, to include combi boilers.
- Traditional systems, to include water heated in boiler, rises by convection to hot-water storage cylinder, replaced by colder water from bottom of storage cylinder, hot water drawn from storage cylinder is replaced with cold water from cistern.
- Selection of materials used, dimensions and capacities to include copper pipes (28 mm diameter primary feed from boiler to hot-water cylinder, 22 mm diameter cold feed from cistern to hot-water cylinder, 22 mm for hot water supply to bath, otherwise 15 mm diameter), minimum 140-litre hot-water cylinder, 230-litre cold-water cistern.
- Situations where system is appropriate, to include in soft water areas and where there is no associated central heating circuit.
- Annotated line diagram for the layout showing key components.

A4 Indirect hot-water systems

- Mains pressure system using pressure vessels.
- Traditional system similar to direct system, but with a separate small-capacity-feed cistern to charge and top up the primary circuit, hot-water storage cylinder to act as a heat exchanger providing heat for secondary circuit from which hot water is drawn.
- Selection of materials used, dimensions and capacities:
 - as for direct systems plus 36-litre plastic feed and expansion cistern
 - situations where system is appropriate, to include hard water areas and systems with associated central heating circuits.
- Annotated line diagram for the layout showing key components.

Learning aim B: Examine the principles and approaches associated with the provision of above- and below-ground drainage systems

The above-ground and below-ground systems used to remove foul water and surface water from a building, and the plot on which the building stands, together with an understanding of the difference between combined and separate systems.

B1 Above-ground drainage principles

The design of above-ground drainage systems, to include:

- need for water seal
- reduction of siphonage effect
- provision of ventilation
- fall for the waste pipes.

B2 Above-ground drainage approaches

Single-stack and two-pipe systems designed to prevent siphoning and discharge of gases.

- Single-stack and two-pipe systems, to include:
 - single-stack, to include waste from washbasins, sinks, baths and WCs feeds into single 100 mm vertical waste pipe, vented to outside above the roof line, all appliances have U-bend trap full of water (exceptions may be kitchen sink and cloakroom WC)
 - two-pipe system, to include older properties only, WC waste fed into a large-bore soil pipe leading directly to sewage network, remaining waste waters from washbasins, bath and kitchen sink are combined and led to a gully just below ground level.
- Selection of layout, materials used, dimensions and falls, to include:
 - all in uPVC or polypropylene
 - 100 mm diameter soil and vent pipe (SVP)
 - appliances connected separately into the stack to prevent induced and self-siphonage
 - limits on the length and levels of branch connections
 - all branch pipes to have 50 mm sweep into SVP
 - compliance with regulatory requirements
 - annotated line diagram for the layout showing key components.

B3 Below-ground drainage principles

The design of below-ground drainage systems, to include:

- capacity
- fall for self-cleansing flow
- ventilation
- support
- avoidance of leakage
- access at every change in gradient (inspection chambers, manholes, rodding points)
- pipe size or bend
- minimisation of pipe runs
- all junctions oblique and in direction of flow.

B4 Below-ground drainage approaches

- Separate systems used for surface and foul water as the standard modern method, to include:
 - separate systems used for surface and foul water where surface water and foul water are conveyed in separate drains and sewers
 - surface water requires no treatment before final outfall.
- Combined systems for surface and foul water where surface water and foul water are both conveyed in the same drain and sewer, to include:
 - entire effluent requires treatment
 - simpler and cheaper to construct, but more expensive to operate
 - a traditional approach not preferred in new constructions.
- Selection of layout, materials used, dimensions, falls and capacities:
 - rigid pipes, to include vitrified clay, concrete, cast iron
 - flexible pipes, to include uPVC, polyethylene, ductile iron, glass-reinforced plastic
 - appropriate falls for surface water and foul-water drainage
 - appropriate bedding materials for pipes and surrounds
 - annotated line diagram for the layout showing key components.

Learning aim C: Understand the principles of the provision of simple, single-phase electrical systems and domestic gas installations

The systems used for single-phase electrical supplies, gas installations and understanding of good health and safety.

C1 Electrical principles

- Electrical principles, to include sufficient capacity, prevention of excess current, protection from shock, prevention of fire, means of isolation, health and safety issues.

C2 Electrical components

A typical circuit to include the following components:

- mains isolation switches, to include main service fuse, meter, main switch
- consumer control unit, to include residual current devices (RCD), miniature circuit breakers (MCB) or fuses
- earth connectors
- outlet sockets
- switches and light fittings.

C3 Ring final circuits

Ring final circuits for a maximum permissible floor area.

- Circuits, to include:
 - live conductor and neutral conductor
 - earth looped from socket to socket
 - protected by 32 amperes (A) fuse or miniature circuit breaker.
- Socket outlets, to include individual as well as spur outlets:
 - individual socket outlets to accept fused appliances up to 13 A
 - unlimited number of socket outlets
 - spur outlets not to exceed number of primary outlets
 - maximum of two outlets per spur.

C4 Radial circuits

Radial circuits for lighting and individual high-power appliances.

- Lighting, to include loop-in method using earthed twin cable with 6 A protection:
 - individual high-power appliances, to include electric cookers, showers, water heaters, protected up to 45 A depending on power taken by appliance.

C5 Gas installation principles

Gas installation principles to support combustion and disposal of combustion products.

- Adequate supply of ventilation air to support combustion.
- Effective flue arrangements to dispose of combustion products:
 - conventional flues, to include brick or stone chimney, prefabricated or precast systems
 - balanced flues, to include air for combustion drawn in through the outer pipe, inner pipe removes combustion gases to outside.

C6 Gas installations

Metering arrangement, connecting of gas mains and entry of gas service pipes into a building, in compliance with the relevant legislation.

- Compliance with relevant legislation, to include Part P of the Building Regulations 2010, and the Gas Safety (Installation and Use) Regulations 1998:
 - connection to gas main, to include slope towards house, arrangements for collecting condensate.
- Entry of gas service pipe into building:
 - arrangement, to include from side nearest main, not under foundations, not run in a cavity, sleeved if passing through solid floor or wall, not housed in an unventilated void
 - dimension, to include minimum 25 mm diameter pipe
 - enter building 375+ mm below ground
 - gas meter arrangements, to include generally external (but can be internal) meter box to contain control level, situated at height sufficient to facilitate access and reading.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Examine the practices associated with the provision of hot- and cold-water systems		A.D1 Evaluate, with detailed and comprehensive line drawings, the distribution of hot- and cold-water systems in terms of materials used and the dimensions and capacities of fittings and components, and their efficient positioning.
A.P1 Explain, with appropriately annotated illustrations, the distribution and layout of cold water by direct and indirect systems. A.P2 Explain, with appropriately annotated illustrations, the distribution and layout of hot water by direct and indirect systems.	A.M1 Analyse, with clear and accurate line drawings, the distribution of hot- and cold-water systems in terms of materials used and the dimensions and capacities of fittings and components, and their relative positioning.	
Learning aim B: Examine the principles and approaches associated with the provision of above- and below-ground drainage systems		B.D2 Evaluate, with detailed and comprehensive line drawings, the distribution of above- and below-ground drainage systems in terms of materials used, appropriate falls, and the dimensions and capacities of fittings and components, and their efficient positioning.
B.P3 Explain, with appropriately annotated illustrations, the distribution and layout of above-ground drainage systems. B.P4 Explain, with appropriately annotated illustrations, the distribution and layout of below-ground drainage systems.	B.M2 Analyse, with clear and accurate line drawings, the distribution of above- and below-ground drainage systems in terms of materials used, appropriate falls, and the dimensions and capacities of fittings and components, and their relative positioning.	
Learning aim C: Understand the principles of the provision of simple, single-phase electrical systems and domestic gas installations		C.D3 Evaluate the installation of single-phase electrical systems and domestic gas installations in terms of components, layout, integration of both services, and compliance with health and safety legislation.
C.P5 Explain the installation of single-phase electrical systems for both radial and ring final circuits. C.P6 Explain domestic gas installations from entry to the building to the point of use. C.P7 Outline the important health and safety requirements relevant to the installation of single-phase electrical systems and domestic gas installations.	C.M3 Analyse the installation of single-phase electrical systems and domestic gas installations in terms of components and layout. C.M4 Discuss the important health and safety requirements relevant to the installation of single-phase electrical systems and domestic gas installations.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.P7, C.M3, C.M4, C.D3)

Further information for teachers and assessors

Resource requirements

There are no specific additional resource requirements for this unit.

Essential information for assessment decisions

Learning aims A and B

For distinction standard, learners will evaluate, with the aid of detailed and comprehensive line drawings indicating the layout of service runs, the distribution of both direct and indirect hot- and cold-water systems in terms of materials used, and the dimensions and capacities of fittings and components and their efficient and appropriate positioning. They will also evaluate, with detailed and comprehensive line drawings, the distribution of above- and below-ground drainage systems in terms of materials used, appropriate falls, access arrangements, and the dimensions and capacities of fittings and components, and their efficient positioning. In their evaluation, learners will consider the advantages and disadvantages of alternate systems and the significance of key performance requirements. Their inquiry will lead to a supported judgement showing clear links to the domestic installation scenario.

For merit standard, learners will analyse, with clear and accurate line drawings, the distribution of hot- and cold-water systems in terms of materials used, and the dimensions and capacities of fittings and components, and their relative positioning. They will also analyse, with clear and accurate line drawings, the distribution of above- and below-ground drainage systems in terms of materials used, appropriate falls, dimensions and capacities of fittings and components, and their relative positioning. In conducting their analysis, they will consider the key components of the system and how these combine to provide effective performance.

For pass standard, learners will explain, with appropriately annotated illustrations, the distribution and layout of hot and cold water by direct and indirect systems. They will also explain, with appropriately annotated illustrations, the distribution and layout of above- and below-ground drainage systems. In their work, learners will demonstrate that they understand the functional requirements of the system and whether the system can be considered to be fit for purpose.

Learning aim C

For distinction standard, learners will evaluate the installation of single-phase electrical systems and domestic gas installations in terms of components, layout, integration of both services and compliance with health and safety legislation. In their evaluation, they will consider the advantages and disadvantages of alternate systems and the significance of key performance requirements, including associated health and safety considerations. Their inquiry will lead to a supported judgement showing clear links to the domestic installation scenario.

For merit standard, learners will analyse the installation of single-phase electrical systems and domestic gas installations in terms of components and layout. In conducting their analysis, they will consider the key components of the system and how these combine to provide effective performance. They will discuss the important health and safety requirements relevant to the installation of single-phase electrical systems and domestic gas installations. In their discussions, learners will consider the key health and safety considerations and how they interrelate, together with some consideration of their relative importance.

For pass standard, learners will explain the installation of single-phase electrical systems for both radial and ring final circuits. They will also explain domestic gas installations from entry to the building to the point of use, and outline the important health and safety requirements relevant to the installation of single-phase electrical systems and domestic gas installations. In their work, learners will demonstrate that they understand the functional requirements of the systems and the associated health and safety considerations, including and whether the system, and the safety precautions, can be considered to be fit for purpose.

Links to other units

This unit links to:

- Unit 1: Construction Principles
- Unit 2: Construction Design
- Unit 7: Graphical Detailing in Construction
- Unit 13: Measurement Techniques in Construction.

Employer involvement

Centres can involve employers in the delivery of this unit if there are local opportunities to do so. There is no specific guidance related to this unit.

Unit 19: Quantity Surveying

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners understand the underlying principles of quantity surveying when working for both the client and main contractor.

Unit introduction

The financial management of construction projects has to be closely monitored to ensure that projects meet the financial needs of both the client and the contractor. The client needs the project to be completed within budget and the contractor needs to maximise return on the project. In this unit, you will gain an understanding of the role of a quantity surveyor and the differences when working for a client and a main contractor. You will learn about the financial management of contracts, including the preparation of valuations and the administration of variations, through to the preparation of the final account. You will also learn about the management of cash flow in an organisation, including valuations and payments to subcontractors, suppliers and manufacturers. You will complete a final account for a given project.

This unit will support you in progressing to a higher-level construction programme, such as the Higher National in Construction (with the quantity surveying pathway), or to a general construction or quantity surveying degree. It also supports progression to the workplace as a technician, or direct entry as an assistant quantity surveyor with a construction company.

Learning aims

In this unit you will:

- A** Understand the functions of a quantity surveyor
- B** Undertake the production of bills of quantities for a project
- C** Undertake the production of a final account for a project.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Understand the functions of a quantity surveyor	A1 Professional quantity surveyor (PQS) functions A2 Main contractor quantity surveyor functions A3 Preparation of bills of quantities A4 Financial management A5 Contractual management	Learners will explain the differences between a professional quantity surveyor and a main contractor's quantity survey.
B Undertake the production of bills of quantities for a project	B1 Taking off B2 Abstraction and bill production	Using a set of given drawings, learners will produce bills of quantities for two elements: a substructure and an element of superstructure.
C Undertake the production of a final account for a project	C1 Variations C2 Valuations and final accounts	Using a scenario and information given, learners will produce a final account for a given project.

Content

Learning aim A: Understand the functions of a quantity surveyor

A1 Professional quantity surveyor (PQS) functions

The PQS acts mainly for a client in the preparation of the following in support of the feasibility of a proposal.

- The preparation of cost budgets:
 - providing guidance to the architect on the scale and type of construction that can be designed within a given budget
 - using historical cost data:
 - obtained from similar developments
 - analysis of elements
 - elemental analysis using bills of quantities data from previous projects
 - using Building Cost Information Service (BCIS) data:
 - types of available data from BCIS
 - identifying appropriate data from similar construction project types
 - applying approximate quantities
 - superficial application on a cost per m² basis
 - updating costs to current price levels using cost indices
 - using approximate quantities:
 - taking off from available drawn information
 - using direct billing techniques
 - interpreting missing requirements
 - formulation of the cost budget
 - comparison and feasibility:
 - project feasibility studies
 - comparison of alternative project costs
 - leading value engineering workshops.
- The preparation of tender documentation to be sent out to contractors for pricing:
 - specification and drawings:
 - drawings to be provided
 - content of the specification
 - how preliminary items are included
 - how prime cost (PC) and provisional sums (PS), including contingencies, are included
 - bills of quantities:
 - content and layout
 - preliminaries
 - preambles
 - measured work sections
 - PC and PS, including contingencies and dayworks
 - final summary
 - tender documentation:
 - covering letter
 - invitation to tender
 - form of tender and return envelope
 - bill of quantities or specification and drawings
 - pre-contract programme
 - pre-construction information
 - tender drawings
 - form of contract and terms and conditions.

- Analysis of submitted tenders:
 - checking submitted bills of quantities
 - notifying errors to the lowest tendering organisation
 - adjustment of errors – standby or withdraw
 - analysing abnormal or variant bids
 - recommending final appointment of successful tendering organisation.
- Preparation of contract documents.
- Post-contract activities:
 - providing ongoing cost advice to the client
 - administration of nominated subcontracts
 - updating the projected final cost
 - remeasuring the work as required
 - producing monthly valuations in conjunction with the main contractor's quantity surveyor
 - pricing variations
 - negotiating any contractual claims for loss and expense
 - producing the final account
 - negotiating and agreeing the final account with the main contractor's quantity surveyor.

A2 Main contractor quantity surveyor functions

The functions of the main contractor's quantity surveyor and how these differ from the PQS in terms of working for a client.

- Agreeing monthly valuations of work undertaken.
- Remeasuring the work as required.
- Pricing of variations and architect's instructions and agreement with the PQS.
- Agreeing subcontract accounts and authorising payments.
- Final account preparation:
 - providing information to the PQS to facilitate final account preparation
 - pricing dayworks
 - agreeing the final account with the PQS.
- Cost control and reconciliation, including cost value comparisons.
- Preparing claims for loss and expense:
 - contractual notification letters
 - providing information to determine extensions of time
 - calculation of loss and expense claims
 - negotiating loss and expense claims.
- How, in smaller organisations, quantity surveyors may have multiple roles, to include:
 - buying:
 - negotiating prices
 - scheduling materials
 - placing all orders for resources
 - estimating:
 - sending out materials and subcontract enquiries
 - pricing tenders
 - participating in tender settlement or adjudication
 - bonus surveying and labour only subcontract payments.

A3 Preparation of bills of quantities

The preparation of a bill of quantities, schedules and specifications for the procurement processes.

- Use of standard methods of measurement:
 - New Rules of Measurement (NRM 2)
 - Civil Engineering Standard Method of Measurement, Fourth Edition (CESMM4).
- Use of measurement and bills of quantity production software packages.
- Use of dimension paper, direct billing paper and cut and shuffle paper.
- Working up quantities and abstraction.
- Producing bill of quantities pages.
- Inclusion of PC and PS.
- Direct billing and bills of approximate quantities.

A4 Financial management

The control of construction costs to ensure that a client's budget is not exceeded. Control of main contractor's costs against the tender value to maximise contribution.

- Professional quantity surveyor:
 - changes to specifications to lower costs
 - monitoring monthly valuations
 - valuing variations
 - forecasting projected final account
 - life cycle analysis.
- Main contractor quantity surveyor:
 - buying efficiently against estimate values
 - subcontract procurement
 - main contractor's discounts
 - changes to specifications to lower costs
 - ensuring delays are minimised
 - claims for variations.

A5 Contractual management

The administration of a contract on a project in terms of the clauses relating to time, risks, insurance, compensation, payments and termination.

- Joint Contracts Tribunal Contracts (JCT).
- New Engineering Contract (NEC).

Learning aim B: Undertake the production of bills of quantities for a project

The production of quantities by taking off dimensions from drawings, in accordance with a standard method of measurement. Production of a bill of quantities page that covers a construction element by writing item descriptions presented in a vocationally correct format.

B1 Taking off

Taking off quantities using appropriate mensuration techniques to produce bills of quantities for a building element.

- Substructure elements:
 - excavation
 - earthwork support
 - treatments
 - fill
 - concrete works
 - reinforcement
 - blockwork
 - cavity walls
 - damp-proof course (DPC).

- Superstructure elements:
 - solid ground floors
 - external cavity walls
 - internal partitions
 - intermediate floors.

B2 Abstraction and bill production

- Abstraction of quantities.
- Use of cut and shuffle.
- Use of direct billing methods.
- Writing bill item descriptions in accordance with a standard method of measurements.
- Format and presentation of bill items on pages.
- Page totals, collections, bill summaries and final summary.
- Use of measurement and bills of quantity production software packages.

Learning aim C: Undertake the production of a final account for a project

C1 Variations

The administration and management of a contract variation through an Architect's Instruction (AI).

- Site instructions, confirmation and issue of an AI.
- Preparation of quotations.
- Valuation and measurement of variations.
- Remeasurement of the works.
- Adjustment of provisional quantities.
- Use of unit rates and dayworks.
- Acceptance and agreement.
- Disputes and claims.
- Changes to design and significant contract durations.

C2 Valuations and final accounts

The preparation of an interim valuation to obtain a progress payment and the compilation of the final account.

- Tender sum.
- Use of bills of quantities to value the works.
- Adjustments as additions and omissions.
- Architect's Instructions and variations.
- Dayworks.
- Adjustments to PC and PS.
- Contingency adjustments.
- Extensions of time.
- Loss and expense claims.
- Adjustment for liquidated and ascertained damages.
- Calculation of the final account sum.
- Presentation of a final account, timelines and format.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand the functions of a quantity surveyor		A.D1 Evaluate the roles of quantity surveyors for a given project scenario.
A.P1 Explain the role of the professional quantity surveyor. A.P2 Explain the role of the contractor's quantity surveyor.	A.M1 Discuss the roles of quantity surveyors for a given project scenario.	
Learning aim B: Undertake the production of bills of quantities for a project		B.D2 Produce bills of quantities for construction elements in an appropriate format, with precision, accuracy and attention to detail.
B.P3 Produce quantities for a complete substructure element. B.P4 Produce quantities for a complete superstructure element.	B.M2 Produce bills of quantities for construction elements, in an appropriate format.	
Learning aim C: Undertake the production of a final account for a project		C.D3 Produce a final account in an appropriate format, with precision, accuracy and attention to detail.
C.P5 Produce costings for variations. C.P6 Produce costings for dayworks.	C.M3 Produce a final account in an appropriate format.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of three summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aim: B (B.P3, B.P4, B.M2, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.D3)

Further information for teachers and assessors

Resource requirements

There are no specific additional requirements for this unit.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners must evaluate the roles of quantity surveyors for a given project scenario. Learners will consider how the roles of the professional quantity surveyor and the contractor's quantity surveyor differ and interact in the context of a complex building project. Learners will compare the differing objectives of both roles and draw conclusions relating to the key priorities for both parties in the pre- and post-contract phases of the project. Learners will demonstrate a developed understanding of the role of the quantity surveyor.

For merit standard, learners must discuss the roles of quantity surveyors for a given project scenario. Learners will cover both professional and contractor's quantity surveyors and their roles in the given scenario. Learners will consider the objectives, key focus and content in their discussions, covering the quantity surveyor's work linked to the project scenario. This will include the work of the quantity surveyors during both the pre- and post-contract phases of construction projects. Learners will demonstrate a good understanding of the role of the quantity surveyor.

For pass standard, learners must explain the roles of the professional quantity surveyor and the contractor's quantity surveyor. Learners will consider, within their explanations, the key objectives and content of the quantity surveyor's work in generic terms but without focus on the project scenario. Learners will cover the work of the quantity surveyors during the pre- and post-contract phases of construction projects. Learners will demonstrate a generic understanding of the role of the quantity surveyor.

Learning aim B

For distinction standard, learners must produce bills of quantities for construction elements in an appropriate format and with precision, accuracy and attention to detail. These will include a substructure and a superstructure element produced using vocationally relevant mensuration techniques and in accordance with an appropriate standard method of measurement. The production of quantities and subsequent abstracting and billing can be completed using traditional paper-based methods or by using an appropriate software package. Learners will demonstrate a developed understanding of the techniques, methodologies and standards used in the production of bills of quantities.

For merit standard, learners must produce bills of quantities for construction elements in an appropriate format. These will include a substructure and a superstructure element produced using vocationally relevant mensuration techniques and generally following an appropriate standard method of measurement. The production of quantities and subsequent abstracting and billing can be completed using traditional paper-based methods or by using an appropriate software package. Learners will demonstrate a good understanding of the techniques, methodologies and standards used in the production of bills of quantities.

For pass standard, learners must produce quantities for a complete substructure element and a complete superstructure element produced using some vocationally relevant mensuration techniques and generally following an appropriate standard method of measurement. The production of quantities can be completed using traditional paper-based methods or by using an appropriate software package. Learners will demonstrate a generic understanding of the techniques, methodologies and standards used in the take-off of quantities for the elements.

Learning aim C

For distinction standard, learners produce a final account, in an appropriate format, with precision, accuracy and attention to detail. Learners will complete the final account accurately, using sector-specific methodologies and layout. Using the contract sum as a starting point, learners will make adjustments to consider AI, dayworks, adjustment of prime cost (PC) and provisional sums (PS), loss and expense or liquidated and ascertained damages, and adjustment of contingencies. Learners will demonstrate a developed understanding of the techniques, methodologies and standards utilised in the production of final accounts.

For merit standard, learners produce a final account in an appropriate format. Learners will complete the final account using some sector-specific methodologies and layout. Using the contract sum as a starting point, learners will make adjustments to consider AI, dayworks, adjustment of PC and PS, and adjustment of contingencies. Learners will demonstrate a good understanding of the techniques, methodologies and standards utilised in the production of final accounts.

For pass standard, learners produce costings for variations and dayworks. Learners will include a cost analysis of AI and the accurate pricing of dayworks using sector-specific methodologies. Learners will demonstrate a generic understanding of the techniques, methodologies and standards utilised in the production of aspects of final accounts.

Links to other units

This unit links to:

- Unit 1: Construction Principles
- Unit 2: Construction Design
- Unit 3: Tendering and Estimating
- Unit 4: Construction Technology
- Unit 6: Surveying in Construction
- Unit 7: Graphical Detailing in Construction
- Unit 10: Building Surveying in Construction
- Unit 13: Measurement Techniques in Construction
- Unit 14: Provision of Primary Services in Buildings.

Employer involvement

This unit would benefit from employer involvement in the form of:

- office visits to a quantity surveying practice
- a guest speaker in the form of a professional quantity surveyor and a contractor's quantity surveyor
- employer case studies
- site visits to study quantity surveying roles.

4 Planning your programme

How do I choose the right BTEC National qualification for my learners?

BTEC Nationals come in a range of sizes, each with a specific purpose. You will need to assess learners very carefully to ensure that they start on the right size of qualification to fit into their 16–19 study programme, and that they take the right pathways or optional units that allow them to progress to the next stage.

If a learner is clear that they want to progress to the workplace they should be directed towards an occupationally-specific qualification, such as a BTEC National Diploma, from the outset.

Some learners may want to take a number of complementary qualifications or keep their progression options open. These learners may be suited to taking a BTEC National Certificate or Extended Certificate. Learners who then decide to continue with a fuller vocational programme can transfer to a BTEC National Diploma or Extended Diploma, for example for their second year.

Some learners are sure of the sector they want to work in and are aiming for progression into that sector via higher education. These learners should be directed to the two-year BTEC National Extended Diploma as the most suitable qualification.

As a centre, you may want to teach learners who are taking different qualifications together. You may also wish to transfer learners between programmes to meet changes in their progression needs. You should check the qualification structures and unit combinations carefully as there is no exact match among the different sizes. You may find that learners need to complete more than the minimum number of units when transferring.

When learners are recruited, you need to give them accurate information on the title and focus of the qualification for which they are studying.

Is there a learner entry requirement?

As a centre it is your responsibility to ensure that learners who are recruited have a reasonable expectation of success on the programme. There are no formal entry requirements but we expect learners to have qualifications at or equivalent to Level 2.

Learners are most likely to succeed if they have:

- five GCSEs at good grades and/or
- BTEC qualification(s) at Level 2
- achievement in English and mathematics through GCSE or Functional Skills.

Learners may demonstrate ability to succeed in various ways. For example, learners may have relevant work experience or specific aptitude shown through diagnostic tests or non-educational experience.

What is involved in becoming an approved centre?

All centres must be approved before they can offer these qualifications – so that they are ready to assess learners and so that we can provide the support that is needed. Further information is given in *Section 8*.

What level of sector knowledge is needed to teach these qualifications?

We do not set any requirements for teachers but expect that centres will assess their overall skills and knowledge of the teaching team to ensure that they are relevant and up to date. This will give learners a rich programme to prepare them for employment in the sector. As part of the requirements of the programme are to involve employers in delivery this should support centres in ensuring that they are following up to date practices when delivering the programme.

What resources are required to deliver these qualifications?

As part of your centre approval you will need to show that the necessary material resources and work spaces are available to deliver BTEC Nationals. For some units, specific resources are required. This is indicated in the units.

Which modes of delivery can be used for these qualifications?

You are free to deliver BTEC Nationals using any form of delivery that meets the needs of your learners. We recommend making use of a wide variety of modes, including direct instruction in classrooms or work environments, investigative and practical work, group and peer work, private study and e-learning.

What are the requirements for meaningful employer involvement?

Requirements

This BTEC National Foundation Diploma in Construction and the Built Environment has been designed as a Tech Level qualification. As an approved centre you are required to ensure that during their study, every learner has access to meaningful activity involving employers. Involvement should be with employers from the construction and the built environment sector and should form a significant part of the delivery or assessment of the qualification. Each centre's approach to employer involvement will be monitored in two ways. It will be monitored at centre level in the first term each year as part of the annual quality management review process that addresses centre strategy for delivery, assessment and quality assurance, when we will ask you to show evidence of how employer involvement is provided for all learners. You will need to show evidence in order to gain reporting clearance for certification. It will be monitored also at programme level as part of the standards verification process to confirm that plans for employer involvement meet the requirements of the specification. These approaches are designed to ensure additional activities can be scheduled where necessary so learners are not disadvantaged (see *Section 8: Quality assurance*).

We know that the vast majority of programmes already have established links with employers. In order to give you maximum flexibility in creating and strengthening employer involvement, we have not specified a particular level of input from employers. However, meaningful employer involvement, as defined below, should contribute significantly to at least **one** mandatory unit.

The mandatory unit that specifies where delivery and/or assessment will be linked to employers is *Unit 6: Surveying in Construction*.

There are suggestions in many of the units about how employers could become involved in delivery and/or assessment. These suggestions are not exhaustive and there will be other possibilities at local level.

Employer involvement in these units is subject to verification as part of the standards verification process (see *Section 8*).

Definition

Activities that are eligible to be counted as meaningful engagement are:

- structured work experience or work placements that develop skills and knowledge relevant to the qualification
- projects or assessments set with input from industry practitioners
- masterclasses or guest lectures from industry practitioners
- 'expert witness' reports from practitioners that contribute to the assessment of a learner's work.

There may be other ways in which learners can benefit from contact with employers or prepare for employment, such as listening to careers talks or working in simulated environments. While they provide benefits to learners they do not count as meaningful engagement.

Support

It is important that you give learners opportunities that are high quality and directly relevant to their study. We will support you in this through guidance materials and by giving you examples of best practice.

What support is available?

We provide a wealth of support materials, including curriculum plans, delivery guides, authorised assignment briefs, additional papers for external assessments and examples of marked learner work.

You will be allocated a Standards Verifier early on in the planning stage to support you with planning your assessments. There will be extensive training programmes as well as support from our Subject Advisor team.

For further details see *Section 10*.

How will my learners become more employable through these qualifications?

All BTEC Nationals are mapped to relevant occupational standards (see *Appendix 1*).

In the mandatory content and the selected optional units that focus on technical preparation learners will be acquiring the key knowledge and skills that employers need. Also, employability skills such as teamwork and entrepreneurialism, and completing realistic tasks, have been built into the design of the learning aims and content. This gives you the opportunity to use relevant contexts, scenarios and materials to enable learners to develop a portfolio of evidence that demonstrates the breadth of their skills and knowledge in a way that equips them for employment.

5 Assessment structure and external assessment

Introduction

BTEC Nationals are assessed using a combination of *internal assessments*, which are set and marked by teachers, and *external assessments* which are set and marked by Pearson:

- mandatory units have a combination of internal and external assessments
- all optional units are internally assessed.

We have taken great care to ensure that the assessment method chosen is appropriate to the content of the unit and in line with requirements from employers and higher education.

In developing an overall plan for delivery and assessment for the programme, you will need to consider the order in which you deliver units, whether delivery is over short or long periods and when assessment can take place. Some units are defined as synoptic units (see *Section 2*). Normally, a synoptic assessment is one that a learner would take later in a programme and in which they will be expected to apply learning from a range of units. Synoptic units may be internally or externally assessed. Where a unit is externally assessed you should refer to the sample assessment materials (SAMs) to identify where there is an expectation that learners draw on their wider learning. For internally-assessed units, you must plan the assignments so that learners can demonstrate learning from across their programme. A unit may be synoptic in one qualification and not another because of the relationship it has to the rest of the qualification.

We have addressed the need to ensure that the time allocated to final assessment of internal and external units is reasonable so that there is sufficient time for teaching and learning, formative assessment and development of transferable skills.

In administering internal and external assessment, the centre needs to be aware of the specific procedures and policies that apply, for example to registration, entries and results. An overview with signposting to relevant documents is given in *Section 7*.

Internal assessment

Our approach to internal assessment for these qualifications will be broadly familiar to experienced centres. It offers flexibility in how and when you assess learners, provided that you meet assessment and quality assurance requirements. You will need to take account of the requirements of the unit format, which we explain in *Section 3*, and the requirements for delivering assessment given in *Section 6*.

External assessment

A summary of the external assessment for this qualification is given in *Section 2*. You should check this information carefully, together with the unit specification and the sample assessment materials, so that you can timetable learning and assessment periods appropriately.

Learners must be prepared for external assessment by the time they undertake it.

In preparing learners for assessment you will want to take account of required learning time, the relationship with other external assessments and opportunities for retaking. You should ensure that learners are not entered for unreasonable amounts of external assessment in one session. Learners may resit an external assessment to obtain a higher grade of near pass or above. If a learner has more than one attempt, then the best result will be used for qualification grading, up to the permitted maximum. It is unlikely that learners will need to or benefit from taking all assessments twice so you are advised to plan appropriately. Some assessments are synoptic and learners are likely to perform best if these assessments are taken towards the end of the programme.

Key features of external assessment in construction and the built environment

In construction and the built environment, after consultation with stakeholders, we have developed the following.

- Unit 1: Construction Principles – learners complete a written examination, demonstrating the skills needed to solve a variety of practical construction problems by applying science knowledge and carrying out mathematical and statistical techniques. Learners will apply mathematical principles and techniques to carry out calculations that determine how materials behave under the action of forces or loads when used as structural members, and draw conclusions regarding whether a material is fit for purpose.
- Unit 2: Construction Design – learners will complete an externally-marked task, demonstrating their understanding of the principles and practice involved in the design and construction of low- and medium-rise buildings and structures, and showing an understanding of how design is influenced by client requirements and external constraints.

Units

The externally-assessed units have a specific format which we explain in *Section 3*. The content of units will be sampled across external assessments over time through appropriate papers and tasks. The ways in which learners are assessed are shown through the assessment outcomes and grading descriptors. External assessments are marked and awarded using the grade descriptors. The grades available are Distinction (D), Merit (M), Pass (P) and Near Pass (N). The Near Pass (N) grade gives learners credit below a Pass, where they have demonstrated evidence of positive performance which is worth more than an unclassified result but not yet at the Pass standard.

Sample assessment materials

Each externally-assessed unit has a set of sample assessment materials (SAMs) that accompanies this specification. The SAMs are there to give you an example of what the external assessment will look like in terms of the feel and level of demand of the assessment. In the case of units containing synoptic assessment, the SAMs will also show where learners are expected to select and apply from across the programme.

The SAMs show the range of possible question types that may appear in the actual assessments and give you a good indication of how the assessments will be structured. While SAMs can be used for practice with learners, as with any assessment the content covered and specific details of the questions asked will change in each assessment.

A copy of each of these assessments can be downloaded from our website. An additional sample of each of the Pearson-set units will be available before the first sitting of the assessment to allow your learners further opportunities for practice.

6 Internal assessment

This section gives an overview of the key features of internal assessment and how you, as an approved centre, can offer it effectively. The full requirements and operational information are given in the *Pearson Quality Assurance Handbook*. All members of the assessment team need to refer to this document.

For BTEC Nationals it is important that you can meet the expectations of stakeholders and the needs of learners by providing a programme that is practical and applied. Centres can tailor programmes to meet local needs and use links with local employers and the wider vocational sector.

When internal assessment is operated effectively it is challenging, engaging, practical and up to date. It must also be fair to all learners and meet national standards.

Principles of internal assessment

Assessment through assignments

For internally-assessed units, the format of assessment is an assignment taken after the content of the unit, or part of the unit if several assignments are used, has been delivered. An assignment may take a variety of forms, including practical and written types. An assignment is a distinct activity completed independently by learners that is separate from teaching, practice, exploration and other activities that learners complete with direction from, and formative assessment by, teachers.

An assignment is issued to learners as an assignment brief with a defined start date, a completion date and clear requirements for the evidence that they need to provide. There may be specific observed practical components during the assignment period. Assignments can be divided into tasks and may require several forms of evidence. A valid assignment will enable a clear and formal assessment outcome based on the assessment criteria.

Assessment decisions through applying unit-based criteria

Assessment decisions for BTEC Nationals are based on the specific criteria given in each unit and set at each grade level. To ensure that standards are consistent in the qualification and across the suite as a whole, the criteria for each unit have been defined according to a framework. The way in which individual units are written provides a balance of assessment of understanding, practical skills and vocational attributes appropriate to the purpose of qualifications.

The assessment criteria for a unit are hierarchical and holistic. For example, if an M criterion requires the learner to show 'analysis' and the related P criterion requires the learner to 'explain', then to satisfy the M criterion a learner will need to cover both 'explain' and 'analyse'. The unit assessment grid shows the relationships among the criteria so that assessors can apply all the criteria to the learner's evidence at the same time. In *Appendix 2* we have set out a definition of terms that assessors need to understand.

Assessors must show how they have reached their decisions using the criteria in the assessment records. When a learner has completed all the assessment for a unit then the assessment team will give a grade for the unit. This is given simply according to the highest level for which the learner is judged to have met all the criteria. Therefore:

- to achieve a Distinction, a learner must have satisfied all the Distinction criteria (and therefore the Pass and Merit criteria); these define outstanding performance across the unit as a whole
- to achieve a Merit, a learner must have satisfied all the Merit criteria (and therefore the Pass criteria) through high performance in each learning aim
- to achieve a Pass, a learner must have satisfied all the Pass criteria for the learning aims, showing coverage of the unit content and therefore attainment at Level 3 of the national framework.

The award of a Pass is a defined level of performance and cannot be given solely on the basis of a learner completing assignments. Learners who do not satisfy the Pass criteria should be reported as Unclassified.

The assessment team

It is important that there is an effective team for internal assessment. There are three key roles involved in implementing assessment processes in your centre, each with different interrelated responsibilities, the roles are listed below. Full information is given in the *Pearson Quality Assurance Handbook*.

- The Lead Internal Verifier (the Lead IV) has overall responsibility for the programme, its assessment and internal verification to meet our requirements, record keeping and liaison with the Standards Verifier. The Lead IV registers with Pearson annually. The Lead IV acts as an assessor, supports the rest of the assessment team, makes sure that they have the information they need about our assessment requirements and organises training, making use of our guidance and support materials.
- Internal Verifiers (IVs) oversee all assessment activity in consultation with the Lead IV. They check that assignments and assessment decisions are valid and that they meet our requirements. IVs will be standardised by working with the Lead IV. Normally, IVs are also assessors but they do not verify their own assessments.
- Assessors set or use assignments to assess learners to national standards. Before taking any assessment decisions, assessors participate in standardisation activities led by the Lead IV. They work with the Lead IV and IVs to ensure that the assessment is planned and carried out in line with our requirements.

Effective organisation

Internal assessment needs to be well organised so that the progress of learners can be tracked and so that we can monitor that assessment is being carried out in line with national standards. We support you through, for example, providing training materials and sample documentation.

It is particularly important that you manage the overall assignment programme and deadlines to make sure that learners are able to complete assignments on time.

Learner preparation

To ensure that you provide effective assessment for your learners, you need to make sure that they understand their responsibilities for assessment and the centre's arrangements.

From induction onwards, you will want to ensure that learners are motivated to work consistently and independently to achieve the requirements of the qualifications. Learners need to understand how assignments are used, the importance of meeting assignment deadlines, and that all the work submitted for assessment must be their own.

You will need to give learners a guide that explains how assignments are used for assessment, how assignments relate to the teaching programme, and how learners should use and reference source materials, including what would constitute plagiarism. The guide should also set out your approach to operating assessment, such as how learners must submit work and request extensions.

Setting effective assignments

Setting the number and structure of assignments

In setting your assignments, you need to work with the structure of assignments shown in the *Essential information for assignments* section of a unit. This shows the structure of the learning aims and criteria that you must follow and the recommended number of assignments that you should use. For some units we provide authorised assignment briefs, for all the units we give you suggestions on how to create suitable assignments. You can find these materials along with this specification on our website. In designing your own assignment briefs you should bear in mind the following points.

- The number of assignments for a unit must not exceed the number shown in *Essential information for assignments*. However, you may choose to combine assignments, for example to create a single assignment for the whole unit.
- You may also choose to combine all or parts of different units into single assignments, provided that all units and all their associated learning aims are fully addressed in the programme overall. If you choose to take this approach, you need to make sure that learners are fully prepared so that they can provide all the required evidence for assessment and that you are able to track achievement in the records.
- A learning aim must always be assessed as a whole and must not be split into two or more tasks.
- The assignment must be targeted to the learning aims but the learning aims and their associated criteria are not tasks in themselves. Criteria are expressed in terms of the outcome shown in the evidence.
- You do not have to follow the order of the learning aims of a unit in setting assignments but later learning aims often require learners to apply the content of earlier learning aims and they may require learners to draw their learning together.
- Assignments must be structured to allow learners to demonstrate the full range of achievement at all grade levels. Learners need to be treated fairly by being given the opportunity to achieve a higher grade if they have the ability.
- As assignments provide a final assessment, they will draw on the specified range of teaching content for the learning aims. The specified content is compulsory. The evidence for assessment need not cover every aspect of the teaching content as learners will normally be given particular examples, case studies or contexts in their assignments. For example, if a learner is carrying out one practical performance, or an investigation of one organisation, then they will address all the relevant range of content that applies in that instance.

Providing an assignment brief

A good assignment brief is one that, through providing challenging and realistic tasks, motivates learners to provide appropriate evidence of what they have learned.

An assignment brief should have:

- a vocational scenario, this could be a simple situation or a full, detailed set of vocational requirements that motivates the learner to apply their learning through the assignment
- clear instructions to the learner about what they are required to do, normally set out through a series of tasks
- an audience or purpose for which the evidence is being provided
- an explanation of how the assignment relates to the unit(s) being assessed.

Forms of evidence

BTEC Nationals have always allowed for a variety of forms of evidence to be used, provided that they are suited to the type of learning aim being assessed. For many units, the practical demonstration of skills is necessary and for others, learners will need to carry out their own research and analysis. The units give you information on what would be suitable forms of evidence to provide learners with the opportunity to apply a range of employability or transferable skills. Centres may choose to use different suitable forms for evidence to those proposed. Overall, learners should be assessed using varied forms of evidence.

Full definitions of types of assessment are given in *Appendix 2*. These are some of the main types of assessment:

- written reports
- projects
- time-constrained practical assessments with observation records and supporting evidence
- recordings of performance
- sketchbooks, working logbooks, reflective journals
- presentations with assessor questioning.

The form(s) of evidence selected must:

- allow the learner to provide all the evidence required for the learning aim(s) and the associated assessment criteria at all grade levels
- allow the learner to produce evidence that is their own independent work
- allow a verifier to independently reassess the learner to check the assessor's decisions.

For example, when you are using performance evidence, you need to think about how supporting evidence can be captured through recordings, photographs or task sheets.

Centres need to take particular care that learners are enabled to produce independent work. For example, if learners are asked to use real examples, then best practice would be to encourage them to use their own or to give the group a number of examples that can be used in varied combinations.

Making valid assessment decisions

Authenticity of learner work

Once an assessment has begun, learners must not be given feedback on progress towards fulfilling the targeted criteria.

An assessor must assess only learner work that is authentic, i.e. learners' own independent work. Learners must authenticate the evidence that they provide for assessment through signing a declaration stating that it is their own work.

Assessors must ensure that evidence is authentic to a learner through setting valid assignments and supervising them during the assessment period. Assessors must take care not to provide direct input, instructions or specific feedback that may compromise authenticity.

Assessors must complete a declaration that:

- the evidence submitted for this assignment is the learner's own
- the learner has clearly referenced any sources used in the work
- they understand that false declaration is a form of malpractice.

Centres can use Pearson templates or their own templates to document authentication.

During assessment, an assessor may suspect that some or all of the evidence from a learner is not authentic. The assessor must then take appropriate action using the centre's policies for malpractice. Further information is given in *Section 7*.

Making assessment decisions using criteria

Assessors make judgements using the criteria. The evidence from a learner can be judged using all the relevant criteria at the same time. The assessor needs to make a judgement against each criterion that evidence is present and sufficiently comprehensive. For example, the inclusion of a concluding section may be insufficient to satisfy a criterion requiring 'evaluation'.

Assessors should use the following information and support in reaching assessment decisions:

- the *Essential information for assessment decisions* section in each unit gives examples and definitions related to terms used in the criteria
- the explanation of key terms in *Appendix 2*
- examples of assessed work provided by Pearson
- your Lead IV and assessment team's collective experience, supported by the standardisation materials we provide.

Pass and Merit criteria relate to individual learning aims. The Distinction criteria as a whole relate to outstanding performance across the unit. Therefore, criteria may relate to more than one learning aim (for example A.D1) or to several learning aims (for example DE.D3). Distinction criteria make sure that learners have shown that they can perform consistently at an outstanding level across the unit and/or that they are able to draw learning together across learning aims.

Dealing with late completion of assignments

Learners must have a clear understanding of the centre policy on completing assignments by the deadlines that you give them. Learners may be given authorised extensions for legitimate reasons, such as illness at the time of submission, in line with your centre policies.

For assessment to be fair, it is important that learners are all assessed in the same way and that some learners are not advantaged by having additional time or the opportunity to learn from others. Therefore, learners who do not complete assignments by your planned deadline or the authorised extension deadline may not have the opportunity to subsequently resubmit.

If you accept a late completion by a learner, then the assignment should be assessed normally when it is submitted using the relevant assessment criteria.

Issuing assessment decisions and feedback

Once the assessment team has completed the assessment process for an assignment, the outcome is a formal assessment decision. This is recorded formally and reported to learners.

The information given to the learner:

- must show the formal decision and how it has been reached, indicating how or where criteria have been met
- may show why attainment against criteria has not been demonstrated
- must not provide feedback on how to improve evidence
- must be validated by an IV before it is given to the learner.

Resubmission of improved evidence

An assignment provides the final assessment for the relevant learning aims and is normally a final assessment decision, except where the Lead IV approves one opportunity to resubmit improved evidence based on the completed assignment brief.

The Lead IV has the responsibility to make sure that resubmission is operated fairly. This means:

- checking that a learner can be reasonably expected to perform better through a second submission, for example that the learner has not performed as expected
- making sure that giving a further opportunity can be done in such a way that it does not give an unfair advantage over other learners, for example through the opportunity to take account of feedback given to other learners
- checking that the assessor considers that the learner will be able to provide improved evidence without further guidance and that the original evidence submitted remains valid.

Once an assessment decision has been given to the learner, the resubmission opportunity must have a deadline within 15 working days in the same academic year.

A resubmission opportunity must not be provided where learners:

- have not completed the assignment by the deadline without the centre's agreement
- have submitted work that is not authentic.

Retake of internal assessment

A learner who has not achieved the level of performance required to pass the relevant learning aims after resubmission of an assignment may be offered a single retake opportunity using a new assignment. The retake may only be achieved at a pass.

The Lead Internal Verifier must only authorise a retake of an assignment in exceptional circumstances where they believe it is necessary, appropriate and fair to do so. For further information on offering a retake opportunity, you should refer to the *BTEC Centre Guide to Assessment*. We provide information on writing assignments for retakes on our website (www.btec.co.uk/keydocuments).

Planning and record keeping

For internal processes to be effective, an assessment team needs to be well organised and keep effective records. The centre will also work closely with us so that we can quality assure that national standards are being satisfied. This process gives stakeholders confidence in the assessment approach.

The Lead IV must have an assessment plan, produced as a spreadsheet. When producing a plan, the assessment team may wish to consider:

- the time required for training and standardisation of the assessment team
- the time available to undertake teaching and carry out assessment, taking account of when learners may complete external assessments and when quality assurance will take place
- the completion dates for different assignments
- who is acting as IV for each assignment and the date by which the assignment needs to be verified
- setting an approach to sampling assessor decisions through internal verification that covers all assignments, assessors and a range of learners
- how to manage the assessment and verification of learners' work so that they can be given formal decisions promptly
- how resubmission opportunities can be scheduled.

The Lead IV will also maintain records of assessment undertaken. The key records are:

- verification of assignment briefs
- learner authentication declarations
- assessor decisions on assignments, with feedback given to learners
- verification of assessment decisions.

Examples of records and further information are given in the *Pearson Quality Assurance Handbook*.

7 Administrative arrangements

Introduction

This section focuses on the administrative requirements for delivering a BTEC qualification. It will be of value to Quality Nominees, Lead IVs, Programme Leaders and Examinations Officers.

Learner registration and entry

Shortly after learners start the programme of learning, you need to make sure that they are registered for the qualification and that appropriate arrangements are made for internal and external assessment. You need to refer to the *Information Manual* for information on making registrations for the qualification and entries for external assessments.

Learners can be formally assessed only for a qualification on which they are registered. If learners' intended qualifications change, for example if a learner decides to choose a different pathway specialism, then the centre must transfer the learner appropriately.

Access to assessment

Both internal and external assessments need to be administered carefully to ensure that all learners are treated fairly, and that results and certification are issued on time to allow learners to progress to chosen progression opportunities.

Our equality policy requires that all learners should have equal opportunity to access our qualifications and assessments, and that our qualifications are awarded in a way that is fair to every learner. We are committed to making sure that:

- learners with a protected characteristic are not, when they are undertaking one of our qualifications, disadvantaged in comparison to learners who do not share that characteristic
- all learners achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Further information on access arrangements can be found in the Joint Council for Qualifications (JCQ) document *Access Arrangements, Reasonable Adjustments and Special Consideration for General and Vocational Qualifications*.

Administrative arrangements for internal assessment

Records

You are required to retain records of assessment for each learner. Records should include assessments taken, decisions reached and any adjustments or appeals. Further information can be found in the *Information Manual*. We may ask to audit your records so they must be retained as specified.

Reasonable adjustments to assessment

A reasonable adjustment is one that is made before a learner takes an assessment to ensure that they have fair access to demonstrate the requirements of the assessments. You are able to make adjustments to internal assessments to take account of the needs of individual learners. In most cases this can be achieved through a defined time extension or by adjusting the format of evidence. We can advise you if you are uncertain as to whether an adjustment is fair and reasonable. You need to plan for time to make adjustments if necessary.

Further details on how to make adjustments for learners with protected characteristics are given on our website in the document *Supplementary guidance for reasonable adjustment and special consideration in vocational internally-assessed units*.

Special consideration

Special consideration is given after an assessment has taken place for learners who have been affected by adverse circumstances, such as illness. You must operate special consideration in line with our policy (see previous paragraph). You can provide special consideration related to the period of time given for evidence to be provided or for the format of the assessment if it is equally valid. You may not substitute alternative forms of evidence to that required in a unit, or omit the application of any assessment criteria to judge attainment. Pearson can consider applications for special consideration in line with the policy.

Appeals against assessment

Your centre must have a policy for dealing with appeals from learners. These appeals may relate to assessment decisions being incorrect or assessment not being conducted fairly. The first step in such a policy could be a consideration of the evidence by a Lead IV or other member of the programme team. The assessment plan should allow time for potential appeals after assessment decisions have been given to learners. If there is an appeal by a learner, you must document the appeal and its resolution. Learners have a final right of appeal to Pearson but only if the procedures that you have put in place have not been followed. Further details are given in the document *Enquiries and appeals about Pearson vocational qualifications and end point assessment policy*.

Administrative arrangements for external assessment

Entries and resits

For information on the timing of assessment and entries, please refer to the annual examinations timetable on our website.

Access arrangements requests

Access arrangements are agreed with Pearson before an assessment. They allow students with special educational needs, disabilities or temporary injuries to:

- access the assessment
- show what they know and can do without changing the demands of the assessment.

Access arrangements should always be processed at the time of registration. Learners will then know what type of arrangements are available in place for them.

Granting reasonable adjustments

For external assessment, a reasonable adjustment is one that we agree to make for an individual learner. A reasonable adjustment is defined for the individual learner and informed by the list of available access arrangements.

Whether an adjustment will be considered reasonable will depend on a number of factors, to include:

- the needs of the learner with the disability
- the effectiveness of the adjustment
- the cost of the adjustment; and
- the likely impact of the adjustment on the learner with the disability and other learners.

Adjustment may be judged unreasonable and not approved if it involves unreasonable costs, timeframes or affects the integrity of the assessment.

Special consideration requests

Special consideration is an adjustment made to a student's mark or grade after an external assessment to reflect temporary injury, illness or other indisposition at the time of the assessment. An adjustment is made only if the impact on the learner is such that it is reasonably likely to have had a material effect on that learner being able to demonstrate attainment in the assessment.

Centres are required to notify us promptly of any learners who they believe have been adversely affected and request that we give special consideration. Further information can be found in the special requirements section on our website.

Conducting external assessments

Centres must make arrangements for the secure delivery of external assessments. External assessments for BTEC qualifications include examinations, set tasks and performance.

Each external assessment has a defined degree of control under which it must take place. Some external assessments may have more than one part and each part may have a different degree of control. We define degrees of control as follows.

High control

This is the completion of assessment in formal invigilated examination conditions.

Medium control

This is completion of assessment, usually over a longer period of time, which may include a period of controlled conditions. The controlled conditions may allow learners to access resources, prepared notes or the internet to help them complete the task.

Low control

These are activities completed without direct supervision. They may include research, preparation of materials and practice. The materials produced by learners under low control will not be directly assessed.

Further information on responsibilities for conducting external assessment is given in the document *Instructions for Conducting External Assessments*, available on our website.

Dealing with malpractice in assessment

Malpractice means acts that undermine the integrity and validity of assessment, the certification of qualifications, and/or that may damage the authority of those responsible for delivering the assessment and certification.

Pearson does not tolerate actions (or attempted actions) of malpractice by learners, centre staff or centres in connection with Pearson qualifications. Pearson may impose penalties and/or sanctions on learners, centre staff or centres where incidents (or attempted incidents) of malpractice have been proven.

Malpractice may arise or be suspected in relation to any unit or type of assessment within the qualification. For further details regarding malpractice and advice on preventing malpractice by learners, please see Pearson's *Centre guidance: Dealing with malpractice and maladministration in vocational qualifications*, available on our website.

The procedures we ask you to adopt vary between units that are internally-assessed and those that are externally assessed.

Internally-assessed units

Centres are required to take steps to prevent malpractice and to investigate instances of suspected malpractice. Learners must be given information that explains what malpractice is for internal assessment and how suspected incidents will be dealt with by the centre. The *Centre Guidance: Dealing with Malpractice* document gives full information on the actions we expect you to take.

Pearson may conduct investigations if we believe that a centre is failing to conduct internal assessment according to our policies. The above document gives further information, examples and details the penalties and sanctions that may be imposed.

In the interests of learners and centre staff, centres need to respond effectively and openly to all requests relating to an investigation into an incident of suspected malpractice.

Externally-assessed units

External assessment means all aspects of units that are designated as external in this specification, including preparation for tasks and performance. For these assessments centres must follow the JCQ procedures set out in the latest version of *JCQ Suspected Malpractice in Examinations and Assessments Policies and Procedures* (www.jcq.org.uk).

In the interests of learners and centre staff, centres need to respond effectively and openly to all requests relating to an investigation into an incident of suspected malpractice.

Learner malpractice

Heads of Centres are required to report incidents of any suspected learner malpractice that occur during Pearson external assessments. We ask that centres do so by completing a *JCQ Form M1* (available at www.jcq.org.uk/exams-office/malpractice) and emailing it and any accompanying documents (signed statements from the learner, invigilator, copies of evidence, etc.) to the Investigations Team at candidatemalpractice@pearson.com. The responsibility for determining appropriate sanctions or penalties to be imposed on learners lies with Pearson.

Learners must be informed at the earliest opportunity of the specific allegation and the centre's malpractice policy, including the right of appeal. Learners found guilty of malpractice may be disqualified from the qualification for which they have been entered with Pearson.

Teacher/centre malpractice

Heads of Centres are required to inform Pearson's Investigations Team of any incident of suspected malpractice by centre staff, before any investigation is undertaken. Heads of centres are requested to inform the Investigations Team by submitting a *JCQ Form M2(a)* (available at www.jcq.org.uk/exams-office/malpractice) with supporting documentation to pqsmalpractice@pearson.com. Where Pearson receives allegations of malpractice from other sources (for example Pearson staff or anonymous informants), the Investigations Team will conduct the investigation directly or may ask the head of centre to assist.

Incidents of maladministration (accidental errors in the delivery of Pearson qualifications that may affect the assessment of learners) should also be reported to the Investigations Team using the same method.

Heads of Centres/Principals/Chief Executive Officers or their nominees are required to inform learners and centre staff suspected of malpractice of their responsibilities and rights; see Section 6.15 of the *JCQ Suspected Malpractice in Examinations and Assessments Policies and Procedures* document.

Pearson reserves the right in cases of suspected malpractice to withhold the issuing of results and/or certificates while an investigation is in progress. Depending on the outcome of the investigation results and/or certificates may be released or withheld.

You should be aware that Pearson may need to suspend certification when undertaking investigations, audits and quality assurances processes. You will be notified within a reasonable period of time if this occurs.

Sanctions and appeals

Where malpractice is proven we may impose sanctions or penalties.

Where learner malpractice is evidenced, penalties may be imposed such as:

- mark reduction for external assessments
- disqualification from the qualification
- being barred from registration for Pearson qualifications for a period of time.

If we are concerned about your centre's quality procedures we may impose sanctions such as:

- working with you to create an improvement action plan
- requiring staff members to receive further training
- placing temporary blocks on your certificates
- placing temporary blocks on registration of learners
- debarring staff members or the centre from delivering Pearson qualifications
- suspending or withdrawing centre approval status.

The centre will be notified if any of these apply.

Pearson has established procedures for centres that are considering appeals against penalties and sanctions arising from malpractice. Appeals against a decision made by Pearson will normally be accepted only from Heads of Centres (on behalf of learners and/or members of staff) and from individual members (in respect of a decision taken against them personally). Further information on appeals can be found in our *Enquiries and appeals about Pearson vocational qualifications and end point assessment policy*, which is on our website. In the initial stage of any aspect of malpractice, please notify the Investigations Team by email via pqsmalpractice@pearson.com who will inform you of the next steps.

Certification and results

Once a learner has completed all the required components for a qualification, even if final results for external assessments have not been issued, then the centre can claim certification for the learner, provided that quality assurance has been successfully completed. For the relevant procedures please refer to our *Information Manual*. You can use the information provided on qualification grading to check overall qualification grades.

Results issue

After the external assessment session, learner results will be issued to centres. The result will be in the form of a grade. You should be prepared to discuss performance with learners, making use of the information we provide and post-results services.

Post-assessment services

Once results for external assessments are issued, you may find that the learner has failed to achieve the qualification or to attain an anticipated grade. It is possible to transfer or reopen registration in some circumstances. The *Information Manual* gives further information.

Changes to qualification requests

Where a learner who has taken a qualification wants to resit an externally-assessed unit to improve their qualification grade, you firstly need to decline their overall qualification grade. You may decline the grade before the certificate is issued. For a learner receiving their results in August, you should decline the grade by the end of September if the learner intends to resit an external assessment.

Additional documents to support centre administration

As an approved centre you must ensure that all staff delivering, assessing and administering the qualifications have access to this documentation. These documents are reviewed annually and are reissued if updates are required.

- *Pearson Quality Assurance Handbook*: this sets out how we will carry out quality assurance of standards and how you need to work with us to achieve successful outcomes.
- *Information Manual*: this gives procedures for registering learners for qualifications, transferring registrations, entering for external assessments and claiming certificates.
- *Lead Examiners' Reports*: these are produced after each series for each external assessment and give feedback on the overall performance of learners in response to tasks or questions set.
- *Instructions for the Conduct of External Assessments (ICEA)*: this explains our requirements for the effective administration of external assessments, such as invigilation and submission of materials.
- *Regulatory policies*: our regulatory policies are integral to our approach and explain how we meet internal and regulatory requirements. We review the regulated policies annually to ensure that they remain fit for purpose. Policies related to this qualification include:
 - adjustments for candidates with disabilities and learning difficulties, access arrangements and reasonable adjustments for general and vocational qualifications
 - age of learners
 - centre guidance for dealing with malpractice
 - recognition of prior learning and process.

This list is not exhaustive and a full list of our regulatory policies can be found on our website.

8 Quality assurance

Centre and qualification approval

As part of the approval process, your centre must make sure that the resource requirements listed below are in place before offering the qualification.

- Centres must have appropriate physical resources (for example, equipment, IT, learning materials, teaching rooms) to support the delivery and assessment of the qualification.
- Staff involved in the assessment process must have relevant expertise and/or occupational experience.
- There must be systems in place to ensure continuing professional development for staff delivering the qualification.
- Centres must have in place appropriate health and safety policies relating to the use of equipment by learners.
- Centres must deliver the qualification in accordance with current equality legislation.
- Centres should refer to the teacher guidance section in individual units to check for any specific resources required.

Continuing quality assurance and standards verification

On an annual basis, we produce the *Pearson Quality Assurance Handbook*. It contains detailed guidance on the quality processes required to underpin planning for delivery, including appropriate employer involvement, and for robust assessment and internal verification.

The key principles of quality assurance are that:

- a centre delivering BTEC programmes must be an approved centre, and must have approval for the programmes or groups of programmes that it is delivering
- the centre agrees, as part of gaining approval, to abide by specific terms and conditions around the effective delivery and quality assurance of assessment; it must abide by these conditions throughout the period of delivery
- Pearson makes available to approved centres a range of materials and opportunities, through online standardisation, intended to exemplify the processes required for effective assessment, and examples of effective standards. Approved centres must use the materials and services to ensure that all staff delivering BTEC qualifications keep up to date with the guidance on assessment
- an approved centre must follow agreed protocols for standardisation of assessors and verifiers, for the planning, monitoring and recording of assessment processes, and for dealing with special circumstances, appeals and malpractice.

The approach of quality-assured assessment is through a partnership between an approved centre and Pearson. We will make sure that each centre follows best practice and employs appropriate technology to support quality-assurance processes, where practicable. We work to support centres and seek to make sure that our quality-assurance processes do not place undue bureaucratic processes on centres. We monitor and support centres in the effective operation of assessment and quality assurance.

The methods we use to do this for BTEC Level 3 include:

- making sure that all centres complete appropriate declarations at the time of approval
- undertaking approval visits to centres
- making sure that centres have effective teams of assessors and verifiers who are trained to undertake assessment
- undertaking an overarching review and assessment of a centre's strategy for ensuring sufficient and appropriate engagement with employers at the beginning of delivery of any BTEC programme(s)
- undertaking a review of the employer involvement planned at programme level to ensure its appropriateness at a time when additional activities can be scheduled where necessary
- assessment sampling and verification, through requested samples of assessments, completed assessed learner work and associated documentation

- an overarching review and assessment of a centre's strategy for delivering and quality assuring its BTEC programmes, for example making sure that synoptic units are placed appropriately in the order of delivery of the programme.

Centres that do not fully address and maintain rigorous approaches to delivering, assessing and quality assurance cannot seek certification for individual programmes or for all BTEC Level 3 programmes. An approved centre must make certification claims only when authorised by us and strictly in accordance with requirements for reporting.

Centres that do not comply with remedial action plans may have their approval to deliver qualifications removed.

9 Understanding the qualification grade

Awarding and reporting for the qualification

This section explains the rules that we apply in awarding a qualification and in providing an overall qualification grade for each learner. It shows how all the qualifications in this sector are graded.

The awarding and certification of these qualifications will comply with regulatory requirements.

Eligibility for an award

In order to be awarded a qualification, a learner must complete all units, achieve a Near Pass (N) or above in all external units and a pass or above in all mandatory units unless otherwise specified. Refer to the structure in *Section 2*.

To achieve any qualification grade, learners must:

- complete and **have an outcome** (D, M, P, N or U) for all units within a valid combination
- achieve the **required units at pass or above** shown in *Section 2*, and for the Diploma achieve a minimum of 600 GLH and Extended Diploma achieve a minimum 900 GLH at Pass or above (or N or above in external units)
- achieve the **minimum number of points** at a grade threshold.

It is the responsibility of a centre to ensure that a correct unit combination is adhered to. Learners who do not achieve the required minimum grade (N or P) in units shown in the structure will not achieve a qualification.

Learners who do not achieve sufficient points for a qualification or who do not achieve all the required units may be eligible to achieve a smaller qualification in the same suite provided they have completed and achieved the correct combination of units and met the appropriate qualification grade points threshold.

Calculation of the qualification grade

The final grade awarded for a qualification represents an aggregation of a learner's performance across the qualification. As the qualification grade is an aggregate of the total performance, there is some element of compensation in that a higher performance in some units may be balanced by a lower outcome in others.

In the event that a learner achieves more than the required number of optional units, the mandatory units along with the optional units with the highest grades will be used to calculate the overall result, subject to the eligibility requirements for that particular qualification title.

BTEC Nationals are Level 3 qualifications and are awarded at the grade ranges shown in the table below.

Qualification	Available grade range
Certificate, Extended Certificate, Foundation Diploma	P to D*
Diploma	PP to D*D*
Extended Diploma	PPP to D*D*D*

The *Calculation of qualification grade* table, shown further on in this section, shows the minimum thresholds for calculating these grades. The table will be kept under review over the lifetime of the qualification. The most up to date table will be issued on our website.

Pearson will monitor the qualification standard and reserves the right to make appropriate adjustments.

Learners who do not meet the minimum requirements for a qualification grade to be awarded will be recorded as Unclassified (U) and will not be certificated. They may receive a Notification of Performance for individual units. The *Information Manual* gives full information.

Points available for internal units

The table below shows the number of **points** available for internal units. For each internal unit, points are allocated depending on the grade awarded.

	Unit size	
	60 GLH	90 GLH
U	0	0
Pass	6	9
Merit	10	15
Distinction	16	24

Points available for external units

Raw marks from the external units will be awarded **points** based on performance in the assessment. The table below shows the **minimum number of points** available for each grade in the external units.

	Unit size	
	90 GLH	120 GLH
U	0	0
Near Pass	6	8
Pass	9	12
Merit	15	20
Distinction	24	32

Pearson will automatically calculate the points for each external unit once the external assessment has been marked and grade boundaries have been set. For more details about how we set grade boundaries in the external assessment please go to our website.

Claiming the qualification grade

Subject to eligibility, Pearson will automatically calculate the qualification grade for your learners when the internal unit grades are submitted and the qualification claim is made. Learners will be awarded qualification grades for achieving the sufficient number of points within the ranges shown in the relevant *Calculation of qualification grade* table for the cohort.

Calculation of qualification grade

Applicable for registration from 1 September 2016.

Extended Certificate		Foundation Diploma		Diploma		Extended Diploma	
360 GLH		540 GLH		720 GLH		1080 GLH	
Grade	Points threshold	Grade	Points threshold	Grade	Points threshold	Grade	Points threshold
U	0	U	0	U	0	U	0
P	36	P	54	PP	72	PPP	108
				MP	88	MPP	124
						MMP	140
M	52	M	78	MM	104	MMM	156
				DM	124	DMM	176
						DDM	196
D	74	D	108	DD	144	DDD	216
				D*D	162	D*DD	234
						D*D*D	252
D*	90	D*	138	D*D*	180	D*D*D*	270

The table is subject to review over the lifetime of the qualification. The most up-to-date version will be issued on our website.

Examples of grade calculations based on table applicable to registrations from September 2016

Example 1: Achievement of a Foundation Diploma with a P grade

	GLH	Type (Int/Ext)	Grade	Unit points
Unit 1	120	Ext	Pass	12
Unit 2	120	Ext	Pass	12
Unit 4	60	Int	Pass	6
Unit 5	60	Int	Pass	6
Unit 10	60	Int	Unclassified	0
Unit 11	60	Int	Distinction	16
Unit 13	60	Int	Merit	10
Totals	540		P	62

The learner has achieved a Near Pass or above in Units 1 and 2.

The learner has sufficient points for a P grade.

Example 2: Achievement of a Foundation Diploma with a D grade

	GLH	Type (Int/Ext)	Grade	Unit points
Unit 1	120	Ext	Near Pass	8
Unit 2	120	Ext	Distinction	32
Unit 4	60	Int	Merit	10
Unit 5	60	Int	Distinction	16
Unit 10	60	Int	Distinction	16
Unit 11	60	Int	Distinction	16
Unit 13	60	Int	Merit	10
Totals	540		D	108

The learner has sufficient points for a D grade.

Example 3: An Unclassified result for a Foundation Diploma

	GLH	Type (Int/Ext)	Grade	Unit points
Unit 1	120	Ext	Merit	20
Unit 2	120	Ext	U	0
Unit 4	60	Int	Pass	6
Unit 5	60	Int	Distinction	16
Unit 10	60	Int	Distinction	16
Unit 11	60	Int	Distinction	16
Unit 13	60	Int	Pass	6
Totals	540		U	80

The learner has a U in Unit 2.

The learner has sufficient points for an M grade but has not met the minimum requirement for a Near Pass or higher in Units 1 and 2.

10 Resources and support

Our aim is to give you a wealth of resources and support to enable you to deliver BTEC National qualifications with confidence. On our website you will find a list of resources to support teaching and learning, and professional development.

Support for setting up your course and preparing to teach

Specification

This **specification** (for teaching from September 2017) includes details on the administration of qualifications and information on all the units for the qualification.

Delivery Guide

This free guide gives you important advice on how to choose the right course for your learners and how to ensure you are fully prepared to deliver the course. It explains the key features of BTEC Nationals (for example employer involvement and employability skills). It also covers guidance on assessment (internal and external) and quality assurance. The guide tells you where you can find further support and gives detailed unit-by-unit delivery guidance. It includes teaching tips and ideas, assessment preparation and suggestions for further resources.

Schemes of work

Free sample schemes of work are provided for each mandatory unit. These are available in Word™ format for ease of customisation.

Curriculum models

These show how the BTECs in the suite fit into a 16–19 study programme, depending on their size and purpose. The models also show where other parts of the programme, such as work experience, maths and English, tutorial time and wider study, fit alongside the programme.

Study skills activities

A range of case studies and activities is provided; they are designed to help learners develop the study skills they need to successfully complete their BTEC course. The case studies and activities are provided in Word™ format for easy customisation.

Support for teaching and learning

Pearson Learning Services provides a range of engaging resources to support BTEC Nationals, including:

- textbooks in e-book and print formats
- revision guides and revision workbooks in e-book and print formats
- teaching and assessment packs, including e-learning materials via the Active Learn Digital Service.

Teaching and learning resources are also available from a number of other publishers. Details of Pearson's own resources and of all endorsed resources can be found on our website.

Support for assessment

Sample assessment materials for externally-assessed units

Sample assessments are available for the Pearson-set units. One copy of each of these assessments can be downloaded from the website/available in print. For each suite an additional sample for one of the Pearson-set units is also available, allowing your learners further opportunities for practice.

Further sample assessments will be made available through our website on an ongoing basis.

Sample assessment materials for internally-assessed units

We do not prescribe the assessments for the internally-assessed units. Rather, we allow you to set your own, according to your learners' preferences and to link with your local employment profile.

We do provide a service in the form of Authorised Assignment Briefs, which are approved by Pearson Standards Verifiers. They are available via our website.

Sample marked learner work

To support you in understanding the expectation of the standard at each grade, examples of marked learner work at PM/MD grades are linked to the Authorised Assignment Briefs.

Training and support from Pearson

People to talk to

There are many people who are available to support you and provide advice and guidance on delivery of your BTEC Nationals. These include:

- Subject Advisors – available for all sectors. They understand all Pearson qualifications in their sector and so can answer sector-specific queries on planning, teaching, learning and assessment
- Standards Verifiers – they can support you with preparing your assignments, ensuring that your assessment plan is set up correctly, and support you in preparing learner work and providing quality assurance through sampling
- Curriculum Development Managers (CDMs) – they are regionally based and have a full overview of the BTEC qualifications and of the support and resources that Pearson provides. CDMs often run network events
- Customer Services – the ‘Support for You’ section of our website gives the different ways in which you can contact us for general queries. For specific queries, our service operators can direct you to the relevant person or department.

Training and professional development

Pearson provides a range of training and professional development events to support the introduction, delivery, assessment and administration of BTEC National qualifications. These sector-specific events, developed and delivered by specialists, are available both face to face and online.

‘Getting Ready to Teach’

These events are designed to get teachers ready for delivery of the BTEC Nationals. They include an overview of the qualifications’ structures, planning and preparation for internal and external assessment, and quality assurance.

Teaching and learning

Beyond the ‘Getting Ready to Teach’ professional development events, there are opportunities for teachers to attend sector- and role-specific events. These events are designed to connect practice to theory; they provide teacher support and networking opportunities with delivery, learning and assessment methodology.

Details of our training and professional development programme can be found on our website.

Appendix 1 Links to industry standards

BTEC Nationals have been developed in consultation with industry and appropriate sector bodies to ensure that the qualification content and approach to assessment aligns closely to the needs of employers. Where they exist, and are appropriate, National Occupational Standards (NOS) and professional body standards have been used to establish unit content.

In the construction and the built environment sector, the following approach has been used.

- The mandatory content has been mapped to NOS to reflect the essential skills and knowledge needed for entry to employment.

Appendix 2 Glossary of terms used for internally-assessed units

This is a summary of the key terms used to define the requirements in the units.

Term	Definition
Analyse	<p>Learners present the outcome of methodical and detailed examination, either:</p> <ul style="list-style-type: none"> • breaking down a theme, topic or situation in order to interpret and study the interrelationships between the parts and/or • of information or data to interpret and study key trends and interrelationships. <p>Analysis can be through performance, practice, written or, less commonly, verbal presentation.</p>
Assess	<p>Learners present a careful consideration of varied factors or events that apply to a specific situation or, to identify those which are the most important or relevant and arrive at a conclusion.</p>
Carry out	<p>Learners demonstrate skills through practical activities, in line with certain requirements. Learners do this in order to complete an identified activity or to demonstrate personal achievement for an audience.</p>
Compare	<p>Learners identify the main factors relating to two or more items/situations or aspects of a subject that is extended to explain the similarities, differences, advantages and disadvantages.</p> <p>This is used to show depth of knowledge through selection and isolation of characteristics.</p>
Demonstrate	<p>Learners' work, performance or practice evidences the ability to carry out and apply knowledge, understanding and/or skills in a practical situation.</p>
Develop	<p>Learners acquire and apply skills and understanding through practical activities that involve the use of concepts, processes or techniques to expand or progress something.</p>
Discuss	<p>Learners consider different aspects of:</p> <ul style="list-style-type: none"> • a theme or topic; • how they interrelate; and • the extent to which they are important. <p>A conclusion is not required.</p>

Term	Definition
Evaluate	<p>Learners' work draws on varied information, themes or concepts to consider aspects such as:</p> <ul style="list-style-type: none"> • strengths or weaknesses • advantages or disadvantages • alternative actions • relevance or significance. <p>Learners' inquiries should lead to a supported judgement showing relationship to its context. This will often be in a conclusion.</p> <p>Evidence of explanations could be through visual explanations with annotations, as well as written work, presentation, performance or practice.</p>
Examine	Learners select and apply knowledge to less familiar contexts.
Explain	Learners' work shows clear detail and gives reasons and/or evidence to support an opinion, view or argument. It could show how conclusions are drawn (arrived at). Learners show that they comprehend the origins, functions and objectives of a subject, and its suitability for purpose.
Explore	Learners apply their skills and/or knowledge in contexts involving practical research or investigation.
Investigate	Learners' application of knowledge is based on personal research and development.
Justify	<p>Learners give reasons or evidence to:</p> <ul style="list-style-type: none"> • support an opinion • prove something right or reasonable.
Perform	Learners demonstrate a range of skills required to complete a given activity.
Review	<p>Learners make a formal assessment of work produced.</p> <p>The assessment allows learners to appraise existing information or prior events, and reconsider information with the intention of making changes, if necessary.</p>
Understand	Learners demonstrate knowledge related to defined situations.
Undertake	Learners demonstrate skills through practical activities, often referring to given processes or techniques.

This is a key summary of the types of evidence used for BTEC Nationals.

Type of evidence	Definition and purpose
Case study	A specific example to which all learners must select and apply knowledge. Used to show application to a realistic context where direct experience cannot be gained.
Individual project	A self-directed, large-scale activity requiring, planning, research, exploration, outcome and review. Used to show self-management, project management and/or deep learning, including synopticity.
Practical task (artefact/outcome)	Learners carry out a defined or self-defined task to produce an outcome.
Presentation	To show presentation skills, including communication. To direct to a given audience and goal. To extract and summarise information.
Written task/report	Individual completion of a task in a work-related format, e.g. a report, marketing communication, set of instructions.

Pearson BTEC Level 3 Nationals in Construction and the Built Environment

Extended Certificate in Construction and the Built Environment

Foundation Diploma in Construction and the Built Environment

Diploma in Construction and the Built Environment

Extended Diploma in Construction and the Built Environment

Diploma in Building Services Engineering

Extended Diploma in Building Services Engineering

Diploma in Civil Engineering

Extended Diploma in Civil Engineering

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