

Unit 9: Measuring, Estimating and Tendering Processes in Construction and the Built Environment

NQF Level 3: BTEC National

Guided learning hours: 60

Unit abstract

Estimating is concerned with the processes used by contractors to establish the cost to themselves of carrying out construction work. Tendering is concerned with the commercial aspects of bidding for and obtaining work by contracting companies.

Measurement and accurate estimation of the cost of work is crucial to providing meaningful cost information for both the construction business and the client, and the process of bidding for a construction contract normally involves the contractor in accurately measuring the works required to enable the costs to be estimated in order to compile the tender.

Measurement and the estimation of costs is concerned with the practical activity of construction work. The estimator needs to possess a detailed knowledge of all relevant activities involved in constructing the building's elements, to enable the projected and final costs of all materials, plant and labour to be calculated accurately.

The unit will provide learners with a basic understanding of the processes and techniques commonly involved in measuring, estimating and tendering. They will be able to obtain detailed quantities from drawings and other documents, estimate the cost of a variety of construction works, know how to convert the estimate into a tender, and to provide outline cost estimates of proposed construction projects.

Learning outcomes

On completion of this unit a learner should:

- 1 Be able to record dimensions and descriptions of construction work in a methodical way and process these into final quantities for varying purposes, eg bills of quantities, variations, final account, interim payments, claims, etc
- 2 Understand the purpose of estimating and the common techniques used to price construction work
- 3 Be able to calculate all-in costs of materials, labour and plant, together with unit rates, for a variety of construction work
- 4 Be able to derive approximate quantities and costs to determine the approximate value of building projects at varying pre-contract development design stages and to understand the limitations on the accuracy that might be achieved
- 5 Understand the purpose of tendering, the common techniques used and the relevant documentation and explain the factors that can affect the level of tenders.

Unit content

- 1 Be able to record dimensions and descriptions of construction work in a methodical way and process these into final quantities for varying purposes, eg bills of quantities, variations, final account, interim payments, claims, etc**

Applications: detailed measurement and production of quantities and descriptions for bills of quantities, variations, interim payments, final account work, claims and disputes

Processes: traditional; cut and shuffle

Production of accurate descriptions and quantities: compilation of descriptions for works; basic mensuration techniques for calculation of accurate quantities for volume, area and lengths of items of construction works

Application of standard methods of measurement: Standard Method of Measurement for Building Work; Civil Engineering Standard Method of Measurement

- 2 Understand the purpose of estimating and the common techniques used to price construction work**

Purposes of estimating: estimating net cost; pricing of preliminaries; profit and general overheads; the effects of quantity and value on the method of estimating chosen

Estimating techniques: different methods of estimating used for different types of construction work

Documentation: Code of Estimating Practice

- 3 Be able to calculate all-in costs of materials, labour and plant, together with unit rates, for a variety of construction work**

Materials costs: calculation of materials quantities and costs of construction works based on unit costs of materials

Labour rates: calculation of 'all-in' rates for craft workers, skilled, unskilled, gang rates; application of labour costs in unit rates; definition of prime cost of daywork, comparison with 'all-in' rates

Plant rates: calculation of fixed and operating costs; calculation of hourly rates; application of plant costs in unit rates

Calculation of unit rates for various classes of construction work: eg excavation, masonry, concrete work, underground drainage, structural steelwork, suspended timber floors, roof construction, roof coverings, plastering and dry linings, painting and decorating, plumbing work, electrical installation, glazing, etc

- 4 Be able to derive approximate quantities and costs to determine the approximate value of building projects at varying pre-contract development design stages and to understand the limitations on the accuracy that might be achieved**

Traditional cost modelling: approximate estimating techniques; cost per unit, eg bed, seat, pupil, space; cost per unit area, eg m² of gross floor area, m² of functional space; cost of functional element; approximate quantities

Application: feasibility studies, pre-contract cost planning and control; links to stages of RIBA Plan of Work

Processes: use of historical data, application of tender price indices and location factors; principles of wall-to-floor ratios; window-to-floor ratios; plan shape; number of storeys

- 5 Understand the purpose of tendering, the common techniques used and the relevant documentation and explain the factors that can affect the level of tenders**

The purpose, aims and objectives of tendering: for main or principal contractors, subcontract and supply packages

Common methods of tendering: methods of tendering relevant to the scale, size and value of the construction works, and to the type of work (building, civil engineering or building services work) for a range of construction works eg single stage selective, two stage selective, open, serial, target cost, measured term, fee bidding, etc

Documentation: functions of different documentation used for each method of tendering, eg drawings, schedules, specifications, schedules of work, bills of quantities, activity schedules; codes of procedure for tendering relevant to main and principal contractors, sub-contract and supply packages

Factors affecting the level of tenders: impact on value, price or level of a tender for main and principal contractors, sub-contract and supply packages; profit element; potential variations; quality of tender document; standard form of contract; amended standard form or bespoke contract forms

Grading grid

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

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:
<p>P1 use basic mensuration techniques to calculate and record accurate dimensions, volumes, areas and lengths from drawings</p>	<p>M1 apply the rules of the Standard Method of Measurement to the production of accurate quantities and descriptions</p> <p>M2 explain the reasons for the differences in the accuracy of the measurements for different applications and stages of work</p>	
<p>P2 explain the purpose of different estimating methods and the meaning of net pricing, the content of the preliminaries section of a project and general overheads and profit</p> <p>P3 calculate all-in labour rates, plant rates and unit rates</p>		<p>D1 use, evaluate, and justify the selection of an appropriate estimating method for a tutor-specified scenario</p> <p>D2 use, evaluate, and justify the selection of an appropriate tendering method for a tutor-specified scenario</p>
<p>P4 identify and explain those factors that affect percentage profit margins, those that affect the output of labour and those that affect the working hourly/idle rates for a variety of plant items</p>	<p>M3 describe the items that contribute to on-costs and overheads and explain how percentage on-costs and overheads might be determined for a given organisation</p>	

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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:
<p>P5 describe the common methods of tendering for contractors, sub-contractors and supply package contractors and explain how different objectives might affect the tender price</p> <p>P6 identify the factors that influence the levels of tenders for the main contract, sub-contract works or supply packages and explain how these factors may affect pricing strategies.</p>	<p>M4 explain how the method of tendering selected matches the nature of the project.</p>	<p>D3 examine and evaluate the use of a tutor specified software system for facilitating the estimating and tendering processes.</p>

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 practicals, research using the internet and/or library resources and the 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.

The recording of measurements should follow the use of industry standard methods, using taking-off sheets for either the traditional or cut and shuffle methods of processing into finished quantities. Whichever approach is adopted, the alternative method should be demonstrated, explaining the advantages and disadvantages of each method. Similarly, the production of bills of quantities should follow industry standard formats and layouts. Learners should be encouraged to follow a logical and methodical approach to the processes of measurement, tendering and estimating, and to develop appropriate descriptions of the work they are measuring. Reference to the appropriate standard method of measurement will provide a useful guide. The unit should develop an awareness and understanding of, rather than an ability to use, relevant computer software and its applications.

The application of different estimating methods to different types of construction work should be demonstrated and the learner given the opportunity to calculate rates and prices for a variety of types of construction work. The emphasis should be on applying principles in addition to calculating realistic prices. As part of the estimating process, calculation of all-in costs of labour and plant resources will be a feature as will the pricing of preliminary items and the factors to be considered in calculating general overheads and profit.

Learners should be made aware of the procedures and processes involved in managing the initial enquiry through to tender and of the distinction between the estimating and tendering stages of the process.

Where possible, links should be formed with industry in order to procure real examples of measurement, estimating and tendering documentation and to seek specialist input from current practitioners.

Overall delivery of the unit should be supported by the use of case-studies and visual media where appropriate, including documentation and project drawings, to illustrate and contextualise the methods used for measurement, estimating and tendering.

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

Health, safety and welfare issues are paramount and should be strictly reinforced through close supervision of all workshops and activity areas, and risk assessments must be undertaken prior to practical activities. Centres are advised to read the *Delivery approach* section on page 24, and *Annexe G: Provision and Use of Work Equipment Regulations 1998 (PUWER)*.

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 employed, and tutors are encouraged to consider and adopt these where appropriate. Some examples of possible 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. General guidance on the design of suitable assignments is available on page 19 of this specification.

Some criteria could be assessed directly by the tutor during practical activities. If this approach is used, suitable evidence from guided activities 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 may be fully addressed by using three assignments. The first of these would cover criteria P1, M1 and M2; the second would cover grading criteria P2, P3, P4, M3, D1 and D2 and the third would cover P5, P6, M4 and D3.

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

For P1, learners are required to use basic mensuration techniques to calculate and record accurate dimensions, volumes, areas and lengths from drawings. They must demonstrate an ability to extract accurate dimensions from information provided and use basic mensuration techniques where appropriate for a variety of work sections. These should be recorded using standard formats to enable their processing into bills of quantities and other estimating and tendering documentation.

For P2, learners must be able to explain the purpose of different estimating methods and the meaning of net pricing, the content of the preliminaries section of a project and general overheads and profit. The applications of the different estimating methods should be explained and a clear distinction made between providing a client with an estimate of the likely cost of a project and those used when actually tendering for work. Learners must also be able to distinguish between the net cost to the firm prepared to carry out construction work and the value to the client of having the work done. The inclusion of preliminaries, general overheads and profit in the pricing should be explained. Learners must also be able to show an understanding of the content and purpose of the preliminaries section of a project and the contribution it makes to the execution of the works.

For P3, learners must demonstrate an ability to calculate all-in labour rates, plant rates and unit rates. This will require the learner to use basic cost and output data to calculate all-in labour rates for skilled and unskilled operatives which must include the direct and indirect employment costs. Learners must be able to calculate the hourly cost of various types of mechanical plant including operating costs, finance charges, and other direct and indirect costs. Using the above information, learners must then be able to compute unit rates, which include the labour and plant elements, for a variety of work sections, together with allowances for materials.

For P4, learners must be able to identify and explain those factors that affect percentage profit margins, those that affect the output of labour and those that affect the working hourly/idle rates for a variety of plant items. This requires the identification of the elements that comprise the general overheads of an organisation and the factors to be considered in determining the level of profit to be added to the net cost. Learners must also be able to identify and explain the factors that affect the output of labour and plant used in a variety of categories of work. The above should be related to the work sections used for the calculation of unit rates to illustrate the points made.

For P5, learners have to describe the common methods of tendering for contractors, sub-contractors and supply package contractors and explain how different objectives might affect the tender price. They must be able to show an understanding of the various methods of tendering that apply to the different types of contractor on a project together with the circumstances under which each might be used. Learners must also be able to explain how different objectives of the project, and timing of the tender process, might affect the level of tender prices received by the client.

For P6, learners are required to identify the factors that influence the levels of tenders for the main contract, sub-contract works or supply packages and explain how these factors may affect pricing strategies. A clear understanding of the implications for both parties to the contract should be in evidence.

To achieve a merit grade learners must meet all of the pass grade criteria **and** the four merit grade criteria.

For M1, learners must be able to apply the rules of the Standard Method of Measurement to the production of accurate quantities and descriptions. Their evidence must show correct interpretation and application of the appropriate standard method of measurement throughout the execution of the measurement and description processes.

For M2, learners should explain the reasons for the differences in the accuracy of the measurements for different applications and stages of work. The evidence must clearly explain the reasons for the varying degrees of accuracy that might be achieved in the measurement processes used during the different stages of a project, from inception to project completion.

For M3, learners are required to describe the items that contribute to on-costs and overheads and explain how percentage on-costs and overheads might be determined for a given organisation. Their evidence must provide a detailed description of the items that comprise the general overheads of an organisation and illustrate how their cost may be determined to enable a satisfactory allowance to be made for recovery on projects undertaken by the organisation.

For M4, learners must be able to explain how the method of tendering selected, matches the nature of the project. Their evidence must demonstrate a clear link between the method of tendering selected and the nature of the project.

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

For D1, learners have to use, evaluate, and justify the selection of, an appropriate estimating method for a tutor-specified scenario. The selected estimating method must be described, and evaluated in terms of its suitability for the scenario, as compared to other commonly used methods.

For D2, learners have to use, evaluate, and justify the selection of, an appropriate tendering method for a tutor-specified scenario. The selected tendering method must be described, and evaluated in terms of its suitability for the scenario, as compared to other commonly used methods.

For D3, learners are required to examine and evaluate the use of a tutor specified software systems for facilitating the estimating and tendering process.

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

The learning outcomes in this unit are closely linked with, for example, *Unit 5: Construction Technology and Design in Construction and Civil Engineering*, *Unit 6: Building Technology in Construction*, *Unit 11: Economics and Finance in Construction and Civil Engineering* and *Unit 22: Design Procedures in Construction* together with similar units at Higher National and degree level.

This unit may have links to the Edexcel Level 3 Technical and Professional NVQs for Construction and the Built Environment. Updated information on this, and a summary mapping of the unit to the CIC Occupational Standards, is available from Edexcel. See *Annexe D: National Occupational Standards/mapping with NVQs*.

The unit provides opportunities to gain Level 3 key skills in application of number, communication, information and communication technology and improving own learning and performance. Opportunities for satisfying requirements for Wider Curriculum Mapping are summarised in *Annexe F: Wider curriculum mapping*.

Essential resources

The availability of good quality drawings for taking off quantities and standard documentation are essential to the delivery of the unit, together with current data on costs and outputs. Learners should also have access to relevant software systems for demonstration purposes.

Indicative reading for learners

Textbooks

Ashworth A – *Cost Studies of Buildings, 4th Edition* (Pearson, 2004)
ISBN 013145322X

Brook M – *Estimating and Tendering for Construction Work, 3rd Edition*
(Butterworth-Heinemann, 2004) ISBN 0750658649

Buchan R D, Fleming F W E and Grant F E K – *Estimating for Builders and Surveyors, 2nd Edition* (Butterworth-Heinemann, 2004) ISBN 0750642718

CIOB – *Code of Estimating Practice, 6th Edition* (Longman, 1997) ISBN 058230279X

Ferry D J, Brandon P and Ferry J – *Cost Planning of Buildings, 7th Edition* (Blackwell, 1999) ISBN 0632042516

ICE – *Civil Engineering Standard Method of Measurement, 3rd Edition*
(Thomas Telford, 1991) ISBN 0727715615

Lee S, Trench W and Willis J – *Elements of Quantity Surveying, 10th Edition*
(Blackwell, 2005) ISBN 1405125632

Packer A D – *Building Measurement* (Longman, 1996) ISBN 0582098165

RIBA – *Code of Procedure for Selective Tendering*, revised 1999 (RIBA, 1995)

RICS – *Standard Method of Measurement of Building Works, 7th Edition*
(Revised 1998) ISBN 0854063609

Seeley I H and Winfield R – *Building Quantities Explained, 5th Edition*
(Palgrave Macmillan, 1998) ISBN 0333719727

Smith A J – *Estimating, Tendering and Bidding for Construction* (Macmillan, 1995)
ISBN 0333627946

Key skills

Achievement of key skills is not a requirement of this qualification but it is encouraged. Suggestions of opportunities for the generation of Level 3 key skill evidence are given here. Tutors should check that learners have produced all the evidence required by part B of the key skills specifications when assessing this evidence. Learners may need to develop additional evidence elsewhere to fully meet the requirements of the key skills specifications.

Application of number Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> • calculating accurate dimensions from drawings, plans and sections and accurate volumes, areas and lengths from data supplied or derived • explaining the purpose of different estimating methods and what is meant by net pricing, the content of the preliminaries section of a project and general overheads and profit • calculating all-in labour rates, plant and unit rates. 	<p>N3.1 Plan an activity and get relevant information from relevant sources.</p> <p>N3.2 Use your information to carry out multi-stage calculations to do with:</p> <ul style="list-style-type: none"> a amounts or sizes b scales or proportion c handling statistics d using formulae. <p>N3.3 Interpret the results of your calculations, present your findings and justify your methods.</p>

Communication Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> explaining the purpose of different estimating methods and what is meant by net pricing, the content of the preliminaries section of a project and general overheads and profit identifying those factors that affect percentage profit margins, those that affect the output of labour and those that affect the working hourly/idle rates for a variety of plant items describing the common methods of tendering for contractors, sub-contractors and supply package contractors and explaining how different objectives might affect the tender price. 	<p>C3.1a Take part in a group discussion.</p> <p>C3.1b Make a formal presentation of at least eight minutes using an image or other support material.</p> <p>C3.2 Read and synthesise information from at least two documents about the same subject. Each document must be a minimum of 1000 words long.</p> <p>C3.3 Write two different types of documents, each one giving different information about complex subjects. One document must be at least 1000 words long.</p>
Information and communication technology Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> using the internet and other electronic media to research and gather information on measurement, estimating and tendering methods using ICT processes to produce the assessment evidence. 	<p>ICT3.1 Search for information, using different sources, and multiple search criteria in at least one case.</p> <p>ICT3.2 Enter and develop the information and derive new information.</p> <p>ICT3.3 Present combined information such as text with image, text with number, image with number.</p>

Improving own learning and performance Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> • preparing for and carrying out work for assessment. 	<p>LP3.1 Set targets using information from appropriate people and plan how these will be met.</p> <p>LP3.2 Take responsibility for your learning, using your plan to help meet targets and improve your performance.</p> <p>LP3.3 Review progress and establish evidence of your achievements.</p>