Unit 7: Project Management in Construction and the Built Environment

Unit code: T/600/0235

QCF Level 3: BTEC Nationals

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit will enable learners to develop project management skills and to understand and apply project planning techniques to plan, organise and control resources effectively and efficiently in construction and the built environment.

Unit introduction

A project requires the careful planning, organisation and control of resources to achieve a successful outcome for the client. For the contractor, good planning, organisation and control are essential in order to achieve a timely and satisfactorily completion for the client, and to ensure a financial profit.

Labour, plant, materials and management resources must be employed efficiently to ensure the satisfactory conclusion of a project. This requires the logistical organisation of the site, procurement schedules, material movement and handling, plant selection and usage, construction activities, the management and effective use of site labour, coordination of sub-contractors, the allocation of appropriate timescales and resources for the construction work, and the continuous monitoring of site progress and costs.

Learners will develop an understanding of the management function of planning and the techniques that are available both off and on site to effectively plan the deployment of the resources needed to complete a project successfully. They will develop an insight into the importance of planning and resource control for the overall construction process. They will gain knowledge and understanding of the techniques used in planning, be able to identify the human and physical resources needed for a typical low-rise domestic or commercial building, produce a simple programme and explain the associated resourcing, monitoring and controls.

Sustainability is a key issue in modern construction and learners will develop an understanding of how effective site planning can minimise the impact of the project on the natural environment, the local community and wider stakeholders.

Learning outcomes

On completion of this unit a learner should:

1 Know the roles and responsibilities of, and interaction between, the parties involved at each stage of a construction process

2 Understand the resources required to complete a construction project

3 Understand the functions of management in the production stage of a construction project

4 Be able to develop documentation for construction teams.

Unit content

1 Know the roles and responsibilities of, and interaction between, the parties involved at each stage of a construction process

Stages of a construction process: design; construction; maintenance; repair; alteration; refurbishment; demolition; recycling; feasibility studies; procurement; pre-contract; post-contract; elements of a typical low-rise domestic or commercial building

Members of the building team: management at director or site level; technical and professional roles eg planner, buyer, estimator, quantity surveyor; supervisory roles, eg contract supervisor, general foreperson; general operative roles, eg labourer, drain layer, steel fixer; craft roles, eg joiner, bricklayer, plasterer

Interrelationships: head office and site organisational charts; communication (methods, instruction, cooperation, coordination, control); levels of responsibility and accountability

2 Understand the resources required to complete a construction project

Resources: human (direct and sub-contract labour, management and supervision); plant and machinery; materials; domestic and nominated sub-contractors

Techniques: production of long- and short- term programmes; scheduling of material requirements; requisitioning; ordering; receiving and checking; site handling; storage and security issues; labour management techniques (work and method study; control and organisation of labour); plant management (hire, lease or purchase; utilisation and control); relevant documentation; software for producing a construction programme; software for monitoring a construction programme

Aspects of construction projects: planning; context

Factors affecting the planning process: labour factors eg availability and cost, skill levels, motivation, productivity; plant factors eg output rates, efficiency; material factors eg availability, delivery periods, lead times; design approval; site handling; waste; sustainability issues; community/stakeholder issues

Context: finance; contractual including contract period and liquidated and ascertained damages; site layout and organisation; temporary facilities and works; health, safety and welfare issues

3 Understand the functions of management in the production stage of a construction project

Management procedures: forecasting; planning; organising; monitoring; controlling; coordinating; reviewing

Organising construction projects: site layout plan; traffic routes; labour movement; materials and plant location; access and egress; site accommodation; storage; security; health, safety and welfare; method statements; progress monitoring; site meetings; sub-contractor liaison; site resources documentation control; programmes of work; bar charts; schedules eg line of balance; network diagrams eg arrow diagrams and critical path analysis; variables to be taken into account eg weather, availability of skilled labour, labour disputes, confined access, late design changes, late construction information, material shortages

4 Be able to develop documentation for construction teams

Documentation: head office and site documentation (schedules; requisitions; method statements; budgets; cost plans); bar charts; schedules eg line of balance; network diagrams eg arrow diagrams, critical path analysis

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 identify the various stages of the construction process for a low-rise domestic or commercial building [IE1]	**M1** produce organisational charts to explain the group dynamics of team working	
P2 describe the roles and interrelationships of the members of the building team involved in resource management, planning and production [IE1, IE2]		
P3 discuss the resources required to complete a construction project [IE1, IE2, IE4, CT2, EP3]	**M2** compare the advantages and disadvantages of resource management techniques	**D1** compare two software systems that can facilitate planning, organisation and control processes
P4 explain the techniques used to plan, organise and control a construction project [IE1, IE2, IE4, CT2, EP3]	**M3** discuss the factors that may have an adverse impact on planning and organisation.	**D2** evaluate a range of planning, organisational and control techniques in terms of utility and efficacy.
P5 explain the management procedures used to monitor and control resources when organising construction projects [IE1, IE2, IE4, CT2, EP3]		
P6 discuss examples of resource planning and management documentation [IE4 and CT4]		

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P7 create planning documentation, including bar charts, networks and schedules, for typical low-rise domestic or commercial projects. [IE1, IE3, IE4, CT1, SM3, EP3]		

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills which are embedded in the assessment of this unit. By achieving the criteria, learners will have demonstrated effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Tutors delivering this unit have opportunities to use a wide range of techniques. Lectures, discussions, seminar presentations, site visits, supervised practical activities, research using the internet and/or library resources and use of personal and/or industrial experience are all suitable. Delivery should stimulate, motivate, educate and enthuse learners. Visiting expert speakers could add to the relevance of the subject.

An overview of the resources and logistical requirements needed to complete a construction project should be introduced at an early stage of delivery to help place resource planning and control into context. Learners must then develop a detailed insight into the physical and human resources required for a typical project and the techniques used to organise, plan, monitor and control their deployment. Learners should be aware of the key players who are directly responsible for planning, site organisation and control, their specific roles and how they interact to achieve the goals of completing a project on time and to budget.

Learners should understand the applications of, and be able to compare and evaluate, a range of programming techniques, including those that use computer software. The ability to produce simple programmes for the resource management of typical low-rise domestic or commercial buildings should be developed along with the ability to use monitoring strategies to make adjustments for variations in progress or other unforeseen factors.

Where possible, links should be formed with industry and visits to construction sites arranged as this will provide an opportunity for learners to contextualise their learning and use this to inform their study of the various aspects of planning, organisation and control. The learning process could be enhanced further by seeking specialised input from current practitioners.

Overall delivery of the unit should be supported by the use of case studies and visual media, where appropriate, including real construction programmes, photographs, videos, DVDs and drawings to demonstrate the methods used for planning, organisation and control.

Group activities are permissible, but tutors will need to ensure that individual learners have equal experiential and assessment opportunities.

Health, safety and welfare issues are paramount and should be reinforced through close supervision of all workshops and activity areas, and risk assessments must be undertaken before practical activities are taken. Centres are advised to read the *Delivery approach* section in the specification, and *Annexe H: Provision and Use of Work Equipment Regulations 1998 (PUWER)*.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction: Unit structure and the programme Construction planning Assimilation exercises
Site visit and/or visiting speaker(s) to contextualise
Roles, responsibilities and team working Didactic input Independent investigations Class discussions Role-play exercises Formative assessment exercises
Stages of construction and required resources Didactic input Independent investigations Examination of project plans for familiar projects Sequencing of construction activities Formative assignment with experiential learning
The function of management Didactic input Class discussions Role play Contextualised formative assignment with experiential learning
Interpretation of project planning documentation Examination of documentation Use of real-life exemplars and comparison with learners' potential outcomes Focused guidance Formative assessment exercises with experiential learning
Production of project planning documentation Introduction and didactic input Project familiarisation Focused guidance Formative assessment exercises with experiential learning Comparison with real-life scenarios and project planning decisions

Topic and suggested assignments/activities and/assessment
Assignment 1: Investigation of the Planning of a Low-rise Domestic or Commercial Building
Identification and description of stages of construction for a specific project
Investigation into the roles and interrelationships of members of the building team involved in resource management, planning and production
Recognition and interpretation of resource planning and management documentation
Evaluation of ICT systems used for planning construction projects
Assignment 2: Production of Planning Documentation
Identification of appropriate planning techniques
Identification of the physical and human resources required to complete a project
Production of planning documentation for low-rise domestic or commercial project
Evaluation of techniques, systems and the impact of external factors
Review of unit and assignment feedback

Assessment

Evidence for this unit may be gathered from a variety of sources, including well-planned investigative assignments, case studies or reports of practical assignments.

There are many suitable forms of assessment that could be used, and centres are encouraged to consider and adopt these where appropriate. Some example assessment approaches are suggested below. However, these are not intended to be prescriptive or restrictive, and are provided as an illustration of the alternative forms of assessment evidence that would be acceptable.

Some criteria could be assessed directly by the tutor during practical activities. If this approach is used, suitable evidence would be observation records or witness statements. Guidance on the use of these is provided on the Edexcel website.

The structure of the unit suggests that the grading criteria could be addressed fully by using two assignments. The first would cover P1, P2, P3, P4, P5, P6, M1, M2, M3 D1, and D2 and the second would cover P7. Case studies could provide suitable vehicles for assessment. As the time required for completion of each assessment is likely to be extensive, staged submissions should be considered and regular, interim tutor feedback would be essential.

To achieve a pass grade learners must meet the seven pass criteria listed in the grading grid.

For P1, learners must identify the various stages of the construction process for a low-rise domestic or commercial building. This should encompass all stages from design to construction and handover of the completed building. Learners should be able to divide a construction project into a manageable number of stages and should include all elements of the completed building, along with all the temporary infrastructures needed to complete the work.

For P2, learners must describe the roles of and interrelationships between the members of the building team involved in resource management, planning and production. Learners have to examine the functions of each member and how they interact in the management of construction resources. The key aspects of interaction should be identified including communication, instruction, cooperation, coordination and control.

For P3, learners must discuss the physical and human resources required to complete a construction project. Learners should identify the principal physical resources, such as plant and materials, and the human resources needed to execute the building work. Learners should also understand the role of sub-contractors in the construction process. Evidence could be in the form of a written report.

For P4, learners must explain the techniques used to plan, organise and control a construction project. Evidence should be restricted to techniques which are commonly used and current. Mention could be made of software-based systems but there is no requirement for a detailed treatment of these techniques for this grade.

For P5, learners must explain the management procedures used to monitor and control resources. Learners must convey knowledge and understanding of standard organisational aspects and documentation, such as delivery documentation, goods received sheets, stock issue sheets, plant utilisation sheets, timesheets, job cards, requisition orders and software resource allocation. As above, mention could be made of software-based systems but there is no requirement for a detailed treatment of these techniques for this grade.

For P6, learners must discuss examples of resource planning and management documentation. There are many ways to do this and evidence will depend on the specific nature of each project. Bar charts, scheduling methods such as line of balance, and network diagrams such as arrow diagrams could all be used in this context provided that learners can explain their application. Evidence could be in the form of a written report.

For P7, learners must create planning documentation, including bar charts, networks and schedules, for typical low-rise domestic or commercial projects. Knowledge of the standard formats used and an understanding of the need for the logical sequencing of construction activities must be demonstrated. Evidence for this criterion could be in the form of a written report.

To achieve a merit grade learners must meet all seven pass criteria and the three merit grade criteria.

For M1, learners must produce organisational charts to explain the group dynamics of team working. Team working for a typical construction project should be investigated and the links and interdependencies between team members shown and explained in a chart or diagrammatic format. This should be completed for both management and site operatives.

For M2, learners must compare the advantages and disadvantages of resource management techniques. The use of paper-based and computer-based systems should be evaluated, including site documentation, contract programs and materials schedules. Learners should also evaluate and compare different programming techniques for various scenarios.

For M3, learners must discuss the factors that may have an adverse impact on planning and organisation, if not considered and explain their possible effects. Variables can be taken to include unforeseen factors such as the weather, changes to the design, changes to construction methods and materials and problems with supply and delivery. The effects of each one on the planning and organisation of the project should be explained.

To achieve a distinction grade learners must meet all of the pass criteria and merit grade criteria and the two distinction grade criteria.

For D1, learners must compare two software systems that can facilitate planning, organisation and control processes. Learners should identify and describe typical examples of software systems used for planning, organising and controlling building projects, and explain their application.

For D2, learners must evaluate a range of planning, organisational and control techniques in terms of utility (how useful they are) and efficacy (how efficient they are). A range of techniques could be used to provide evidence including contract programs, the control of labour, site organisation strategies such as traffic planning, site layout charts, work study and waste management.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, P5, P6, M1, M2, M3, D1, D2	Investigation of the Planning of a Low-rise Domestic or Commercial Building.	You are working as a planner for a local construction company and have been asked to develop materials that will help trainees to understand the role of the planner and the ICT systems that they use.	Presentation.
P7	Production of Planning Documentation.	You are working as a planner for a local construction company and have been asked to plan the production stage of a construction project that has recently been procured by your company.	Planning documentation.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Construction and the Built Environment sector suite. This unit has particular links with the following unit titles in the Construction and the Built Environment suite:

Level 1	Level 2	Level 3
		Health, Safety and Welfare in Construction and the Built Environment
		Construction Technology and Design in Construction and Civil Engineering
		Building Technology in Construction

This unit links to the Edexcel Level 3 NVQ in Technical Design (Construction Environment), the Edexcel Level 3 NVQ in Construction, Plant and Equipment Supervision, the Edexcel Level 4 NVQ in Construction, Plant and Equipment Management and the Edexcel Level 4 NVQ in Site Inspection. It also links to the following National Occupational Standards at Level 3:

- Built Environment Design
- Built Environment Development and Control
- Construction Contracting Operations
- Construction Site Supervision
- Spatial Data Management
- Surveying, Property and Maintenance.

Essential resources

A set of construction drawings, a site layout plan, a construction programme and other relevant schedules for a typical project are needed.

Access to computing facilities and planning software would give learners an appreciation of what can be achieved using non-manual programming techniques.

The use of live or completed construction projects as a basis for assessment tasks would enhance the learning experience by contextualising the study of planning, organisation and control.

Employer engagement and vocational contexts

Industry involvement is essential to the establishment of a real world context within the delivery of the course content. Most medium to large construction companies are actively seeking to make links with schools and colleges, especially with a view to recruiting trainees and future graduates. Centres should actively seek links with such companies and establish the help they will be able to provide. Links or assistance could include:

- visiting speakers to promote recruitment onto the BTEC programme
- possible sponsorship of the centre's construction programme
- provision of exemplar documentation or resources
- loan of or assistance with specialist equipment or ICT access
- access to specifications, construction drawings, quality control and health and safety documentation
- assistance with developing links with other sources of help, including material suppliers, architects, clerk of works consultancies, trade associations, consultants etc
- sponsorship of individual learners and direct recruitment onto modern apprenticeships and training schemes
- the provision of focused site or office visits and/or sector-related work experience
- access to visiting speakers who will put learning into an industrial context. Specific content level and expected outcomes will need to be discussed in advance.

Whilst site and office visits will aid general awareness and perceptions of site and office-based construction activities, it is essential that all visits have a specific focus. Preparation and follow up activities should be prepared and discussed with the company well in advance of the visit. It will probably be necessary to have copies of drawings or other documentation in advance of the visit. Suitable activities could include:

- an investigation of quality control procedures used on site
- an investigation into the different resources used on site and their use within the main elements of substructure, superstructure, external works and drainage
- an analysis of the management and supervisory structures used on site and within the organisation
- an investigation into the roles and responsibilities of management and planners
- an investigation of potential risks associated with site operations and how these impact on the planning process (companies will be sensitive to possible conclusions and may require you to be guided by their health and safety officer)
- a comparison of actual site layout and organisation compared with learners' own ideas and plans produced before the site visit
- an investigation into how planning and control documents are actually used by site management
- an investigation into the communication systems used within the organisation.

It may be that within one site visit different groups investigate different elements of the planning process and gather research and information for other BTEC units.

It is essential that centres and LEA guidelines and procedures are strictly adhered to for all visits, and that tutors visit the site in advance to carry out risk assessments and agree specific health and safety requirements with the company's health and safety officer. Learners should be supervised and accompanied at all times during a site visit.

Support to enable centres to initiate and establish links to industry, and to networks arranging visits to industry and from property practitioners is given below:

- Learning and Skills Network – www.vocationallearning.org.uk.
- National Education and Business Partnership Network – www.nebpn.org.
- The Royal Institution of Chartered Surveyors – www.rics.org.
- Work Experience/Workplace learning frameworks – Centre for Education and Industry (CEI University of Warwick) – www.warwick.ac.uk/wie/cei/.

Indicative reading for learners

Textbooks

Burke R – *Project Management: Planning and Control Techniques* (John Wiley and Sons Ltd, 2003) ISBN 0470851244

Gould F E – *Managing the Construction Process: Estimating Scheduling and Project Control* (Prentice Hall, 2001) ISBN 0130604062

Journals

The Architects' Journal – Emap

Construction News – Emap

Websites

www.greenspec.co.uk	Green Building
www.thenbs.com	National Building Specification
www.planningportal.gov.uk	The Complete Online Planning and Building Resource

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are ...
Independent enquirers	identifying questions to answer and problems to resolve, planning and carrying out research, appreciating the consequences of decisions and analysing and evaluating information, judging its relevance and value, as they: • investigate stages of the construction process • research the roles and interrelationships of members of the building team • research construction planning techniques • evaluate software systems that facilitate planning processes • investigate external factors that may impact on the planning of a project
Creative thinkers	generating ideas and exploring possibilities, asking questions to extend their thinking and questioning their own and others' assumptions, as they: • identify the resources needed to complete a construction project • produce organisational charts to explain the group dynamics of team working • produce bar charts, networks and schedules for construction projects
Self-managers	organising time and resources and prioritising actions, as they: • organise and plan their assignment work • complete project planning documentation
Effective participators	proposing practical ways forward and breaking them down into manageable steps, as they: • produce organisational charts to explain the group dynamics of team working • participate in class discussions and role-play exercises.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	exploring issues, events or problems from different perspectives and supporting conclusions, using reasoned arguments and evidence, as they: • prepare for role-play activities and presentations • prepare for and contribute to discussion forums
Creative thinkers	trying out alternatives or new solutions and following ideas through, as they: • analyse and investigate alternative planning solutions and methods of working • investigate ICT systems that can be used for project planning
Reflective learners	assessing themselves and others, identifying opportunities and achievements, setting goals with success criteria for their development and work, reviewing progress and acting on the outcomes, inviting feedback and dealing positively with praise, setbacks and criticism and evaluating their experiences and learning to inform future progress, as they: • participate in formative and experiential learning exercises and reflect on feedback and outcomes • participate in Assessment for Learning (AfL) including peer assessment activities • act on feedback and adjust their approach to planning activities
Team workers	collaborating with others to work towards common goals and reach agreements, managing discussions to achieve results, as they: • participate in role-play activities • work in teams on formative and experiential assignments
Self-managers	seeking out challenges or new responsibilities and showing flexibility when priorities change, and working towards goals, showing initiative, commitment and perseverance, as they: • seek alternative positions within role-play activities • re-schedule plans as part of experiential learning exercises • work to deadlines for the sectional completion of formative assessment
Effective participators	discussing issues of concern, seeking resolution where needed, presenting a persuasive case for action and identifying improvements that would benefit others as well as themselves, as they: • participate in class discussions and role-play activities • make a contribution to peer assessment • discuss issues during AfL feedback.

Functional Skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	producing technical reports which include digital images and work imported from other software packages
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	using ICT to plan construction activities evaluating two software systems that can facilitate planning, organisation and control processes
Manage information storage to enable efficient retrieval	organising their folders and file storage
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	using the internet and historic planning information to complete assessment tasks
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	using the internet and historic planning information to complete assessment tasks
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	producing technical reports which include digital images and work imported from other software packages producing construction planning documentation
Bring together information to suit content and purpose	producing organisational charts to explain the group dynamics of team working
Present information in ways that are fit for purpose and audience	developing presentations and producing of planning documentation
Evaluate the selection and use of ICT tools and facilities used to present information	evaluating two software systems that can facilitate planning, organisation and control processes
Mathematics	
Identify the situation or problem and the mathematical methods needed to tackle it	identifying the physical and human resources required to complete a construction project
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	producing and interpreting bar charts, networks and schedules for typical low-rise domestic or commercial projects
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	presenting their work and participating in question and answer sessions
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	producing technical reports.