



BTEC Subsidiary Diploma

Construction

Course Handbook

2011-2013



Student Handbook—BTEC Construction

Qualification Details and Programme Overview

The course is;
BTEC Subsidiary Diploma in Construction

Exam Board: EdExcel

Website: www.edexcel.com

Course Elements

Unit_1_Health_Safety_and_Welfare_in_Construction_and_the_Built_Environment
Unit_2_Sustainable_Construction
Unit_4_Science_and_Materials_in_Construction_and_the_Built_Environment
Unit_5_Construction_Technology_and_Design_in_Construction_and_Civil_Engineering
Unit_10_Surveying_in_Construction_and_Civil_Engineering
Unit_29_Construction_in_Civil_Engineering

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Why Choose Construction?

The BTEC is a vocational course. It is targeted to those wishing to work in the industry. Do you see yourself as an architect? A land surveyor? A civil engineer? The course will take you through these careers and many more and give you a taste of a plethora of possible jobs within the industry. This could be the beginning of your well-paid career in construction.

Course Outline

Year One

Unit 5 Construction
Technology and Design in
Construction and Civil Engineering

Terms 1-6

Unit 10 Surveying in Construction and Civil Engineering

Terms 1-3

Unit 4 Science and Materials in Construction and the Built
Environment

Terms 4-6

Year Two

Unit 2 Sustainable Construction

Terms 7-11

Unit 29 Construction in Civil Engineering

Terms 7-9

Unit 1 Health Safety and Welfare in Construction and the
Built Environment

Terms 10-11

Unit 1: Health, Safety and Welfare in Construction and the Built Environment

Unit code:	L/600/0211
QCF Level 3:	BTEC Nationals
Credit value:	10
Guided learning hours:	60

● Aim and purpose

This unit enables learners to understand the responsibilities of employers and employees and the control measures used to reduce risk and meet legal requirements. They will gain knowledge of how to undertake risk assessments and accident recording and reporting procedures.

● Unit introduction

The construction industry is complex, dynamic and diverse. It is essential that high standards of health, safety and welfare are maintained during all stages of a construction project. This should be a major priority and dedicated resources must be made available to ensure consistently high standards of safety. This unit encourages learners to explore the health, safety and welfare procedures used to mitigate and control risks on site. The unit will provide learners with a knowledge and understanding of the legal framework relating to the responsibilities of employers, employees, site visitors and the general public.

Learners will investigate common accidents and dangerous occurrences and how to report an accident. They will explore the importance of planning for health and safety and the consequences of technical, engineering and human failures for themselves and others. Learners will become familiar with enforcement routes for breaches of health and safety including prosecution costs and fines.

Learners will explore risk assessment methods and the legislation used to identify and report workplace hazards, risks and control measures in construction. Hazards covered will include physical, environmental, psychosocial, chemical and biological. Control strategies and risk control hierarchies will be explored. Learners will produce risk assessments in a format that can be understood by everyone who needs to read or review the risk assessment, or comply with its contents.

Learners will become familiar with the legal requirements for and required content of a health and safety policy including organisational sections and safe systems of work. They must be able to identify and implement adequate monitoring and review arrangements for all identified control measures. Learners will become familiar with components of health and safety management systems and understand the importance of training, information, instruction and supervision, along with techniques which can be used to aid understanding and adherence on site.

Unit content

1 Know the responsibilities of employers and employees under current health, safety and welfare legislation

Persons: client; employers; designers, architects, directors, managers, employees; principal contractor; construction design and management coordinator; sub-contractors; directors; managers; Health and Safety Executive (HSE); local authority; consequences for individuals and employers (eg corporate manslaughter, fines, imprisonment)

Health, safety and welfare legislation: relevant provisions of Health and Safety at Work Act 1974; Construction Design and Management Regulations 2007; Work at Heights Regulations 2005; Management of Health and Safety at Work Regulations 1999; Fire Regulatory Reform (Safety) Order 2006; Provision and Use of Work Equipment Regulations 1998; Lifting Equipment and Lifting Operations Regulations 1998; Control of Substances Hazardous to Health Regulations 2002; Personal Protective Equipment Regulations 1992; Electricity at Work Regulations 1989; Confined Spaces Regulations 1997; Noise at Work Regulations 2005; Control of Vibration at Work Regulations 2005

2 Know how to undertake risk assessments using appropriate principles and formats

Identification of hazards: direct observation of work environment; use of accident data, checklists and method statements; regular safety inspections

Hazard and risk: difference between hazard and risk

Persons who may be at risk: employees; site visitors; general public; indirect and direct exposure

Consequences for individuals and employers: eg corporate manslaughter, fines, imprisonment

Risk rating and reporting methods: qualitative and quantitative risk assessment methodology; hazard; likelihood and overall risk rating calculations

Hazards: environmental; physical; chemical; biological; psychosocial

Principles: employer obligations under Management of Health and Safety at Work Regulations 1999 and other secondary legislation; development of safe system of work; minimisation of risk to employees and others affected by work; concept of 'reasonably practicable' in terms of cost and other design goals; advantages of using a standard format

Five steps to risk assessment: identification of hazards in the proposed work activity or the adjacent area; consideration of who might be harmed and how; evaluation of risks and existing requirements; risk control hierarchy principles; recording of findings; review of risk assessments; revision where necessary

Formats: risk assessment templates (COSHH assessments; work at heights assessments; provision and use of workplace equipment assessments; manual handling assessments)

3 Understand the control measures used to reduce risk and meet legal requirements

Control measures: for workplace procedures; hazardous substances; lifting and manual handling; working at height; working in excavations; site traffic and plant; contaminated ground

Legal requirements: duty of everyone to conform to health, safety and welfare legislation and workplace policies

Policies: general workplace health and safety; non smoking; drugs and alcohol

4 Know their own role in accident recording and reporting procedures

Accident: definition of accident, near miss and dangerous occurrence; major injury; occupational disease; elements of a typical accident; chain of events or omissions leading to accidents; main accident investigation elements; relevant legislation eg First Aid at Work Regulations, Reporting of Injuries Diseases and Dangerous Occurrences Regulations (RIDDOR)

Recording and reporting: current regulations on recording and reporting accidents, diseases, near misses and dangerous occurrences; procedures to be followed after an accident; individual roles and responsibilities; accident investigation principles; evidence gathering techniques, interviewing and questioning; report formatting; root causes; explanation of contributory factors

Assessment

Unit 1

To achieve a pass grade you must :

P1 outline the roles and responsibilities of people assigned specific health and safety duties at work
[IE4]

P2 outline the legal duties of employees and employers in relation to three pieces of health, safety and welfare legislation relevant to the construction and built environment sector
[IE2]

P3 describe how to identify the hazards present in a given workplace situation, the people who may be at risk, and the possible consequences
[IE3, TW4]

P4 describe the main principles and features of a typical risk assessment for a given workplace situation
[IE2]

P5 select control measures for a given workplace situation to reduce risks and meet legal requirements, using workplace health and safety policies
[EP2]

P6 describe the role of the individual in accident recording and reporting

To achieve a merit grade you must also :

M1 explain how members of the site construction team interact in terms of their health, safety and welfare roles and responsibilities

M2 carry out a typical risk assessment for a given workplace situation using a suitable format

D1 justify the contents of a risk assessment, in terms of available control measures and what is 'reasonably practicable'

M3 explain how accurate data on accidents and incidents contributes to improving health, safety and welfare in the workplace.

To achieve a distinction grade you must also:

D1 justify the contents of a risk assessment, in terms of available control measures and what is 'reasonably practicable'

D2 evaluate a given accident report and suggest improvements to workplace

Unit 2: Sustainable Construction

Unit code:	R/600/0212
QCF Level 3:	BTEC Nationals
Credit value:	10
Guided learning hours:	60

● Aim and purpose

The aim of this unit is to enable learners to know which features of the natural environment need to be protected and understand how the activities of the construction and built environment sector impact on the natural environment. Learners will also find out about how the natural environment can be protected against these activities, including the use of sustainable construction techniques.

● Unit Introduction

The construction industry poses a major potential pollution threat to our environment and is responsible for many pollution incidents. The implications of this must include possible less evident, longer-term or indirect effects on succeeding generations, other species and biodiversity in general.

Pollution incidents may arise out of ignorance, apathy, neglect, accident, vandalism or theft, and all of these causes must be addressed. This is a challenge, but responding to them should not be looked on as a burden. The cost of non-compliance with increasingly demanding environmental legislation will be very high. The construction industry must carry with it both the public and the institutions that provide its financial backing if it is to prosper.

Learners will understand the important features of the natural environment and the relationship between the natural and the built environment. The unit will provide a fundamental understanding of how the activities of the construction sector impact on the natural environment. The techniques, processes and procedures used to protect the natural environment are investigated and the advantages of adopting a sustainable approach to construction work are explored in the contexts of energy, materials and waste.

● Learning outcomes

On completion of this unit a learner should:

- 1 Know the important features of the natural environment that need to be protected
- 2 Understand how the activities of the construction and built environment sector impact on the natural environment
- 3 Understand how the natural environment can be protected against the activities of the construction and built environment sector
- 4 Understand sustainable construction techniques that are fit for purpose.

Unit content

1 Know the important features of the natural environment that need to be protected

Features: air quality; ozone quality; soil quality; natural drainage landscape; natural amenities; land use; green belts; agriculture; forestry; countryside; heritage; water (resources, quality); marine environment; wildlife; biodiversity; natural habitat

2 Understand how the activities of the construction and built environment sector impact on the natural environment

Global pollution: build-up of greenhouse gases (CO₂) causing global warming; polluting emissions to air causing acid rain; ozone depletion due to use of chlorofluorocarbons (CFCs); over-extraction (of water, fossil fuels and raw materials); increased energy consumption; electricity generation; deforestation; loss of natural habitat; reduction in biodiversity

Local pollution: air pollution from combustion products and volatile organic compounds (VOCs); polluting discharges to water by communities, industry and agriculture, contaminated land; waste disposal; existing site dereliction; comfort disturbance (traffic, smells, noise, dust and dirt); increased pressure on existing services and infrastructure; specification of hazardous materials eg lead and asbestos; extraction of raw materials (by drilling, mining and quarrying); electromagnetic radiation from overhead power lines; 'sick building' syndrome

3 Understand how the natural environment can be protected against the activities of the construction and built environment sector

Protection by legislation: relevant Acts of Parliament; UK regulations; European directives

Protection by control: Health and Safety Executive (HSE); Environment Agency (EA); local authorities (eg environmental services, planning, building control departments)

Protection by design and specification: reduction in energy usage; minimisation of pollution; reduction in embedded energy; specification of environmentally friendly/renewable materials; re-use of existing buildings and sites

Protection by management: simple environmental impact assessments (EIAs); improved management of construction sites; clear policies and objectives (eg reduction in wastage, increase in recycling, noise management, dust and dirt control); sharing of good practice; raising awareness; communication of information

4 Understand sustainable construction techniques that are fit for purpose

Fit for purpose: to meet the needs of the present without compromising the ability of future generations to meet their own needs eg social progress that recognises the needs of everyone, effective protection of the environment, prudent use of natural resources, maintenance of high and stable levels of economic growth and employment

Sustainable construction techniques: energy based; materials based; waste based

Energy-based techniques: eg reduced energy consumption, improved energy efficiency, use of renewable and alternative sources of energy

Materials-based techniques: eg specification of renewable materials, consideration of embodied energy and low-energy manufacture of materials and components

Waste-based techniques: eg producing less waste and recycling more, off-site prefabrication, modern methods of construction

Assessment

Unit 2

To achieve a pass grade you must :

P1 describe six different features of the natural environment that must be considered at the planning stage of a construction project
[IE 3, SM2, SM3]

P2 explain four different forms of global pollution arising from construction projects
[SM2, SM3, IE1, IE3, IE4, RL2, TW1]

P3 explain how four different forms of local pollution arising from construction projects may harm the local environment
[SM2, SM3, IE1, IE3, IE4, RL2, TW1]

P4 explain four key methods used to protect the natural environment from the impact of the construction and built environment sector
[SM2, SM3]

P5 explain three different, fit-for-purpose sustainable construction techniques.
[SM2, SM3]

To achieve a merit grade you must also :

M1 assess the potential environmental impact of a proposed construction project on the local natural environment

M2 compare the four key methods used to protect the natural environment in terms of cost, effectiveness and public perception

M3 compare sustainable construction techniques in terms of relative cost and performance.

To achieve a distinction grade you must also:

D1 assess the importance of addressing environmental issues for the mutual benefit of the community and individual construction firms

D2 justify the use of appropriate sustainable construction techniques for a specified construction project.

Unit 4:

Science and Materials in Construction and the Built Environment

Unit code:	T/600/0221
QCF Level 3:	BTEC Nationals
Credit value:	10
Guided learning hours:	60

● Aim and purpose

This unit develops learner knowledge of the factors that affect human comfort, the performance criteria applicable to construction materials, and the techniques used to produce such materials. They will also gain an understanding of how forces act on structures, construction materials and the techniques used to prevent and remedy their deterioration.

● Unit introduction

Two important functions of a building are to provide shelter and create a comfortable space in which to live or work. To achieve this, it is necessary to know about and understand the materials used to construct a building, the basic concepts that underpin the structural integrity of the building, and the design of the building's internal spaces.

The occupants of a building require a comfortable internal environment and there are several key factors that contribute to this. There are generally accepted ranges for these factors. Understanding what is acceptable to different end users who undertake a variety of tasks and activities is an essential requirement of good design.

The forces that act on buildings, the stresses generated by these forces and the effects of these stresses on the materials used to construct the building are also explored.

Materials may be used for their structural or insulating properties; others, for example conduct heat and/or electricity well. Learners will have the opportunity to investigate some of the typical materials used in their specific vocational pathway, including identifying the most important materials, a basic understanding of how they are extracted, harvested or manufactured, their key properties and uses, the mechanisms that cause them to deteriorate and the techniques used to prevent such deterioration.

● Learning outcomes

On completion of this unit a learner should:

- 1 Know the basic factors that affect human comfort
- 2 Understand how forces act on structures
- 3 Know the performance criteria applicable to construction materials and the techniques used to produce such materials
- 4 Understand construction materials and the techniques used to prevent their deterioration.

Unit content

1 Know the basic factors that affect human comfort

Factors that affect human comfort: thermal, sound, illumination

Thermal factors: physical factors (air temperature; mean radiant temperature; relative humidity; air velocity); personal factors (eg age, gender, state of health, clothing, level of activity); methods used to measure physical factors (eg thermometers, globe thermometer, hygrometer, anemometer); acceptable range of values for each factor; standard units

Sound factors: loudness of sound; frequency of sound; intrusive sound; sound insulation; methods used to measure each factor (sound level meter); acceptable range of values for each factor; standard units

Illumination factors: level of artificial lighting; level of natural lighting; glare; methods used to measure each factor (eg light meter, daylight meter); acceptable range of values for each factor; standard units

2 Understand how forces act on structures

Structural members: struts; ties; beams; columns; walls; frames

Underpinning concepts: loadings (dead loads; imposed loads; wind loads); forces (concurrent; non-concurrent; coplanar); load configurations (point; uniformly distributed); stresses (compression; tension; bending, shear)

Predicting structural behaviour: calculations to determine important factors (eg stress, strain, modulus of elasticity, factor of safety; simple beam reactions for point loads and uniformly distributed loads); graphical methods (triangle of forces; parallelogram of forces) to solve simple frames

3 Know the performance criteria applicable to construction materials and the techniques used to produce such materials

Performance criteria relating to the specification: fitness for purpose; visual appearance; costs; resistance to degradation; ease of installation or use; environmental implications; sustainability and recycling potential; COSHH considerations; compatibility

Construction materials relevant to the learner's vocational pathway: eg limes; cements; aggregates; concrete; gypsum plasters; timber; metals; paints; bricks; plastics; liquids (especially water); gases (especially air)

4 Understand construction materials and the techniques used to prevent their deterioration

Features and properties: strength; elasticity; porosity and water absorption; thermal and moisture movement; thermal and electrical conductivity/resistivity; thermal transmittance (U values); durability; workability; density; specific heat capacity; viscosity

Deterioration: corrosion; electrolytic action; fungal attack; insect attack; frost attack; chemical attack; sulphate attack; efflorescence; ultraviolet (UV) attack; stress; fatigue; role of water in failure mechanisms

Preventive and remedial techniques: as applicable to the construction materials specified in learning outcome 3 above

Assessment

Unit 4

To achieve a pass grade you must :

- P1** describe the basic factors in simple scientific terms that influence human comfort in the internal environment
[IE1, IE2, IE4, IE6, CT1, RL3, RL4, SM3]
- P2** describe how each factor is measured
[IE1, IE2, IE4, IE6, CT1, RL3, RL4, SM3]
- P3** state acceptable values for each factor
[IE1, IE2, IE4, IE6, CT1, SM3]
- P4** interpret underpinning concepts relating to structures under load
[IE1, IE2, IE4, IE6, CT1, RL3, RL4, TW1, TW6, SM3]
- P5** predict simple structural behaviour from given data
[IE1, IE2, IE4, IE6, CT1, RL3, RL4, TW1, TW6, SM3]
- P6** identify the main performance criteria relating to the specification of a range of vocationally relevant construction materials
[IE1, IE2, IE4, IE6, CT1, RL3, RL4, SM3]
- P7** describe the production and/or manufacturing processes for two vocationally relevant construction materials
[IE1, IE2, IE4, IE6, CT1, RL3, RL4, SM3]
- P8** describe the important features and properties of construction related materials
[IE1, IE2, IE4, IE6, CT1, RL3, RL4, TW1, TW6, SM3]
- P9** explain how construction materials can deteriorate in use
[IE1, IE2, IE4, IE6, CT1, RL3, RL4, TW1, TW6, SM3]
- P10** explain the preventive and remedial techniques used

To achieve a merit grade you must also :

- M1** produce clearly worked, accurate answers for three different calculations relating to human comfort in the internal environment
- M2** produce clearly worked, accurate answers for three different problems involving simple structures under load
- M3** make and support valid decisions relating to the specification of materials for a tutor-provided application.

To achieve a distinction grade you must also:

- D1** analyse, in both qualitative and quantitative terms, the basic factors that affect human comfort
- D2** evaluate preventative and remedial techniques applicable to the failure of materials.

Unit 5:

Construction Technology and Design in Construction and Civil Engineering

Unit code:	T/600/0283
QCF Level 3:	BTEC Nationals
Credit value:	10
Guided learning hours:	60

● Aim and purpose

The aim of this unit is to enable learners to gain knowledge of construction methods and factors that influence design, and develop skills in communicating ideas between team members and in translating construction details into written and graphical instructions.

● Unit introduction

In recent times we have built far bigger and far more complex buildings than before. For many years the UK has been among the market leaders in this field and UK construction workers are taking their knowledge and expertise all over the world.

Modern developments in construction technology and materials have enabled us to create more efficient and complex structures. The ability to design, plan and communicate ideas effectively is essential if a project is to be translated from an idea into reality. Poor communication will lead to poor construction.

This unit will encourage learners to develop their understanding of the design process and to recognise the contribution of other members of the design team.

Planning and organising design activities is related to the decision-making process and the likely outcomes of decisions taken by the team within a legal framework should be considered in the wider social context, rather than as simple subjective preferences.

This unit will enable learners to cope with the requirements of construction-related projects as they pass through various stages from design to construction, including the implications of changes and variations in the design. Learners will develop their ability to produce clear drawings of construction components, using both manual and CAD techniques, together with succinct and accurate explanations that specify for builders the exact characteristics of relevant construction details. Use of scale, proportion and appropriate description is expected of all successful learners.

Learners will be able to use appropriate design and planning procedures to specify for and communicate to other team members involved in a construction project requirements for the technical components of buildings.

Unit content

1 Know the factors that influence the design process

Factors: financial; social; client needs; legal and environmental constraints for the design team (building regulations, health, safety and welfare); Construction Design and Management (CDM) Regulations; planning acts

Design process: need for and benefits of a structured framework for design eg RIBA (Royal Institute of British Architects) Architect's Plan of Work/Job Book; characteristics of individual stages; factors that affect each stage; ways in which various stages interconnect

2 Be able to communicate ideas between various members of the design and production teams

Design team: client; architect; architectural technologist; landscape architect; structural engineer; services engineer; facilities manager; qualifications

Production team: project manager; site manager; quantity surveyor; site engineer

Legal implications: legal position of each member of a design team; rights of client; damages; negligence; health, safety and welfare; environment

Written communications: brief (initial brief; after consideration of client's requirements; to aid design); decision-making process; factors that contribute to making design decisions; influence of such decisions on final project outcomes

3 Know about construction methods

Construction methods: characteristics, applications and limitations of traditional and modern methods of construction; influence of these on design; identification of multiple construction options to satisfy requirements of a given design; variety of construction options available to satisfy the primary and secondary requirements of a design; sustainability

Terminology: construction and architectural terminology to describe traditional and modern building elements and methods; terminology associated with legislation; health and safety and environmental factors

4 Be able to translate construction details into written and graphical instructions

Specifications: to meet requirements of client, building control and production team

Sketch designs: multiple options in sketch form to satisfy given brief and comply with technical, financial, legal and environmental constraints; drawings and documentation needed to make a formal planning and building regulations application; working drawings and details to facilitate construction, to include variations and superseded drawings; compliance with current British Standards, eg BSI 192, Drawing Office Practice

Assessment

Unit 5

To achieve a pass grade you must :

P1 describe the factors that influence the design process

[IE1, IE2, SM2, SM3, TW1, TW3]

P2 explain the roles and responsibilities of the design team

[IE1, IE2, TW1, TW3]

P3 explain the roles and responsibilities of the production team

[IE1, IE2, TW1, TW3]

P4 describe the legal implications that could arise from miscommunication

[IE1, IE2, SM2, SM3]

P5 produce written communications between members of the design and production teams

[IE1, IE2, CT1, CT2, CT3, CT4, SM2, SM3, TW1, TW3]

P6 describe construction methods using relevant terminology

[CT1, CT2, CT4, SM2, SM3]

P7 create specifications for construction details, providing suitable instructions for the construction team

[CT1, CT2, CT4, SM2, SM3]

P8 produce sketch designs, plans, elevations, sections and details using standard conventions and symbols.

To achieve a merit grade you must also :

M1 explain for a complex project the operation and effectiveness of the RIBA Architect's Plan of Work

M2 compare the methods recommended for communicating design changes to other members of the design team

M3 interpret tutor-provided construction details, using recognised technical and architectural terminology

To achieve a distinction grade you must also:

D1 evaluate the effectiveness of the RIBA Architect's Plan of Work in terms of teamwork and the introduction of design changes after construction has started

D2 appraise a set of instructions that represent design modifications to the original contract.

Unit 10: Surveying in Construction and Civil Engineering

Unit code:	J/600/0224
QCF Level 3:	BTEC Nationals
Credit value:	10
Guided learning hours:	60

● Aim and purpose

The aim of this unit is to enable learners to develop skills in linear and levelling surveys, measuring angles and setting out of small buildings.

● Unit introduction

Land surveying 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 in the design of construction projects. It plays an important role in the early stages of the design process, and has clear links with the setting out process.

Setting out is the process by which information is taken from construction design drawings to enable pegs, profiles or other marks to be set out to control construction work, and ensure that each element of the work is constructed in the correct position and to the correct level. In some senses setting out is the opposite of surveying, but the instruments and basic principles of measurement and accuracy are the same and people will often work in both disciplines.

This unit is practical, and learners will spend a significant amount of time carrying out fieldwork and producing drawings. There are also opportunities to use electronic instruments and CAD. Learners will need a reasonable standard of arithmetic and trigonometry in order to complete this unit successfully.

Learners will become familiar with basic surveying techniques, be able to carry out simple surveying tasks and present the data, and understand the roles of surveying and setting out in the construction process.

● Learning outcomes

On completion of this unit a learner should:

- 1 Be able to perform linear surveys to produce drawings
- 2 Be able to perform levelling surveys to produce drawings
- 3 Be able to measure angles and produce results from calculations
- 4 Be able to perform the setting out of small buildings.

Unit content

1 Be able to perform linear surveys to produce drawings

Terminology: framework; whole to part; well conditioned; taping; horizontal and slope distances; chainage; running measurements; perpendicular offsets; tie lines; check lines

Equipment: tapes; bands; rules; handheld lasers; ancillary equipment

Calculations: basic arithmetical operations

Drawings: internal or external survey plotted to scale

2 Be able to perform levelling surveys to produce drawings

Terminology: back sight; intermediate sight; fore sight; reduced level; datum; Ordnance Survey Bench Mark; Temporary Bench Mark; height of collimation; rise and fall; fly levelling

Equipment: automatic levels; tilting levels; water levels; rotating lasers; barcode instruments

Calculations: basic arithmetical operations, simple trigonometry

Drawings: spot heights on plans; sections

3 Be able to measure angles and produce results from calculations

Terminology: whole circle bearings; azimuth; horizontal angle; zenith angle; angles of inclination

Equipment: optical square; theodolites

Calculations: addition and subtraction of angles; sine, cosine, tangent; Pythagoras; sine rule; cosine rule

4 Be able to perform the setting out of small buildings

Terminology: plan measurement; check measurement; baseline; profile

Equipment: theodolites; site square; tapes; ancillary equipment

Techniques: set out pegs and profiles to control construction of a small house; constraints on positioning; application of arithmetic and simple trigonometry

Assessment

Unit 10

To achieve a pass grade you must :

P1 identify linear surveying terminology

P2 carry out linear surveys, using appropriate equipment, to produce accurate drawings
[IE1, IE2, IE4, CT1, CT5, TW1, TW3, TW4, RL6, SM2, SM3]

P3 identify levelling surveying terminology
IE1, IE2, IE4, CT1, CT5, TW1, TW3, TW4, SM3]

P4 carry out levelling surveys, using appropriate equipment, to produce accurate drawings
[IE1, IE2, IE4, IE6, CT1, CT5, TW1, TW3, TW4, SM2, SM3]

P5 identify angular terminology

P6 carry out angular measurements, using appropriate equipment, and calculations
[IE1, IE2, IE4, IE6, CT1, CT5, TW1, TW3, TW4, SM2, SM3]

P7 identify setting out terminology

P8 set out and check corner pegs for a small building using appropriate equipment and techniques.
[IE1, IE2, IE4, CT1, CT5, TW1, TW3, TW4, SM3]

To achieve a merit grade you must also :

M1 carry out levelling calculations using both height of collimation and rise and fall methods

M2 use angular measurements and trigonometry to calculate heights and distances

M3 set out and check profiles for a small building.

To achieve a distinction grade you must also:

D1 analyse the methods used for levelling surveys in terms of accuracy

D2 analyse the methods used to take angular measurements in terms of trigonometric accuracy

D3 explain the constraints on the positioning of profiles.

Unit 29: Construction in Civil Engineering

Unit code:	K/600/0314
QCF Level 3:	BTEC Nationals
Credit value:	10
Guided learning hours:	60

● Aim and purpose

The aim of this unit is to give learners knowledge of the fundamental techniques, processes and materials used in the construction of civil engineering works, and the factors that constrain civil engineering work. Learners will also gain an understanding of the function of civil engineers and of the economics and lifecycle issues associated with infrastructure projects, and develop skills in selecting plant, materials and methods for civil engineering projects.

● Unit introduction

Infrastructure projects such as new roads, railways, airports and water projects all require the skills of the civil engineer. This unit gives learners an opportunity to understand the role of those responsible for these projects, and how projects are developed and achieved.

Civil engineers may choose to specialise in a particular area of work or may work across a number of different areas. However, all civil engineers must have a fundamental knowledge of civil engineering construction methods and processes.

The civil engineering works learners investigate will include groundworks, foundations and substructure, superstructure and external works. In each of these areas, learners will study the techniques, processes and key materials used.

Projects are constrained by physical conditions, financial and environmental requirements. Learners will develop an understanding of how these factors influence the selection of techniques, processes and materials used in a variety of different situations.

● Learning outcomes

On completion of this unit a learner should:

- 1 Know about fundamental techniques, processes and materials used in the construction of civil engineering works
- 2 Know the factors that constrain civil engineering work
- 3 Be able to select plant, materials and methods for civil engineering projects
- 4 Understand civil engineering infrastructure projects.

Unit content

1 Know about fundamental techniques, processes and materials used in the construction of civil engineering works

Civil engineering works: groundworks; foundations and substructure; superstructure; external works

Groundworks: site investigation eg site history, site surveys, site geology, ground investigation, potential ground contaminants, water table; earthworks eg general excavation and groundwater control by pumping, embankments, cuttings and retaining walls; relevant techniques, processes, materials and associated construction plant

Foundations and substructure: different types of foundation eg strip, pad, raft, piles in plain or reinforced concrete; basements; relevant techniques, processes, materials and associated construction plant

Superstructures: frames; connections; floors; wall claddings; roof coverings; relevant techniques, processes, materials and associated construction plant

External works: flexible and rigid pavement construction; lorry and car parks; highway drainage details; relevant techniques, processes and associated construction plant

2 Know the factors that constrain civil engineering work

Physical conditions: ground conditions; climatic conditions; timescale

Financial requirements: cost; quality

Environmental constraints: noise; visual impact; pollution factors; environmental impact assessment; legislation

3 Be able to select plant, materials and methods for civil engineering projects

Specification of plant, materials and methods: based on knowledge and understanding; fundamentals of civil engineering construction; constraints applicable to civil engineering projects

Materials: properties and specification of eg aggregates, concrete, bituminous materials, steel, timber

4 Understand civil engineering infrastructure projects

Role and responsibilities of civil engineers: design, development, construction; maintenance *Infrastructure:* eg road, rail, harbour, airports, major services; component parts of infrastructure; project sponsors

Economics: role of infrastructure in economic growth; relationship of public and private sectors; role of civil engineering professionals in assessing demand; construction and financing

Lifecycle issues: eg development, adaptation, maintenance and repair, demolition and sustainability of infrastructure

Assessment

Unit 29

To achieve a pass grade you must :

P1 describe fundamental techniques, processes, plant and materials used in groundworks, foundations and substructures [IE1, IE2, IE3, IE4, IE6, CT2, CT6, RL3, SM2, SM3]

P2 describe the plant and materials used in groundworks, foundations, substructures and superstructures [IE1, IE2, IE3, IE4, IE6, CT2, CT6, RL3, SM2, SM3]

P3 describe how physical conditions, financial requirements and environmental constraints impact on civil engineering works [IE1, IE2, IE3, IE4, IE6, CT2, CT6, RL3, SM2, SM3]

P4 produce method statements specifying the plant, materials and methods to be used in two separate civil engineering projects [CT1, CT2, CT6, RL2, RL3, RL4, RL6, SM2, SM3, EP3]

P5 explain the roles and responsibilities of civil engineers in civil engineering infrastructure projects [CT1, CT2, CT6, RL2, RL3, RL4, RL6, SM2, SM3, EP3]

P6 explain the economics associated with civil engineering infrastructure projects [CT1, CT2, CT6, RL2, RL3, RL4, RL6, SM2, SM3, EP3]

P7 explain lifecycle issues associated with civil engineering infrastructure projects. [CT1, CT2, CT6, RL2, RL3,

To achieve a merit grade you must also :

M1 compare fundamental techniques, processes, plant and materials used in groundworks, foundations and substructures

M2 compare fundamental techniques, processes, plant and materials used in superstructure and external works

M3 relate the specification of plant, materials and methods to be used in a civil engineering project to the constraints placed on that Project

M4 explain how infrastructure projects are developed and maintained in the public and private sectors, both separately and in partnership.

To achieve a distinction grade you must also:

D1 justify the selection of the techniques, processes, plant and materials used in a given civil engineering project

D2 evaluate the relationship between demand, provision and funding of infrastructure projects