ELSEVIER
BUTTERWORTH HEINEMANN

MARTIN BROOK

Estimating and Tendering for Construction Work

THIRD EDITION

Estimating and Tendering for Construction Work

This page intentionally left blank

ESTIMATING AND TENDERING FOR CONSTRUCTION WORK

Third edition

Martin Brook
BEng(Tech) FCIOB

ELSEVIER
BUTTERWORTH
HEINEMANN

AMSTERDAM BOSTON HEIDELBERG LONDON NEW YORK OXFORD PARIS
SAN DIEGO SAN FRANCISCO SINGAPORE SYDNEY TOKYO

Elsevier Butterworth-Heinemann
Linacre House, Jordan Hill, Oxford OX2 8DP
200 Wheeler Road, Burlington, MA 01803

First published 1993
Second edition 1998
Reprinted 1999, 2001, 2002, 2003
Third edition 2004

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloguing in Publication Data
A catalogue record for this book is available from the Library of Congress

ISBN 0 7506 5864 9

For information on all Elsevier Butterworth-Heinemann publications visit our website at http://books.elsevier.com

Printed and bound in Great Britain

Contents

	Preface	ix
	Acknowledgements	xii
	List of figures	xiii
	Abbreviations used in the text	xvi
1	Organization of the estimating function	1
2	Procurement paths	10
	Introduction	10
	Clients' needs	11
	Contractor involvement	12
	Partnering	13
	Apportionment of risk	14
	Traditional method	16
	Design and build	17
	Management contracting	19
	Construction management	21
	Private finance initiative	22
3	Forms of contract	34
	Introduction	34
	Essentials of a valid construction contract	34
	Standard forms of contract	36
	Sub-contract forms	38
	Comparison of forms	43
	Selection of contract forms	44
4	Tender documentation	46
	Introduction	46
	Coordinated project information	47
	CPI and the estimator	55
	Documents used as the basis of a tender	58
	Formal tender documents	61

5	Estimating methods	66
	Introduction	66
	Single-rate approximate estimating	70
	Multiple-rate approximate estimating	71
	Approximate quantities	73
	Analytical estimating	78
	Operational estimating	82
6	Contractor selection and decision to tender	85
	Introduction	85
	Competition and negotiation	86
	Abuse of tendering procedures	90
	Decision to tender	92
	Inspection of tender documents	95
	Competition legislation	96
7	Project appreciation	100
	Introduction	100
	Estimate timetable	100
	Pricing strategy	103
	Schedules	103
	The estimating team	103
	Visits to consultants and site	107
8	Enquiries to suppliers and sub-contractors	109
	Introduction	109
	Enquiries for materials	111
	Enquiries to sub-contractors	113
9	Tender planning and method statements	117
	Introduction	117
	The role of the planning engineer	117
	Method statements	118
	Tender programmes	119
10	Resource costs – labour, materials and plant	125
	Introduction	125
	Labour rates	125
	Material rates	128
	Plant rates	130
11	Unit rate pricing	132
	Introduction	132

	Components of a rate	132
	Method of measurement	134
	Pricing notes	134
	Model rate and pricing examples	135
12	Sub-contractors and nominated suppliers	176
	Introduction	176
	Domestic sub-contractors	176
	Nominated sub-contractors	183
	Nominated suppliers	184
13	Fluctuations	185
	Introduction	185
	Standard fluctuations clauses	186
	Calculation of non-recoverable increases	188
14	Provisional sums and dayworks	192
	Introduction	192
	Provisional sums for undefined work	192
	Provisional sums for defined work	192
	Dayworks	193
	Overheads and profit	196
15	Project overheads	199
	Introduction	199
	Pricing project overheads	199
	Pricing the preliminaries bill	202
	Example of project overheads	216
16	Cashflow forecasts	217
	Introduction	217
	Cashflow calculations	217
	Example of a contractor's cashflow forecast	219
17	Completing the estimate and final tender review	227
	Completing the estimate	227
	Estimator's report	229
	Comments on Estimate Analysis form	229
	Comments on Tender Summary form	234
	Risks and opportunities	235
	Overheads and profit	237
18	Tender submission and results	240
	Introduction	240

	Completion of priced bills	241
	Tender presentation	243
	Vetting of tenders	245
	Post-tender negotiations and award	246
	Tendering performance and analysis of results	247
	Bidding strategy	251
19	Action with the successful tender	254
	Introduction	254
	Information transfer	254
	Feedback	256
20	Computer-aided estimating	260
	Introduction	260
	Aims of computer-aided estimating	261
	Software	262
	Electronic exchange of information	263
	Reverse auctions	265
	Computer-aided estimating packages	267
	General purpose software	271
	Hardware	280
	Networking	283
	Implementation	285
	The future	286
Further reading		291
Index		295

Preface

My aims in this book are to introduce a practical approach to estimating and tendering from a contractor's point of view, and explain the estimator's role within the construction team. The book therefore differs from previous textbooks in three main ways:

1. In general it is assumed that it is the contractor who prepares estimates because in the majority of cases an estimate is produced to form the basis of a tender.
2. I have introduced many typical forms used by estimators to collate data and report to management. Most of the forms relate to two fictitious projects: a new lifeboat station and the construction of offices for Fast Transport Limited.
3. The pricing examples given in Chapter 11 have been produced using a typical build-up sheet. The items of work to which the prices relate are given at the top of each page. Estimating data are given for each trade so that students will have a source of information for building up rates. I suggest that before pricing exercises are undertaken, the first part of Chapter 11 should be read and an understanding of estimating methods should be gained from Chapter 5. The first pricing example is for a 'model rate' that gives a checklist of items to be included in a unit rate.

The estimating function has changed more in the last 15 years than at any time before. Many estimating duties can now be carried out by assistants using word processors, spreadsheets and computer-aided estimating systems. The estimator manages the process and produces clear reports for review by management.

Estimators need to understand the consequences of entering into a contract, which is often defined by a complex combination of conditions and supporting documents. They also need to appreciate the technical requirements of a project from tolerances in floor levels to the design of concrete mixes, and from temporary electrical installations to piling techniques.

The Chartered Institute of Building publishes a series of guides to good practice – the Code of Estimating Practice and its supplements. I have not duplicated their fine work in this book but hope that my explanation and examples show how the guidelines can be used in practice.

Contractors now assume an active role in providing financial advice to their clients. The estimator produces financial budgets for this purpose and assembles cost allowances for use during construction. Computers have been introduced by most organizations, with a combination of general purpose and specialist software. Computers have brought many benefits during the tender period, and are seen as essential for the handover of successful tenders; adjustments can be made quickly, information can be presented clearly, and data can be transferred in a more compact form.

The changes brought about by the introduction of SMM7 and the other principles of Coordinated Project Information have reduced the number of items to be measured in a typical building contract. The item descriptions no longer provide information for pricing, the estimator must always refer to the specification and drawings. In practice this is time consuming for both contractors and subcontractors, and the amount of paperwork has increased immensely. Nevertheless, contractors always need a bill of quantities, whether produced by the client's quantity surveyor, by an in-house commission or by sharing the services of an independent quantity surveyor. Traditionally bills of quantities were used as a fair basis for preparing and comparing tenders, but increasingly the responsibility for quantities is being passed to contractors. It is of some concern that estimators continue to have difficulty entering bills of quantities in their estimating systems and look forward to the time when a common approach to electronic data transfer is widely adopted.

This third edition has been written to reflect changes in estimating since 1997. These include:

- The recommendations of Sir Michael Latham in his 1994 report *Constructing the Team*, and Sir John Eagan *Rethinking Construction*, 1998.
- A section on the Private Finance Initiative (PFI) has been added to Chapter 2, and an example of project overheads has been added to Chapter 15.
- A short introduction to competition legislation in the UK. In particular the Competition Act 1998 and Enterprise Act 2002; Chapter 6.
- A major review of JCT contracts took place in 1998 with most of the main contract forms consolidated into new editions.
- Increases in labour and plant rates which affect rate build-ups (Chapter 10), daywork calculations (Chapter 14), and pricing notes given in Chapter 11. In 2003, a long-term wage agreement has introduced a 21% overall increase in basic labour costs over three years. The effect of this, combined with the shortage of skilled operatives, will be a period of significant inflation running ahead of the UK annual inflation rate.
- Many tables and figures have been enhanced so that they will be easier to read.
- Some new terminology introduced by the 6th edition of the CIOB Code of Estimating Practice 1997, particularly the recommendation that structured discussions with management are referred to as 'review' meetings, and what was the 'adjudication' meeting is now called the 'final review' meeting. This avoids conflict with the action by quantity surveyors in checking tenders which is also referred to as the 'adjudication of a tender'.

I recognize and support the role of women in construction and ask readers to accept that the use of the masculine pronoun is intended to refer equally to both sexes.

Martin Brook
2004

Acknowledgements

I wish to acknowledge the help given by Michael Hawkridge for checking the text to the first edition, and Dr Jane Brook for the cartoons.

List of figures

Fig. 1.1	Estimating staff structure for a medium-sized organization	2
Fig. 1.2	Estimating and tendering flowchart	4
Fig. 1.3	Estimating programme	5
Fig. 1.4	Tender register	7
Fig. 2.1	A guide to the apportionment of financial risk	15
Fig. 2.2	The traditional procurement method	16
Fig. 2.3	The design and build system	17
Fig. 2.4	Management contracting	20
Fig. 2.5	Construction management	22
Fig. 2.6	Private finance initiative	24
Fig. 2.7	Example of a pricing strategy for a PFI hospital scheme	30–32
Fig. 3.1	Contractual relationships between parties using JCT98	39
Fig. 3.2	Contractual relationships between parties using ICE 7th Edition	39
Fig. 3.3	Simplified checklist for the selection of a contract	44
Fig. 4.1	Typical formal invitation letter	62
Fig. 4.2	Typical form of tender	63
Fig. 4.3	Example of an alternative tender	64
Fig. 5.1	Estimating methods in 1930s and today	67
Fig. 5.2	Example of a development budget	69
Fig. 5.3	Degree of certainty for a typical construction project	70
Fig. 5.4	Elemental cost plan for portal-framed building	72
Fig. 5.5	Elemental cost plan for building under construction	74
Fig. 5.6	Elemental cost plan for similar factory building	75
Fig. 5.7a	Example of 'builder's quantities'	76
Fig. 5.7b	Example of preamble for 'builder's quantities'	77
Fig. 5.8	Contractor's bill of quantities priced analytically	79
Fig. 5.9	Contractor's spreadsheet bill for weighbridge foundation	80
Fig. 6.1	Preliminary enquiry information form	94
Fig. 7.1	A typical estimate timetable	101
Fig. 7.2	Typical pricing strategy for a college building	102
Fig. 7.3	List of PC and Provisional Sums at project appreciation stage	104
Fig. 7.4	Trade abstract for sections to be priced by the contractor	105
Fig. 7.5	Coordination of the estimating team	106

Fig. 8.1	Abstract form for materials or sub-contract enquiries	110
Fig. 8.2	Typical enquiry for materials	112
Fig. 8.3	Sample enquiry letter to domestic sub-contractors	114
Fig. 9.1	Example of a tender method statement for submission to a client	120
Fig. 9.2	Example of a tender programme	122
Fig. 9.3	Example of a programme submitted with a tender	123
Fig. 10.1	Calculation of all-in rates for labour using spreadsheet software	127
Fig. 10.2	Calculation of all-in rates for site working 50 hours/week with an extended summer period of 35 weeks and supervision and insurance priced in project overheads	129
Fig. 11.1	Estimator's build-up sheet for fixing ironmongery	133
Fig. 11.2	Model rate calculations	136
Fig. 12.1	Example of a sub-contract comparison sheet	178
Fig. 12.2	Computer comparison system showing problem of average rate inserted automatically	179
Fig. 12.3	Sub-contract types and attendances	181
Fig. 12.4	Typical summary form for domestic sub-contractors in a tender	182
Fig. 13.1	Calculation of fluctuations for a project starting in September	189
Fig. 13.2	Calculation of fluctuations for a project starting in March	190
Fig. 14.1	Estimator's spreadsheet for calculating the prime cost of building labour for daywork 2003/2004	195
Fig. 14.2	Items to be added to the 'all-in' rates for labour	197
Fig. 15.1	Preliminaries checklist	201
Fig. 15.2	Pricing preliminaries	202–211
Fig. 15.3	Project overheads	212–214
Fig. 16.1	Simple linear plot of cumulative value	218
Fig. 16.2	Simple S-curve for cumulative value and costs, calculated at 'third' points	220
Fig. 16.3	S-curve based on GC/Works/1 Edition 3 data	221
Fig. 16.4	Client's cashflow forecast produced by the estimator	223
Fig. 16.5	Multiple sheets for cashflow analysis	224
Fig. 16.6	Contractor's cashflow forecast using priced programme	226
Fig. 17.1	Summary of sub-contractors (reproduced from Chapter 12)	230
Fig. 17.2	Estimate Analysis form	231
Fig. 17.3	Tender Summary form	232
Fig. 18.1	Cumulative tender ratio	248
Fig. 18.2	Cumulative value of tenders and awards	249
Fig. 18.3	Alternative methods for tender ratio analysis (relates to data given in Tender Summary form)	250

Fig. 18.4	Tender results	251
Fig. 18.5	Summary of tender results	252
Fig. 19.1	Extract from contractor's bill of allowances	257
Fig. 19.2	Comparison of sub-contracts placed with sub-contract allowances	258
Fig. 20.1	Features checklist for estimating packages	269
Fig. 20.2	Creating a bill of quantities using a Windows program	270
Fig. 20.3	Example of a spreadsheet template for formwork	274
Fig. 20.4	Example of a spreadsheet template for drainage excavation	275
Fig. 20.5	Terms used in a simple database program	277
Fig. 20.6	Typical specification for a desktop computer	282
Fig. 20.7	The roles of the estimator and estimating assistant using computer systems	288

Abbreviations used in the text

BEC	Building Employers Confederation
BPF	British Property Federation
BS	British Standard
BWIC	Builders Work In Connection
CAD	Computer-Aided Design (or Draughting)
CAWS	Common Arrangement of Work Sections
CD	Compact Disc
CESMM3	Civil Engineering Standard Method of Measurement Third Edition
CIB	Construction Industry Board
CI/SfB	Construction Index – Samarbetskommitten for Byggnadsfragor
CIOB	Chartered Institute of Building
COEP	Code of Estimating Practice (published by the CIOB)
Conc	Concrete
CPSSST	Code of Procedure for Single Stage Selective Tendering
CPI	Coordinated Project Information
DOS	Disk Operating System
DOT	Department of Transport
e-mail	Electronic mail
Exc	Excavation
FCEC	Federation of Civil Engineering Contractors
ICE	Institution of Civil Engineers
Inc	Included
JCT	Joint Contracts Tribunal
LAN	Local Area Network
LCD	Liquid-Crystal Display
LOSC	Labour Only Sub-contractor
MB	Megabyte
ne	Not exceeding
NJCC	National Joint Consultative Committee for Building
PC	Prime Cost
PC	Personal Computer
PQS	Private Quantity Surveyor
Prov	Provisional

Quant	Quantity
RAM	Random-Access Memory
RIBA	Royal Institute of British Architects
RICS	Royal Institution of Chartered Surveyors
ROM	Read-Only Memory
SMM	Standard Method of Measurement
SMM6	Standard Method of Measurement of Building Works: Sixth Edition 1978
SMM7	Standard Method of Measurement of Building Works: Seventh Edition 1988
WAN	Wide Area Network

This page intentionally left blank

1 Organization of the estimating function

'The corporate image consultant is in reception, Sir.'

The role of the contractor's estimator is vital to the success of the organization. The estimator is responsible for predicting the most economic costs for construction in a way that is both clear and consistent. Although an estimator will have a feel for the prices in the marketplace, it is the responsibility of management to add an amount for general overheads, assess the risks and turn the estimate into a tender. The management structure for the estimating function tends to follow a common form with variations for the size of the company. In a small firm, the estimator might be expected to carry out some quantity surveying duties and will be involved in procuring materials and services. For large projects, the estimator may be part of a multi-disciplinary team led by a project manager. The estimating section in a medium-sized construction organization (Fig. 1.1) will often comprise a chief estimator, senior estimators and estimators at various stages of training.

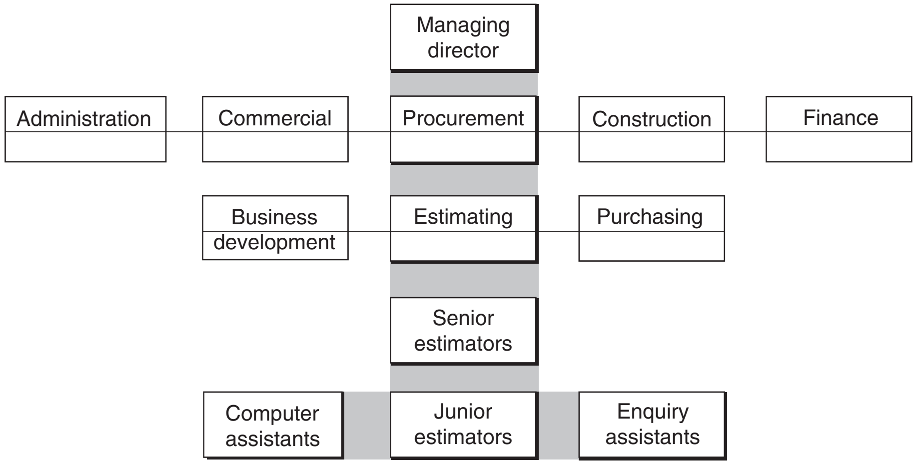


Fig. 1.1 *Estimating staff structure for a medium-sized organization*

Larger estimating departments may have administrative and estimating assistants who can check calculations, photocopy extracts from the tender documents, prepare letters and enter data in a computer-assisted estimating system.

The estimating team for a proposed project has the estimator as its coordinator and is usually made up of a contracts manager, buyer, planning engineer and quantity surveyor. The involvement of other people will vary from company to company. A quantity surveyor is often consulted to examine amendments to conditions of contract, prepare a bill of quantities, assess commercial risks and identify possible difficulties which have been experienced on previous contracts. Clients sometimes like to negotiate agreements with quantity surveyors where a good working relationship has been established and follow-on work is to be based on pricing levels agreed for previous work. A planning engineer might be asked to prepare a preliminary programme so that the proposed contract duration can be checked for possible savings. He can also prepare method statements, temporary works designs, organizational charts and site layout drawings. Some or all of this material can be used to demonstrate to a client that satisfactory systems have been developed for the project. The buying office will provide valuable information leading to the most economic sources for the supply of materials and plant. In many organizations today, the buyer is responsible for getting quotations from suppliers and sub-contractors. At the very least, the buyer (sometimes called 'procurement manager' or 'supply chain manager') helps prepare lists of suitable suppliers, keeps a library of product literature and advises on likely price trends and changes. His knowledge of local suppliers and current discounts is essential at the final review meeting when decisions need to be taken about the availability and future costs of materials and services.

Site managers should report on the technical and financial progress of their projects so that the estimator can learn from the company's experience on site. On completion of contracts, site staff will usually contribute to larger and more complex schemes – particularly for civil engineering and large-scale building work – where alternative construction methods have a significant affect on tender price. The department dealing with business development and presentations can contribute in two ways: by maintaining close contacts with clients to ensure their needs are met, and by producing submission documents often using desktop publishing software.

The aim of the team is to gain an understanding of the technical, financial and contractual requirements of the scheme in order to produce a professional technical document with a realistic prediction of the cost of construction. The construction manager or director will then use the net cost estimate to produce the lowest commercial bid at which the company is prepared to tender. Figure 1.2 shows the various stages in preparing a tender and the action needed with successful tenders. The workflow in an estimating department is never constant; the ideal situation is to have people available who are multi-disciplinary and can deal with administrative tasks. A buyer can provide an invaluable service in sending out enquiries and chasing quotations.

The cost of tendering for work in the construction industry is high and is included in the general overhead which has been added to each successful tender. For one-off large projects, such as Private Finance Initiative (PFI) contracts, bidding costs can be several millions of pounds. These costs are recovered when schemes are successful but written off against annual profits when contractors fail to win. The chief estimator needs to be sure there is a reasonable chance of winning the contract if the organization is in competition with others. The decision to proceed with a tender is based on many factors including: the estimating resources available; extent of competition; tender period; quality of tender documents; type of work; location; current construction workload and conditions of contract. With all these points to consider, a chief estimator could be forgiven for declining a high number of invitations to tender to maintain a high success rate and avoid uncompetitive bids which can lead to exclusion from approved lists. On the other hand, he must recognize the goodwill which often flows from submitting competitive prices and the need to carry out work which might lead to suitable and profitable contracts.

There are several forms that can be used to plan, control and monitor estimating workload. The first is a chart to show the opportunities to tender when they have been confirmed. The information for this programme usually comes from the marketing personnel who are responsible for bringing in invitations to tender for projects that are in line with company strategy. The chief estimator will prepare a bar chart (Fig. 1.3) to show how the estimators will be assigned to present and future tenders, showing the expected dates for receipt of documents and submission of tenders. Copies are sent to heads of other departments so they can

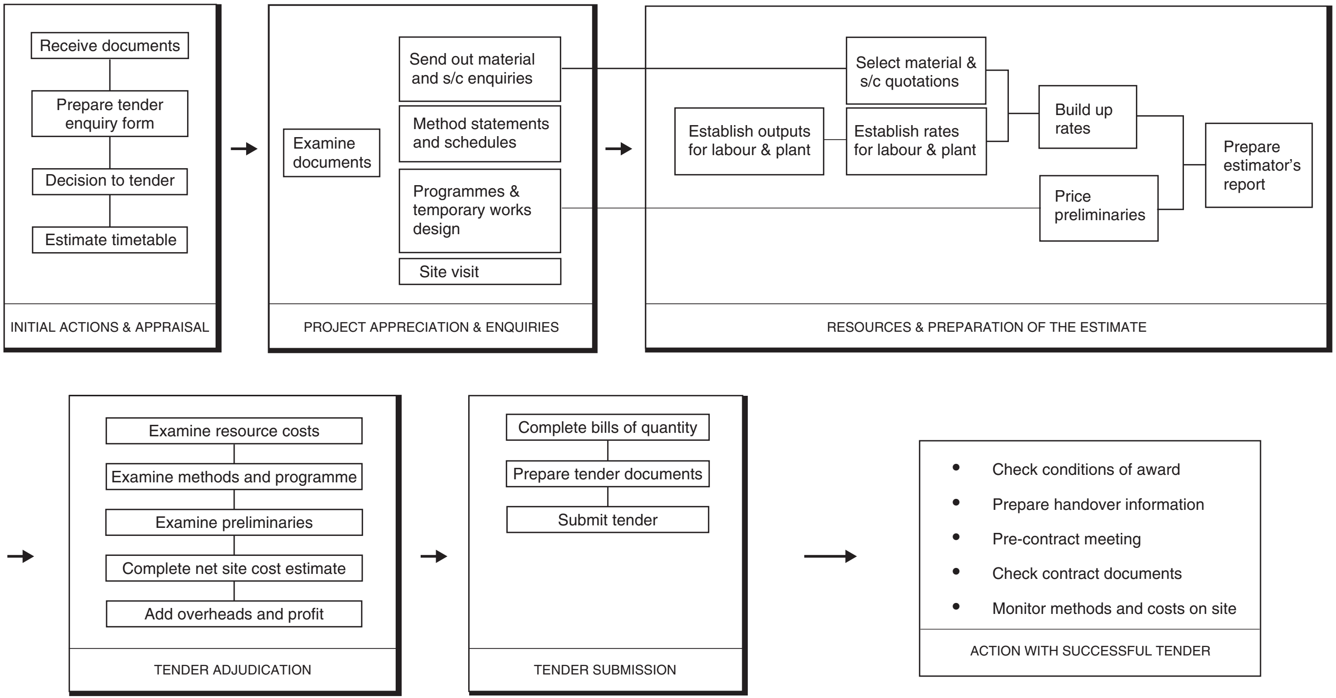


Fig. 1.2 *Estimating and tendering flowchart*

CB CONSTRUCTION LIMITED	Date: 3.6.04
ESTIMATING PROGRAMME	

Estimator	**Project title**	**value** £m	**June**				**July**				**August**			
			7	14	21	28	5	12	19	26	2	9	16	23
JOHN EDWARDS	Colliery Office	0.45	xxxxx	xxFxT										
	Lifeboat Station	1.50		xxxxx	xxxxx	xxxxx	xxxxF	T						
								hhhhh	hhhhh					
JEAN SMITH	Access road	0.50	xxFT											
	Treatment works	0.75	xx	xxxxx	xxxxx	xxFxT								
	Superstore	2.25				x	xxxxx	xxxxx	xxxxx	xxxxx	xxFxT			
									hhhhh					
GRAHAM THOMAS	Fast Transport	0.70	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxFxT						
										hhhhh				
	Total	6.15												

Key: F = Final review T = Tender date h = holiday

Fig. 1.3 *Estimating programme*

plan their input; they may also wish to attend the final review meetings. A tender register is also needed (Fig. 1.4) to record the main details of each tender such as reference number, client, price, tender date and an analysis of performance in relation to the competition.

The success ratio for a construction firm is often quoted at about 1 in 6 although it can be as high as 1 in 10 and down to 1 in 3 where competition is limited. Since the directors of a company are more concerned with turnover and profit, then success is better measured in terms of value, and the estimating department may be given annual targets to meet. Clearly, negotiated work can save a great deal of abortive tendering.

Estimators are drawn from two sources: direct from school with some good grades in GCSE subjects which suggest a potential to study to a higher technician or professional level, or from experienced staff where management has identified an aptitude and willingness for the job. In both cases a reasonable time must be spent on site to gain experience in construction methods, materials identification, use and practice. The skills, which are needed, are the ability to read and interpret technical documentation, the ability to communicate with clients, specialists and other members of the team, and the faculty to make accurate calculations.

Technically an estimator must have a working knowledge of all the major trades, to identify packages of work to be carried out by sub-contractors, and the direct workforce, to foresee the time and resources that will be needed. It is also necessary to have the ability to take off quantities from drawings, where there are no bills of quantities. When bills of quantities are provided, the estimator will need to check the principal quantities to understand how corrections to the quantities during the contract will affect the profitability of the scheme.

An estimator needs to refer to many information sources either in book form or through more modern means such as microfiche, CD-ROM and on-line databases. The following list shows some of the basic material required:

- Code of Estimating Practice (COEP) … *pro-formas for estimators.*
- Code of Procedure for the Selection of Main Contractors … *tendering procedures.*
- Standard Method of Measurement (SMM) … *explanation of item coverage.*
- Standard forms of contract … *contractual obligations.*
- Standard specifications for highways and water industries … *specifications for pricing.*
- National Working Rule Agreement … *labour rates.*
- Definition of prime cost of daywork … *pricing daywork percentages.*
- Daywork plant schedules … *pricing daywork percentages.*
- Trade literature:
  (a) standard price lists
  (b) technical product information.

CB CONSTRUCTION LIMITED	TENDER REGISTER	page

Tender no.	Tender title	Date received	Location	Client	QS Architect Engineer	Tender details		Tender evaluation			
						Date	Price	No. of tenderers	Rank	% over lowest	% over mean
001											
002											
003											
004											
005											
006											
007											
008											
009											
010											
011											
012											
013											
014											
015											
016											
017											
018											
019											
020											
021											

Fig. 1.4 *Tender register*

- Trade directory of suppliers and sub-contractors … *lists of suppliers to receive enquiries.*
- Reference data for weights of materials … *unit rate pricing.*

The work of the estimating department is an important part of the company's quality management system. The decisions made at tender stage will often determine the way in which the project is carried out. It is therefore important when preparing a tender to ensure that the client's requirements are understood.

Many organizations have adopted a standard approach to the process of estimating and prepared documented procedures that detail the preparation, review and submission of a tender. This is particularly useful for newly appointed staff as it provides a standard framework for the preparation of an estimate and ensures consistent records and reports for others. The preparation of documented procedures has come with the introduction of a British Standard (BS) which provides a model for quality assurance. Now known as the BS EN ISO 9000 series, this standard was first introduced to the construction industry as BS 5750 in 1979.

The objective of a quality assurance system is to provide confidence that a product, in this instance the tender submission, is correct, is provided on time and produces the right price. This price might be defined as that which the client can afford and deems reasonable, and is sufficient for the contractor to meet his objectives. However, it is acknowledged that tenders are always submitted on time, but owing to time and information constraints, the price may not always be the 'right price'.

The benefits of implementing quality assurance in the estimating function are:

1. *Profitability* – an improvement to the profitability of the organization.
2. *Accuracy* – a reduction of errors.
3. *Competence* – better trained staff.
4. *Efficiency* – work properly planned and systematically carried out.
5. *Job satisfaction* – for the whole estimating team.
6. *Client satisfaction* – leading to likelihood of repeat business.

Safety is high on the agenda of construction organizations. Estimators must understand the implications of current legislation for the design and procurement stages and include sufficient costs to carry out the work safely.

A client's professional team contributes to the writing of a pre-tender health and safety file, by assessing hazards which might be inherent in the design. These hazards include possible dangers to construction operatives, staff and the public – during construction, for occupants and in carrying out repairs over the life of the building. The health and safety file tells the estimator about the project, setting out hazards associated with the design, and dangers known about the existing site.

The Construction (Design and Management) Regulations 1994 impose greater responsibilities on design and build contractors. Their tasks will often be extended by clients to include:

1. The role of planning supervisor.
2. Vetting of designers for competence in designing safely.
3. Producing the pre-tender stage health and safety file.

2 Procurement paths

Introduction

The Banwell Report, published in 1964, expressed the view that existing contractual and professional conventions do not allow the flexibility that is essential to an industry in the process of modernization. The report of the committee asked the industry to experiment to secure efficiency and economy in construction.

The traditional method of organizing construction work starts with appointing a consultant designer, usually an architect or engineer, or both. Other specialists may be needed, in particular a quantity surveyor is appointed to provide cost information, prepare bills of quantity, compare bids and maintain financial management during construction.

Since the early 1960s, the construction industry has experienced significant changes in the way in which contracts are managed. In some cases, contractors have been brought in at an early stage as full members of the design team, in others clients have appointed project managers to act on their behalf. During the 1980s clients became increasingly concerned about problems such as poor design, inadequate supervision, delays and increased costs. They were also critical of the separation of design from construction, particularly between the building professions.

In an attempt to overcome some of these long-standing criticisms, the British Property Federation (BPF) published its manual for building design and construction in 1983. It wanted to introduce a new system to change attitudes and alter the way in which the members of the construction team deal with one another. The BPF also tried to remove some of the overlap of effort between quantity surveyors and contractors without the need for the traditional bill of quantities. This system for building procurement was little used and to some extent was superseded by new forms of contract such as the Engineering and Construction contract. This had the support of Sir Michael Latham in his report, *Constructing the Team* (HMSO 1994), although its implementation has been slower than Sir Michael Latham had recommended.

The design and build method has gradually grown in popularity during the last three decades by offering single point responsibilities, certainty of price and short overall durations. Management contracting was used in the 1970s and 1980s for large complex projects but construction management is now seen as a more attractive choice. An alternative, which is sometimes forgotten, is the client's own in-house design team, usually led by a project manager who supervises designers, cost specialists and contractors. This method accounts for a large part of construction work because it is the one commonly used in the public sector; but even this is being replaced with new systems, in particular the Private Finance Initiative (PFI) and Prime Contracting.

Clients' needs

Client organizations are divided between those in private and public sectors although this distinction is becoming more difficult to define since the privatization of many national bodies. The private sector includes industrial, commercial, social, charitable and professional organizations, and individuals. The public sector is taken to mean government departments, nationalized industries, statutory authorities, local authorities and development agencies. The experience which a client has of building procurement ranges from extensive, in the case of a client with a project management team, to none, where a private individual may want a development only once in a lifetime.

Clients will usually identify their needs in terms of commercial or social pressure to change; by an examination of primary objectives such as:

1. Space requirements: the need to improve production levels, add to production capacity, accommodate new processes or provide domestic or social accommodation;
2. Investment: to exploit opportunities to invest in buildings;
3. Identity: to enhance the individual's or organization's standing in its market or society;
4. Location: could lead to a better use of resources, capture a new market or improve amenity;
5. Politics: mainly in the public sector.

The client's experience of building will influence his expectation of the industry. Property developers on the one hand can influence their professional advisers and the contractual arrangements, and select a contractor with the right commitment to meeting project targets. The main aim is to achieve a degree of certainty in the building process. On the other hand, individuals and inexperienced clients are guided by their advisers and contractors, and will be offered what the construction team think they need.

In general a client aims to appoint a team which he can trust and rely on to reduce uncertainties during a building's design, construction and use. This is achieved by control of the following:

1. The design: by designing to a budget, taking advantage of the contractor's experience, avoiding excessive use of new systems, designing for buildability, safety, security, producing a good life expectancy and low maintenance, allowing flexibility for future change and employing environmental and energy efficient designs;
2. The time: by contractors accepting more responsibility for meeting completion dates, and designers being more aware of the importance of complete information well in advance of work on site;
3. The cost: by achieving realistic cost estimates and tenders which reflect the final cost, reducing risk of contractual claims stemming from poor documentation and late receipt of information, and avoiding delays which can cause loss of revenue and costly funding arrangements.

Many clients are prepared to pay for a good service and see these objectives being met through alternative methods of contracting.

The client has traditionally occupied a passive role in the construction process. Standard forms of contract require the employer to pay for work properly executed, give possession to the site on the agreed date and appoint his professional team to design, supervise and inspect the work and account the finances. A more realistic view is that the client is the most important member of the team because, as patron for the scheme, he identifies the need for the building and he must pay everyone who is directly or indirectly involved in the construction process. This is why we now see clients taking a more active part in the control of construction work and in part explains the emergence of construction management in the UK.

Contractor involvement

During the late 1980s, clients were looking for procurement methods which could quickly produce (or refurbish) large buildings with complex designs. Clearly the contractor needed to contribute to the design phase and continue to advise on the design during construction. At the same time, where projects were less complex, design and build systems were being adopted for both building and civil engineering projects.

In order to respond to these different needs, contractors have developed a wider range of construction services, sometimes setting up separate divisions within a company. The danger is that a contractor more used to working in a traditional market may fail to achieve the objectives expected by the clients. This can occur where there is a lack of trained staff and there is an over-reliance on specialists, for design and construction, who are sometimes engaged on onerous conditions of sub-contract.

For construction management, as seen in the USA, to flourish, contractors must accept the responsibility for producing detailed drawings and cost-effective production techniques. Whichever method is used, there will usually be a number of tendering stages that encourage the parties to harmonize their aims and develop cooperation and trust which did not always happen in the past. If this is the way ahead, then architects and quantity surveyors will concentrate on creating an outline of the client's requirements, providing financial advice and setting up independent monitoring systems on site. Partnerships between clients and contractors provide the benefit of more open relationships based on trust and cooperation. By relaxing many of the traditional contract conditions and formalities the parties can achieve their goals of repeat business and a less adversarial approach.

In civil engineering, there are generally fewer professional interests, and an engineer whether working for a client or contractor works in a similar way. Civil engineers understand standard documentation which is used for most engineering schemes. Contractors can, however, influence the design for civil engineering work significantly, and often submit tenders with alternative bids, which can offer substantial savings to a client. Again partnership arrangements have developed in contracting, principally in process engineering, water industries and where modularization and standardization have been used.

Partnering

During the mid-1990s, partnering emerged in a number of forms, partly to reverse the suicidal fall into institutionalized conflict with appalling relationships between contracting parties in the construction industry, and more recently as a means of securing more work by creating a competitive advantage.

Attempts to foster cooperation between contractors and clients first appeared in standard contracts with the publication of the Joint Contracts Tribunal (JCT) Management Contract in 1987. The New Engineering Contract (NEC) introduced the principles of trust and cooperation to general contracting in the early 1990s and Sir Michael Latham's 1994 report *Constructing the Team* asked for core clauses to be added to the NEC contract to establish that the employer and contractor would undertake the project 'in a spirit of mutual trust and cooperation, and to trade fairly with each other and with their subcontractors and suppliers'. Sir Michael Latham also recommended a key objective must be 'that "win-win" solutions to problems should be devised in a spirit of partnership'.

These developments are clear attempts to get the parties to construction contracts to work together with less adversarial methods of procurement. But is a positive working spirit the same as closing the gap between design and construction?

In many ways consultants and contractors still assume their specialist roles and prejudices without having precisely the same aims. It is difficult to imagine the prescriptive method of partnering, through carefully worded contracts, being successful. It is not appropriate to draw up a contract to say you will agree with each other each time an unexpected problem arises.

Perhaps this is the reason for the growth of contractor-led partnerships. It has often been observed that contractors have developed partnering schemes in order to add a powerful ingredient to what may be a highly competitive bid. For many years alternative tenders have been submitted by civil engineering contractors based on changes to the design or specification. More recently, partnering has been used as the basis for alternative bids to combine technical innovation with an offer to look for additional savings such as sharing site staff and testing equipment; continuous improvement; ensuring quality and eliminating claims.

So which approach is better for clients? A prescriptive arrangement embodied in a modified standard form of contract or the acceptance of a contractor's proposal with an ad-hoc verbal or brief partnering agreement? In order to answer this question, and explore the expertise of tenderers, many public and influential clients are asking for elaborate pre-selection submission documents (and interviews) whereby contractors must demonstrate a proven track record in partnering with other clients.

There is some evidence that clients are satisfied with partnering arrangements particularly when an element of competition has been provided at an early stage of the scheme. It is clearly encouraging to have a team working to a set of mutual objectives which can achieve a project within the budget, no claims and completion on time. Contractors have also benefited when work has been scarce by first securing the work, then receiving a reasonable gross margin and finally by sharing cost savings as the project develops.

Partnering is not about the allocation of risk. Risk will depend on the contract option: design and build, lump sum or prime cost, and the nature of the works. Unforeseen ground conditions, for example, can be a risk which can be minimized by open and frank problem solving, but are by definition unpredictable. Partnering should ensure that the team (consultants, contractor, sub-contractors and suppliers) work together with what Sir Michael Latham calls a 'shared financial motivation'.

It is worth noting that clients have been prepared to pay a fair price for a good job for hundreds of years. It is for the construction industry to prove that it can deliver the service that clients deserve.

Apportionment of risk

The procurement system, and associated contractual arrangement, will dictate the financial and other risks borne by the parties to the contract. Risk cannot be eliminated by choosing a particular form of contract, but will be shifted towards one party or the other. A guide to how the risks are divided for each contractual arrangement is given in Fig. 2.1.

Lump-sum contracts based on complete pre-tender design and full documentation spread a smaller risk of cost overrun evenly between the parties. Results may be further improved by using a selective list of tenderers, avoiding nominations, checking ground conditions, and reducing the guesswork needed by contractors at tender stage.

A contract where the price is calculated from a schedule of rates has two major problems:

1. The contractor is unable to identify the full extent of the work at tender stage, he is thus unable to plan and accurately assess his overheads; and
2. The client will not know the full price of the work until the contract is complete.

A cost-reimbursement contract allows the contractor to claim all the prime cost of carrying out the work on an 'open book' basis and amounts are paid for site overheads and the management fee. Although this arrangement has the benefit of a quick start, there is little incentive to save time or costs. It would be unfair to say, however, that management contracting or construction management is more expensive than an alternative approach. All the package contracts are let competitively and the management fees are surprisingly low. It has been suggested that in the case of management contracting the management contractor makes more money by looking after the payments to package contractors. This point is often

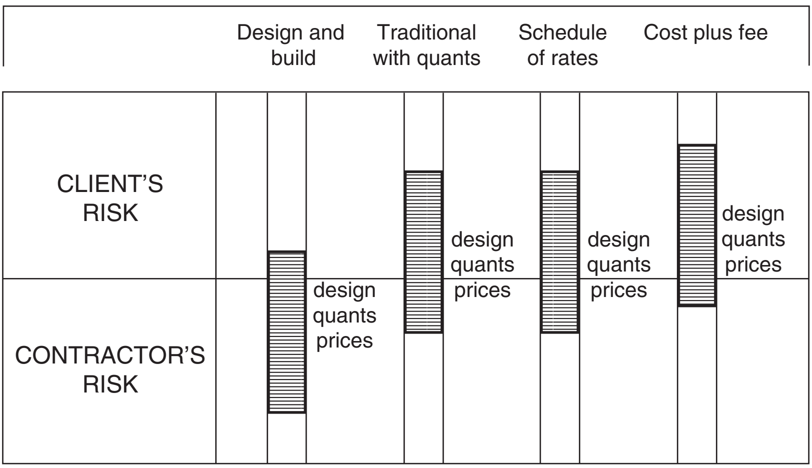


Fig. 2.1 *A guide to the apportionment of financial risk*

made in acclaiming the benefits of construction management where the client deals directly with the specialist contractors.

Traditional method

The traditional structure for project procurement shown in Fig. 2.2 is a sequential method because the employer takes his scheme to an advanced stage with his professional team before appointing a contractor. The consultant's role is seen as an independent one. The designer is employed to advise the client, design, ensure the work is kept within the cost limit and complies with the standards required. A quantity surveyor can be engaged to give guidance on design costs and budgets, prepare bills of quantities, check tenders, prepare interim valuations and advise on the value of variations. Consultant structural and services engineers may be employed either by the client, or his advisers, to design the specialist parts of the project.

Separating responsibilities for design and construction is seen as the main reason for the move away from traditional contractual arrangements. The building industry suffers from the old distinctions between the professional interests and suspicion brought about by ignorance of each other's work. In civil engineering there is more freedom for individuals to move to and from consultants and contractors' organizations – there is an understanding of each other's point of view.

Instead of the direct appointment of consultants, many major building owners and developers make use of in-house project managers either to control independent consultants or to carry out all the design and financial control of the project. Project management is therefore seen as a management tool and not a

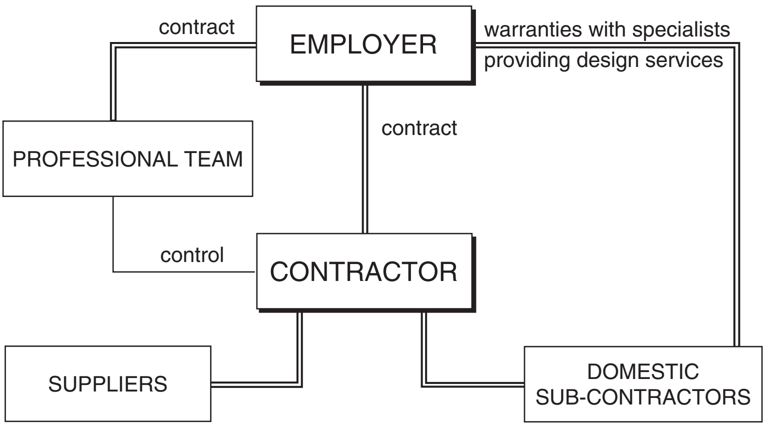


Fig. 2.2 *The traditional procurement method*

procurement system. The JCT Standard Form of Building Contract 1998 and JCT Intermediate Form of Contract 1998 with the Agreement for Minor works are the most popular forms for building work. The Institution of Civil Engineers (ICE) Form of Contract is used for most civil engineering work in both the public and private sectors, and GC/Works/1 is used for traditional civil engineering and building contracts let by central government departments. The continuing high sales of these contracts point to the commanding position of traditional methods.

Design and build

The design and build arrangement is an attractive option for clients. It simplifies the contractual links between the parties to the main contract (see Fig. 2.3) because the contractor accepts the responsibility for designing and constructing.

The benefits include: single-point responsibility, prices which reflect more closely the final cost to the client, inherently more buildable designs and an overlap of design and construction phases leading to early completion. A distinction is sometimes drawn between design and build and package deal, the latter being an agreement for the contractor to provide a semi-standardized or off-the-peg building which can be adapted to meet the client's needs. The contractual arrangement known as 'Turnkey' allows a client to procure from a single contractor all the requirements of a scheme in the shortest possible time. Apart from the usual design and construction responsibilities the agreement will often include land acquisition, short- and long-term finance, commissioning, fitting out and recruitment and training of personnel.

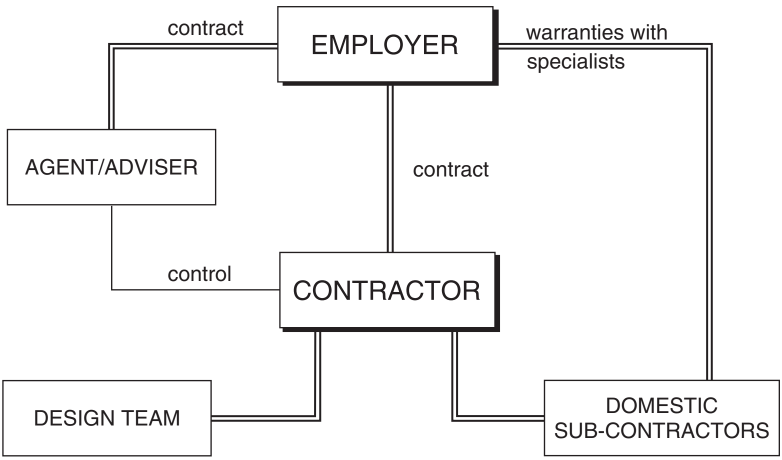


Fig. 2.3 *The design and build system*

A design and build contractor may commission design and cost services from outside consultants or can employ a design team from within his own organization. Occasionally the client will ask the contractor to adopt a design started by his preferred consultant. Assigning (or 'novating') a design team in this way can arise when a client decides to switch to design and build from a traditional method, or more commonly, clients need to use a design team in order to carry out feasibility studies and gain planning consents prior to the appointment of a contractor. A designer needs a flexible outlook when he is thrust from the freedom of private practice, talking to a valued client, to being responsible mainly to the contractor, working to tight financial and time constraints, seeking solutions which satisfy the client's brief and enlarge the contractor's profits. It is generally believed that novation of consultants in design and build contracts is a recipe for friction between the parties and the contractor seldom maintains full control over his consultant team. The main drawback of novation of designers is that once the designers are fully acting in the employment of the contractor, the client finds himself without his team of advisers needed to check the tender and monitor post-tender changes and quality of work.

At tender stage the employer will introduce some competition, either open or selective tendering, which is followed by clarification of the agreement and negotiation. The National Joint Consultative Committee for Building (NJCC) published an advisory booklet in 1985 for private clients and public authorities planning to engage a contractor who would be responsible for the design and construction of a building project. The Code of Procedure for Selective Tendering for Design and Build stresses the importance of full and clear documents setting out the Employer's Requirements. The number of contractors invited to submit tenders in the form of Contractor's Proposals should be limited to three or four firms to reduce the high tendering costs. Each firm invited to tender for design and build work is carefully selected not only for its financial standing and construction record but its design capability and management structure for the work.

The Code of Procedure recognizes the need for longer tendering periods (often three to four months and longer on more complex schemes) and where extensive specialist work or negotiations with statutory bodies is required even more time may be needed. The employer must clearly state the form and content of the contractor's proposals and say whether the price alone will determine the offer accepted. The Code suggests that the design proposals and contract sum analysis are supporting documents which could be submitted separately. The contractor's proposals must be checked with great care because if there is a discrepancy in the employer's requirements the contractor's proposals will prevail, without any adjustment to the contract sum. The Code was replaced in 1997 by the Code of Practice for the Selection of Main Contractors, published by the Construction Industry Board.

Before entering into a design and build arrangement a client should consider the drawbacks. A contractor may offer a functional design which is not aesthetically appealing; he is inclined to develop a low-cost design with opportunities to increase his margins. A contractor might make a client's brief fit his own preferred solution; the long-term life of a building might be overlooked and if the brief is vague, the client could pay an inflated price or take possession of an inferior building. A client may not realize the importance of independent professional advice. The cost of abortive designs and tendering is a heavy burden on contractors' overheads and eventually the costs will be passed on to clients.

It would be difficult to support these criticisms now that design and build is so well established. Professional contractors have taken a pride in their approach to this system, which reduces conflict between the parties and gives the client single-point responsibility for design, time and cost.

In 1981 the JCT published a new form of building contract with contractor's design (now WCD98), and an addendum for changing existing standard forms where the contractor must prepare the design for only part of the works. The new form was based on the 1980 standard form of building contract, with quantities. The contract is for a lump sum price payable in stages or monthly. In place of a bill of quantities the form provides for a contract sum analysis to assist those preparing interim valuations and valuing variations. It must be said, however, the contract sum analysis only helps with significant variations and is of no use with day-to-day changes. The JCT published Practice Note CD/1B in 1984 which includes a useful explanation about the purpose and recommended structure for the contract sum analysis.

With a greater number of public contracts let under the PFI, contractors have formed consortia to provide services which include the whole design and construction process together with responsibility for financing costs, fitting out, staffing, revenue collection, operation costs, maintenance and replacement.

Management contracting

During the 1980s, clients were attracted to management contracting because it offered early starts to large-scale and often complex construction projects. The management contractor is appointed to work with the professional team, to contribute his construction expertise to the design and later to manage the specialist 'package' or 'works' contractors. He is responsible for the smooth running of the work on site so that the contract can be finished within time and cost. Although most major contractors have undertaken work using management contracts, there has been a feeling that it is not a final solution and a better method will evolve in the future. One development has been a combination of design and build and management contracting whereby the contractor produces a design and guaranteed maximum price, and the work is later assigned to a number of major package contractors.

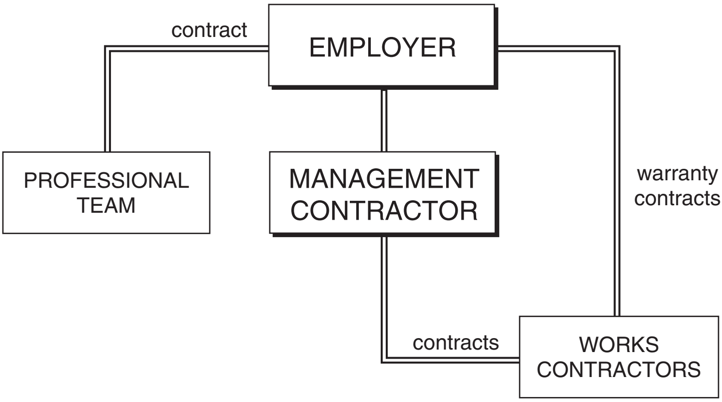


Fig. 2.4 *Management contracting*

Figure 2.4 shows the system adopted by the JCT in 1987 for its Standard Form of Management Contract (now MC98). The contract was needed to meet the growth in this procurement method and the need for standard documentation to replace the many improvised forms which had been used.

A management contractor is selected using the following criteria:

1. Experience of management contracting.
2. Quality and experience of project staff.
3. Fee.
4. Programme and method statement.

The consultants, grouped under the title of 'the professional team', prepare the drawings, specifications and bills of quantities for the various works contracts. The Architect (or Contract Administrator) leads the Professional Team and issues instructions to the management contractor on behalf of the employer. The management contractor's role is in coordinating the design and preparing cost studies at the pre-construction stage. During construction his duties include placing and letting contracts with specialists, cost studies, setting out, provision of shared facilities, plant, and scaffolding, planning and monitoring the work, and coordinating all the activities on site, but not carrying out the permanent works. The management contractor's main duty is to cooperate with the professional team in the above functions.

The JCT Management Contract is not a lump-sum contract. The Employer pays the prime cost of carrying out the work and the fees for providing the management services. These fees will be either a lump sum or calculated as a percentage of the contract value. The recommended retention is 3% applied to both the management and works contracts, but not the fee because fees are calculated after retention is deducted. Trade discounts including the 2.5% contractor's discount are deducted from the management contractor to the benefit of the employer.

Clients are attracted to management contracting for the following reasons:

1. Construction can start before design is complete, and design can be changed during the construction phase;
2. Construction expertise is available to improve on the design;
3. Better coordination of specialist contractors through detailed planning of work packages and common facilities;
4. A contractor's knowledge of construction costs is used to maintain tight budgetary control.

Some problems have emerged, and management contracting has declined, except for a few very large projects. Contractors are less enthusiastic now that margins have fallen and sub-contractors have demanded prompt payments. For works contractors the conditions of contract are becoming more demanding with regard to the management contractor's right of set-off, liquidated damages, performance bonds and guarantees. The specialists often carry the burden of late changes to drawings and specifications which are more common when design development takes place during construction. The client cannot be sure of the final cost and will carry more risk. This is because the management contractor can pass on all the costs incurred for each trade, site staff and site facilities.

Construction management

In the USA, where the roles of the professionals are different, the client or his project manager will take a more active part in the construction phase. A construction manager is appointed as a professional consultant with powers to inspect work on site and issue instructions (see Fig. 2.5).

The client has a greater control over funds during construction because he has a contract with all the trade and specialist contractors. These contractors welcome the direct links with the client partly for the higher status this brings but more importantly because the lines of communications are clearer and payments are made sooner.

There have been some spectacular building failures in the USA; a congressional inquiry in 1984 found that design quality can be impaired by excessive speed and cost cutting exercises. Problems have been found when designers, who are often selected on a least fee basis, pass preliminary designs to works contractors who produce the detailed drawings. This is a division of responsibilities which can lead to errors and legal action.

In the UK, some clients would not want to deal directly with sub-contractors or be involved in every problem of time and cost that could arise. Construction

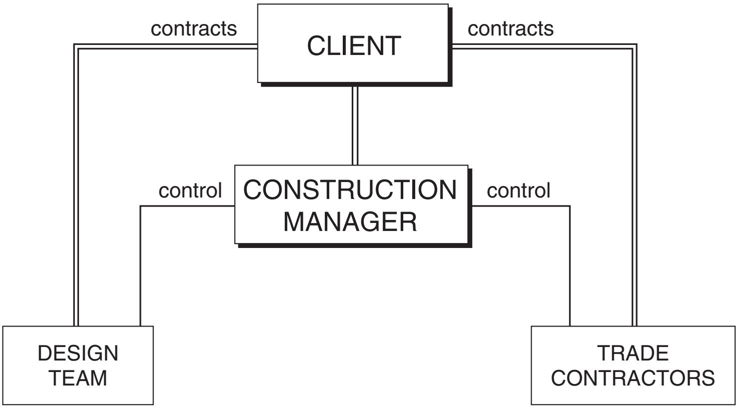


Fig. 2.5 *Construction management*

management has, however, grown steadily in the 1990s and there is ample evidence of experimentation by large property developers who want firm control of and involvement at all stages in building projects. Construction management also allows for change, and the delay of decisions until the latest possible time. In large businesses which rely on new technologies this can be important. Standard documentation has been prepared by the JCT and published in January 2002. Previously variants of main forms of contract have been drafted by large client bodies, and it is likely that these will continue to be used.

At tender stage, each specialist contractor receives specifications, drawings, method statements, and details of the scope of works from which each estimator can prepare his own bills of quantity. A number of onerous responsibilities are placed with package contractors, such as:

1. All risks associated with the preparation of bills of quantity which must include all work needed to complete the package whether shown clearly on the drawing or not. In some cases contractors must assess reinforcement quantities, for example, before the reinforcement is designed;
2. The need to complete elements of the design to the satisfaction of the architect;
3. Payment retentions may be kept for up to 12 months after the completion of the whole project;
4. Complex warranties for all contractors with design responsibilities.

Private finance initiative

The UK government is committed to PFI for major projects. This procurement option has been successful in delivering high quality facilities for public services since the early 1990s. By June 2003, over 280 projects had been signed with a total value exceeding £35 billion.

In July 2003, the Treasury report '*PFI: Meeting the Investment Challenge*' highlighted some key issues underpinning the PFI approach. The main points were:

- PFI investment in public services represents about 13.5% of total investment.
- Of 61 operational projects, 89% were delivered on time or early and all within public sector budgets.
- Benefits are achieved in new build large capital projects (small projects and schemes which are subject to rapid technological changes are less effective, and will be discouraged).
- PFI should only be used where it can be proved to be value for money.
- There is a need for the Government to ensure that value for money is not obtained at the expense of employees' terms and conditions.

There are concerns in certain sectors that there is a need to evaluate competitive interest and market capacity. An amount of money will be set aside by the public sector to ensure that, if this is not the case, there will be sufficient funds to proceed using a traditional procurement route.

Terminology

Awarding authority
The public sector body (department agency, NHS trust, local authority etc.) which is procuring a service through PFI.

BAFO
Best and final offer. Final priced bid submitted by tenderers following the evaluation of initial bids.

Benchmarking
A procedure for testing whether the standard and price of services is consistent with the market standard, without any formal competitive tendering. This is usually adopted during the project concession period to ensure FM services continue to represent value for money.

Consortium
The group of private sector participants who have come together for the purpose of tendering for a PFI contract. Also becomes a Special Purpose Company (SPC) or Special Purpose Vehicle (SPV). The generic term is the Project Company, which is established by the preferred tenderer and is the contracting party for a project (see Fig. 2.6).

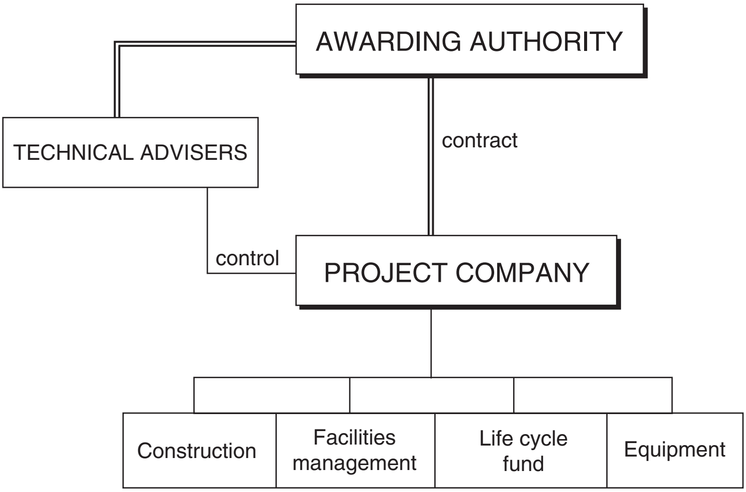


Fig. 2.6 *Private finance initiative*

ITN
Invitation to negotiate. The first stage at which a design and competitive bid is submitted.

Market testing
A procedure for repricing the provision of services on a periodic basis by means of competitive tender.

Output specification
The specification which sets out the requirements in non-prescriptive terms, so that the tenderers can determine how to provide the services.

Public sector comparator (PSC)
The PSC is an assessment of the scheme which includes capital costs, operating costs and third party revenues. The PSC is a benchmark against which value for money can be gauged. Clients use technical advisers to produce a reference project – sometimes called the Public Sector Scheme (PSS).

Service level specification
The specification given in the agreed project agreement setting out the standard to which the service must be provided. This is accompanied by an agreed performance monitoring regime.

TUPE
The Transfer of Undertakings (Protection of Employment) Regulations 1981.

Unavailability
The test for determining deductions from unitary payment by reference to standards for the provision of the facility.

Unitary payment
The payment by the awarding authority to the project company for the provision of the facility.

Variant bid
A bid which does not comply with the prescribed requirements of the awarding authority for a reference bid but which a tenderer is proposing as offering better value for money.

The PFI process

Step 1 The Client identifies the need for a new building in the area. This is done on the basis of its own priorities. There is no private sector involvement in the choice.

Step 2 The Client identifies the operational requirements that it is seeking to provide in the area concerned: for schools, the number of places required, the age group to be served, the curriculum to be taught, the methods of teaching. For a hospital the requirements might be the number of scanners, operating theatres and number of beds.

Step 3 Sites are identified for the proposed new buildings.

Step 4 Private sector firms are invited to express an interest in providing the facilities on a Public Private Partnership (PPP) basis.

Step 5 A short list is drawn up and an invitation to tender is issued.

Step 6 The tenderers are asked to provide a site plan and building design, and to indicate the annual charge for building, equipping, maintaining and operating the new premises (including the grounds). At least 20% of the annual charge must be on a performance-related basis. Potential income from dual use of premises will need to be taken into account.

Step 7 The tender responses are evaluated on the basis of best value for money.

Step 8 The Client names a preferred bidder and negotiates a contract on a PPP basis.

Step 9 The site is leased to the private contractor for 30 years. The premises are built, equipped and made available to the Client from the agreed dates.

Step 10 All operational matters remain the sole responsibility of the Client (governors and the Council in case of a school and an NHS Trust in the case of a hospital).

Step 11 The buildings and grounds are maintained and operated to agreed standards over a 30-year life span at the expense of the private sector. The Client pays an annual fee (unitary payment) or in some cases where a toll can be imposed on users the project can be financially free-standing.

Step 12 At the end of the 30-year period the building and grounds will usually revert to the Client.

Frequently asked questions

What is PFI?

'The involvement of private sector skills which offer the prospect of better value for money' – Gordon Brown, Chancellor of the Exchequer.

Have there been any real benefits?

In February 2003 the National Audit Office published its report on building projects carried out under the private finance initiative. It found that of the 37 PFI construction projects looked at, less than a quarter came in over the original contract price. Previous experience of similar schemes indicated three-quarters of public sector schemes exceeded the price agreed at contract.

There were similar improvements for timely delivery with only a quarter of PFI projects delivered late which compares with three-quarters of similar projects which ran over schedule previously.

What are the commercial foundations of PFI transactions?

In many cases it is a service which is being sold to the public sector over a defined period, for example the provision of computers to a government department. As an alternative, the project can be financially free-standing where the costs are recovered from private users. Examples are the Second Severn Crossing and A69 through road tolling. There are many projects where the costs are met from public funds and partly from asset development, such as the shared use of the facility or development of other parts of the site.

People talk about better value for money. How does this happen for PFI projects?

1. Innovative and economical design calculated on whole life basis. Since the project company is responsible for maintaining the asset it is more likely to take care to secure quality of construction work.

2. Allocation of risks to the parties able to manage them at least cost. The National Audit Office Report published in February 2003 noted that some PFI contractors have actually lost money during the construction phase. This indicated that the private companies were absorbing risk that would previously have been borne by the taxpayer.
3. Greater exploitation of assets – additional income from shared use of facilities or the sale of redundant assets.
4. Integration of design, build and service operation.

What are the real costs of all the elements of a PFI contract?

The costs are typically divided between:

- Initial construction costs (30%);
- Maintenance costs (10%);
- Services (50%);
- Financing charges and project management costs (10%).

Are PFI bids tendered on a competitive basis?

Yes. The bid takes place in three stages:

1. Tenders respond to an advertisement by completing a Pre-qualification Questionnaire (PQQ stage).
2. Invitation to negotiate stage leads to firm bids from a short list of tenderers. A preferred bidder can then be selected.
3. Negotiation to complete the detailed contract terms with a preferred bidder.

There is also a cost check against a public sector comparator. This is a calculation showing what it would cost to provide the outputs from the private sector by a non-PFI route.

Are all risks transferred to the private sector?

Not necessarily. Sponsors need to understand which party is best placed to take responsibility for managing risks with costs being kept to a minimum, such as:

- Design and construction;
- Planning;
- Routine repairs and maintenance;
- Demand for the facility, e.g. number of people crossing a bridge;
- Residual value;
- Technology and obsolescence;

- Legal requirements and regulation;
- Taxation;
- Project financing.

Risks will be different for different projects. For older buildings, for example, there might be a greater emphasis on maintenance. Furthermore, there could be defects which have been ignored for a number of years – backlog maintenance.

Who can provide the service to the public sector?

In the past, a SPC has been set up to engage in the PFI contract. This is formed by a contractor joining forces with an FM service provider and various developers and financiers.

How does a public body test the willingness of the private sector to engage in the tender process?

The simple answer is by discussing the scheme with potential operators before sending out the invitation to negotiate. For defence contracts this is achieved by holding an 'industry briefing' day. The key issues, which need to be discussed, are:

- Size and length of the PFI contract;
- The amount of asset provision and service delivery;
- Structure of the contract;
- Scope for transfer of risks;
- Management of people;
- Scope for shared use and alternative uses of the asset;
- Ownership of the asset at the end of the contract.

The estimating process for a PFI project

Enquiry documentation

The awarding authority will issue 'Invitation to Negotiate' (ITN) documents to the bidders. The content will vary for different public sector schemes, but usually includes the following:

- A business case for the development.
- A fully documented public sector scheme (usually comprising drawings, cost plans, area schedules and financial projections).
- Output specifications.

- Lists of questions (answers to the questions become the framework for the submission documentation).
- Operational policies.

Estimating methods for PFI construction

It can be seen in Chapter 5 that the estimating method chosen will depend on the amount of information available and the design stage reached. For hospitals, there are four stages:

	Stage	**Typical number of bidders**	**Duration**	**Estimating method**
PQ	Pre-qualification	Over 5	1 month	Single rate approx. estimating
PITN	Preliminary invitation to tender	3–5	4 months	Short elemental cost plan
FITN	Final invitation to tender	2–3	6 months	Detailed elemental cost plan
PB	Preferred bidder	1	8 months	Elemental cost plan with market testing

At FITN and PB stages there will be some input from supply chain, in the form of first-stage procurement.

The project team must read the extensive enquiry documents carefully to understand the requirements for the formal submission. In particular the financial aspects must comply with the forms to be submitted. It is sometimes difficult to assess how much the design should be developed, particularly when bidding costs must be kept under control. At an early client meeting it would be wise to ask for a copy of the selection criteria.

Start the submission document from day one!

The preparation of the submission document can be a mammoth task. A senior member of staff should be nominated as presentation manager.

Agree with members of the team what they are going to provide. Consider the following: site masterplan, design concepts, specification, floor plans, elevations, artist impressions and electronic ‘fly-through’ or ‘fly-past’ presentations.

Although clients ask for documents to be exchanged electronically, they often demand paper copies, sometimes running to 30 or 40 copies. It is prudent to ensure that the lorry delivering the tender can reliably transport over a tonne of cargo!

CB CONSTRUCTION LIMITED

Pricing Strategy for Stansford NHS Trust PFI Hospital

This is a combined PITN/FITN scheme leading to selection of preferred bidder. At the start of the 26 weeks tender period no design has been produced and the Trust's Public Sector Scheme will be issued shortly.

There are three stages as follows:

1. Target setting;
2. Cost control and net construction cost;
3. Submission documents.

1. *TARGET SETTING*

Affordability

Assessment by Consortium following discussions with Trust finance director.
Eg: £180 000 000

Gross internal floor area

Set area target.
Eg: £180 000 000 divide by £2 750 /m^2 = 65 500 m^2

Area breakdown

Break down area into departmental gross, communications and plant.
Eg: 14% on departmental gross for communications; 11% for plant

So Departmental gross = 52 400 m^2
Communications = 7 340 m^2
Plant = 5 760 m^2

Schedule of accommodation

- Health planner produce departmental schedule of accommodation Eg: 52 400 m^2.
- List departments in same order as Trust.
- Estimator check maths in schedule of accommodation.
- Produce strategy for closing gap between affordability and drawn area.

New build and reconfigure

Assess where accommodation can be provided in retained estate. Potentially convert Pathology into University labs and Fred Jones ward into outpatients.

Produce categories of reconfiguration: Heavy/Medium/Light or more refined.

Tactics might be:

- 90% of cost for heavy Refurb/reconfiguration.
- 55% of cost for medium Refurb/reconfiguration.
- 20% of net cost for light Refurb.

First pass cost plan for run of financial model

Produce a single sheet cost plan:

- Buildings priced on £/m^2 costs.
- Add abnormals.
- Add equipment.
- Add infrastructure charges.
- Add typical mark-ups for risk, fees, inflation and margin.

Fig. 2.7 *Contd*

Target cost plan for cost control

- Elemental breakdowns for target affordability.
- Research elemental cost plans for typical hospital buildings.
- Check elemental costs against similar projects.

2. *COST CONTROL AND NET CONSTRUCTION COST*

Cost control

- Design to cost document – issue target cost plan and elemental costs to design management.
- Attend design meeting and advise on compliance with target costs.
- Do sufficient taking off to check elemental costs.

Procurement

- Market testing to extent possible within design programme constraints.
- Consider: site works and frame; fitting and furniture; equipment.
- Advise cost team on current budget costs.

Programme for capital building price

	Activity	From week	To week
1	Issue of ITN documents	1	1
2	Project appreciation	1	2
3	Affordability target	1	3
4	Gross internal floor area (GIFA)	3	3
5	Area targets for communications and plant	3	3
6	New build/reconfigure splits	3	5
7	First pass cost plan for Financial Model	5	5
8	Target cost plan	2	6
9	Attend design meetings and monitor costs	4	24
10	Report on cost plan at regular intervals	4	24
11	Draft cashflows for interim runs of financial model	4	24
12	Take off and price external works and shell	16	20
13	Advice from trade for major packages	16	22
14	Measure final GIFA on submission drawings	22	24
15	Complete estimate cost plan	20	24
16	Complete site overheads book (project overheads)	23	24
17	Final review meeting	24	24
18	Final cashflow to include in financial model	25	25
19	Insert costs in submission documents	25	26
20	Submit bid	26	26

Net construction cost

- Produce data sheets from previous hospital tenders/contracts.
- Compare Trust brief with developing scope to identify over-provision.
- Identify scope items that exceed the benchmark costs.
- Modify elemental costs where necessary.
- Use costs current at time of tender. Inflation can be dealt with separately.
- Produce project-specific project overheads.
- Produce project-specific equipment schedule from room data sheets.
- Use spreadsheet format that accords with submission requirements.

Fig. 2.7 *Contd*

3. *SUBMISSION DOCUMENTS*

Drawings and specification

- Check submission drawings meet requirements of cost plan.
- Check submission specification meets requirements of cost plan.

Costs workbook

1. Single spreadsheet workbook with elemental cost plans, and summaries of risk, fees, prelims, cashflow and inflation.
2. Schedule of equipment costs.

Produce early cost plan, by week three if possible.
Your financial adviser will need some costs in order to set up a spreadsheet model.

Pick an architect who fully understands the market sector.
For example, up-to-date experience in education is vital for a school project. There is a temptation to choose an architect or engineer because he is well known by the client or is willing to work at risk in the early stages.

Decide who is responsible for each aspect of cost.
Show on a chart who is pricing: capital maintenance, routine maintenance, decanting, life cycle fund, new furniture, up-grading existing building stock etc.

Do people understand their roles?

Completing the price
Design fees
Infrastructure charges
Risk
Inflation
Margin

Cashflow forecast
Input to financial model, may also be required for submission.

Life cycle costs analysis (capital replacement costs)
What information is needed for the life cycle cost model?

Tender submission
Including FM, site developments, variant bids and finance.

Fig. 2.7 *Example of a pricing strategy for a PFI hospital scheme*

Consider getting specialist help to produce copies of the submission documents. The tender team will not have sufficient time for collating and binding submission documents.

Decide on estimating method to adopt

It is important to know the construction cost from an early stage. An approximate estimate method should be used at the start, such as superficial cost plan or unit of accommodation. Then costs can be refined when design information is available from the designers.

Since PFI projects are very large, and the design developing during the whole tender period, it is unlikely that contractor's bills of quantities can be produced in the tender period. There is a reliance on cost planning and approximate estimating techniques.

Figure 2.7 is the pricing strategy for a hospital scheme at the Invitation to Negotiate (ITN) stage of a PFI hospital scheme.

3 Forms of contract

Introduction

Standard forms of contract exist to identify the roles and responsibilities of the parties, and their agents; and provide rules to protect and direct the parties should things go wrong. Clients have a wide choice of standard contracts for construction work, in particular the forms used for building, which cover most of the common procurement systems. Standard conditions have been written by bodies such as the Joint Contracts Tribunal (JCT) and Institution of Civil Engineers (ICE), following changing procurement methods in the industry – they seldom lead. The alternative approach would be to produce a common form of contract for all construction work whether in the public or private sector, building or civil engineering, English or Scottish law. This idea is not new; it was one of the principal recommendations of the Banwell Report in 1964. Sir Michael Latham also addressed the problem in 1994. One of his recommendations was for public and private sector clients to begin to use the New Engineering Contract (NEC) family of contracts, in particular the Engineering and Construction contract. These ideals have not borne fruit, and there are more forms of contract published every year using different principles, terminology and apportionment of risk.

Where a standard form of contract is proposed, an estimator must carefully examine the information which will be inserted in the Appendix and note any amendments to the standard conditions so that the terms of the offer can be evaluated. An estimator should assess the cost of complying with certain terms and advise management of any onerous conditions that may influence the bid. Non-standard forms of contract are sent to the commercial department, company secretary or director so that the conditions can be evaluated before the final review meeting.

Essentials of a valid construction contract

Construction contracts are the same as any other contract, and in the end, will depend on general principles of law. A short definition of a contract is ‘an agreement between two or more parties which is intended to have legal consequences'. In construction, the contract is generally for producing a building or part of the built environment, and can be entered in one of four ways:

1. Implied by conduct of the parties; a contractor may submit an offer and later have access to the site.
2. By word of mouth; typically where an offer is accepted by telephone.
3. By exchange of letters; common for small domestic works of extension, alteration or repair.
4. Using a written contract; the contract documents often include the enquiry documents, the written offer, minutes of meetings, tender-stage correspondence, a programme, a method statement and a formal contract with the agreed terms.

An estimator should keep a separate file containing all papers which will form the basis of the agreement. This is most important where negotiations take place after a formal offer has been made. If the estimator secures the work, he will need to present the contractor's undertakings to the construction staff at a handover meeting. The importance of written evidence cannot be overstressed because usually the formal documents will be the only evidence of what exactly had been agreed at the beginning of a project.

To make a contract valid and legally enforceable, certain simple rules are applied, as follows:

1. There must be an offer by one party and an acceptance by the other or others.
2. Each party must contribute something of value to the other's promise; a client is responsible for making payments and the contractor must complete the construction.
3. Each party must have the legal capacity to make a contract.
4. The parties must have exercised their own free will, without force or pressure.

A contract comes into existence when an offer has been unconditionally accepted. In construction the offer is the 'tender', 'estimate' or 'bid' and suppliers and sub-contractors sometimes refer to their offers as 'quotations'. The term 'estimate' could be used in a wider context to mean a guide to how much something will cost. This ambiguity should be avoided wherever possible.

A contractor expects to receive an acceptance in clear terms from the client or his adviser. A letter of intent is often used to let a contractor know that he should prepare to start work. This statement should state clearly that all work carried out by the contractor and specialists, even if the contract does not follow, will be paid for in full.

An offer must be distinguished from an 'invitation to treat' which is an invitation for others to make an offer. In an auction sale, for example, an auctioneer invites offers which he may accept or reject. In a similar way, a client seeking tenders is not bound to accept the lowest or any bid. An offer cannot be accepted once it has terminated. Termination happens:

1. On death of either party if the contract is for personal services.
2. By the contractor withdrawing the offer.
3. After a specified time (usually stated in the tender instructions or stated by the contractor in his tender) or after a reasonable time.
4. When there has been outright rejection by the client, or where the client makes a counter-offer, usually in the form of a qualified acceptance.

Although contractors and sub-contractors can withdraw their tenders at any time before acceptance, this practice can lead to many problems for the recipient. A main contractor, awarded a contract, could lose a large sum of money if a sub-contractor's offer, used in a tender, is withdrawn or changed. The main contractor should clearly state in his enquiry documents the acceptance period for sub-contractors' tenders taking into account the requirements of the main contract and the possible delay in placing contracts. A contractor can reduce this risk by thoroughly checking quotations for sufficiency, completeness and compliance with the tender requirements. Clearly it is important to maintain up-to-date lists of reliable trade contractors.

Standard forms of contract

The standard printed forms of contract have been developed over many years to take account of the many events which could occur during and after a construction project. Contract law will of course deal will many of the problems, but there are many matters peculiar to construction which need clarification. Once these terms have been incorporated, they reduce the likelihood of disputes which can lead to arbitration or litigation. Contract conditions are outlined by a reference being made to the standard conditions in the tender documents, with amendments to suit the particular project. The parties to most of the JCT contracts sign copies of the printed forms, which is not the case for the ICE and GC/work/1 forms, which could be used by reference to an 'office' copy. JCT contracts are now printed in two parts: the Agreement which is signed by the contractor and sub-contractor, and Conditions of Sub-contract, which are incorporated by reference in the Agreement.

Some clients require a contract to be executed under seal; the standard forms have provision for this after the Articles of Agreement. A contract executed as a deed (or speciality contract) would allow an action to be brought within 12 years as opposed to 6 years for simple contracts. It is unwise to amend the conditions of a standard form because great effort has gone into producing a carefully drafted document with many links between clauses and other documents. Nevertheless, all contracts take effect by agreement and so standard contracts can be amended in any way the parties choose.

The standard form contracts currently in use between client and contractor are:

1.	Standard Form of Building Contract – with or without quantities	JCT98
2.	JCT Standard Form with Contractor's Design	WCD98
3.	JCT Agreement for Minor Building Works	MW98
4.	JCT Intermediate Form of Building Contract	IFC98
5.	JCT Standard Form of Management Contract	MC98
6.	GC/Works/1 for Government Contracts	1998
7.	ICE Conditions of Contract 7th Edition	1999
8.	NEC Engineering and Construction Contract	1996
9.	ACA Project Partnering Contract	PPC2000
10.	JCT Major Project Form	MPF2003

The JCT is made up of bodies representing differing interests in building work, including the British Property Federation (BPF), Construction Confederation, Royal Institute of British Architects (RIBA), Royal Institution of Chartered Surveyors (RICS), Local Government Association, consulting engineers and specialist contractors' associations. The Standard Form of Building Contract has six variants that cater for local authority and private clients, contracts with bills of quantities, without quantities and those with approximate quantities. The six forms do not differ in substance, but describing and costing the work is easier with bills of quantities. The local authority forms are similar to private forms but contain extra terms for local government law and practice. Each of the variants creates a lump-sum contract: the lump sum is that which the contractor expects to be paid but is subject to adjustment in many carefully defined ways, mainly following the issue of an instruction. A bill of quantities is also used with the ICE conditions for civil engineering work, but the conditions create a remeasurement or 'measure-and-value' contract where all the bill items will be remeasured as the work proceeds. The ICE conditions are alone in defining permanent and temporary works; the ICE form makes it clear that temporary works are solely the responsibility of the contractor except where they have been designed by the engineer. The GC/Works/1 and NEC contracts are used for building and civil engineering works. The NEC forms use non-technical language, which allows their use for a variety of construction and engineering projects. The basis for valuing work is also flexible – there are options for bills of quantity, activity schedules or a cost reimbursement basis. GC/Works contracts are also available in many variants, including major and minor works, design and build, construction management and M + E contracts.

It can be seen that new editions of most standard forms have been published in the late 1990s. This was in response to the 'Latham' Report 1994 and many changes brought about by the Housing Grants, Construction and Regeneration Act 1996. In particular many changes have been made for the following:

1. Electronic Data Interchange, EDI (requires a separate EDI agreement to be entered into).
2. CDM Regulations.
3. Construction Industry Scheme (a contractor cannot pay a sub-contractor unless the sub-contractor has provided valid authorization in the form of a registration card or tax certificate).
4. Third party rights (contracting out).
5. Landfill tax (addition to fluctuations clause).
6. Contractor's retention bond.

The appendix section of standard forms enables the parties to insert provisions that vary from job to job, such as:

1. *Sums of money* for liquidated damages and insurances;
2. *Periods of time* for carrying out the work and making payments;
3. *Percentages* for retaining parts of the interim payments;
4. *Statements* giving the options which apply to the contract, an important example would be to show which clause has been selected for dealing with price fluctuations.

This information must be given to tenderers, otherwise they will make their own assumptions.

Sub-contract forms

The contractual links between parties using standard forms of contract are shown in Figs 3.1 and 3.2.

Terms used

Nominated sub-contractors are persons whose final selection and approval, for supplying and fixing materials or goods, has been reserved to the architect (clause 35 JCT98). In the ICE conditions nominated sub-contractors are 'any merchant

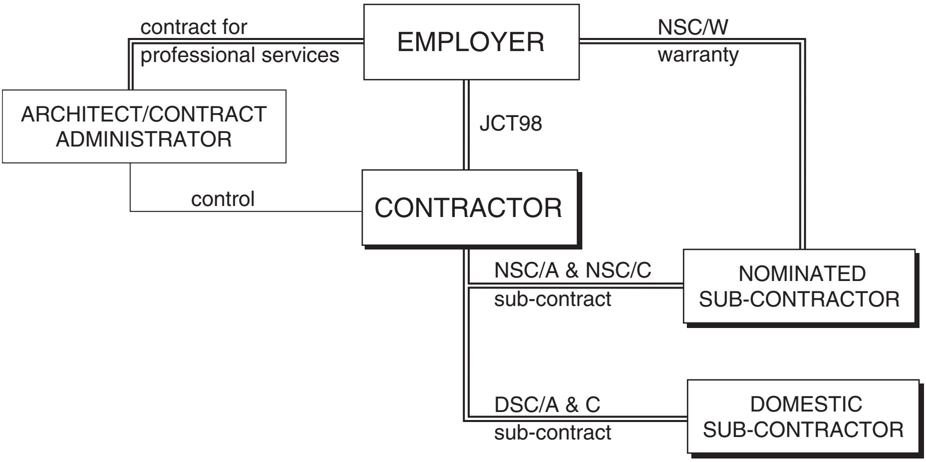


Fig. 3.1 *Contractual relationships between parties using JCT98*

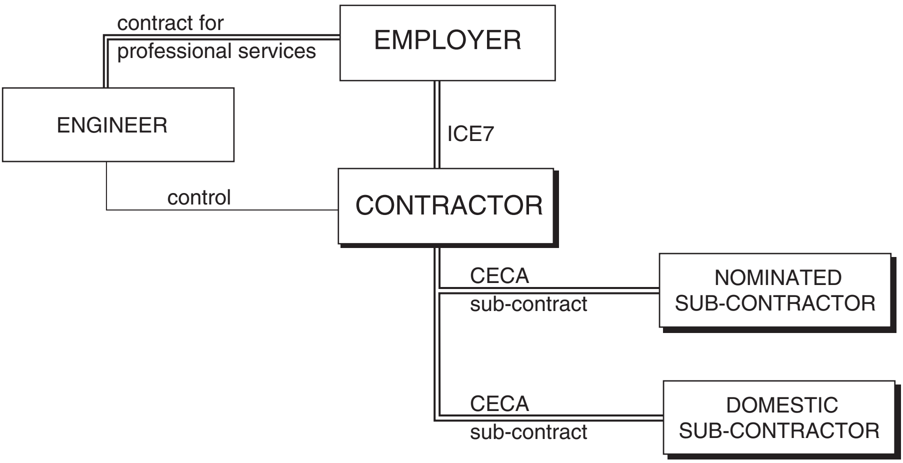


Fig. 3.2 *Contractual relationships between parties using ICE 7th Edition*

tradesman specialist or other person firm or company nominated in accordance with the contract to be employed by the contractor for the execution of work or supply of materials for which a prime cost has been inserted in the contract …'. There is usually a right of objection to the nomination of particular sub-contractors because it would be contrary to contract law to insist that a party enters a contract involuntarily.

Domestic sub-contractors are engaged where a contractor elects to sub-let part of the work with the written consent of the architect (clause 19 JCT98). The ICE contract goes on to say that the contractor shall not sub-let all the works without the written consent of the Employer.

'*Named sub-contractor*' is the term used in IFC98 and ACA84 where the contractor is required to enter a (domestic) sub-contract with a firm named by the architect.

Many contractors sub-let large portions of their work to specialist contractors, the main exceptions being where reliable building workers are needed for difficult or small maintenance contracts. Under clause 19 of JCT98, there are two arrangements for sub-letting work to domestic sub-contractors:

1. The architect approves the sub-letting of the works to a firm of the contractor's choosing.
2. The contractor must choose a sub-contractor from a list of at least three names which have been included in the specification, schedules of work or contract bills, (in the case of bills, for work fully measured in the bills and priced by the contractor).

The latter arrangement is used sometimes to replace nominated sub-contractors with a short list of specialists who may have expressed an interest in doing the work. Where large service installations are required, the quantity surveyor can send the drawings and specification to each of the sub-contractors on the list so the main contractors can avoid unnecessary duplication. The estimator just sends his enquiry letter with details of the conditions which the sub-contractor will be expected to sign.

If a single firm is named in the contract bills to carry out work that is measured, then it should in effect be a nominated sub-contractor. In fact this would be bad practice because SMM7 requires a PC sum for work to be executed by a nominated sub-contractor. This problem is unfortunately all too common. An example is where a client or consultant wants a particular window system but wishes to avoid setting up a formal nomination. The standard form of contract does not allow the architect to choose a specialist who is to become a domestic sub-contractor.

The standard forms commonly used between contractors and their sub-contractors are:

1. DSC/C: Domestic sub-contract conditions produced by JCT for use with the JCT98 main forms, with or without quantities. These conditions are widely used by main contractors often with amendments.
2. JCT is to publish a short form of domestic sub-contract in 2003 that can be used in connection with most standard forms of contract but principally with the Agreement for Minor Building Works.

3. DOM/2: Domestic sub-contract for use with the JCT Standard Form with Contractor's Design 1998. The document comprises the articles of agreement with a schedule of changes, such as:
   (a) Delete 'Architect' and insert 'Employer';
   (b) Provision for stage OR periodic payments.
   The JCT version of this sub-contract is due for publication late in 2003.
4. CECA: Form of sub-contract for use with the ICE Conditions of Contract (commonly referred to as the 'Blue Form').
5. NAM/SC: Conditions for named sub-contractors under the Intermediate Form of Contract 1998.
6. IN/SC: Domestic sub-contract for use with IFC 1998.
7. GW/S: Standard form of sub-contract for use with GC/Works/1; published by Construction Confederation and approved by specialist trade associations. The terms of this sub-contract stem from DOM/1, NSC/4 and obligations passed down from GC/Works/1.
8. The Engineering and Construction Sub-contract.

Most sub-contract forms are printed in two parts: the articles of agreement and conditions. This could be to save money since only the articles of agreement are needed each time contracts are signed.

Non-standard forms of sub-contract are sometimes used by main and management contractors to impose extra obligations and ensure the sub-contractor is bound by the same conditions found in the main contract. The trade bodies which represent the views of specialist sub-contractors claim that their members have suffered under terms such as:

1. The 'pay when paid' arrangement which means that a sub-contractor will be paid when the main contractor has received a payment. This practice is now negated by the Housing Grants, Construction and Regeneration Act 1996.
2. The 'discount fiddle' happens when the 2.5% discount for prompt payment is held by the main contractor, well beyond the agreed time.
3. Reduced attendances provided by main contractors, in some cases expecting sub-contractors to provide their own scaffolding, temporary services, disposal of rubbish and hoisting.
4. The sub-contractor's right to an extension of time might only be granted when the main contractor himself receives an extension.
5. The main contractor can hold wide-ranging rights to take sums of money from payments, sometimes without having to prove that a loss has occurred.
6. A requirement for a sub-contractor to protect his work even when he is not present on site.
7. Badly drafted 'on demand' bonds and parent company guarantees irrespective of the size or stature of the company.

It is becoming more common for main contractors to be on the receiving end of some of these practices. In particular, some clients want set-off clauses and performance guarantees which can be taken 'on demand' and may be kept in place for a long time after the project is complete. Both main and sub-contractors when faced with such enquiries should submit their tenders with a statement asking to discuss the terms of contract with the client before entering a formal agreement.

The practice of nominating sub-contractors has declined to the point of extinction because although the main contractor is contractually responsible for all the works there is a reduced liability for the work sub-let under the nomination system. The JCT98 Form of Contract makes the following provisions:

1. Delay by a nominated sub-contractor is a relevant event that can lead to an extension of time under clause 25.
2. Breach by the nominated sub-contractor imposes a duty on the architect to nominate a new sub-contractor if the first is incapable of performance.
3. Failure of design by a nominated sub-contractor under clause 35.
4. Delay caused by a nominated sub-contractor who gives late information.

In a traditional contract, where a decision to adopt a particular supplier or sub-contractor is needed before appointing a main contractor, a nomination is required. It allows the architect to prepare full working drawings, integrating and coordinating specialist design with building design. Costs are saved at tender stage because the specialist prepares one tender on a standard set of conditions.

The main documents for nomination introduced by the JCT80 contract are:

1. NSC/1: JCT Standard Form of Nominated Sub-contract Tender and Agreement is used to invite tenders from potential nominated sub-contractors which gives the sub-contractor information about the contract, allows the sub-contractor to submit his tender and later agree programme and attendance details with the main contractor.
2. NSC/2: JCT Standard Form of Employer/Nominated Sub-contractor Agreement which sets out the obligations of the sub-contractor to exercise reasonable skill and care in the design of the works and perform satisfactorily when under contract to the main contractor. It is important to remember that neither the architect nor the contractor is party to this contract, which is used to provide a warranty agreement to protect the client's interests. The client also has obligations, mainly to pay for design work and materials before and after the start of construction works.
3. NSC/3: JCT Standard Form of Nomination is an instruction from the architect for the contractor to enter a sub-contract.
4. NSC/4: JCT Standard Form of Nominated Sub-contract that should be read in conjunction with clause 35 of the main contract form.

Comparison of forms

Contract documents all include the various parts of the standard forms plus:

JCT98	Contract drawings, contract bills
WCD98	Employer's requirements, contractor's proposals (including contract sum analysis)
MW98	Contract drawings, contract specification, priced specification or schedule of rates
IFC98	Contract drawings, contract specification, schedules of work or bill of quantities
MC98	Project drawings, the project specification, Contract cost plan and the schedules
GC/Works/1	Drawings, specification, bills of quantities or schedule of rates
ICE	Drawings, specification, bill of quantities, tender and the written acceptance

The employer may deduct a *retention* as follows:

JCT98	5% until practical completion then 2.5% (3% if estimated value is over £500 000)
WCD98	5% until practical completion then 2.5%
MW98	5% until practical completion then 2.5%
IFC98	5% until practical completion then 2.5% (no retention on insurance payments)
MC98	3% for management contractor and works contractor (not applied to fees) and 1.5% for work which has reached practical completion
GC/Works/1	5% of each advance payment and nil for the value of variation instructions
ICE	Recommended not to exceed 5%, recommended limit is 3% of tender total, and retention halved following certificate of completion.

All the standard forms contain terms for insurances but only the ICE conditions include a recommended form of bond. The new (Edition 3) of the GC/Works/1 contract has brought in some radical changes which have an effect on the tender. For example, there is no longer a discount retained by the contractor from PC sums for nominated sub-contractors. Valuations made monthly by reference to a pre-determined stage payment chart would undervalue the work at the beginning of a contract. The Minor Works agreement does not cater for long projects which need a price fluctuations clause and does not provide for nominations by the supervising officer.

Selection of contract forms

For many clients the choice of contract will be dictated by the type of work, size of contract and their position in society. A local authority carrying out a

CONTRACT SELECTION CHECKLIST

Procurement method	Lump sum	
	Measurement	
	Cost reimbursement	
Design	Employer	
	Part by contractor	
	Contractor	
Cost control document	Bills of quantities	
	Schedule of rates	
	Priced specification	
	Contract sum analysis	
Payment	Stage	
	Time-related	
	Turnkey	
Roles and relationships	Client	
	Contractor	
	Design team	
	Specialists	
Time	Open	
	Fixed	
	Acceleration	
	Damages	

Fig. 3.3 *Simplified checklist for the selection of a contract*

£2 million refurbishment contract, for example, is likely to choose the JCT Standard Form of Building Contract, Local Authorities Edition, with approximate quantities. A contractor offering his services to design and build a factory unit will suggest the Standard Form with Contractor's Design WCD98. Perhaps the most difficult decisions to be made by a client are the composition of the professional team and how financial risks will be shared. In particular he must decide whether to commission a bill of quantities or ask for tenders on a lump sum. Figure 3.3 shows the primary elements which need to be considered. Clearly a non-construction client would need professional advice in selecting a contract that satisfies all his needs.

The Joint Contracts Tribunal publishes a guide to selecting the appropriate JCT form of contract which is available on their website: www.jctltd.co.uk.

4 Tender documentation

Introduction

The key to a successful project often lies in the understanding and cooperation that is essential from all participants; each must be clearly aware of his duties and rights. The documentation is the vital link between design and construction.

Adequate and accurate drawings and specifications are indispensable if the team is going to achieve success in terms of quality, time and cost. Drawings in particular have served the construction industry well for hundreds of years as the primary means of communication. Unfortunately, poor specification writing continues to be a weak link in the information chain and leads to disputes, particularly in a competitive market where estimators will use a strict interpretation of the documents to arrive at the lowest tender. Another cause of friction is when bills of quantities differ from the drawings and specification. This often happens when the quantity surveyor is short of information from the designers.

Time spent on preparing documents, which aid the contractor's understanding of the work, will benefit the finished product. In 1964, the report of the committee chaired by Sir Harold Banwell stated:

> It is natural that a client, having taken the decision to build, should wish to see work started on site at the earliest possible moment. It is the duty of those who advise him to make it clear that time spent beforehand in settling the details of the work required and in preparing a timetable of operations … is essential if value for money is to be assured and disputes leading to claims avoided. It is also necessary for the client to be told of the need to give the contractor time to make his own detailed arrangements after the contract has been let, and of the penalties of indecision and the costs of changes of mind once the final plans have been agreed.

Tenderers will assess the quality of documentation, partly because poor information can add to the time wasted by site supervisors and partly because unreliable information can lead to claims. If the contractor has enough information he can avoid guesswork, include all the important items in his tender and will not need to add global sums for poorly defined elements of work.

Coordinated project information

The Coordinating Committee for Project Information was set up in 1979 to look for improvements in the way construction documents are produced and presented. The committee published its recommendations in December 1987 for drawings, specifications and bills of quantities for building work; and included proposals for ways in which the following problems may be overcome:

1. Missing information – not produced, or not sent to site.
2. Late information – not available in time to plan the work or order the materials.
3. Wrong information – errors of description, reference or dimension; out-of-date information.
4. Insufficient detail – both for tender and construction drawings.
5. Impracticable designs – difficult to construct.
6. Inappropriate information – not relevant or suitable for its purpose.
7. Unclear information – because of poor drafting or ambiguity.
8. Not firm – provisional information often indistinguishable from firm information.
9. Poorly arranged information – poor and inconsistent structure, unclear titling.
10. Uncoordinated information – difficult to read one document with another.
11. Conflicting information – documents which disagree with each other.

The Building Project Information Committee (BPIC) encouraged the use of CPI throughout the UK building industry. To endorse their work, Sir Michael Latham, in his 1994 report, says 'CPI is a technique which should have been normal practice years ago … its use should be made part of the conditions of engagement of the designers'.

Drawings

Drawings are the most common means of communication for all types and sizes of project; the main exceptions being some maintenance contracts and minor works which can be scheduled or described in a written statement. The CPI initiative includes a production drawings code that gives advice on good practice for planning and producing drawings. The code stresses the need for careful coordination of the information, shown on drawings, with the other documents. One way to avoid mistakes is to replace specifications on drawings with reference numbers, which refer to the written specification. This could, however, lead to confusion on site if taken to an extreme case such as a drainlayer asked to lay a drain

R12/123 in a trench type R12/321. Would he need to be armed with the drawing and specification? Probably not; because designers understand the need for clear information for those working on site and on large-scale projects, site engineers interpret the drawings for the operatives.

The CPI code is to be read with BS 1192:1984 'Construction Drawing Practice'. This British Standard (BS) was being rewritten during the 1980s and published in five parts. This revision was brought about by the need for international standardization of drawing practice; and many industrialized countries have taken part in the search for suitable conventions and methods. Part 5, dated 1990, is a guide for the structuring of computer graphic information. The aim of the new standard is to provide good drawing practice which will provide communication with:

1. Accuracy.
2. Clarity.
3. Economy.
4. Consistency.

between architects, contractors, civil engineers, service engineers and structural engineers.

There are four main types of drawing commonly used in construction:

1. Survey drawings – which are based on a measured survey or an Ordnance Survey sheet; and are used to produce block and site plans.
2. Preliminary drawings – which are the designer's early interpretation of the brief.
3. Production drawings – include general arrangement drawings, layout drawings, assembly drawings, standard details such as those provided for highways drainage, schedules and additional detail drawings as necessary. They are used to go with applications for statutory approvals, to invite contractors to tender, and construction purposes.
4. Record drawings – are used to show a record of construction as it has been built and services installed. They provide essential information for maintenance staff.

Since the publication of SMM6, some drawn information can now be provided with bills of quantities. SMM6 recommended the use of bill diagrams to help describe an item of work.

In SMM7, general rule 5.3 states 'dimensioned diagrams shall show the shape and dimensions of the work covered by an item and may be used in a bill of quantities in place of a dimensioned description, but not in place of an item otherwise required to be measured'. The intention is for these diagrams to be prepared by the quantity surveyor and included in the bill of quantities. Often this has not happened with either SMM6 or SMM7. This might be because bills are produced using text-based computer systems and more drawings are now sent to contractors at tender stage.

Specifications

A specification is prepared by an architect or consulting engineer to provide written technical information mainly on the quality of materials and workmanship. The specification would be a contract document in its own right if the contractor tenders on the basis of drawings and specification only. Where bills of quantities are used for building work the specification is included with the bill of quantities as preambles. In this way the specification again becomes part of the contract documents.

There are some standard specifications published for civil engineering contracts – in particular specifications for highways and the water industry. A bill of quantities for civil engineering work will include specification clauses and a preambles section which is used to define any departures from the standard method of measurement.

The designer notes the matters needing detailed specification clauses as he prepares the drawings. The quantity surveyor will advise on a proper format for the bill of quantities. On small contracts, where a PQS is not appointed, an architect could produce a specification which is broken down into parcels of work. The contractor would be expected to price the document to assist post-contract cost control, such as the preparation of valuations. In this context, this document is sometimes called a schedule of works or priced specification. Another document in the CPI suite is a code for specification writing. The Project Specification Code is a guide to good practice.

Many architects, engineers, quantity surveyors and contractors will subscribe to the National Building Specification (NBS), which is written in line with the Common Arrangement of Work Sections (CAWS). The NBS is a library of clauses, regularly updated, using either the CI/SfB classification or the recommended CAWS method which divides building into over 300 work sections which aim to reflect the way work is sub-contracted. In broad terms CI/SfB relates to the elements of a building and the CAWS is in trade order. Normally, only a fraction of the work sections will be used on a simple project.

Specifications are prepared by design teams (or contractors in the design and build contract) using their own procedures and often vary widely in coverage and technical content. It has been said that specifications have lagged furthest behind drawings and bills for quality and helpfulness. This is probably unfair where the NBS is carefully edited and changes thoroughly researched with assistance from manufacturers and specialist sub-contractors.

There is a danger that specifications may be ignored by contractors, subcontractors and suppliers because they:

1. Contain many standard clauses which are not relevant to the job.
2. Are usually too long.
3. May be a collection of protection clauses, for example: 'to the best quality', because the designer is not sure what quality to specify.
4. Are sometimes out of date.

Traditionally the architect has been responsible for the specification, but may delegate the printing to the PQS. The CPI initiative assumes that the designer provides more reliable specification information before tender stage. The PQS must ensure the bill descriptions do not conflict with the specification. With the introduction of SMM7, bill descriptions include cross-references to the specification, which will remove duplication.

The Project Specification Code recommends improvements, so specifications will be:

1. Complete – covering every significant aspect of the work.
2. Project specific – produced for the project, without irrelevant material.
3. Appropriate – for available materials and skills; and can be checked and standards enforced.
4. Constructive – helping all the parties to understand what is expected of them.
5. Up-to-date – using current good building practice and most recent standards.
6. Clear – economically worded.

Bills of quantities

The traditional purpose of bills of quantities is to act as a uniform basis for inviting competitive tenders, and to assist in valuing completed work. Bills of quantity are first designed to meet the needs of estimators, although some estimators say the bill format has changed to assist the consultants, in cost planning exercises through the widespread use of elemental bills.

A contractor can also make use of the bill of quantities in many ways, for example:

1. To plan material purchasing (note the danger in ordering from a bill: the contractor should always order materials from drawn information and the specification, making the contract administrator aware of any differences).
2. Preparing resourced programmes.
3. Cost control during the contract to ensure work is within budget.
4. Data collection during construction for bonus systems and feedback information for estimators.

Unlike drawings and specifications, there have been rules for measuring building work for many years. The first edition of the Standard Method of Measurement for Building Works was published in 1922 and has been a compulsory document since its incorporation in the RIBA (now JCT) contract 1933. The civil engineering methods include rules for highways and the water industry but the publication for mainstream civil engineering works is the Civil Engineering Standard Method of Measurement (CESMM3) now in its third edition 1991.

Bills of quantities for building are divided into the following sections:

1. Preliminaries.
2. Preambles.
3. Measured work.
4. Prime cost and provisional sums.

There are number of formats for civil engineering bills of quantities. CESMM3 gives the following sections:

1. List of principal quantities.
2. Preamble.
3. Daywork schedule.
4. Work items (Class A General items may be grouped in a separate part of the bill of quantities).

In both sectors of construction, the estimator prices sections 3 and 4 and the specific items described in the preliminaries, having taken full account of all the requirements in the other sections.

The preliminaries (general items) section gives general details about the project and contract conditions, as follows:

1. Description of the work, location of the site, site boundaries, names of parties, and lists of drawings;
2. The form of contract used, with any amendments clearly defined, with contract appendix details giving information such as the retention percentage, liquidated damages, possession and completion dates and fluctuation provisions;
3. Specific requirements which should be priced by the contractor as fixed or time-related items to reflect the actual costs arising from supervision, site accommodation, temporary works, site running costs, general plant, transport, client's requirements and safety.

CESMM3 and SMM7 provide for fixed and time-related items so that a contractor can show the cost of bringing plant or facilities to site, their maintenance during the job and removal on completion. The SMM7 Measurement Code suggests that prices should be split between fixed and time-related sums only if the tenderer wishes to do so. He rarely does! There should also be space in the preliminaries section of a bill for the contractor to add to the list of items to suit his particular methods of working. In CESMM these are called 'method-related charges'.

In bills of quantities for building work, the preambles contain specification clauses which provide information about the expected type and standard of materials and workmanship. They should relate to the work in the bill and so reduce the length of work descriptions. The measured work section of the bill of quantities is divided into trade or element headings and measured according to the rules of a standard method of measurement. SMM7 defines its role by the statement 'The standard method of measurement provides a uniform basis for measuring building works, and embodies the essentials of good practice. Bills of quantities shall fully describe and accurately represent the quantity and quality of the works to be carried out.' The Standard Form of Building Contract JCT80 requires the use of the standard method of measurement where the contract includes bills of quantities. Clause 2.2.2.1 states 'the contract bills shall be prepared in accordance with SMM7'.

Accuracy in preparing a bill is essential because the contract conditions allow the contractor payment for any omission or error in description or quantity. Clause 2.2.2.2 states '. . . an error is treated as a variation' and clause 8.1 states '. . . all materials, goods and workmanship shall be to the standards described in the contract bills'. Clause 1.10.3 JCT Work Contract/2 used with the Management Contract similarly states 'the quality of the work included in the Works Contract Sum or Tender Sum shall be deemed to be that which is set out in the bills of quantities'.

SMM7 begins with general rules for preparing bills, followed by details of preliminary particulars and about 300 work sections under 24 main headings. Rule 4.1 is an example of a rule of particular interest to an estimator:

> Dimensions shall be stated in descriptions generally in the sequence length, width, height (or depth). Where ambiguity could arise the dimension shall be identified.

Where work can be identified and described in a bill of quantities, but the quantity cannot be accurately determined, an estimate of the quantity can be given and identified as an 'approximate quantity'. This will typically occur when dealing with ground problems such as stone filling to make up levels, or maintenance work such as cutting out defective rafters.

A provisional sum in a bill of quantities is for work which cannot be described and given in items, which follows the measurement rules. SMM7 introduced two kinds of provisional sum, defined and undefined, both for work which is not completely designed. 'Defined' means the nature and quantity of the work can be identified, and the contractor must allow for programming, planning and pricing preliminaries. 'Undefined' means that the scope of the work is not known, and the contractor will be paid for all costs associated with carrying out the work, planning the work, and overheads, which are reasonable.

A contingency sum is often included in a bill, as a provisional sum, for unforeseeable work, such as difficult ground conditions. The reason for its inclusion is not stated in the bill. The sum is spent at the discretion of the architect/contract administrator. SMM7 does not mention the contingency sum.

A prime cost sum is provided in a bill of quantities for work to be carried out by a nominated sub-contractor (SMM7 A51) or for materials to be obtained from a nominated supplier (SMM7 A52). Work by statutory authorities is now given as a provisional sum (SMM7 A53). SMM7 does not define PC sums to the extent found in SMM6 presumably because the form of contract deals with this. The term 'prime cost' is also used in connection with:

1. An allowance for the cost of a material such as bricks when the final selection has not been made; for example, Facing Brickwork PC £250.00 a thousand (the estimator must be told how to deal with waste, transport and other on costs).
2. The basic cost of labour, materials and plant in cost-plus arrangements such as daywork contracts and some management contracts. SMM7 now gives dayworks as a provisional sum (A55).

The SMM7 Measurement Code recommends clear information about nominated sub-contractors' work, so that the tenderers can assess their responsibilities, for their programme. At tender stage the contractor should know:

1. The extent of the nominated sub-contractor's work with approximate quantities or values in each part of their work;
2. The location of the work, in particular where large items of plant will be situated;
3. Special attendance which is needed by the specialists, with the location and dimensions being given wherever possible (if details of special attendance are not available then a provisional sum should be used).

SMM7 provides for certain drawings to be issued to contractors at tender stage. More detailed guidance on which drawings are needed is given at the beginning of each work section in SMM7. The following drawings are considered to be essential:

1. Block plan.
2. Site plan.
3. Plans, sections and elevations.

Component drawings are required by general rule 5.2 to show the information necessary for the manufacture of components. The work sections, which require component drawings, are listed in Appendix 2 of the Measurement Code.

Bill formats

The development unit, which prepared SMM7, made some general recommendations for good practice, as follows, and included some of them in the SMM7 Measurement Code:

1. The full benefits of the CPI initiative will be gained if bills and specifications are prepared using the CAWS. By the late 1990s this recommendation had been implemented and well established for fully documented building schemes.
2. Items for separate buildings should be kept separate, by providing separate bills.
3. Items for external works should be given in a separate bill.
4. Provisional sums, prime cost sums and dayworks should form a separate section at the end of the measured work part of the bill (avoiding confusion during the tender stage). Provisional sums inserted in the preliminaries bill cause a great deal of confusion and can be missed by an estimator expecting to find all written-in sums grouped in a dedicated section.
5. The summary should be at the end of the bills of quantities.

Estimators have a strong preference for trade bills which separate work strictly in accordance with the measurement rules and trade headings of SMM7. This is convenient for sending enquiries to suppliers and sub-contractors, but does not help in showing the relative quantities for each building in a development.

Elemental bills relate to the functional parts (or elements) of a building; for example, upper floors, roofs, and external walls. This has the benefit of helping the quantity surveyor check his cost analysis and collect data for future cost exercises, and the estimator can find the location of work. The main disadvantage is that it produces a longer bill which is not only less efficient to prepare but will add to the work of the estimator. He must bring together items for each trade from various parts of the document, which can produce great deal of paperwork.

Sectionalized trade bills could be used to overcome the disadvantages of the elemental bill. For estimating purposes the trade order bill is subdivided into elements. If each element is printed on separate sheets, it is possible to assemble the bill in trade *or* elemental order.

Computer packages are available for producing bills of quantities and subsequent financial control. They are usually based on a library of standard items that can be called up by using codes or by accessing a hierarchal database through menus. Measurements can be entered either manually or using digitizers and the computer will sort the items before printing the complete bill of quantities.

CPI and the estimator

The CAWS was developed to align packages of work more closely with the pattern of sub-contracting in the industry. For example, SMM7 now clearly distinguishes between many cladding methods and materials in group heading H, Patent glazing, Curtain walling and many kinds of sheet cladding. Unfortunately, this fine subdivision has some awkward results. For example, an enquiry for plumbing will include measured work from Group R Disposal systems, Group S Piped water supply systems, Part T Mechanical heating, Group N Sanitary appliances and Group Y for pumps and calorifiers. Furthermore, with an elemental bill any of the 300 work categories can be repeated for each element.

Two of the objectives of SMM7 were: (1) to simplify bills of quantities and (2) to develop a method which could help with computer applications. To an extent, modern bills of quantity have been accepted by estimators because they have developed an understanding of the coding system and descriptions have not been shortened by the amount envisaged when SMM7 was published. Many quantity surveyors have avoided a total reliance on specifications; they are aware that estimators need more than an abbreviated description.

With the SMM7 there are now shorter bills of quantities. Many items have been removed where they had little cost significance. Other items have been grouped, again to lessen the number of measurable items of work. The nominal size of bar reinforcement is stated but its location is not. This means that the bill rate for 12 mm reinforcement in an eaves beam will be the same as 12 mm bars in a ground floor slab. An estimator may be able to identify the weights in each location by studying the drawings and bar schedules, but will all the estimators and sub-contractors do the same? Since SMM6 was introduced, estimators have been faced with formwork measurements grouped in height bands, which effectively mean that he does not know the actual quantity. As an example, 200 linear metres of formwork 500 mm–1.00 m high could be as little as 100 m^2 or as much as 200 m^2 of shuttering. It would take some time to measure the real area from the drawings received at tender stage.

The move towards computer-aided billing and estimating has been difficult, and many doubt whether SMM7 has helped. On first sight, the tables of measurement rules appear to be an aid to all those involved in computer-aided bill production and pricing. Unfortunately there have been some problems:

1. There are too many rogue items in an average bill, which do not match a standard coding system.
2. Libraries of standard descriptions do not use the numbering system given in SMM7.
3. Computer packages have moved away from code numbers for items, preferring to use windows of items from which relevant descriptions and resources can be selected.

It is also argued that the standard method of measurement is not a method for producing bills nor is it an aid to pricing bills. It is purely a set of rules about how work is measured and what is to be included in an item (item coverage).

The CESMM3 states that the system of work classification adopted by the method should simplify the production of bills of quantities making the use of computers easier. The foreword to the First Edition encourages the use of work reference numbers to identify work items. This uniform (and coded) description of work was seen as a way to standardize the layout and contents of bills of quantities; and the engineer is recommended to use the standard method numbers in bills of quantities.

This recommendation does not exist in SMM7. The use of code numbers as item references in civil engineering bills causes some confusion when inputting items in a computer system. Many estimators change the reference system to the familiar A, B, C etc. format and use the code numbers as a sort code reference.

Every estimator, whether working for a contractor or sub-contractor, must understand the coverage rules of the standard method, which applies to the contract. This is important where sundry items are now included in the main work item. For example, in SMM7 formed joints in *in-situ* concrete are deemed to include formwork; and working space allowance must include the extra cost of work below ground water level and breaking out existing hard materials.

By making the detailed specification the central reference document under CPI, the way in which estimators work has changed. Enquiries to sub-contractors and suppliers must include all relevant specification clauses, preliminary section items and appropriate drawings; otherwise the prices will not reflect the true value of the work. Bill descriptions are shorter by adding references to the specification. The following example illustrates the problem:

Forming cavities in hollow walls 60 mm wide; wall ties spec F30:310; cavity insulation spec F30:560, 30 mm thick	115 m^2

If a sub-contractor receives an incomplete enquiry, he is likely to guess what he is being asked to fix. Fortunately many quantity surveyors have recognized this problem and have enlarged item descriptions so that their meanings are clearer, for example:

Forming cavities in hollow walls 60 mm wide; stainless steel wall ties, F30:310 as System Ties Ltd, 210 mm long; Becker rigid board cavity insulation, F30:560, 30 mm thick fixed to ties with retaining clips	115 m^2

Experience of pricing documents, which have been produced using the CPI guidelines, shows that some new problems have emerged, as follows:

1. Many specifications have no page numbers. The explanation is that the estimator must use the NBS codes to find the relevant clauses. The problem for the estimator is that the page numbers are needed for printing and distributing pages to sub-contractors.
2. There is confusion with the way work section numbers are used in specifications. On one page the estimator might find clause 310 which is for laying bricks and on another page clause 310 could be for cavity wall ties. The problem is that the work section reference is missing; in the first case it should be F10:310 and the second F30:310. The work category numbers must be repeated on each new page if this problem is to be solved.
3. Some sub-contractors have argued that they received the bill but not the specification; with SMM6, the bill description often had enough detail to price the work. This may be the estimator's fault but in some cases the specification references are more complex. The estimator might find the correct clause referred to in the bill but not notice the specification clause includes references to other clauses. For example, a patent glazing specification could itself refer to a separate glazing specification, which the estimator must also send to the patent glazing sub-contractor.
4. Defined provisional sums are being used incorrectly. The tender documents should provide information about the nature of the work, a statement about how and where the work is fixed, quantities to show the scope of work, and any limitations. It is common to see defined provisional sums such as: 'drainage outfall to culvert' or 'additional dry-rot treatment'.
5. The number of drawings needed by sub-contractors at tender stage has increased dramatically. This is due to the reduction in the number of bill items; or as some would say, 'the quantity surveyor doing less work'. Many contractors have incurred an increase in printing costs since the introduction of SMM7. This may also be due to smaller margins and the need to ensure that sub-contractors will tender on exactly the same basis as the main contractor.

Now that main contract bids rely heavily on quotations from sub-contractors, the estimator must exercise great skill and care in dealing with changing procedures and new methods of measurement for bills of quantities. The PQS still has the responsibility to provide adequate information for the estimator to price. As SMM7 insists 'More detailed information than is required by these rules shall be given where necessary in order to define the precise nature and extent of the required work'.

Documents used as the basis of a tender

The basis of the tender will dictate the way in which the contractor will be paid and the relative accuracy of the estimate. The contractor's bid will be for one of the following:

1. Fixed price contract: where the sum of money is stated in the contract as payment for work, the payment may be adjusted according to strict conditions in the contract.
2. Measurement contract: will allow the contract sum to be calculated later, usually as the aggregate of various rates submitted by the contractor. The contract sometimes includes a target price.
3. Cost-reimbursement contract: an arrangement whereby the cost, whatever it may be, will be paid by the client on the basis of the actual cost incurred by the contractor, plus overheads and profit.

Fixed price contracts

The price is fixed in advance but is subject to variation under the terms of the contract. This could include a fluctuations clause to pay for the increases caused by inflation. This definition leads to much confusion in the construction industry where 'fixed price' is the term for a price, which will not be subject to fluctuations. An arrangement which is not subject to fluctuations is better described as 'firm price'.

Lump-sum contracts are the simplest type where a lump-sum offer is made by a contractor to carry out the work, which might be outlined on drawings and described in a specification but no quantities have been prepared. This is the usual form for a small job carried out by a local builder. Where a full set of working drawings and a specification are available, a drawings and specification ('plan and spec') arrangement is popular for small projects. The main advantage is the saving in time and money needed to prepare a bill of quantities. The client will also have a reasonable estimate of the total cost before the contract is signed. For small contracts where the client's requirements are clear and there are good drawings and specification, this can be a useful way to enter a contract. There are, however, some serious drawbacks. Each contractor must prepare his own bill of quantities and the employer must bear in mind the time needed during the tender stage. If construction details or specification requirements are missing, it is common to find each contractor tendering on different assumptions. The contractor must allow a contingency for the risk of making mistakes in taking off. There will be no detailed breakdown of the tender sum which would be needed for interim payments and for valuing variations. To overcome some of these disadvantages, the specification should include a description of work in a series of numbered items, each of which is to be priced.

Bills of quantities provide the most detailed basis for estimating cost. Each contractor tendering for work will be familiar with their use and can save wasteful effort in preparing quantities for the same building. They represent a clear list of items included in the contract and a schedule on which variations may be valued. Bills of quantity give a fair basis for competition, and a firm contract sum is known in advance. The main disadvantages are the time needed for the accurate preparation of bills (less of a problem with computer techniques) and the risk carried by the client for quantities. Firm bills of quantities remove the onus for correct quantities from the contractor but may inflict higher charges on the employer if discrepancies exist between the documents.

When a contractor tenders for a design and build project, he prepares his own bill of quantities (from his own drawings and specification) in order to invite sub-contract bids and arrive at a cost for direct work. Where the design team is novated to the contractor, construction drawings and specifications are usually well advanced prior to tender stage.

The contractor's proposals include a contract sum analysis. The purposes of the contract sum analysis are:

1. To value changes in the employer's requirements;
2. To value provisional sums given in the employer's requirements;
3. To allow the use of price adjustment formulae where they apply.

The contract sum analysis should be divided into sums of money for design work carried out before and during construction, and the following:

1. Preliminaries.
2. Provisional sums.
3. Trade headings similar to those in SMM6 or SMM7.

Work in different buildings and external works are usually shown separately. Alternatively, and more commonly in practice, the client's agent produces a list of items for a contract sum analysis using elemental headings in order to compare the tender against the elemental cost plan set up as the scheme budget.

Bills of approximate quantities provide a fair basis for tendering when drawing details are not complete. The bills will represent an estimate of the quantities of work in the project. By definition, the work will be subject to remeasurement and a firm value will not be known at the start of the project. This method is commonly used with refurbishment work where the full extent of the work cannot be accurately determined. The quantities set out in bills of quantities for civil engineering are the estimated quantities and are not to be taken as the actual quantities; the actual quantities are measured during the construction phase.

Measured contracts

The total cost of a contract can be calculated by measuring the work as it advances on site and pricing the measured items using the rates given in an agreed schedule of rates or approximate bill of quantities. A schedule of rates lists all the items likely to arise, in a similar way to a bill of quantities, but no quantities are included. A schedule of rates is also used with drawing and specification contracts to value additional work. There are two principal types of schedule.

1. A standard schedule of rates, issued or published by an employer, will usually list standard items and rates, and the tenderer is asked to submit an overall percentage addition or deduction to reflect current pricing levels. Since the tender is a single figure, contractor selection is simple. Schedules of this sort enable orders to be placed before the project details are complete.
2. An ad-hoc schedule of rates is a pricing document prepared for a particular job. Only those items needed for the project will be incorporated. This type of schedule is difficult to use because, in the absence of quantities, tenders are difficult to compare and the value of the project is not known at the start. An ad-hoc schedule should contain approximate quantities to help overcome these problems. With all schedules of rates used at tender stage, the estimator is unable to foresee the full extent of the work. Contractors have been asked to quote for drainage trenches, for example, without knowing the ground conditions. Should the contractor assume that the ground conditions were good, and free of obstructions and other services? If he does then there is a chance he would ask for reimbursement for additional costs for bad ground conditions.

Cost reimbursement contracts

The basis of this method is for the contractor to be repaid with the prime cost of completed work as defined in the contract, and a management fee to cover overheads and profit. The fee can be based on a percentage of cost (cost plus percentage contract) or a lump sum based on the estimated project cost (cost plus fixed fee contract). The advantages of this method are: the project can start quickly, the contractor can contribute to the design, competition can be introduced through the size of the fee, and the contractor is unlikely to cut corners. The disadvantages may be: the contractor has little incentive to save on time and resources (in some management contracts if the construction costs rise the fee to the management contractor rises), the client is unable to predict the total cost accurately, and it can be tedious to calculate costs during the construction stage. It should be remembered that most of the work is carried out by package contractors who tender for work on a traditional bill of quantities.

Formal tender documents

Formal invitation

The Code of Procedure for Single Stage Selective Tendering gives an example letter. The letter is not long because essential information is normally set out in the tender documents. The letter is needed to tell the contractor which drawings have been sent, arrangements for site visits, date for return of tender and how the tender should be submitted. If the tenderer wishes to decline an offer he should have done so at pre-selection stage. The client should issue the tender documents on an agreed date in order to enable the contractor to plan his estimating workload. A typical invitation to tender letter is given in Fig. 4.1.

Bill of quantities

If a priced bill of quantities is required with the tender then two copies should be sent to each contractor. As much information as possible should be included in the bill to reduce the need for many drawings to accompany enquiries to sub-contractors. If domestic sub-contractors are named in the bill then the consultants can send copies of the drawings and specification direct to the specialists to assist the contractors not least in reducing the reproduction and postage costs.

Drawings

The bill of quantities will list the drawings which were used in preparing the documents. With standard methods of measurement aimed at producing shorter bills of quantities, there is a greater reliance on drawings by the tenderers. Tendering costs could be cut if copy negatives or reduction prints can be produced. Full-size drawings are clearly essential if the contractor or sub-contractor is responsible for taking-off quantities. For large projects, drawings are often issued electronically. This might be on CD-ROM, by e-mail or with tenderers downloading drawings from a secure website.

John Price & Partners

Chartered Quantity Surveyors
32 Westgate Road
Northbridge NB33 6XD

28 May 2004

CB Construction Ltd
8 Brecon Road
Northbridge
NB21 8DR

Dear Sirs,

INVITATION TO TENDER
NEW OFFICES FOR FAST TRANSPORT PLC

Following your agreement to tender for the Fast Transport contract, we enclose the following documents:

1. Two copies of the bill of quantities.
2. The general arrangement drawings.
3. Health and Safety Plan.
4. Two copies of the form of tender.
5. Envelope for the return of the tender.

The completed form of tender is to be sealed in the envelope provided, and sent to the architect's office to arrive not later than 12 noon on Tuesday 13th July 2004.

The complete set of contract drawings and site investigation report may be inspected during normal working hours at the offices of the architect, the Swallow Partnership, at 102 Cantilever Drive, Stansford. Arrangements to visit the site should be made with the project architect, Mrs K. Edwards tel: 0123 344334.

Please acknowledge receipt of this letter and tender documents.

Yours faithfully,

Fig. 4.1 *Typical formal invitation letter*

FORM OF TENDER

To: Fast Transport Ltd, Stansford

Tender for: Proposed Office Building, Stansford

Dear Sirs,

Having examined the conditions, drawings and bills of quantities, we offer to carry out and complete the works described, for the FIRM price of:

£ ____________________ (in words) ____

____

and complete within 34 weeks from the date of possession.

This tender will remain open for acceptance for three months from the date of return of tender.

We agree that should any obvious pricing or arithmetic error be discovered before acceptance of this offer in the priced bills of quantities then these errors will be corrected using Alternative 1 in Section 6 of the Code of Procedure for Single Stage Selective Tendering.

We understand that we are tendering at our own expense and that neither the lowest nor any tender need be accepted.

Signature: ________________________________ Date: ________

Company: ________________________________

Address: ________________________________

____

Fig. 4.2 *Typical form of tender*

CB Construction Ltd
8 Brecon Road
Northbridge
NB21 8DR

13 July 2004

Fast Transport Ltd
Stanton Lane
Stansford

Dear Sirs,

New Offices, Stansford

Alternative Tender

Following discussions with the architect and engineer during the tender period, we have examined an alternative design which would lead to a significant saving of time and money, as follows:

1. By a small increase of plan dimensions (to the lines shown on our layout drawing F/1 attached) including some accommodation in the roof space, there would be no need for the basement construction.
2. You will see on our preliminary programme (our drawing number F/2) the contract duration can be reduced by 4 weeks to 30 weeks, with completion by 22nd December.
3. Our alternative proposals would offer a financial saving amounting to £49 552 and a tender sum of £1 013 100.

We hope that this will help you in your appraisal of the scheme and would be pleased to provide more information and discuss the work with you soon.

Yours faithfully,

J Lewis

Regional Manager

For CB Construction Ltd

Fig. 4.3 *Example of an alternative tender*

Form of tender

The form of tender is a pre-printed formal offer, usually in letter form, which ensures that all tenders are received on the same basis and should be simple to compare. The tenderer fills in his name and address and a sum of money, for a lump sum offer. It may be sent with a collusive tendering certificate and appendices that are used for declarations about 'fair wages' or 'basic lists of materials'. A typical tender form is shown in Fig. 4.2; and Fig. 4.3 is an example of an alternative tender which might be produced in addition to a compliant bid.

Health and safety plan

A pre-tender health and safety plan is a requirement of the Construction (Design and Management) Regulations 1994. This document is produced by the planning supervisor appointed by the client, and included in the tender documents. The principal contractor is then required to develop the health and safety plan before work starts on site, and keep it up to date throughout the construction phase.

The pre-tender health and safety plan will include information which the client can provide about the existing site or buildings; details of significant risks identified in the design; construction materials which could be hazardous to site personnel; and operational hazards on an occupied site.

Return envelope

Each contractor should be provided with a pre-addressed envelope clearly marked 'Tender for … '. They are to be marked so that they will be easily recognized and not opened too early or by the wrong person. Some clients insist that the contractor's name must not appear on the envelope, in order to avoid any opportunity for tampering with a particular tender.

The Construction Industry Board, CIB, has published a comprehensive list of tender enquiry documents in its 'Code of Practice for the Selection of Main Contractors' 1997.

5 Estimating methods

'*Brian does his estimates on the back of a cigarette packet*'

Introduction

During the first half of the twentieth century six methods of estimating were used (Fig. 5.1). The methods are much the same today. The main difference is the current popularity of elemental cost models, which are used by quantity surveyors and contractors alike, in advising clients on their likely building costs, and helping designers to work within a budget.

Methods of estimating, used in the early stages of cost planning, depend on reliable historical cost data whereas an analytical approach to estimating is based on

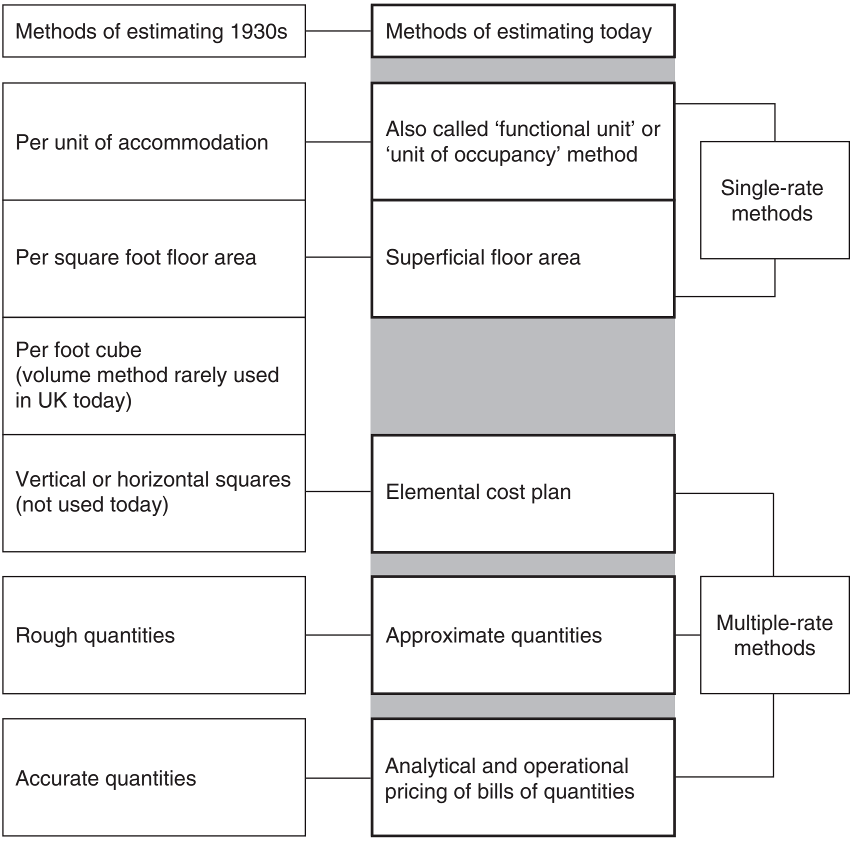


Fig. 5.1 *Estimating methods in 1930s and today*

applying current prices for resources to a well-developed design. A contractor may use a combination of estimating methods in developing a cost for a design and build project. For example, a client could be given a cost range for construction using the unit method and an elemental cost plan would be produced when the client's outline brief is received. Approximate (or builder's) quantities are used to produce a formal tender and when a contractor has received an order a full bill of quantities may be written for financial control during construction. The two main benefits of cost planning are:

1. To ensure tenders received do not exceed the budget. This is achieved by making design decisions early with advice from the cost team. Changes made early in the design process can be accommodated without too much affect on other elements.

2. To collect cost information from a number of buildings, at various stages of development, thus improving the quality of cost data for future projects.

In some sectors of construction, *cost limits* have traditionally been applied well before a scheme is well defined. This can sometimes lead to unrealistic targets that can produce poor designs, to the detriment of the building's functionality. For example, in public schemes a great deal of effort is given to driving down floor areas. A school library could be located in a wide corridor or hospital consultants might be expected to share open-plan offices.

In recognition of these problems the concept of 'value for money' has been adopted. In the case of new hospitals, the Government has pledged more money to pay for 'consumerism', which for hospitals means more friendly spaces and more space around patients' beds. Nevertheless, central government still sets challenging targets for public buildings and value for money is appraised during an examination of tenders submitted.

The first step in cost planning is to advise a client of a budget at the inception of a project. An example of a development budget for construction costs is given in Fig. 5.2. Once preliminary drawings have been produced, a cost plan can be produced. The contractor is in the unique position of having detailed knowledge of current prices for all the resources used in construction. The Private Quantity Surveyor (PQS) has the benefit of rates submitted in priced bills of quantities from a broad selection of contractors although he must be aware that rates do not necessarily reflect the actual cost of individual items of work.

The final cost of construction may be different from the forecast, for many reasons, namely:

1. The type of building; schools may be easier to predict than a bridge, the extent of repairs in a maintenance contract can be difficult to foresee;
2. The effect of competition in the market;
3. The amount and quality of historical data available;
4. The amount of design information available;
5. The performance of the design team;
6. The nature of the workplace in terms of weather, ground conditions, resource prices and other uncertainties;
7. Changes introduced by the client;
8. The estimator's skill and method used.

The degree of certainty increases as the design stages evolve. Figure 5.3 illustrates a diminishing cost range for a project from inception (setting a budget) to agreement of final account.

The contractor's estimator has the dual roles of forecasting the cost of construction and advising how competing organizations will bid for the same job. Although

St John's Church **Development Financial Summary** **January 2004**

	New Church Hall (GIFA: 200 m^2) and refurbishment of Church		Budget	Actual cost	Notes
	Total costs		**315 165**		
1	Development costs	Concept architect	6 500		Concept architect taking early retirement
		Planning consent fees	600		Check for other application
		Building regulation fees	1 500		Check for other application
		Additional insurances during construction	500		Amount not known
		Photocopying costs	150		Tender documents
2	Professional fees	Architect – pre-contract	9 000		
		Architect – post-contract	10 000		Includes inspection role
		Structural engineer	3 850		Includes unrecoverable VAT
		Planning supervisor	600		
		Quantity surveyor	2 250		Produce valuations and value variations
		Risk assessment – fire	650		Develop spec for fire alarms
3	Construction costs	Main contract	320 565		New hall and church refurbishment excluding VAT
4	Value added tax	Unrecoverable VAT	16 000		Refurb portion of the works
5	Direct suppliers – fit out	Costs for sanctuary furniture	11 000		Self-financing (see 6)
		Refurbish kneelers	3 000		
		Loose furniture	5 000		
6	Cost recovery	Sale of land (old hall)	−65 000		Net income from sale and agent's fee
		Donations for sanctuary furniture	−11 000		£9 400 so far pledged or banked

Fig. 5.2 *Example of a development budget*

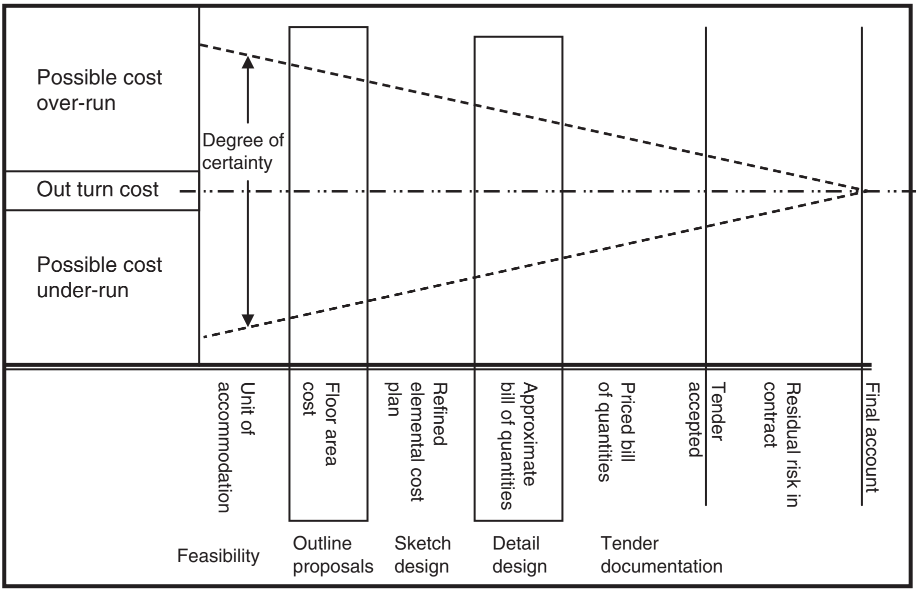


Fig. 5.3 *Degree of certainty for a typical construction project*

the commercial tender is the responsibility of management, the estimator must tell his managers how market trends will affect the prices, particularly where subcontracting has a strong influence on the tenders.

Single-rate approximate estimating

Unit of accommodation method

This method is commonly used by national bodies such as the education and health services at the inception stage of construction. If a client has an amount of money to spend (a budget) then it would be possible to consider the likely number of functional units which can be provided. From experience, it might be found that the cost of providing a study bedroom in student accommodation is £20 000. Using this figure an expenditure of £12 million would provide accommodation for approximately 600 students. On the other hand if the number of units is known, a budget cost (usually expressed as a cost range) can be calculated.

Providing there are recent comparable data available, the unit method is useful where a simple and quick cost range is needed in the early stages. It is difficult, however, to adjust the costs for specific projects, in different locations, with varying ground conditions and so on.

Floor area method

The main reason for the popularity of the floor area method is its simplicity. There are few rules to remember and the cost per square metre is well understood by property developers. A proposed building is measured at each floor level (between inside faces of external walls); no deductions are made for internal walls, stairs or lift zones. Previous similar building costs are used by dividing the construction cost by the internal floor area. Adjustments can be made for location and inflation; but specification adjustments are much more difficult to estimate. Subjective judgements are made for size, shape, number of storeys, services, ground conditions and standard of finishes. A separate assessment should be made for external works, demolitions, incoming services and drainage which can be significantly different for similar buildings.

There are many buildings where the unit of accommodation method is impracticable; such as warehouse projects or open-plan offices. In these cases the superficial floor area method is found to be reliable with an accuracy of 10% to 15%. This method also works well with certain external works contracts such as concrete paving or macadam surfacing.

Sometimes contractors are asked to quote for building work using sketch drawings and a square metre price. It is unlikely that a contractor would risk signing a contract on this basis. First a clear scope of works would be needed together with a site survey and soil investigation report. The price must accurately reflect the amount and specification of works.

Building volume method

There are several methods, which use the volume of a building as the cost yardstick, but they are not widely used today. In some European countries, architects and engineers are familiar with building costs expressed as cubic metre prices. In Germany, there are publications, which list typical building costs in terms of their volume, and the procedure for calculating volumes is given in a DIN standard.

Multiple-rate approximate estimating

Elemental cost plans

A cost plan is prepared from the designer's preliminary drawings. It is a list of the elements of a building such as substructure, frame and upper floors, each with its share of the total budget cost (see Fig. 5.4).

CB Construction Limited, Northbridge

Proposed Workshop for Fast Transport Limited

		GIFA (m^2)	2 310
	Element	**Cost £/m^2**	**Element cost**
1	**Substructure**	65	151 210
2	**Superstructure**		
	Frame	66	153 280
	Roof coverings	32	74 560
	Roof drainage	4	9 450
	External walls	33	75 410
	Windows	13	29 550
	External doors	5	11 850
	Internal walls	7	15 201
	Internal doors	6	13 541
3	**Internal finishes**		
	Wall finishes	11	24 856
	Floor finishes	4	8 513
	Ceiling finishes	4	8 145
4	**Fittings and furniture**	2	3 990
5	**Services**		
	Sanitary appliances	3	6 050
	Internal drainage	–	inc
	Hot and cold water	–	inc
	Heating	12	28 560
	Electrical installation	9	21 650
	BWIC	1	1 520
6	**External works**		
	Site works	39	89 525
	Drainage	11	25 140
	External services	3	7 520
7	**Preliminaries**	40	92 850
8	**Contingencies**	16	37 150
9	**Budget total**	£ 385	£ 889 521

Fig. 5.4 *Elemental cost plan for portal-framed building*

The forecast cost of each element can be calculated in two ways:

1. By measuring the approximate quantity of each element and applying a unit rate;
2. By calculating the proportion of total cost for each element on a similar building and using this ratio to divide the budget for the proposed building into its elemental breakdown.

The second method is better shown by example. If a contractor has built some portal-framed factories he will know the costs of each element and can express this information as costs for each unit of floor area. Figure 5.5 illustrates a typical analysis for a factory building. The site team has been asked to feed back cost information to the estimator by converting package values to elemental costs.

A cost plan for another similar factory can be generated by multiplying each rate by the new floor area. Figure 5.6 shows the second factory which the contractor will further adjust for inflation, and significant specification changes. Typical examples would be the number of sanitary appliances, internal doors, roller shutter doors and ground improvements. In this example the contractor was confident about this approach because he found the floor area and wall to floor ratio to be similar to the earlier factory.

If a budget is wanted for another factory with a much smaller floor area, say $1200\,m^2$, for example, then a different approach would be needed, since the wall/floor ratio will be greater. The estimator should look at some elements such as external walls and apply a rate per square metre. The preliminaries cannot be assessed using the floor area either. An allowance for preliminaries should be calculated using the cost per week of time-related costs for a similar factory and multiplying by the duration for the new scheme. In this way, a combination of historical data (the cost of elements per square metre of floor area) and calculated costs for certain elements is used.

Contractors and PQSs are becoming more adept at using this method and have adapted the basic principles for computer systems. A spreadsheet template can store the information shown in Fig. 5.6 and the effect of changes can be seen immediately they are made. In fact computers are now used to produce sophisticated budgets for clients at the early stages of design.

Approximate quantities

There are many ways in which approximate quantities are used depending on who uses them and for what purpose. A PQS may want an alternative estimating technique to check cost forecasts before tenders are returned. Measurements will be concentrated into as few items as possible for grouped work components. A simple example is a cavity wall measured and priced with both skins included

CB Construction Limited, Northbridge		***COST FEEDBACK***	
Factory for Hitech Cables Limited		**GIFA (m^2)**	**3 120**
	Element	**Element cost**	**Rate £/m^2**
1	**Substructure**	186 450	60
2	**Superstructure**		
	Frame	207 410	66
	Roof coverings	120 360	39
	Roof drainage	11 520	4
	External walls	96 580	31
	Windows	23 950	8
	External doors	16 580	5
	Internal walls	8 780	3
	Internal doors	15 340	5
3	**Internal finishes**		
	Wall finishes	17 860	6
	Floor finishes	10 050	3
	Ceiling finishes	5 960	2
4	**Fittings and furniture**	7 250	2
5	**Services**		
	Sanitary appliances	7 410	2
	Internal drainage	inc	–
	Hot and cold water	inc	–
	Heating	25 550	8
	Electrical installation	36 870	12
	BWIC	3 630	1
6	**External works**		
	Site works	126 550	41
	Drainage	33 210	11
	External services	5 120	2
7	**Preliminaries**	144 550	46
8	**Contingencies**	56 280	18
9	**Budget total**	£ 1 167 260	£ 374

Fig. 5.5 *Elemental cost plan for building under construction*

in the unit rate. The rate will include forming the cavity, wall ties, plastering and pointing. Rates for composite items can be found in price books, calculated from rates in priced bills of quantities or calculated from first principles. A contractor needs to produce bills of approximate quantities when tendering for work based

CB Construction Limited, Northbridge		COST FEEDBACK		NEW PROJECT
		Hitech Cables		Pluto Blinds
		GIFA	3 120	2 860
	Element	**Element cost**	**Cost £/m²**	**New budget**
1	**Substructure**	186 450	60	170 913
2	**Superstructure**			
	Frame	207 410	66	190 126
	Roof coverings	120 360	39	110 330
	Roof drainage	11 520	4	10 560
	External walls	96 580	31	88 532
	Windows	23 950	8	21 954
	External doors	16 580	5	15 198
	Internal walls	8 780	3	8 048
	Internal doors	15 340	5	14 062
3	**Internal finishes**			
	Wall finishes	17 860	6	16 372
	Floor finishes	10 050	3	9 213
	Ceiling finishes	5 960	2	5 463
4	**Fittings and furniture**	7 250	2	6 646
5	**Services**			
	Sanitary appliances	7 410	2	6 793
	Internal drainage	inc	inc	inc
	Hot and cold water	inc	inc	inc
	Heating	25 550	8	23 421
	Electrical installation	36 870	12	33 798
	BWIC	3 630	1	3 328
6	**External works**			
	Site works	126 550	41	116 004
	Drainage	33 210	11	30 443
	External services	5 120	2	4 693
7	**Preliminaries**	144 550	46	132 504
8	**Contingencies**	56 280	18	51 590
9	**Budget total**	£ 1 167 260	£ 374	£ 1 069 988

Fig. 5.6 *Elemental cost plan for similar factory building*

on drawings and specifications. He will seldom allow the entire ancillary and subsidiary work items found in the standard method of measurement; but must be careful to tell sub-contractors the assumptions made. There is a strong case for attaching a preamble on the rules of measurement used, so any misunderstandings and disputes will be reduced (Figs 5.7a and 5.7b).

The accuracy of this method is related to how far the design has developed. At least the quantities are based on the planned construction and not a previous job and realistic allowances are made for plan shape, height of building, type of ground, quality of finishes etc. For these reasons it is widely used and being developed with computer systems using database and spreadsheet software to produce standard bills for repetitive building types. The danger is the cost calculated using approximate quantities can appear to be as accurate as a full bill of quantities based on working drawings. It is more likely to be an underestimate of the cost of construction unless a generous contingency is added for small components, fittings, fixings and design development.

	CB Construction Limited				
	Builder's quantities for Pluto Blinds				
	Description	Quant	Unit	Rate	**Total**
A	Excavate to reduce level	332	m^3		
B	Excavate for foundations ne 1.0 m deep	248	m^3		
C	Excavate machine pits ne 4.0 m deep	112	m^3		
D	Disposal of surplus from site	445	m^3		
E	Backfilling with selected exc material	247	m^3		
F	DOT type 1 under slab; 400 mm thick	1 330	m^3		

Fig. 5.7a *Example of 'builder's quantities'*

Factory for Hitech Cables Limited	February 2004

PREAMBLE TO BILL OF QUANTITIES

EXCAVATION WORKS

The following information is provided to outline the location and layout of the excavation works:

(a)	Drawing 3409/1	Site plan
(b)	Drawing 3409/2	Details of foundations
(c)	Drawing 3409/4	Details of ground slab and beam
(d)	Drawing 3409/7	Details of machine pits
(e)	Ground investigation report	

Excavation work has been measured under the following headings, followed by item coverage.

ITEM COVERAGE

Excavation rates to include:

1. Excavation in any type of subsoil to the depths shown on the drawings.
2. Dealing with surface water affecting the excavations.
3. Dealing with ground water entering the excavations.
4. Excavating over or around existing services.
5. Any extra width of working space needed for sub-structure work.

Excavate to red level

1. The quantity of excavation includes an allowance of 500 mm for working space. from the outside face of external walls.
2. The depth of excavation is not stated.
3. Any necessary earthwork support is deemed to be included in the rates.
4. Levelling and compacting the ground is deemed to be included in the rates.

Fig. 5.7b *Example of preamble for 'builder's quantities'*

In common with all approximate estimating techniques there are some difficulties which need to be recognized when advising clients. Some of the difficulties to be faced are:

1. The reliability of historical data must always be questioned.
2. Preliminaries are usually unique to a particular job and should be calculated whenever there is deviation from an identical scheme.
3. Incoming services are seldom the same on different sites and can only be assessed after detailed consultation with service providers.
4. Contract conditions can vary markedly between projects; the requirements for bonds, insurances and liquidated damages can be particularly onerous.
5. The contingency sum for design development must be estimated for each job.

Analytical estimating

Analytical estimating is a method for determining unit rates by examining individual resources and the amounts needed for each unit of work. This method for pricing bills of quantities is described in the CIOB Code of Estimating Practice, in four stages:

1. Establish all-in rates for the individual resources in terms of a rate per hour for labour, a rate per hour for items of plant and the cost per unit of material delivered and unloaded at the site.
2. Select methods and outputs to calculate net unit rates to set against items in the bill of quantities.
3. Add to the net cost project overheads, contingencies, inflation and risk.
4. Summarize resources and prepare reports for management.

The ability to analyse unit rates is an important skill for all those engaged in construction. Quantity surveyors and architects may need to value variations using clause 13.5.1.3 of the Standard Form of Building Contract. This states 'where the work is not of similar character to work set out in the contract bills the work shall be valued at fair rates and prices'. This presumably means a properly built-up unit rate. Contractors rely on the pricing carried out by their sub-contractors for an increasing share of the work. A contractor's estimator should be able to build up rates for his direct work and be able to check the rates offered by sub-contractors.

Analytical pricing of bills of quantities is more than just applying resources to items of work to produce a unit rate. The constituents of a rate are inserted in the bill; and totalled for each page, each section, and carried to the summary, so that the contractor has a complete picture of the resource costs at the final review meeting. Figure 5.8 shows a typical printout from a contractor's bill where the rates and totals are shown between the item descriptions. Figure 5.9 is an example of a contractor's bill of quantities priced analytically using a spreadsheet package.

The benefits of analytical pricing of bills of quantities are:

1. The total cost of labour is needed to calculate the cost of insurances, transport of operatives, small tools and equipment, and workforce levels.
2. The breakdown of resource costs is needed to calculate the allowance for firm price tenders.
3. Labour and plant totals for elements of the work are used to calculate activity durations for the tender programme.
4. A breakdown of prices is needed in each trade to make comparisons between direct work and labour-only sub-contracts.
5. The costs of resources are needed to calculate the cost commitment cashflow forecast.

Factory for Hitech Cables Limited **February 2004**

	Description	Lab rate / LAB	Plt rate / PLT	Quant / Mat rate / MAT	Unit / Sub rate / SUB	Rate	Total
	Breakdown	*Lab rate*	*Plt rate*	*Mat rate*	*Sub rate*		
		LAB	*PLT*	*MAT*	*SUB*		
a	Excavate to reduce level			332	m^2	4.00	1 328.00
		1.14	*2.86*				
		378.48	*949.52*				
b	Excavate for foundations ne 1.0 m deep			248	m^3	5.25	1 302.00
		1.71	*3.54*				
		424.08	*877.92*				
c	Excavate machine pits ne 4.0 m deep			112	m^3	6.63	742.56
		2.29	4.34				–
		256.48	486.08				–
d	Disposal of surplus from site			445	m^3	17.91	7 969.95
		5.71	12.20				–
		2 540.95	5 429.00				–
e	Backfilling with selected excavated material			247	m^3	4.34	1 071.98
		1.14	3.20				–
		281.58	790.40				–
f	DOT type 1 under slab 400 mm thick			1 330	m^3	20.09	26 719.70
		1.14	3.20	15.75			
		1 516.20	4 256.00	20 947.5			
	Total to summary						**39 134.19**
	Breakdown	*5 398*	*12 789*	*20 948*			*39 134*

Fig. 5.8 *Contractor's bill of quantities priced analytically*

6. Adjustments can be made to any part of the estimate right up to the submission date.
7. The resource breakdowns will be used on site for post-tender cost control, bonus systems, monitoring and forward costing.

Weighbridge foundation for Hitech Cables Limited **13.2.04** **Analysis of rates**

	Surface weighbridge (15 m long)	quant	unit	rate	total	lab	plt	mat	s/c	LAB	PLT	MAT	S/C
A	Excavate to reduce lev ne 1.0 m dp	23	m^3	8.94	205.62	3.97	4.97			91	114		
B	Excavate for thickening & downstand	9	m^3	24.85	223.65	19.88	4.97			179	45		
C	Load and remove to tip on site	17	m^3	7.96	135.32		7.96				135		
D	Backfill with selected material	15	m^3	5.64	84.60	2.32	3.32			35	50		
E	Level and compact	79	m^2	0.74	58.46	0.58	0.16			46	13		
F	Earthwork support	6	m^2	3.23	19.38	1.07	2.16			6	13		
G	Hardcore (Free Issue)	18	m^3	5.64	101.52	2.32	3.32			42	60		
H	Blind with dust (Free Issue)	62	m^2	0.66	40.92	0.33	0.33			20	20		
J	Soil stabilization mat	79	m^2	1.33	105.07	0.42		0.91		33		72	
K	Concrete grade 40 N in foundation	17	m^3	96.12	1 634.04	23.20		72.92		394		1 240	
L	Concrete grade 40 N in ramps	15	m^3	99.44	1 491.60	26.52		72.92		398		1 094	
M	Concrete grade 40 N in upstands	6	m^3	129.27	775.62	49.72		79.55		298		477	
N	Concrete grade 40 N in plinths	1	m^3	120.98	120.98	41.43		79.55		41		80	
P	Rebar 12 mm (upstand & downstand)	0.6	t	1 068.89	641.33	356.29		712.60		214		428	
Q	Rebar 16 mm	0.12	t	994.32	119.32	331.44		662.88		40		80	
R	Fabric A393	280	m^2	6.79	1 901.20	1.41		5.38		395		1 506	
S	Dowel bars 25 mm	30	nr	3.30	99.00	1.65		1.65		50		50	
T	Form plinths 900×900×250 mm high	4	nr	32.32	129.28	21.55		10.77		86		43	
U	Sawn formwork to sides of founds	47	m^2	34.80	1 635.60	23.20		11.60		1 090		545	
V	Sawn formwork to sides of upstands	17	m^2	38.10	647.70	24.85		13.25		422		225	
W	Cast in service duct	1	nr	16.58	16.58	9.95		6.63		10		7	
X	Grouting baseplates on return visit	1	item	256.87	256.87	207.15		49.72		207		50	
Y	Steel bumper stops	284	kg	3.15	894.60	0.67		2.48		190		704	
				TOTALS	11 338			check	11 338	4 287	450	6 601	–

Fig. 5.9 *Contractor's spreadsheet for weighbridge foundation*

Most contractors know the benefits of analytical estimating but sometimes have difficulty finding time to apply the technique to all tenders. The two main problems are that *all* the rates must be priced analytically for the system to work, and many extra calculations are needed to extend the rates to totals. A computer estimating system is designed to overcome these difficulties and will produce the resource summaries automatically.

Unit rate pricing of a bill of quantities is carried out to certain conventions; those which are expected by the client's representative, and those which the contractor has developed. The notes at the beginning of a bill of quantities usually include instructions such as:

1. All rates shall be inclusive of labour, materials, transport, plant, tools, equipment, establishment and overhead charges, and all associated costs, margins and profit.
2. All items shall be priced; the value of any items unpriced shall be deemed to be included elsewhere in the bill of quantities.

The contractor, on the other hand, is likely to produce rates which exclude:

1. General overheads and establishment charges;
2. Profit, which can only be calculated after the net estimate is complete;
3. Restrictions, which apply to more than one item such as difficult access, difficult handling and protection;
4. Plant, which is common to several activities such as compressors, hoists, mixers, dumpers and cranes.

Contractors may include a nominal mark-up or 'spread' to the rates, which can be supplemented by sums in the preliminaries part of the bill when the true overheads and profit are known after the final review meeting. A computer-aided estimating system would allow some of the overheads and profit to be spread over various parts of the bill of quantities. For example, a contractor might want to add 20% to the earthworks rates. This could improve the cashflow position of the project but would put the contractor at risk if the extent of earthworks reduced.

There are many PQSs and civil engineers who would want to introduce analytical bills. This would be a bill format with extra columns for labour, plant, materials, sub-contractors, and overheads/profit, which would be submitted by the lowest tenderer before entering into a contract. The client's consultants argue that although contractors may resist this duty to reveal confidential information, the idea has the following advantages:

1. There would be a clearer basis from which to value variations.
2. The settlement of final accounts could be based on an examination of which elements had changed, and the effect on the programme may be clearer.

3. The design team could see where they had chosen designs which were labour-intensive.
4. If the analysis was extended into valuations, the contractor could use the data for his own cost monitoring systems without doubling his effort.

There may be contractors who will object to giving a full breakdown of their rates. In order to comply with the instructions to tender, they may insert all their rates in the sub-contract column, and argue that the work will be sub-contracted. Change could come through trust – brought about by partnerships between clients and contractors.

Operational estimating

Operational estimating is a form of analytical estimating where all the resources needed for part of the construction are considered together. For example, an estimator pricing manholes using the Civil Engineering Standard Method of Measurement (CESMM) needs to gauge the time taken to build a complete manhole, whereas a building estimator is expected to price all the individual items for excavation, concrete work, brickwork etc., measured under the rules of the appropriate work sections.

The following examples show some of the many other situations where work is priced as whole packages:

1. Excavation including trimming, consolidation and disposal;
2. Placing concrete in floor slabs including fabric reinforcement, membranes, isolation joints and trowelling;
3. Formwork to complex structures including a unique design, hired-in forms and falsework;
4. Drain runs including excavation, earthwork support, bedding, pipework and backfill;
5. Repairs which often involve more than one trade or a multi-skilled operative;
6. Roof trusses including the use of a crane, a suitable gang of operatives and temporary works.

It must be said that building estimators have become skilled at applying production outputs to units of work and then occasionally employing operational estimating techniques to check the results. Civil engineers, on the other hand, usually examine methods and durations before pricing the work. This is because different construction methods for civil engineering can have a significant effect on costs. There is also a greater reliance on the specification, the drawings and preambles which give the item coverage.

The term 'operational estimating' is often applied to methods that rely on a forecast of anticipated durations of activities, and a resource levelling exercise. The estimator must start with an appraisal of the details on the drawings, the extent of the work described in the specification and bill, and a study of the site conditions. Next, the sequence of work will be found by considering the restraints brought about by site layout, client's requirements, the design, time of year, and temporary works. The critical operation at each stage of the construction can then be plotted and the rest of the activities sketched in. Labour and plant schedules can be drawn up for direct work, specialist sub-contractors will be asked for their advice about their work. It may be necessary to change the programme if there are any unwanted peaks and troughs in the resources needed on site. The estimator will then have a list of resources for each operation from which to calculate costs. This approach will often produce a cost based on a particular method for carrying out the work. If this has brought about a saving in costs the estimator will prepare a method statement so site staff can understand the assumptions made in preparing the estimate.

When a building estimator uses operational estimating with a traditional bill of quantities he has great difficulty dividing the cost of a piece of work among all the related bill items. Where, for example, should an estimator put the rate for casting a concrete floor which includes a DPM, fabric reinforcement, power floating and sealer? The PQS often insists on rates being inserted against items that have a value, so there is better financial control during construction. Clearly this is not a problem with a contractor's bill of quantities produced for design and build or plan and specification projects, because there is no bill of quantities submitted. Another solution to the problem for building estimators would be to rough price the bill, early on in the tender period and adjust the balancing sums of money when operational methods highlight greater or lower costs. This is commonly done during the final review stage, and the rough pricing technique is popular with those using computer systems.

The advantages of operational estimating are:

1. Activities are examined to select those methods that are practicable.
2. Outputs are based on a programme, which includes holiday breaks, time of year, idle time, facilities available on site etc., giving a more realistic guide to the time needed for labour and plant.
3. Alterations and repair work are usually measured as global items which can be overpriced if all the possible trades are examined separately.
4. In a competitive market, the estimator may only look at the labour and plant needed for the core item of work; such as the brickwork in a manhole assuming the bricklayer can fix the cover while finishing the brickwork and the excavator can dig the pit when it digs the pipe trench.

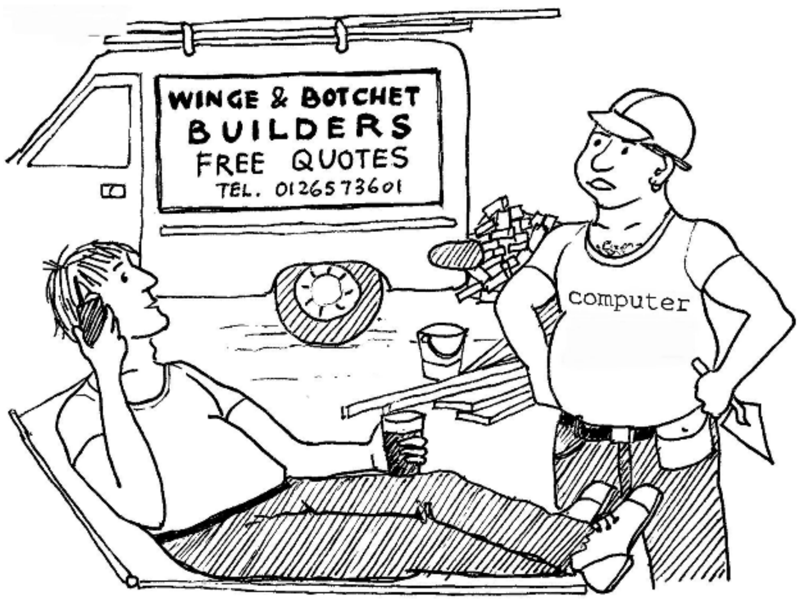
Figure 5.9 is a contractor's bill of quantities for a weighbridge foundation priced analytically. The estimator used an all-in rate of £12.00/hour for all his labour and applied his usual labour outputs from his tables of constants.

The site manager has kept records from previous similar jobs which show that this type of weighbridge foundation usually takes two weeks to construct with four men, and a return visit is needed for two men to grout in the equipment. A backacter and roller costing £28.00/hour is needed for three days. This gives the following net cost for labour and plant:

Labour	4 nr	×	2 weeks	×	45 hours	×	£12.00	=	4 320.00
	2 nr	×	2 days	×	9 hours	×	£12.00	=	432.00
							Total	=	£4 752.00
Plant	1 nr	×	3 days	×	8 hours	×	£28.00	=	£672.00

It can be seen from the comparison that when the project is assessed as a whole, the net cost of labour and plant is more than the total from the unit rate analysis (Fig. 5.9). The estimator may have used his normal constants for labour and plant without checking whether there is a continuous flow of work for labour and plant resources. Perhaps the site manager should next look at materials wastage that he has experienced, in particular blinding concrete and fabric reinforcement, which could be significantly higher for such a small contract.

6 Contractor selection and decision to tender



'Let me run that through our computer'

Introduction

How does a construction organization maintain its turnover? Some enquiries arrive 'out of the blue' arising from hearsay, the *Yellow Pages*, or advertising. Others are sent on the strength of earlier successful contracts or following a direct salesman approach. New markets can be entered by replying to invitations for open tenders; some opportunities can be created by speculation. The greater part of work carried out in the construction industry is secured through a process of tendering which is intended to be an unbiased means of selecting a contractor to carry out work. The client through an evaluation of his needs determines the criteria for selection. The aims of selection are to find a contractor who can supply a product for a competitive price, and can demonstrate the following:

1. A reputation for good quality workmanship and efficient organization.
2. The ability to complete on time.
3. A strong financial standing with a good business record.
4. The expertise suited to the size and type of project.
5. An understanding of the requirements of the scheme in terms of the type of work, the quality expected and the need to achieve target completion dates.

The construction industry is rarely concerned with providing off-the-shelf products; most projects involve unique designs, with purpose-written specifications to be finished in a time which is often difficult to predict. Construction clients must balance the importance of cost, quality and time because it is rare for all three to be satisfied. A client can reduce the financial risks by fully designing the project before selecting contractors.

It is not only clients who need to establish the financial standing of the other party. The contractor will have to be satisfied that the client has the ability to pay, and on time. In the past contractors have not been so careful about selecting their clients. This has changed with the introduction of bonds and guarantees which are now used by both parties to contracts. The word 'trust' is unfortunately absent from conventional agreements, and lawyers are often the main beneficiaries. Recent partnership agreements have been developed using large-scale modifications to standard forms, or occasionally the New Engineering Contract (NEC) Engineering and Construction contract that is plainly written with mutual understanding at its core. The report of Sir Michael Latham in 1994 expresses concern that endless changes to the existing conditions will not avoid confrontation.

Clearly tendering in a competitive marketplace is the norm and will remain the basis for procuring most construction work. Contractors and clients both see the need for longer-term relationships. Since the mid-1990s, partnering between the parties to a construction project has emerged as a route to better communications and a means to improve business performance. There are many forms of partnering, ranging from improved interaction in a traditional contract to long-term relationships using common objectives throughout the supply chain in order to deliver continuous improvement over time. As a result it should be possible to secure lower costs, improved quality and a reasonable profit for everyone.

Competition and negotiation

Contractors may be selected by competition or negotiation and sometimes by a combination of both. Open competition is an arrangement where an advertisement in local newspapers or trade journals invites contractors to apply for tender documents. A deposit is usually required to ensure that only serious offers are made; presumably it is needed to cover the cost of copying the documents. Local authorities have been advised against open tendering because it often leads to excessive tender lists where the cost of abortive tendering is considerable. There are instances of selection criteria being applied after the tender has been submitted, so a bid could be rejected if a contractor does not belong to an approved trade association, for example, after he has submitted his tender. They argue that this method allows new contractors to join the market and increases the chance of gaining a low price. Regional and national contractors avoid this method because they can see no reason to compete against anyone who asks to be included on the tender list and later be subjected to the further hurdle of contract compliance clauses.

Selective tendering consists of drawing up a list of chosen firms and asking them to tender. It is by far the most common arrangement because it allows price to be the deciding criterion; all other selection factors will have been dealt with at the pre-qualification stage. There are three ways in which selective tendering lists are drawn up:

1. An advertisement may produce several interested contractors and suitable firms are selected to tender.
2. The consultants may contact those they would wish to put on an ad-hoc list.
3. Many local authorities and national bodies keep approved lists of contractors in certain categories, such as work type and cost range.

Contractors who ask to be included on select lists of tenderers are usually asked to provide information about their financial and technical performance, particularly about the type of work under consideration. The National Joint Consultative Committee for Building (NJCC) has written the ‘Standard form of tendering questionnaire – private edition’ so contractors can prepare answers to relevant questions in advance. The questions mainly deal with projects carried out during the previous three years. Once the form has been completed, it can be used for specific projects or for those compiling lists of selected contractors. Sir Michael Latham in his 1994 report recommended a single qualification document for contractors wanting to tender for public sector work. Recommendations for the use of a single qualification document were published by the Construction Industry Board (CIB) in its 1997 document ‘Framework for a National Register of Contractors’.

For many years, the building industry has used the ‘Code of Procedure for Single Stage Selective Tendering’ (CPSSST) also published by the NJCC. It was replaced in 1997 with the CIB Code of Practice for the Selection of Main Contractors. These procedures follow a number of well-defined stages for pre-selection and tender stage actions. Their success relies on complete designs before tenders are invited and the use of standard forms of contract but can be used with other procurement systems. The following points illustrate the coverage of the codes:

1. Preliminary enquiry – contractors are given the opportunity to decide whether they wish to tender by receiving a preliminary enquiry letter, four to six weeks before the despatch of tender documents.
2. Number of tenderers – the recommended number of tenderers is a maximum of six (three or four for design and build) and further names could be held in reserve.
3. Tender documents – the aim of the documents is that all tenders will be received on the same basis so that competition is limited to price only.
4. Time for tendering – normally at least four working weeks should be allowed, and more time may be needed depending on the size and complexity of the project.
5. Qualified tenders – tenderers should not try to vary the basis of their tenders using qualifications. Queries or unacceptable contract conditions should be raised at least 10 days before tenders are due. The consultants can then tell all the tenderers of their decisions and if necessary extend the time for tendering. A contractor should be asked to withdraw significant qualifications or else face rejection. This is necessary to ensure tenders are received on a like-for-like basis.
6. Withdrawal of tenders – a tender may be accepted as long as it remains open; a definite period is usually stated in the tender documents. The tenderer may withdraw his offer before its acceptance, under English law.
7. Assessing tenders – the tenders should be opened as soon as possible after they are received. Priced bills may be submitted in a separate envelope by all the contractors, or more likely only the bills of the lowest tenderer will be called for and submitted within four working days. Once the contract has been let, every contractor should be issued with a list of tender prices. Alternatively, tender prices should be given in ascending order and the names listed in alphabetical order.
8. Examination and adjustment of priced bills – the PQS will treat the information in the tender documents as confidential and report errors in computation to the architect and client. There are two methods for dealing with errors. Alternative 1 gives the tenderer the opportunity to confirm his offer or withdraw it. Alternative 2 allows the contractor to confirm his offer or amend it to correct genuine errors. If the contractor amends his offer with a revised tender which is no longer the lowest, the tender of the lowest will be considered.
9. Negotiated reduction of tender – the code of procedure recognizes the need to look for savings in the cost of a project where the tender exceeds the

employer's budget. This can be achieved by negotiation with the lowest tenderer, or the next lowest if negotiations fail.

Two-stage selective tendering may be adopted as an alternative to single-stage selection when a contractor's assistance is needed during the design stage. The first stage will produce a competitive tender based on approximate bills of quantities using preliminary design information. The contractor selected at the first stage helps with design, programming, and cost comparisons, and submits a final tender for the works, without competition, based on the original pricing levels.

The NJCC has published codes of procedure for two-stage selective tendering and selective tendering for design and build. The principles are the same as those described for single-stage tendering. For design and build schemes the client must ascertain the design and build experience of each contractor and limit the number of tenderers to three, or four at the most, because there are large costs involved in preparing designs and cost proposals. Contractors must be told the basis for assessment where the price is not the sole basis for the award. The code suggests that the relative importance of cost, quality and time for construction should be included in the Employer's Requirements. An employer could, for example, state the target cost and time-scale in his tender documents so the principal criterion for selection will be the quality and appearance of the building.

When a contract is negotiated, a contractor is often selected on the basis of past performance, recommendation, familiarity with the work, or from previous experience with the client or his advisers. In certain circumstances only one contractor may be able to provide the service required as in the case of system building. It is more difficult for those in the public sector to negotiate because EC directives insist that projects over a specified value must be subject to competition. Negotiation allows early contractor selection where the extent of work is not fully known and time is of the essence, and more time would be wasted in preparing full tender documents.

The process of negotiation starts with an outline design and a pricing document such as a bill of approximate quantities. The contractor will insert rates which will be agreed by negotiation between the PQS and contractor's QS or estimator. Without competition the initial price may be higher than would be gained by other means, but this may not be a serious problem. An employer is often looking for other factors such as confidence, reliability, speed and experience of working with a known contractor.

Serial tenders allow a number of similar projects to be placed with a particular contractor and thereby provide the incentive of a continuous flow of work. The contractor is normally selected using a priced master bill. Separate contracts for each individual project can then be arranged using the priced master bill as a basis for pricing levels.

Abuse of tendering procedures

The NJCC Codes, and Practice Notes, have encouraged all those involved in tendering to use fair and efficient methods which are the best and most professional techniques in use today. The prime aim is to select the right contractor who will give the client good value for money. Unfortunately, individual interests and lack of time can stand in the way of good practice, and the parties to a contract are often unclear about the true nature of the agreement. Some of the problems faced by the estimator are:

1. *Large tender lists* Open competition has been widely criticized in the construction industry, but it continues to be used, mainly by local authorities. They argue that there cannot be the suspicion of favouritism and the lowest possible price will be secured. They fail to recognize the advice of every committee and working party, which has looked at this matter since the early 1940s. The reports of the Simon (1944) and Banwell (1964) committees stress the need to avoid the temptation to rely on price alone; there should be a sensible number of competent firms selected who can comply with the quality and time requirements. Some clients impose performance bonds to make up for the failings in the system, thus adding to the cost of construction and hoping that a poor job can be corrected when a contractor fails to complete satisfactorily. With the high costs of tendering in mind, many reputable contractors will not willingly take part in open tendering, particularly where local authorities have been known to receive tenders from over 30 contractors. In one example an authority issued tender documents to 28 firms interested in tendering for a multi-storey car park using the design and build system. It is difficult to understand the logic of so many architects producing designs with such a small chance of success.
2. *Short tender periods* The time for tendering should be determined by three factors: the size of the project, the complexity of the project and the standard of the documents. In practice the design and tender documentation is often late with clients wanting to make a start on site quickly, thus eroding the time available for the estimate. A 'rough' estimate could be produced quickly but a contingency sum would be needed for unknown risks. Contractors would prefer to examine the project, the site, the documents and agree methods with the contract staff and sub-contractors, prepare a programme and look for tipping facilities. In fact the longer the tender period, the more likely it is that the contractor will find savings which would increase the possibility of winning the contract and may produce a better price for the client. The estimator will try to respond to such short tender periods by telephoning his enquiries to suppliers and sub-contractors, making use of information from previous jobs, manually or with the help of a computer. The depth of analysis will be

reduced, there is a greater risk of errors and the price is likely to be greater to reflect such problems.

3. *Tender documentation* The estimator should receive enough drawings to understand the nature and scope of the works. The minimums needed are elevations and floor plans to measure temporary works (such as scaffolding), site plans to consider materials access and distribution and component drawings where non-standard elements are to be priced. References to brand names and specialist suppliers should include current telephone numbers and addresses. Information must be provided about any restrictions which might affect the contractor's choice of method. The site investigation report (or extracts) should be sent to each contractor. With design and build projects, problems have arisen when all contractors have been expected to carry out their own site investigations – clearly an enormous waste of effort and a further burden on the already considerable costs of tendering.

   Perhaps differences between documents might be expected at this stage, and so the bills of quantities are used to specify the amount and quality of the works. Discrepancies between the bill descriptions and specification clauses do cause problems but should reduce with the use of Coordinated Project Information (CPI). There will always be people who want to change the agreed conventions. The estimator needs to be alert to traps such as: 'earthwork support shall include all means of holding up the sides of excavations including sheet piling' (normally measurable) or 'hack off external render where necessary and renew' (*where necessary* could be small isolated sections or the whole wall if the contract administrator so decides). Amendments to the tender documents should be avoided but can be allowed early in the tender period. Once quotations have been received from suppliers and sub-contractors, changes will be difficult to build into the bid.

   Estimating without bills of quantities is much more time consuming, not only because so much time is needed to take off quantities but enquiries to sub-contractors are delayed and the risk of errors is greater.

4. *Asking for tenders when the work is unlikely to proceed* There is a tradition in the construction industry for estimates to be given without charge to the client. This can be at great cost to unsuccessful contractors. Some have reported that it costs about 0.25% of the tender price to prepare a bid for a traditional lump-sum form of contract: a design and build tender can cost as much as 2%. Contractors will continue to accept this financial risk providing they are submitting tenders to clients who use selective tendering and eventually award a contract to one of the bidders.

5. *Qualified tenders and alternative bids* The tenderer should submit his bid without adding conditions to his offer. All contractors must consider the terms of their offers, and sometimes will not be able to comply fully with the instructions of the client. On the other hand they should recognize the need for a common

basis from which the best bid can be selected. Contractors may produce an improvement to the design or see a method for completing quicker, and often can calculate an alternative price. Providing an offer is made which complies with the original brief, alternative tenders are considered by employers.

6. *Failure to notify results* A contractor can monitor his tender effectiveness when he receives information about his performance in relation to other tenderers. Tender prices should be published if a contractor is to review his suitability for the type and value of projects. Clients are becoming increasingly reluctant to publish figures because the lowest tenderer could attempt to recover the difference in value between his tender and the second lowest, either before the contract is awarded or later during the construction period. Contractors commonly ask for a briefing on their performance, but will not be told the other tender sums.
7. *Late receipt of tender documents* Estimators do their best to deal with requests for tenders sometimes at short notice, but when tender documents arrive later than promised their programme of work will be affected, and other opportunities to tender may be harmed. It has become common practice for tender submission dates to be held firm regardless of how late the tender documents are despatched.

Decision to tender

All employees of the firm should be made aware that they have a part to play in capturing the opportunities that arise. Senior management will feed back knowledge of projects gained from conversations with prospective clients and partners in related professions at business and social events. Equally, a job surveyor may well gain knowledge picked up while having a pint with his opposite number from the PQS office. All such snippets of information should be fed to the central source and recorded. A list of expected tenders may become a formal report in bigger organizations so resources can be used effectively. Invitations to tender arrive at a contractor's office in a variety of ways and it is important that they should be channelled to a central source for collating and monitoring. Where the organization has a marketing section then this may be the most suitable location. Alternatively, they can be held within the estimating department.

Formal invitations to tender are normally communicated by either letter or telephone. It is to be hoped that the enquiry follows the format laid down in the CPSSST and communicated by letter or facsimile. Compliance with the recommendations given in the Code should be honoured by all parties. The client's professional adviser should provide in good time basic information about the project and ask the contractor if he wishes to be considered for inclusion on a selective tender list. The contractor then has the opportunity to decide, knowing there will be a limit on the number of tenderers.

Regrettably, telephoned enquiries persist! The person answering the phone needs to ask for all the information he would have if a preliminary enquiry had been sent, as detailed in Appendix A of the CPSSST. He is sometimes asked for a decision immediately, which is usually 'Yes' because he knows that his boss can reverse the decision when the documents come in. It is suggested that a pad of forms be available by the telephone of all those likely to accept a call asking if the firm is willing to tender (see Fig. 6.1). The form contains some basic headings as an *aide-mémoire* to those receiving the request. An abstract from the forms and formal letters of invitation could be kept on a weekly report form.

The decision to tender should be made by the chief estimator or general manager using the following points:

1. Is the work of a type which the contractor has experience, both in winning tenders and completing profitably? Does it conflict with the company's objectives and future workload?
2. How many contractors will be invited to tender?
3. Has the contractor the necessary supervisory staff and labour available, he may not wish to recruit untried and unknown personnel in key positions?
4. Will the estimating department have staff available with suitable expertise for the type of work to be priced?
5. Does the location of the proposed site fit the organization's economic area of operation?
6. Are there too many risks in the technical and contractual aspects of the project?
7. Will suitable documents be produced for tender purposes? A busy estimating office may give priority to work that has been measured. Poor documentation might give a clue to the standard of working documents during construction.
8. Has enough time been given to prepare a sensible estimate?
9. What will be the cost of preparing the tender? A contractor might limit the number of design and construct tenders, for example, in order to limit his exposure to cost. In the majority of cases, these costs are not recoverable.

As a client needs to establish the contractor's financial standing, so in turn the contractor will need to be satisfied the client has the ability to pay, and on time. Similarly, as the contractor is investigated for performance on similar work, whether his management structure is satisfactory and his present resources can cope with the added workload, so too the contractor will need to consider experience of working with the architect, engineer, or quantity surveyor.

CB CONSTRUCTION PRELIMINARY TENDER ENQUIRY			
Job title:		Location:	
		Value:	
Employer:		Architect:	
Engineer:		QS:	
Brief description:			
Form of contract:		Bills:	yes / no
		Fluctuations:	firm / fluct
		Bond:	yes / no
		Damages:	£ per
		Nominations:	
Programme:	Tender due in:	Start date:	
	Tender due out:	Duration:	
Action taken:			
Comments:			
Signed:		Date:	
Approved:		Date:	

Fig. 6.1 *Preliminary enquiry information form*

In Appendix A of the CPSSST the draft letter – Preliminary enquiry for invitation to tender – states: '…Your inability to accept will in no way prejudice your opportunities for tendering for further work under my/our direction …'.

This is a plea for the contractor to give an honest answer without fear of being penalized in the future. The Code also states that a contractor, having signified initial agreement to tender, should honour that acceptance except in exceptional circumstances. The exceptions are not indicated but it would be reasonable to withdraw if the contractor experienced a sudden increased workload or the documents arrived later than expected. Appendix B of the Code gives the wording for the letter sent to the contractors selected to tender. The model letter starts: 'Following your acceptance of the invitation to tender ... '. This is a loaded statement as all the contractor has done is to study the preliminary invitation setting out the basic facts of the proposed project and agreed to be considered for selection. Now he is told he has accepted and here are the documents. Notwithstanding the onus placed on the contractor to honour this obligation, now the full documentation is in his possession, he still has every right to confirm or decline to tender.

If the invitation to tender is to be declined, the client's adviser should be told immediately, preferably by phone giving the reasons, and the documents must be returned quickly so that another bid can be invited from a firm on the reserve list. If the decision is to proceed, the estimator should acknowledge the safe receipt of all the tender documents and confirm that a tender will be submitted.

Inspection of tender documents

The arrival of the tender documents within a contractor's office invariably causes a stir; everyone is eager to have a look. The documents should be passed directly to the estimating department. The Code of Estimating Practice (COEP) states that they should be inspected by the person who will be responsible for preparing the estimate. This should be the head of department – the individual who takes the responsibility for the estimate – not the estimator who will later be appointed to deal with the task. It is most important that the early inspection is carried out by a person experienced in current procedures and documentation, and capable in decision making and effective in communicating with others.

The documents should first be checked that they accord with those listed in the letter of invitation, normally:

1. Two copies of the bills of quantities.
2. Two copies of the general arrangement drawings.
3. Two copies of the form of tender.
4. Addressed envelope for the return of tender (and priced bills if applicable).

If the documentation is not complete the fact should be reported immediately by telephone. If reference is made in the letter that certain sections of the bills will follow shortly and the tendering time is as stated in the preliminary invitation, an appeal should be made for a revision of time to comply with the CPSSST. This clearly states 'that the time for tendering should be calculated from the date of issue of the last section'.

The preliminaries sections of the bills need to be examined carefully at this stage, particularly the general and contractual particulars called for under

A10–A37 SMM7. The drawings from which the bills were prepared should be listed in accordance with A11 and the drawings set out in General Rule 5 should be enclosed. Drawing number references should match those recorded, for example if the bills state drawing No. 90/3/2910C: if 'D' is supplied, then it must be questioned.

If further information is needed (to find the extent of temporary works, for example) more drawings may be sought. It is important that the estimator works from actual full-scale prints rather than making a visual inspection at the consultant's office. As a general rule, clients issue all information that is relevant and available at the tender stage.

The contractor may already have a guide to the value of the project; if not, he could get a rough guide to the tender figure by applying approximate rates to the principal quantities. The initial inspection of the tender documents is completed by producing a tender information (enquiry record) form which is similar to the Preliminary Enquiry form but with more details of the estimated cost and contract details. The COEP provides a form for this purpose. The Tender Information form is a valuable source of information because it provides management with a summary of the tender which is being prepared and can be kept for all previous tenders whether successful or not.

Competition legislation

The Competition Act 1998 is designed to make sure that businesses compete on a level footing by outlawing certain types of anti-competitive behaviour. The Office of Fair Trading (OFT) has strong powers to investigate businesses suspected of breaching the Act and to impose tough penalties on those that do.

All businesses, no matter how small, need to know about the Act – to avoid becoming a victim, and to avoid breaking the law. The Act should not be viewed in isolation. The Enterprise Act 2002 among other things introduces a cartel offence under which individuals who dishonestly take part in the most serious types of anti-competitive agreements may be criminally prosecuted.

In addition, as a result of amendments to the Company Directors Disqualification Act 1986 under the Enterprise Act 2002, company directors whose companies breach competition law (including the prohibitions in the Act) may be subject to Competition Disqualification Orders, which will prevent them from being concerned in the management of a company for a maximum of 15 years.

Prohibiting anti-competitive agreements

The Competition Act 1998 came into force on 1 March 2000. It prohibits both informal and formal arrangements, whether or not they are in writing. So an informal understanding where Companies A and B agree to match the prices of Company C will be caught in the same way as a formal agreement between competitors to set prices.

Although many different types of agreement are caught by the prohibition, the Act lists specific examples to which the prohibition particularly applies. These include:

- Agreeing to fix purchase or selling prices or other trading conditions;
- Agreeing to limit or control production, markets, technical development or investment;
- Agreeing to share markets or supply sources;
- Agreeing to make contracts subject to unrelated conditions;
- Agreeing to apply different trading conditions to equivalent transactions, thereby placing some parties at a competitive disadvantage.

Key aspects of the new legislation are:

- Anti-competitive agreements, cartels and abuses of a dominant position are now unlawful from the outset;
- Businesses which infringe the prohibitions are liable to financial penalties of up to 10% of UK turnover for up to three years;
- Competitors and customers are entitled to seek damages;
- The Director General of Fair Trading has new powers to step in at the outset to stop anti-competitive behaviour;
- Investigators are able to launch 'dawn raids', and to enter premises with reasonable force; and
- The new leniency policy will make it easier for cartels to be exposed.

The intention is to create a regulatory framework that is tough on those who seek to impair competition but allows those who do compete fairly the opportunity to thrive.

Cartels

In its simplest terms, a cartel is an agreement between businesses not to compete with each other. The agreement is usually verbal and often informal.

Typically, cartel members may agree on:

- Prices.
- Output levels.
- Discounts.
- Credit terms.

- Which customers they will supply.
- Which areas they will supply.
- Who should win a contract (bid rigging).

Cartels can occur in almost any industry and can involve goods or services at the manufacturing, distribution or retail level. However, some sectors are more susceptible to cartels than others because of the structure or the way in which they operate. For example, where:

- There are few competitors;
- The products have similar characteristics, leaving little scope for competition on quality or service;
- Communication channels between competitors are already established;
- The industry is suffering from excess capacity or there is general recession.

Cartels are a particularly damaging form of anti-competitive behaviour – taking action against them is one of the OFT's priorities under the Act. A business could be a victim of a cartel or could be breaking the law. Either way, it is vital that people know how cartels can affect their business.

A member of a cartel could be fined up to 10% of its UK turnover for up to three years. As a result of the Enterprise Act 2002, participation in cartel agreements may expose individuals responsible for those agreements to criminal sanctions. However, if a business ends its involvement and confesses to the OFT, it can be granted immunity or a significant reduction in any fine.

If there is a compliance programme in place this may be taken into account as a mitigating factor when calculating the financial penalty. The precise circumstances of the infringement, and in particular the efforts made by management to ensure that the programme has been properly implemented, will be carefully considered.

The Enterprise Act 2002

The Enterprise Act received Royal Assent on 7 November 2002. It covers a range of measures to enhance enterprise through strengthening the UK's competition law framework, transforming the UK's approach to bankruptcy and corporate rescue, and empowering consumers.

The Act builds on the progress made by the Competition Act 1998. The substantive consumer and competition provisions of the Act came into force on 20 June 2003.

The measures in the Enterprise Act will empower consumers, modernize the insolvency regime so that it supports enterprise, and help to make UK markets more competitive. The main reforms in the Act are: criminal sanctions with a maximum penalty of five years in prison to deter those individuals who dishonestly operate hardcore cartels – agreements to fix prices, share markets, limit production and rig bids. The offence will be tightly defined ensuring that honest businesspeople will have nothing to fear. US research shows that cartels raise the prices of the affected goods and services by 10% on average.

7 Project appreciation

Introduction

Following management's decision to tender, the tender documents are given to the estimator to prepare the estimate. He should read the documents to gain an overall understanding of the project. A decision can then be made about the help needed from other departments for planning, procurement and commercial appraisal.

If a bill of quantities is available, enquiry schedules can be drawn up immediately, and documents will be prepared for suppliers and sub-contractors (see Chapter 8). Enquiries need to be sent promptly so that specialists have enough time to prepare their quotations.

Once the enquiries are under way, the estimator will broaden his understanding of the project by scheduling principal quantities and PC and provisional sums; he will undertake visits to site and if necessary the offices of the consultants.

Estimate timetable

For most tenders there is an absolute requirement to meet the submission date. The estimator must programme the activities needed to produce a tender to show how the deadline can be met and explain to other members of the team their part in the plan. Each project is different, and some dates such as those for the return of quotations require firm action to maintain the programme dates.

Time allowed for tendering is usually limited by the client's need to start a project quickly. If the design stage has been delayed it is often the tender stage that is shortened. Flexibility is needed to concentrate on the critical parts on the estimate preparation. The estimator can press on to complete his work with a day or so to spare for reconciling and checking the estimate. Much of the early part of the tender period is given over to the dispatch of enquiries to suppliers and sub-contractors and setting up job files when a computer system is used. Figure 7.1 shows a simple timetable for producing an estimate and tender. This programme is simple to produce using a 'blank' standard form because many of the activities are common to all tenders.

CB CONSTRUCTION	ESTIMATE TIMETABLE

Project :	Lifeboat station		
Ref. No:	T384	Date :	14.6.04

	June													July							
	14	15	16	17	18	21	22	23	24	25	28	29	30	1	2	5	6	7	8	9	12
Documents received	e																				
Decision making	e																				
Study documents		e																			
Mark up enquiries		e	e																		
Dispatch enquiries			b	b	b																
Date for return of mat prices																					
Date for return of s/c prices																					
Computer entry			a	a	a	a	a														
Visit site					e																
Visit consultants					e																
Study methods, temp works and programme						e p	p	p	p	p											
Main pricing								e	e	e	e	e	e	e	e	e	e				
Extend bill rates and chase quotations													a	a	a	a	a	a			
Project overheads																		e	e		
Summaries and report																		e	e		
Final review																					
Prepare docs for submission																					
Submission																					

Key: e = estimator, b = buyer, p = planner, a = estimating assistant

Fig. 7.1 *A typical estimate timetable*

The estimator is responsible for preparing the estimating timetable showing the key dates for him and the other members of the estimating team. As the team leader, the estimator will need to coordinate the other people in the team. The Code of Estimation Practice (COEP) gives a typical checklist for a coordination meeting (chaired by the chief estimator), which is presumably for large-scale or complex projects.

CB CONSTRUCTION LIMITED	Project:	Ashbury College		
Pricing Strategy	Type:	Design + Build		
	Ref. No:	T384	Date:	28.6.04

Ref	Aims	Actions	Progress	Owner
1	To research similar schemes and pricing data	Obtain data from Morton College and office database		JM
2	To agree a target cost	Ask Brian to speak to Client about affordability. Use Morton College to produce elemental target cost plan		JM
3	To influence the design of the scheme	Take cost plan to first design meeting. Advise architect about target for each element of the building		JM
4	To quantify the work	Send drawings and specs to Joe Clarke. Ensure quants are received within two weeks. Quants to be in spreadsheet format		PC
5	To monitor the design – ensure it develops within the target cost plan	Attend design meetings. Get Joe to check quants on all drawings issued		JM
6	To obtain quotations for at least 85% of the value of works	Richard to send enquiries to all main trades including groundworks		RH
7	To quantify and price project overheads	Plant, temporary works, scaffolding and supervision to be quantified by planner. Allow subsistence costs for project manager		JM
8	To complete the estimate for review by management	Mid tender review to be on Tuesday 13 July. Final review Wed 4 August 2004		JM
9	To identify risks and opportunities	Phil to arrange risk meeting on Mon 12 July. Check for overlaps with trade contractors		PC
10	To comply with submission requirements and follow-up by contacting client	Ask James Barker to produce/edit submission document		JM/JB

Fig. 7.2 *Typical pricing strategy for a college building*

Pricing strategy

Procedures for estimating are well understood by most contractors, and formal plans are not needed for every tender. On the other hand, large-scale projects, such as hospitals and office blocks, need to be planned from the start by agreeing pricing methods and strategies at a 'start-up' meeting.

A typical pricing strategy document, shown in Fig. 7.2, lists the aims, explains the actions, records progress and identifies the person responsible for completing the actions.

This is an important document to agree with management – before recourses are allocated to the tender. It would be reckless to wait until a mid-tender review meeting to discover that the approach is not in line with management's expectations.

Schedules

The estimator should list all the prime cost and provisional sums to identify the work which will be carried out by other contractors. A summary of costs written into the bill will become part of the estimator's report for management at the final review stage. The example given in Fig. 7.3 shows the structural steelwork and electrical sub-contractors will be chosen by the architect and no enquiries will be sent by the contractor at tender stage.

The summary of PC and provisional sums can also be used to show the attendances required by each nominated sub-contractor. SMM7 (A51.1.3) gives a list of the items of special attendance which must be given in a bill of quantities if required. The summary can include these items in the form of a checklist. The CIOB Code of Estimating Practice provides an alternative form, which encourages the estimator to produce a breakdown of attendances into labour, plant, materials and sub-contractors. Most of the costs of providing these attendances are evaluated when pricing the project overheads because they can be considered in relation to the project as a whole.

The estimator needs to abstract 'direct' work items that will be carried out by the main contractor, such as excavation, concrete work, brickwork and drainage. The trade abstract shown in Fig. 7.4 brings together all the pages to be priced under each trade heading, and helps the estimator to assign pricing duties when more than one estimator is working on the tender.

The estimating team

The roles of the members of the estimating team (Fig. 7.5) will vary from company to company and will depend on the size of the job. Some companies prefer to

CB CONSTRUCTION LIMITED	PC & Provisional sums	Project	Lifeboat Station		
		Ref. No:	T384	Date:	14.6.04

Bill ref:	Description	Prov sums	Prime cost sums Gross	Discount	Nett	Notes for pricing preliminaries
	PC SUMS					Special attendances
6/1a	Structural steelwork (Steelbuild Limited)		23 000	575	22 425	Good access roads and hardstanding
6/1e	Electrical installation (name not given)		15 600	390	15 210	Scaffolding Covered storage
6/2a	Fire doors (nominated supplier)		3 840	192	3 648	
	PROVISIONAL SUMS					Prelims for defined prov sums:
6/2m	Contingencies	5 000				
6/2n	Drainage to sump	1 000				
6/2p	Glazed roof over entrance	3 500				Scaffolding Protection and cleaning
6/3	Daywork – labour add 110%	1 000 1 100				
	Daywork – materials add 15%	500 75				
	Daywork – plant add 60%	500 300				
	Totals:	12 975	42 440	1 157	41 283	

Fig. 7.3 *List of PC and Provisional Sums at project appreciation stage*

hand a copy of the documents to the buyer for sending out enquiries and others elect to keep control of this activity in the estimating section. A compromise would be for the estimator to abstract the materials and sub-contract packages, forming part of the estimate, and ask the buyer to select suitable companies to

CB CONSTRUCTION LIMITED	Project:	Fast Transport		
Trade abstract	Ref:	T354	Date:	21.6.04

Trade		Bill pages	Spec pages	Estr	Quant	Unit	Lab	Plt	Mat	Total
D20	Earthworks	3/1–5, 4/35–37	2/1–12	JM	1075	m^3	7 800	7 980	5 700	21 480
R12	Drainage	5/1–34	2/56–65	JM	823	m	8 650	6 520	9 520	24 690
E10	Concrete work	3/5–7, 4/38–40	2/13–15	JM	956	m^3	12 520	3 750	51 840	68 110
E30	Reinforcement	3/11, 4/43	2/15–16	JM	76	t	13 680		24 700	38 380
E20	Formwork	3/7–10, 4/40–42	2/17–22	JM	2 150	m^2	30 950		16 530	47 480
E40	Concrete sundries	3/7,11–13, 4/44,45	2/14	JM			2 150		3 180	5 330
F31	Precast concrete	4/46	2/35	PC			1 850		8 250	10 100
F10	Brickwork	3/19–22	2/24–28	PC	76	th	18 460		19 520	37 980
F11	Blockwork	3/20	2/27–32	PC	3 100	m^2	18 880		17 450	36 330
F30	Brick sundries	3/22,23	2/24	PC			4 520		5 250	9 770
G20	Timber	3/28–31	2/39–44	PC	4 210	m	5 150		6 210	11 360
P20	Joinery	3/31–38	2/39–46	PC			2 380		5 310	7 690
G12	Metalwork	3/29,39	2/47–48	PC			2 680		8 450	11 130
P31	BWIC	3/55		JM			2 110		2 030	4 140
	Attendances	6/1		JM			410		385	795
					Totals		132 190	18 250	184 325	334 765

Fig. 7.4 *Trade abstract for sections to be priced by the contractor*

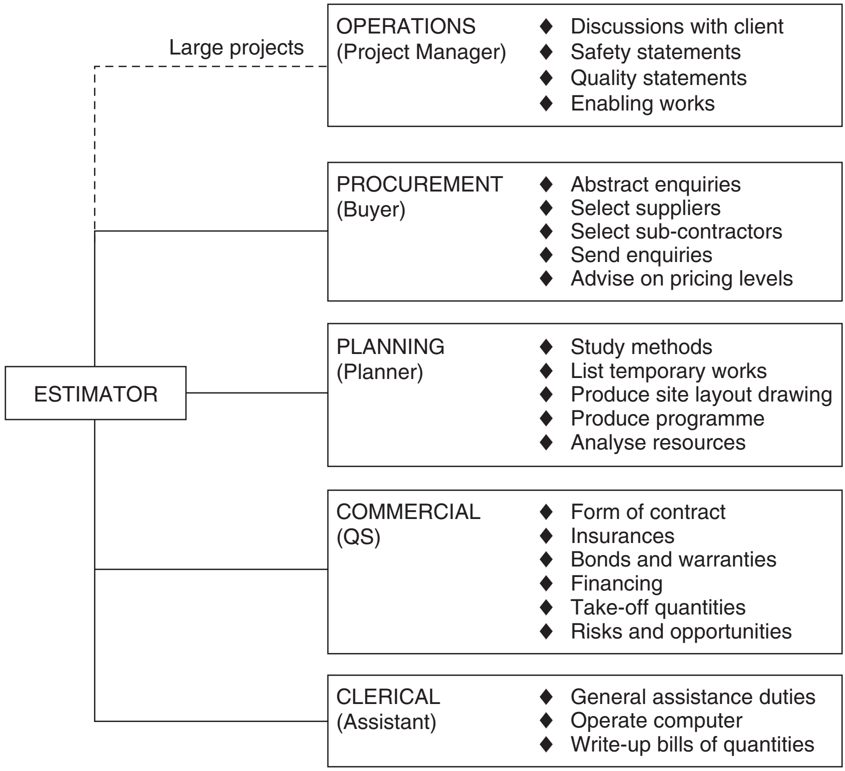


Fig. 7.5 *Coordination of the estimating team*

receive enquiries and coordinate and prepare documents for despatch. This allows the estimator to keep control over what prices are sought, and the buyer can use his experience to get better prices. The commercial manager, or quantity surveyor, should be given the opportunity to comment on the form of contract proposed, insurances, bonds and financing requirements. If there are any onerous or unusual conditions that may cause problems with an unqualified bid, they should be challenged by writing to the client for a ruling. This should produce a more satisfactory result than leaving it for management to decide at the final review meeting when it is too late for an amendment to be made to the tender documents.

The commercial manager needs to develop an overview of the scheme in order to produce a 'risks and opportunities' register. The register will identify a risk (or opportunity), determine its value and the probability of it happening. Many risks can be reduced, during tender stage, by changing the design, passing the risk to others.

During the tender period, a planning engineer has a great deal to contribute. Instead of looking at the project from a financial point of view he will start by examining the layout of the site, methods for construction, temporary works requirements, distribution patterns, sequence of work, a preliminary construction programme and resource levels. A civil engineering estimator will usually assess the temporary works, and programme the works himself because this is often the preparation needed for operational estimating techniques. A building estimator will tend to rate the items in a bill of quantities and rely on the planner for a more detailed examination of methods.

Visits to consultants and site

An estimator needs to examine the documents carefully before leaving his office. It may be helpful to mark up a site plan to highlight the main elements, such as: areas of scaffolding; access routes; existing and proposed services; fencing and external hard landscaping. The estimator must identify the work items which will be priced on site including demolitions, alterations and repairs. A preliminary assessment can be made to find areas for general facilities such as site accommodation, cranage, storage areas and hard standings. If any relevant information is missing then it might be questioned at the consultant's office or during the site visit.

In a perfect world there should be no need to visit the consultant's office – the tender documents should define the basis of an agreement to construct. There are, however, some benefits, as follows:

1. A critical assessment can be made of the progress made with the construction drawings, which would be important if there is a need for a quick start.
2. The estimator can seek clarification of layouts and details that were not included with the tender documents.
3. The names of adjoining property owners can be used to find sites for disposal of surplus materials and search for sources of fill.
4. The contractor can consider opportunities to offer an alternative bid in terms of time or design.
5. A contractor can explain its track record and interest in future projects.

A site visit must be made before a tender is submitted and should wherever possible be carried out by the estimator in person. The COEP provides a comprehensive standard report form which will cater for most projects.

Site features and existing buildings can be recorded on camera, not only to remind the estimator of site details during the pricing stage but will prove an excellent means of communication at the final review meeting. Occasionally permission will be required to take photographs, such as: inside existing buildings, near sensitive production processes and of existing property where security must be preserved. Permission is not needed for photographs taken of any property from outside the site boundary.

In assessing the site, note should be made of the topography, whether it is situated on a hill or in a valley, for example. Some plants could signal that although the ground is dry in summer the same ground may be waterlogged in winter. The general levels of the site need to be related to the information gained from the site investigation report, sometimes the remains of trial holes can be inspected. The contractor must assess the effect of a change of season from summer to winter. Some of the best information is available from residents and landowners. They often have valuable knowledge about flooding and ground conditions met during previous excavation work.

The site location and access routes must be examined. Urban sites need particular consideration. In built-up areas where cranes are to be used permission may be needed to encroach on air space; loading gantries, hoardings, protected walkways and temporary footpaths all need careful consideration when pricing project overheads. In country districts there could be a problem with the loads allowed in narrow lanes. Signboards may be needed to guide traffic from the nearest main road. Will crossovers be needed from public roads to the site, or will they need to be constructed?

There are some questions about existing utility services which must be answered. Who supplies the services, where are the nearest connections and what sizes and capacities are available? Much effort can be saved if site toilets can be connected to a foul drain. Water will be needed early on when the site facilities are set up. Electricity supplies may be present but are they sufficient to meet the heavy demand of running plant? If an electrically powered tower crane is planned a large-capacity supply may be needed. The electricity company is usually reluctant to bring the new main in at an early stage unless the contractor is prepared to contribute to the capital cost.

Security is an increasing problem which must be checked during the site visit. Existing boundaries need to be related to the site boundary and compared with the fencing measured in the bill or described in the preliminaries. A short discussion with a resident might highlight the risks.

Finally and most important are the items which can only be priced by assessing the extent of the work on site. These include: demolitions (usually given as items in the tender documents with overall dimensions), alterations (given as spot items the complexity can be gauged in work-hours), and clearing site vegetation (measured in square metres and varies from site to site). Where the work is predominantly described in spot items, the estimator will make extended and often repeated visits to site on occasions meeting sub-contractors.

8 Enquiries to suppliers and sub-contractors

Introduction

Contractors have developed procedures to ensure that tenders are based on up-to-date prices for materials and specialist services. As the COEP states 'The contractor's success in obtaining a contract can depend upon the quality of the quotations received for materials, plant and items to be sub-contracted'. To illustrate the point, the following breakdown has been taken from a typical building estimate, and shows that materials and sub-contracts account for 72% of the estimated costs before overheads and PC and provisional sums are added:

Breakdown of contractor's costs	
Direct work – Labour	23%
Direct work – Plant	5%
Direct work – Materials	28%
Domestic sub-contractors	44%

Enquiries must be sent promptly but not at the expense of accuracy. Wrong or incomplete information will lead to delay in receiving comparable quotations. An orderly presentation will do much to avoid mistakes. The COEP provides some model forms for use in abstracting and suggests ways of selecting suitable suppliers and sub-contractors. These forms are further developed according to each company's procedures. Figure 8.1 shows a form which can be used for abstracting materials or sub-contract packages and later helps to record the receipt of quotations by highlighting the names of firms which have responded.

Most enquiries consist of photocopies of the relevant pages from the bills of quantities with a letter and any related drawings. Ideally those bill items, which are not to be priced, should be crossed out to avoid confusion. With computer-aided estimating systems, a *sub-contractor* bill of quantities can be generated by choosing only those items relating to a trade package. Although sub-contractors should be sent two copies of the bill pages which are to be returned, this practice has died out largely because sub-contractors prefer to photocopy their priced bills. With the introduction of CPI and SMM7, bill descriptions now have references to the

CB CONSTRUCTION	**ENQUIRY ABSTRACT**	**[X] materials** **[ ] sub-contractors**		

Project	Lifeboat Station		
Ref. No.	T384	Date:	15.6.04

Ref.	Description	Approx. quants	Bill pages	Spec pages	Drawings	Names	Telephone
M1	AGGREGATES					SWANFIELD STONE CO	
	DOT TYPE 1	580 t		2/5,6		LITTLEGREEN QUARRIES	
	DUST	55 t				J.P. HEPPLE	
	20 mm SINGLE SIZE	110 t					
M2	CONCRETE					SWANFIELD STONE CO	
	C15P	25 m^3		2/11–15		DRAY CONC SERVICES	
	C20	40 m^3				PINTO CONCRETE LTD	
	C35	400 m^3					
M3	REINFORCEMENT					BARBEND FABRICATION	
	A393	1 240 m^2		2/19,20		OAKFORD REINFORCEMENT	
	10 mm HY	1.1 t				DOWLAIS STEEL	
	12 mm HY	3.8 t					
	16 mm HY	5.6 t					
M4	PRECAST CONC					HILBERG CASTINGS	
	LINTELS	27 nr	3/22	2/22		TELGAN CONC PRODUCTS	
	KERBS	360 m	4/46				
M5	BRICKS/BLOCKS					SIMGROVE BRICK	
	FACINGS	11 000 nr	3/19–22	2/28–30		BUSH BROS LTD	
	100 mm BLOCKS	550 m^2				HEPPLE BRICK CO	
	140 mm BLOCKS	200 m^2					
M6	JOINERY					GOTHIC JOINERY LTD	
	AS BILL PAGES		3/31–37	2/36–40	SK1,2,3	ST. ANNES TIMBER	
					B/27/204	SHIRE MANUFACTURING	

Fig. 8.1 *Abstract form for materials or sub-contract enquiries*

specification clauses which apply to the item of work. This helps the estimator ensure that he sends the correct specification clauses with the enquiries. For tenders based on drawings and specifications, enquiries must clearly state the scope of work to be priced for each sub-contract package. For example, a flooring sub-contractor will need to know whether to include latex screeding, skirtings and expansion joint covers in their price.

In the past estimators and buyers have kept lists of companies who can supply materials and services in a card index of names usually in trade order. Since desktop computers have been introduced with user-definable databases, many contractors maintain name and address files which can be searched for trade contractors within travelling distance of the site. The software is usually able to address the letters and envelopes and keep track of previous performance, although feedback from site on a sub-contractor's behaviour is not always consistent or reliable. Computer-aided estimating software can also maintain a supplier database. An estimator can then link bill pages to his list of sub-contractors, from within the software running on his computer.

When tendering in an unfamiliar location, the estimator must allow time when visiting the site to tour the area, and note the volume of work going on and what stage individual jobs have reached. Site hoardings which list the sub-contractors being used on a site are a valuable source of information about specialists who are acceptable to your competitors. Another useful starting place, for obtaining names, is the local newspaper; especially when the newspaper has printed a special promotion naming various sub-contractors linked to the completion of a local building. An estimator will often search the Internet or look up nationally published directories. If new sub-contractors are to be invited to tender the buyer should telephone first to ascertain their ability and willingness to prepare a quotation.

Enquiries for materials

Many construction organizations have a standard form of enquiry for suppliers; a typical example is given in Fig. 8.2. Enquiries should give the following information:

1. Title and location of the work; some suppliers complain that enquiries from different contractors are received in varying formats, often making it impossible to decide whether they are for the same job.
2. Description of the materials, supported by specifications.
3. Approximate quantities, so that bulk discounts can be quoted.
4. Date by which the quotation is needed; seven to ten days would seem reasonable although those with complex fabrication work to price, joinery suppliers, for example, may need longer; the most successful approach where time is limited is to say so, and request cooperation by responding as soon as possible.

Our ref: T384/M5 17 June 2004

Simgrove Brick Ltd
Unit 3, Northbridge Industrial Estate
Northbridge
NB3 5MGG

Dear Sirs,

NEW LIFEBOAT STATION
BEACH LANE, STANDSFORD

We are tendering for the above project and ask you to submit your best rates for the following items to be delivered to the site. The project is due to start on Monday 30 August 2004. If you have queries in relation to this enquiry please contact our Regional Buyer, Mr Frank Applecourt.

Please reply by 29 June 2004 and state any known or anticipated price rises likely to affect our tender.

Yours faithfully,

Item	Description	Approx. quants	Supporting documents enclosed
1.	Facing bricks	11 000 nr	Bill pages 3/19–22 Spec pages 2/28–30
2.	100 mm blocks	550 m^2	
3.	140 mm blocks	200 m^2	

Fig. 8.2 *Typical enquiry for materials*

5. Name of the estimator dealing with the tender.
6. The contract period with a guide to the dates for deliveries; it can only be a guide because the start date is rarely known and the construction programme is not yet available.
7. Whether firm price or fluctuating price.
8. Minimum discount terms required.
9. Any limitations on access to the site.

The supplier should make every effort to meet the specified submission date and tell the contractor if a delay is expected. If the supplier is himself awaiting information from his sources, he should submit a quotation with a clear statement where prices are to follow.

There is not much point in keeping price lists unless they are updated regularly. It is more important for an estimator to compile a library on material characteristics, quality, sizes and performance standards. Knowledge of available materials and products will enable the estimator to consider alternatives which comply with the specification.

Enquiries to sub-contractors

There are three kinds of domestic sub-contractor who will be approached at tender stage. The conventional sub-contractor who provides a complete service, labour-only sub-contractors who are supplied with their materials and plant, and labour and plant sub-contractors who receive their materials from the main contractor. Sub-letting work to specialists is an attractive arrangement for contractors because much of the technical and financial risk is passed to another party, and a profit is almost guaranteed (providing the work goes to plan). On the other hand sub-contractors can benefit from increased quantities and certain variations. Most contracts state that the main contractor shall get written permission before sub-letting any of the work, and in some (now rare) instances employers will not allow the use of labour-only sub-contractors.

Domestic sub-contractors will need a lot of information about the site, contract conditions, programme, the specification and extent of work. The example given in Fig. 8.3 shows a standard enquiry letter which can be stored as a word-processor file and tailored for each contract and trade. This example is lacking guidance on the timing of the work, probably because this can be found in the extract from the preliminaries. On larger projects, an outline programme might be available and the sub-contractor will be asked to prepare his own tender programme with information about extended delivery periods which might affect the progress of the works.

16 March 2004

Dear Sirs,

<u>NEW OFFICES FOR MANIFOLD METALS PLC,</u>
<u>NORTH LANE, STANSFORD</u>

We invite you to tender for the PAINTING work for the Manifold Metals project and enclose the following details which describe the quality and quantity of the work:

Preliminaries pages:	1/2–12	
Bill pages:	3/45–48	(2 copies)
Specification pages:	2/39–40	
Drawings:	D/206/1	
Form of tender		(2 copies)

The names of the parties, general description of the works, and details of the main contract are given in the extract from the preliminaries. Your form of tender, priced bill of quantities and daywork rates must be delivered to this address to arrive by 6 July 2004.

The form of sub-contract will be DOM/1 incorporating all relevant published amendments and the following:

Payments	:	Monthly
Discount to main contractor	:	2.5%
Fluctuations	:	Firm price
Liquidated damages	:	£1 200 per week
Basis of daywork	:	Current RICS definition
Retention	:	5%
Method of measurement	:	SMM7
Defect liability period	:	Six months

We will provide all sub-contractors with water, lighting and electricity services near the work and common welfare facilities on site. Sub-contractors will be required to provide the following services and facilities:

(a) unloading, storing and taking materials to working areas
(b) power and fuel charges to temporary site accommodation
(c) clearing-up, removing and depositing in designated collection points on site all rubbish or other surplus or packing materials
(d) temporary accommodation and telephones
(e) day-to-day setting out from main contractor's base lines.

If you have any queries about this enquiry please contact the estimator for the project, Mrs Peggy Carter.

Would you please confirm by return your willingness to tender by the date for tender.

Yours faithfully,

Fig. 8.3 *Sample enquiry letter to domestic sub-contractors*

The COEP lists the details to be given in a contractor's enquiry letter, as follows:

- Site address and location (with a map if necessary).
- Name of employer, and professional team.
- Relevant details of main and sub-contractor.
- Any amendments to the standard conditions, including bonds and insurances.
- A request for daywork rates.
- Date for return of quotations.
- General description of works.
- Details of access, site plant and other facilities available.
- Where full contract details and drawings can be inspected.
- Contract period, programme and any phasing requirements.
- Any discounts to be included.
- Two copies of the relevant sections of the bills of quantities.
- Copies of drawings and schedules where applicable.
- Services and attendances to be provided by the main contractor.
- A clear statement of how fluctuations will be dealt with.

Labour-only sub-contractors usually quote under different arrangements; in particular they often expect:

1. Setting out by the main contractor.
2. Weekly or fortnightly payments by the main contractor.
3. Modified retention sums to reflect the extent of their work.
4. Materials delivered, unloaded and sometimes taken close to the point of fixing.
5. Major items of plant (which will be used by other sub-contractors) to be provided by the main contractor.

Although most enquiries are in the form of photocopies of bill pages, it is important that the estimator clearly states the portions of the work which the labour-only sub-contractor is expected to carry out. As an example, a concrete specialist might be asked to price placing concrete, fixing reinforcement and labour and materials in fixing formwork. Another firm might be asked to lay concrete in floor slabs and power float the surface.

In 1997 the Construction Industry Board produced a 'Code of Practice for the Selection of Sub-contractors' which recommends a tendering procedure which mirrors that suggested in its parallel publication for main contractors. In other words, sub-contractors should be asked for their willingness to tender, there should be full tender documents, sufficient time must be given for preparing tenders, and sub-contractors should be told about their performance.

For design and build projects, there are additional responsibilities for sub-contractors not least the development of the concept design and completion of working drawings. Sub-contractors are expected to submit, with their tender, risks that have been identified and priced in their offer. It is important that the main contractor ensures there is no duplication of risk allowances in the tender.

Sir John Egan's report, 'Rethinking Construction', brought immediate changes to the way in which the construction industry procures supplies and services. John Egan used his experience of other industries to highlight the benefits of smarter procurement through integrated supply chains.

There are efficiencies in working with suppliers and sub-contractors who become part of a close working relationship. Through strong supply chain management, vendor lists are kept small, problems can be shared and organizations begin to work better together. Term contracts can be set up with material and plant suppliers whereby prices are fixed for any site in any location for a fixed period of time.

Defence procurement has taken these concepts further. The prime-contracting route, adopted by Defence Estates, relies on strong relationships between (prime) contractors and their sub-contractors. Commitments to guaranteed maximum cost and risk assessments are made at prime contractor and sub-contractor levels and shared with the client.

9 Tender planning and method statements

Introduction

The estimating team will consider construction methods and employ planning techniques to:

1. Highlight any critical or unusual activities.
2. Examine alternative ways of tackling the work.
3. Calculate optimum durations for temporary works and plant.
4. Reconcile the labour costs in the estimate with a programme showing resources.
5. Determine the general items and facilities priced in the preliminaries section of the bill.
6. Check whether the time for completion is acceptable.

The effort needed will depend on the size and complexity of the project, the proposed use of heavy plant and the design of major temporary works. Estimating for civil engineering work in particular is dependent on an examination of alternative methods and pre-tender programmes. A civil engineering estimator usually produces a resourced programme to price major aspects of the work operationally.

Pre-tender programmes are prepared by either the estimator or planning engineer, or more likely by working together. The choice depends on company policy, size of project and type of work. The planning engineer's contribution can be seen as producing an appraisal of labour and plant resources and general items – in other words the estimator expresses his solutions in terms of cash, the programmer deals with time. The aim is to reconcile one with the other.

The role of the planning engineer

In a competitive market it is important to look for ways to construct the project more economically. Applying planning techniques can have opposite consequences. Increasing the value of the tender when problems are identified and reducing the estimate when methods can be adopted which reduce individual and overall durations. The team must, however, look for the solution, which reflects the 'true' cost of construction. The role of the planning engineer is wider than just producing a programme. His input to a tender can also include:

1. Producing site layout drawings, which are used to locate temporary facilitates, such as concrete batching plant, cranage, access routes, restrictions, areas for accommodation and storage, location of services, overhead service, temporary spoil heaps, and areas which will need reinstatement.
2. Examining the most suitable methods in relation to the design and the temporary works required.
3. Preparing method statements not only for pricing purposes but also for submission to clients or consultants when requested.
4. Producing cashflow forecast charts for management and clients who need them.
5. Providing staff structure and resource histograms for general labour, production labour and plant.

The planning engineer will often have a better understanding of current site practice and will be better placed to collect data from monitoring exercises on site. His experience of completed work will be important especially where the overall duration of a project could be reduced. Shorter contract periods can have a substantial effect on the cost of preliminaries where time-related costs (mainly staff, site accommodation, cranage and scaffolding) account for as much as 12–20% of a tender figure.

Method statements

Method statements are written descriptions of how items of work will be carried out. They usually deal with the use of labour and plant in terms of types, gang sizes and expected outputs.

There are many reasons why method statements are prepared during the tender stage. It is unlikely that an estimator will prepare a written method statement for his own use but if any of the following requirements exist then he will commit his thoughts to paper:

1. The client's advisers may ask for a method statement to accompany the tender, to satisfy themselves that the contractor has an understanding of the technical challenges and has considered suitable ways of overcoming them.
2. The quality management scheme adopted by the organization may give situations where method statements for work worth more than a certain value are required.

3. Management contractors usually ask for method statements where there may be interface problems with other works contractors on the site.
4. In satisfying the need for safe systems of work, an estimator might develop a method statement with a demolition contractor, for example, before agreeing a price to be incorporated in the tender.
5. Large-scale activities needing a combination of items of plant and labour are difficult to price on a unit rate basis and cannot be started without an examination of methods and resources.
6. Where the estimator has investigated an alternative design he will need to assess the effect these changes will have on other elements of the construction.
7. Part of the handover information prepared for successful tenders is a description of the assumptions made by the estimator.

Many contractors are reluctant to submit a detailed method statement at tender stage because their ideas could be used by other parties without any financial return. A preliminary document can be prepared (see Fig. 9.1) based on the broad assumptions made at tender. It is likely to include extracts from the company's manuals for safety and quality management and some development of the client's pre-tender health and safety plan. This method statement can also be of benefit to the contractor because it is a suitable vehicle for:

1. Qualifying the tender.
2. Identifying dates when information is required from the client or his advisers.
3. Indicating when instructions are required for dealing with nominated subcontractors and provisional sums.
4. Explaining the limitations of temporary works; a contractor might have allowed for earthwork support but not sheet piling, for example.

Tender programmes

The tender programme will fix an overall time for the project, from which the estimator can determine times for sections of work in main stages such as:

1. Design and mobilization.
2. Substructure.
3. Independent structures.
4. Superstructure.
5. Engineering services.
6. Internal trades, finishes and fixtures.
7. External works.

Outline Method Statement
for
New Offices
for
Fast Transport PLC
North Lane, Stansford

Site location	The project is located in the existing transport yard of Fast Transport PLC, North Lane, Stansford. Access will be through the main entrance gate.
Restrictions/ Access	Incoming traffic will be directed to use the north access road and will leave the site along the road next to the canteen. The live oil and gas mains will be protected during the contract period and the fibre optics cable will be carefully exposed by hand dig and protected in accordance with the specification prior to piling equipment entering the site.
Sequence of work	Our tender programme T354/P1 shows the preferred sequenceof activities. The aim is to start at the east end of the building progressing to the west. The site will be filled with a stone layer on a ground improvement mat immediately after the site is levelled. Concrete floors will be started after the columns have been cast and before the upper floors are constructed. External paving will be carried out in the last quarter of the contract period. The drain connecting manhole 3 to the existing foul sewer will be completed early to provide disposal from temporary facilities.
Design development	Detailed drawings of the roof cladding will be produced by our specialist sub-contractor. These will clarify the scope of the work giving fixing details, sequencing and weathering procedures. Roof flashings will not be made until formal approval has been received by our sub-contractor.
Temporary works	An independent scaffold will be erected to each external face ofthe building, and a mechanical hoist will be provided near the north-west corner.
Safety	Anyone working on or visiting the site will be required to wear safety helmets and operatives will use other protective clothing depending on the type and location of work. The sides of the drain trench next to the oil tank will be supported with trench sheeting and we will provide barriers next to all excavations where a danger exists. The agent will attend regular meetings with the planning supervisor and cooperate with site regulations to maintain the client's good safety record. The health and safety plan will be developed by our construction team prior to starting any affected works, and sub-contractors will have contributed to any relevant planning for their works. The health and safety file will be prepared as the project progresses. The safety performance of the site is monitored by line management who report to regular safety audit meetings; and external consultants inspect our compliance with current legislation at intervals of no more than three weeks.
Supervision	Our management structure for the project is shown in the diagram attached. We will adopt a flexible approach to site supervision, providing sufficient operatives in suitable disciplines to meet our programme requirements.
Quality plan	The site manager will be responsible for drawing up a quality plan for the project with assistance from the area planning engineer. The control and monitoring framework is given in the company's general procedures and QA manual.

Fig. 9.1 *Example of a tender method statement for submission to a client*

Information about these periods is essential to the estimator, enabling him to calculate times for:

1. Staff requirements.
2. Site accommodation.
3. Mechanical plant and equipment.
4. Temporary works such as falsework and scaffolding.
5. Increased costs for firm-price tenders.
6. Work affected by the seasonal weather changes such as drying out buildings, heating, protection and landscaping.

The overall section durations can be used to check workforce levels and items of plant such as excavators and cranes that often remain on site for continuous periods. There may be times of excessive demand for plant and labour, which will call for a levelling exercise to balance resource needs.

The estimator must be clear about what he needs from the programme so the planner will concentrate on what is important.

To illustrate the point, an estimator has brought together all the labour costs amounting to £91 250 for a clear run of brickwork comprising 250 000 facing bricks. He priced the brickwork items with an all-in rate for bricklayers of £12.50 and labourers £9.50 per hour.

Assuming each bricklayer is serviced with half the time of a labourer, each bricklayer's effective rate is:

12.50 + (9.50/2) = £17.25

The total time included in the rates would be:

£91 250/£17.25/hour = 5 275 *hours work*

The planner has decided to use an average output of 50 bricks per hour.

250 000 bricks at 50 bricks/hour = 5 000 *hours work*

This is clearly close to the estimate. Now that the number of working hours has been established, a duration is calculated by dividing by the number of productive hours in a week and the number of bricklayers. The programme might dictate the number of gangs required. This will not change the rate but will alter the cost of ancillary facilities such as scaffolding and mixers. Most activity durations can be derived from the product of quantities and standard outputs, see Fig. 9.2, but parts of the tender will be based on offers received from specialist sub-contractors and labour-only sub-contractors. These firms will be asked to provide information about the time they will be on site and the effect of delivery periods on the main contractor's programme.

The tender programme must allow for recognized public/industry holidays, inclement weather and the peak summer holiday period which leads to a slowing

CB CONSTRUCTION LIMITED | **Proposed Offices for Fast Transport Limited** | Tender Programme No: T354/P1

	Activity	Quant	Output (hrs/unit)	Man (wks)	Gang size	Duration (wks)
1	Setting up and setting out					
2	Excavation and filling	1 035 m^3	0.13	2.9	JCB+lab	3
3	Foundations formwork	820 m^2	1.20	21.9	4 carp	5
4	Foundations concrete	419 m^3	1.20	11.1	3 lab	4
5	Underslab drainage	178 m	0.50	2.0	2 lab	2
6	Concrete ground floors	137 m^3	1.00	3.0	4 lab	1
7	Columns formwork	279 m^2	1.20	7.5	2 carp	4
8	Columns concrete	21 m^3	3.50	1.6	3 lab	1
9	Floors and beams formwork	962 m^2	1.60	34.2	4 carp	8
10	Floors and beams concrete	203 m^3	2.20	10.0	4 lab	3
11	External walls	1 870 m^2	1.50	62.3	8 brklayer	8
12	Roof timbers	2 300 m	0.20	10.2	4 carp	3
13	Roof covering	685 m^2	0.50	7.6	4 carp	2
14	Windows	£25 500	sub-contract			4
15	Services 1st fix	£43 000	sub-contract			6
16	Plasterwork and partitions	£43 500	sub-contract			8
17	Joinery	£34 000	sub-contract			8
18	Ceilings	945 m^2	1.00	21.0	4 fixers	5
19	Services 2nd fix	£28 000	sub-contract			5
20	Painting	3 500 m^2	0.30	23.3	4 paint	6
21	Floor coverings	£12 300	sub-contract			3
22	External work and drainage	£16 700	labour	52.0	5 lab	10
	PRELIMINARIES	Agent	(24 plus 3 mobilization)			27
		Engineer				17
		Foreman				26
		Crane				7
		Forklift				10

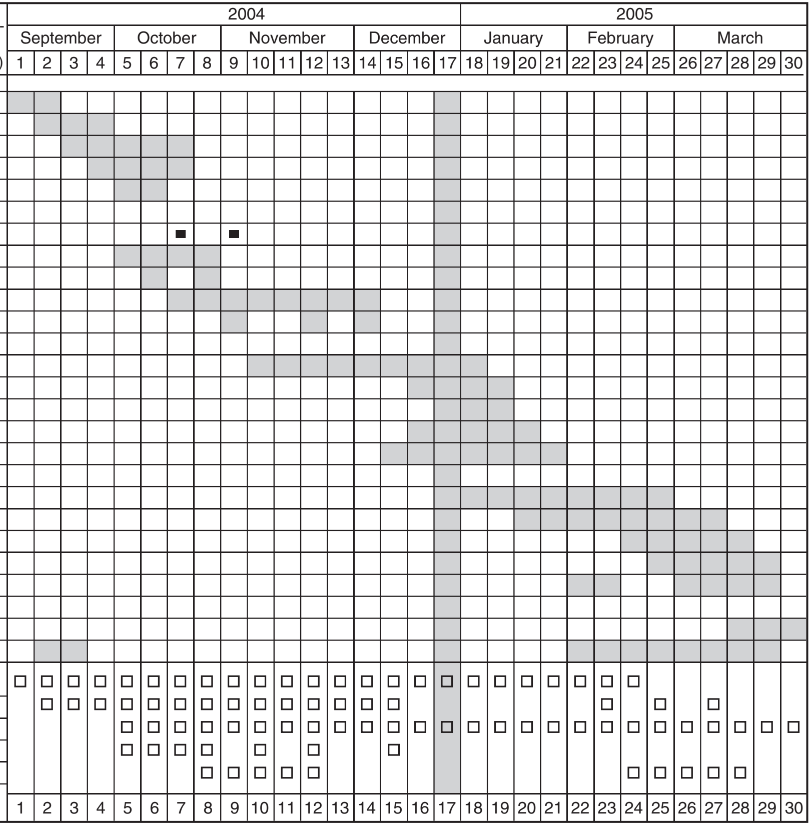


Fig. 9.2 *Example of a tender programme*

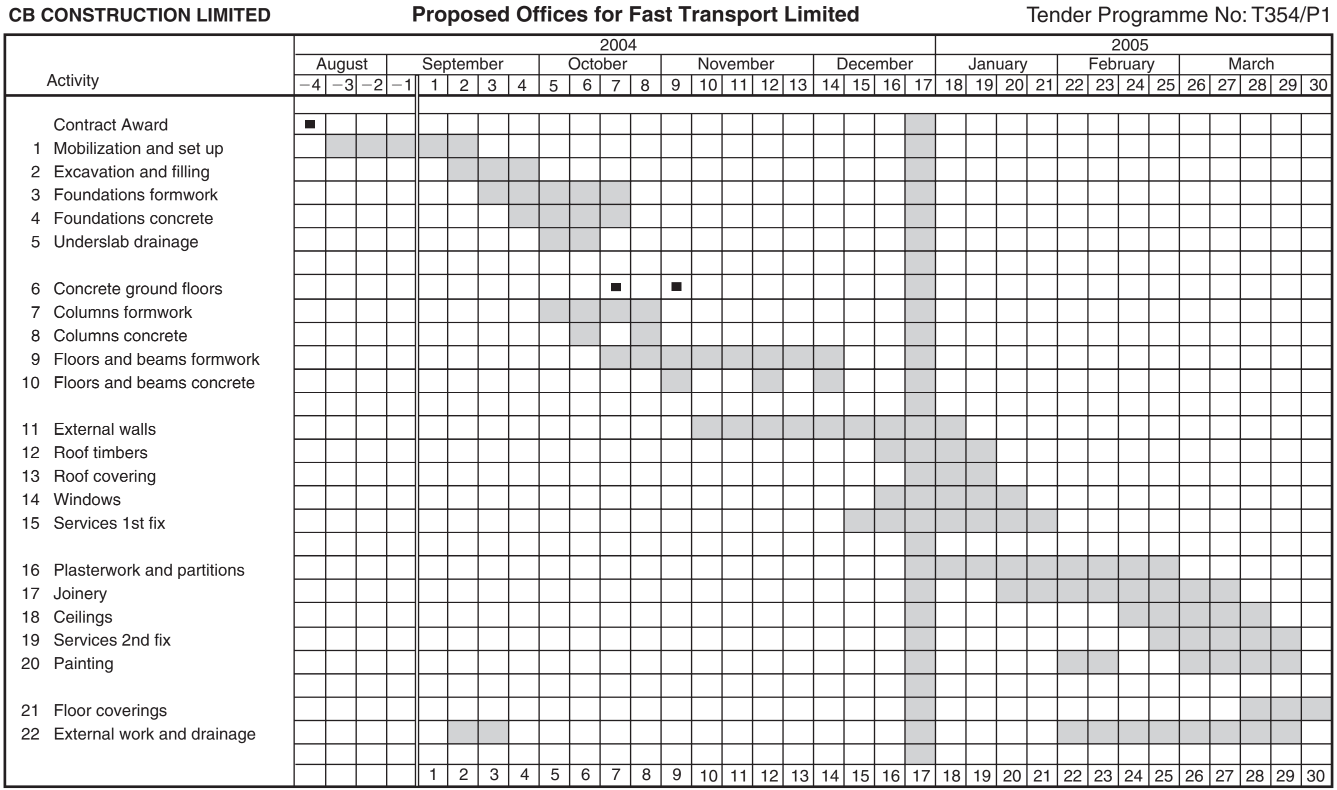


Fig. 9.3 *Example of a programme submitted with a tender*

of progress which may be reflected in output. Clearly, very little work is carried out on site during the two weeks Christmas shutdown. One week is lost at Easter and some planners believe that about two weeks are lost in the summer due to operatives' annual holidays. Scaffolding, fixed cranes and supervision are items that will incur the largest costs during shutdown periods and must be included in the project overheads schedule.

When a client or his advisers request a programme at tender stage the contractor will submit a preliminary or outline programme, such as the example given in Fig. 9.3. The contractor is often unclear about the role of such a programme in vetting tenders. Sometimes contractors have used the opportunity to offer completion sooner than expected and thereby try to gain an advantage over the competition. The drawback is that if the project is delayed, but still finishes within the original duration, the contractor will have difficulty recovering the costs of delay and disruption to the work.

10 Resource costs – labour, materials and plant

Introduction

There was a time when the unit costs of labour and plant were calculated from first principles; the assumption being that the company employed operatives in sufficient numbers to carry out the work and provided its own plant. A more realistic approach today would be to find the current market rates paid for labour near the site and look at the market prices for plant hire. This information is readily available as feedback from current jobs and plant hire rates can be obtained from plant specialists. Another change has come with computers. The importance of establishing accurate rates for labour, materials and plant, before pricing the bill of quantities, has reduced because programs allow the estimator to change unit rates for resources at any stage of the tender period.

Labour rates

A method for estimating all-in rates for labour is given in the CIOB Code of Estimating Practice (COEP). This has been adopted by many publications, professional bodies and contracting organizations as a reasonable basis for calculating the cost to employ an operative. The example given in the Code uses the formula:

Hourly rate = annual cost of employing an operative/actual hours worked

During the first half of the twentieth century, builders calculated labour rates by looking at weekly costs. This was a little easier to do but lacked the precision of the current method. The main reasons for calculating costs and hours on an annual basis are:

1. To include the effect of annual and public holidays on the number of hours for payment.
2. Overtime working often depends on the proportion of summer and winter working, because longer working hours are available and used in the summer period.

The COEP calculation is clearly a theoretical approach that should be checked periodically against recorded costs. The main variance is commonly the amount paid for 'bonuses', such as attraction money, plus rates for semi-skilled operatives, spot bonuses and locally agreed payments.

The estimator needs to be aware of some of the difficulties associated with calculating labour costs, and should answer the following questions:

1. Are there enough skilled operatives in the area? If not, will they need to be paid increased rates to work on the site or is there a need to import labour from outside the area?
2. How many operatives will be paid travelling expenses and will any key people receive a subsistence allowance?
3. Will there be any local union agreements which affect the wage levels, such as those found in the petrochemical industry?
4. Will bonus payments and enhanced wages be self-financing?

Some organizations, typically those that employ their own regular labour force, build up labour rates for every job. This allows changes to be made for the type of work, time of year and location. It must be said, however, that in recent years the nationally agreed wage rates have not reflected the rates paid in the marketplace. On the one hand where skilled labour is scarce, labour costs rise, and during times of recession labour rates fall. There is an argument that an estimator will price work quicker if a constant labour rate is used for several months. Global adjustments can always take place at the final review stage providing an analytical approach to pricing is used. Where computer databases are used, fine-tuning of the labour element can take place at any time before tender submission.

Figure 10.1 illustrates the all-in rate calculation using a spreadsheet model. Travelling and subsistence costs have been omitted on the assumption that they are better assessed when calculating the project overheads. Changes can be made to any of the figures and the following are the items that might change from job to job:

1. Time of year – the proportion of work carried out during 'summer' weeks.
2. Number of hours worked each week – the normal working hours are 39 per week throughout the year, but in the summer more working hours can be achieved.
3. The allowance for bad weather – depends on time of year, exposure to the weather and height above sea level.
4. Attraction bonus – is the non-productive element needed to match the going rate for skilled and semi-skilled people?
5. Trade supervision – is rarely included in the all-in rate today because it is better to consider all aspects of site supervision while assessing project overheads.

CB CONSTRUCTION LTD	**Fast Transport Ltd**				**2003/04**
Description		Entry col	Calc col		
SUMMER PERIOD	Number of weeks	30			
	Weekly hours	44			
	Total hours		1320		
	Days annual hols	14			
	Days public hols	5			
	Total hours for hols		−167		
WINTER PERIOD	Number of weeks	22			
	Weekly hours	39			
	Total hours		858		
	Days annual hols	7			
	Days public hols	3			
	Total hours for hols		−78		
SICKNESS	Number of days (say winter)	8	−62		
TOTAL HOURS FOR PAYMENT			1 870		
% Allowance for bad weather		2	37		
TOTAL PRODUCTIVE HOURS			1 833		
		Craftsman	Labourer	**Craftsman**	**Labourer**
ANNUAL EARNINGS	Basic wage	299.13	225.03		
	Attraction bonus (say)	28.00	14.00		
	Total weekly rate	327.13	239.03		
	Hourly rate of pay (39th)	8.39	6.13		
Annual earnings =	1870.4 × hourly rate			15 692.66	11 465.55
	Public holidays	62.4 hours × rate		565.49	413.16
ADDITIONAL COSTS	NON-PRODUCTIVE OVERTIME (time + half only)				
	Hours per week – summer		2.50		
	Hours per week – winter		0.00		
	Hours per year – summer		65.50		
	Hours per year – winter		0.00		
	Cost of non-prod overtime			502.39	377.94
	SICK PAY excluded from calculation				
TRADE SUPERVISION					
No. of tradesmen per foreman		7.00			
Plus rate for foreman		2.00			
% of time on supervision		50.00		1 388.10	1 086.17
WORKING RULE AGREEMENT					
Skill rate .. per hour		0.32			598.53
		Sub-total		18 148.63	13 941.35
OVERHEADS					
	1 NATIONAL INS	12.80%		1 584.99	998.60
	2 HOLIDAYS WITH PAY	226.20 hours		1 897.82	1 386.61
	3 RETIREMENT BENEFIT	7.50 per week		390.00	390.00
	4 TRAINING LEVY	0.50% on wages		100.23	76.64
		Sub-total		22 121.68	16 793.20
SEVERANCE PAY and SUNDRIES		1.5%		331.83	251.90
		Sub-total		22 453.51	17 045.10
EMPL. LIABTY & 3rd PARTY INS		2%		449.07	340.90
ANNUAL COST OF OPERATIVE				22 902.58	17 386.00
Divide by Total Productive Hours ..		1833			
	COST PER HOUR =			**£12.49**	**£9.49**

Also consider Construction Industry Joint Council pay conditions:

Storage of tools	Maximum liability £400
Loss of clothing	Maximum liability £30
Subsistance allowance	£25 per night
Sick pay	£79.70 per week
Death benefit	£15 000

National insurance is 12.8% above earnings threshold of £89.00 per week

Fig. 10.1 *Calculation of all-in rates for labour using spreadsheet software*

6. Extra payments for special skills – the Working Rule Agreement specifies many additional payments (to be added to the labourer's rate) principally for plant operatives.
7. Employer's liability insurance – although related to the labour value may be part of a general assessment of liabilities in the project overheads schedule.

Spreadsheets are used for these repetitious calculations because various combinations can be tried out, hence the phrase 'what-if calculations'. In Fig. 10.2, supervision and insurances have been removed so that they can be considered in pricing preliminaries. A longer working week is envisaged during a 35-week summer period. The overall effect is a reduced hourly rate.

For the analysis of rates throughout this book, the labour rates have been rounded off to £12.50/hour for craftsmen and £9.50/hour for labourers. These are the labour rates calculated from first principles in this chapter and reflect rates during the period June 2003 and May 2004.

Material rates

Quotations should be obtained for all materials, not only because prices can fluctuate unpredictably but also because the haulage rates to various sites could be different, depending on their distance from the supplier; and the size of loads can dramatically affect the transport costs. The following factors are considered by the estimator in building up the material portion of a unit rate:

1. Check the materials comply with the specification – the estimator may consider the use of an alternative product if it is cheaper and from experience is a satisfactory choice that the contract administrator is likely to accept. A common example is the use of cement replacements and additives in ready-mixed concrete which ironically are readily accepted by the Department of Transport and water industry and sometimes rejected by architects for building work. Many specifications envisage the use of alternatives with the statement 'subject to the approval of the Contract Administrator', for example.
2. The supplier may want payments for the costs of transport or small load charges. Ready-mixed concrete suppliers, for example, impose extra payments for part loads. The cost can be significant and must be considered where small concrete pours are expected.
3. Some products are manufactured in fixed sizes that are the minimum that can be ordered. An estimator may have received a price of £2.35/m for polythene pipe for a job which needs only 15 m. If the minimum coil size is 30 m then the estimator must consider the likelihood of using the pipe on another site that might involve a storage cost. Alternatively it might be more realistic to allow £4.70/m (including waste) in this tender.

CB CONSTRUCTION LTD **Fast Transport Ltd** **2003/04**

Description		Entry col	Calc col
SUMMER PERIOD	Number of weeks	35	
	Weekly hours	50	
	Total hours		1750
	Days annual hols	14	
	Days public hols	5	
	Total hours for hols		−190
WINTER PERIOD	Number of weeks	17	
	Weekly hours	39	
	Total hours		663
	Days annual hols	7	
	Days public hols	3	
	Total hours for hols		−78
SICKNESS	Number of days (say winter)	8	−62
TOTAL HOURS FOR PAYMENT			2083
% Allowance for bad weather		2	42
TOTAL PRODUCTIVE HOURS			2041

		Craftsman	Labourer	**Craftsman**	**Labourer**
ANNUAL EARNINGS	Basic wage	299.13	225.03		
	Attraction bonus (say)	28.00	14.00		
	Total weekly rate	327.13	239.03		
	Hourly rate of pay (39th)	8.39	6.13		
Annual earnings =	2082.6 × hourly rate			17 473.01	12 766.34
	Public holidays	62.4 hours × rate		615.83	449.94
ADDITIONAL COSTS	NON-PRODUCTIVE OVERTIME (time + half only)				
	Hours per week ..summer		5.50		
	Hours per week ..winter		0.00		
	Hours per year ..summer		171.60		
	Hours per year ..winter		0.00		
	Cost of non-prod overtime			1 316.17	990.13
	SICK PAY	excluded from calculation			
TRADE SUPERVISION					
No. of tradesmen per foreman		7.00			
Plus rate for foreman		2.00			
% of time on supervision		0.00		0.00	0.00
WORKING RULE AGREEMENT					
Skill rate .. per hour		0.32			666.43
		Sub-total		19 405.01	14 872.84
OVERHEADS					
1	NATIONAL INS	12.80%		1 584.99	998.60
2	HOLIDAYS WITH PAY	226.20 hours		1 897.82	1 386.61
3	RETIREMENT BENEFIT	7.50 per week		390.00	390.00
4	TRAINING LEVY	0.50% on wages		106.51	81.30
		Sub-total		23 384.34	17 729.34
SEVERANCE PAY and SUNDRIES		1.5%		350.77	265.94
		Sub-total		23 735.11	17 995.28
EMPL. LIABTY & 3rd PARTY INS		0 %		0.00	0.00
ANNUAL COST OF OPERATIVE				23 735.11	17 995.28
Divide by Total Productive Hours ..		2041			
	COST PER HOUR =			**£11.63**	**£8.82**

Also consider Construction Industry Joint Council pay conditions:

Storage of tools	Maximum liability £400
Loss of clothing	Maximum liability £30
Subsistance allowance	£25 per night
Sick pay	£79.70 per week
Death benefit	£15 000

National insurance is 12.8% above earnings threshold of £89.00 per week

Fig. 10.2 *Calculation of all-in rates for site working 50 hours/week with an extended summer period of 35 weeks and supervision and insurances priced in project overheads*

4. The quantity required for each unit of work must be considered for each material. Estimators should keep a note of the conversion factors they need for commonly used materials. For example, a half brick wall has 60 bricks per m^2, 2.1 tonnes of stone may be needed for each cubic metre of hardcore, and 0.07 litres of emulsion paint might be the coverage for work to plastered ceilings.
5. Unloading and distributing materials are activities that can be priced in the unit rate calculation or dealt with as a general site facility in the project overheads. Often a combination of both is needed. With facing bricks, for example, the price for bricks will include the cost of mechanical off-loading; whereas distributing bricks around the site could be catered for by including a forklift and a distribution gang in the project overhead schedule.
6. If the specifications, or preliminaries clauses, call for samples of certain materials the estimator needs to ascertain the cost. Usually a supplier will provide samples without charge. Testing of materials, on the other hand, is usually undertaken by an independent organization, and as such must be specified or preferably included as an item in the bill of quantities. The cost of testing will be assessed when the overheads are calculated.
7. An allowance for *waste* is difficult to estimate. The standard methods of measurement state that work is measured net as fixed in position (SMM7 3.3.1) and the contractor is to allow for any waste and square cutting (SMM7 4.6 e and f) and overlapping of materials (Fabric reinforcement E30.M4, for example). CESMM3 section 5 states that the quantities shall be calculated net using dimensions from the drawings and that no allowance shall be made for bulking, shrinkage or waste. The questions that the estimator must consider are: is there a selection process needed on site to achieve the quality specified (such as picking facing bricks to produce a specific pattern)? Are the materials likely to suffer damage in the off-loading and handling stages? Is the design going to lead to losses in cutting standard components to fit the site dimensions? Is the site secure from theft and vandalism? Will the finished work be protected from damage by following trades? Has the company had previous experiences with the materials? Will some materials be used for the wrong purpose, such as using facing bricks below ground level to avoid ordering a few cheaper bricks?

An estimator will need help in making these decisions. Guidance can be found in price books or research papers and the company should collect information from previous projects.

Plant rates

The plant supply industry can provide a wide range of equipment throughout the United Kingdom. It can offer hire or outright purchase, and in some cases lease and contract rental schemes. The following steps can be taken at tender stage to assess the mechanical plant to be used:

Step 1 Identify specific items of plant needed by looking at quantities and methods. The machine capacities can be found by assessing the rates of production required. Examine the tender programme for overall durations.

Step 2 Obtain prices; the *sources of plant* are:
(a) Purchase for the contract
(b) Company-owned plant
(c) Hire from external source
In practice the *sources of prices* are:
(a) Calculate from first principles
(b) Internal plant department rates
(c) Hirers' quotations
(d) Published schedules.

Step 3 Compare plant quotations on equal basis perhaps by using a standard form (the Code of Estimating Practice provides a typical Plant Quotations Register).

Step 4 Calculate the all-in hourly rate for each item of mechanical plant. The main parts of the calculation are:
1. Cost of machine per hour (including depreciation, maintenance, insurances, licences and overheads).
2. All-in rate for operator (the operator may work longer hours than the plant because of the time needed for minor repairs, oiling and greasing; the National Working Rule Agreement suggests how much time should be added to each eight-hour shift; it also lists extra payments for continuous extra skill or responsibility in driving various items of plant).
3. Fuel and lubricants (the amounts of fuel consumed will depend on the types and sizes of plant; the average consumption during the plant life is used).
4. Sundry consumables (where, for example, the plant specialist is unable to accept the risk of tyre replacement on a difficult site or any costs beyond 'fair wear and tear').

The cost of bringing plant to site is usually dealt in assessing project overheads (preliminaries) when the transport of all plant and equipment is considered.

Step 5 Decide where to price plant – either in the unit rate against each item of measured work or in the project overheads. This decision might be made for the estimator if the company's procedures dictate the pricing method. Plant that serves several trades should be included in the project overheads, such as cranes, hoists, concrete mixers, and materials handling equipment. Estimators also price the erection of fixed plant in the project overheads together with the costs of dismantling plant on completion.

11 Unit rate pricing

Introduction

The estimator must press on with the pricing stage without delay and cannot afford to wait for written quotations from sub-contractors and suppliers.

Once basic rates have been calculated for labour and plant, pricing notes can be written for work which will not be sub-let, such as placing concrete, alterations and brickwork. The pricing form in Fig. 11.1 shows estimator's notes for fixing ironmongery with spaces for the prices from suppliers.

Computer-aided estimating systems allow early pricing to start, using the rates contained in the main library of resource costs. When quotations arrive, the resource costs can be updated in the job library. Estimators can make good progress using this approach but must be careful to check that all the prices are confirmed by suppliers (preferably in writing) before the tender is submitted.

Components of a rate

Unit rates are usually a combination of rates for labour, plant, materials and sub-contractors. *Only the direct site cost is included* because management will develop a better understanding of the pricing level if on-costs are dealt with separately. There is a more extreme view that rates should ignore some or all of the following:

1. General site plant such as cranes and plant for materials distribution such as tractors and trailers, dumpers and forklift trucks.
2. Small plant, tools and safety equipment.
3. General labourers assisting craftsmen, unloading materials, distributing materials and driving mechanical plant.
4. Difficult working conditions such as access, restricted space and exposure to the weather.

The estimator must think about the way in which each operation will be carried out. The following factors must be considered in calculating the cost:

1. Quantity of work to be done.

CB CONSTRUCTION LIMITED

Project	Fast Transport Ltd		
Ref. no	T354	Date	5.7.04

Trade	Ironmongery
Page	1

					Total		LABOUR	12.50	PLANT		MATERIALS					LOSC	
Item	Item	Item	Description	Hrs	Quants	Unit	rate	£	rate	£	basic	sund	waste	rate	£	rate	£
3/26A	4/15F		Overhead door closer	1.50	12	nr	18.75	225.00	–	–			2.50			15.00	180.00
3/26B	4/15G		200 mm flush bolt	0.75	5	nr	9.38	46.88	–	–			2.50			7.00	35.00
3/26C	4/15F		Mortice dead lock	0.75	8	nr	9.38	75.00	–	–			2.50			9.00	72.00
								346.88		–					–		287.00

Fig. 11.1 *Estimator's build-up sheet for fixing ironmongery*

2. Quality of work and type of finish specified.
3. The degree of repetition.

Many clients assume that unit rates are for all the obligations and risks associated with the work, and in some cases include a statement such as: 'the rates inserted in the bill of quantities are to be fully inclusive of all costs and expenses together with all risks, liabilities, obligations given in the tender documents'. Does this mean that a proportion of project overheads should be included in all the rates or can the contractor insert rates for all general obligations and overheads in the preliminaries bill?

Method of measurement

The classification tables in SMM7 set out the work which is to be included in the unit rate. For example, when working space is measured to excavations, the contractor is to allow for additional earthwork support, disposal, backfilling, work below ground level and breaking out. Clearly the estimator must be aware of the coverage rules before pricing the work. With CESMM3, items for excavation include working space as well as upholding sides of excavation and removal of dead services. In addition, bills of quantities often have a preamble (civil engineering work) or rules for measurement (building), which list the changes to the standard measurement rules. A typical example is the statement 'the contractor shall allow all methods necessary to withhold the sides of excavations including where necessary trench sheeting or sheet piling'. This is a significant change to SMM7 because sheet piling is normally measurable under D32 Steel Piling.

Pricing notes

There are many ways to present pricing notes. Standard forms help the estimator produce clear information, which can be read by others.

The form shown in Fig. 11.1 would allow an estimator to price labour and plant himself and add rates received from a labour-only sub-contractor when they arrive. A direct comparison can then be made. This is similar to the example given in Fig. 12.1 in the following chapter for the comparison of sub-contractors' rates. The form used throughout this chapter for pricing notes was typically used for detailed build-ups. Its use has declined with the growth of computing.

Pricing notes are not always clearly presented by estimators. Where time is short, they sometimes produce their notes in the bill of quantities either in the margin or on the facing page. At the final review stage, management would then examine the rated bill of quantities because summaries for labour, materials and plant will not be available.

Construction staff need to be aware, however, that any tender notes may be useful to understand the logic used at tender stage but the costs may have been changed by management at the final review meeting. A computer system, on the other hand, will produce an up-to-date report of resources with all changes made after the review stages. There is no doubt that computer reports are quick to produce and can provide comprehensive site budgets and valuations. Very few give reports on the logic used to build up rates, which means that some manual notes or method statements may still be necessary.

Model rate and pricing examples

The way in which unit rates are built up differs from company to company and between trades. Calculations for earthworks, for example, are based on the use of plant, and formwork pricing depends on the making and reuse of shutters. A checklist of items to include in a rate could be used by trainee estimators or anyone pricing an item for the first time. The 'model rate' calculation given in Fig. 11.2 has more components than any one item would need.

The pricing information sheets given in this chapter contain typical outputs and pricing notes for the categories of work found most often in building and small civil engineering projects.

Most of the data have been expressed in terms of decimal constants which are used for entering resources using computers. Unfortunately, this approach gives some strange results and unfamiliar figures. With excavation of trenches, for example, estimators think in terms of how many cubic metres could be dug in one hour (say 5 m^3/hour), and not the reverse (an output such as 0.20 hour/m^3).

For clarification the following points should also be kept in mind:

1. Most of the examples are for work measured using the rules of SMM7.
2. Each construction organization should decide how to deal with labour and plant in off-loading lorries and distributing materials on site; either in unit rates or preliminaries.
3. The pricing notes do not bring out the concept of gang sizes. The composition of a brickwork gang may be two bricklayers assisted by one labourer, in other words a 2:1 gang. This is written as the time for a bricklayer and half the amount of time for a labourer.
4. The headings SMALL, MEDIUM and LARGE refer to the quantity or size of an operation.
5. The labour rates used are £12.50 for skilled and £9.50 for unskilled operatives. These rates were realistic between June 2003 and May 2004.
6. Outputs for labour and plant represent average times.

CB CONSTRUCTION LIMITED PRICING NOTES

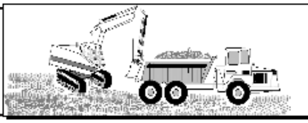
Project		Trade	**MODEL RATE**	Date	
Ref. No.			**Unit rate pricing**	Sheet No.	

Typical bill description	Z20 Section of construction material Section of construction material fixing to brickwork ....160 m

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
Mat	**Unit price from supplier**	**1**	**m**	**2.42**			**2.42**		
	Delivery and packing charges	**1/160**	**item**	**20.00**			**0.13**		
	Overlap (usually sheet materials)								
	Penetration (usually aggregates)								
	Nails, plugs, screws, adhesives etc	**3**	**nr**	**0.12**			**0.36**		
	Mortar (usually bricks, blocks & kerbs)								
	Waste – cutting from larger pieces								
	Waste – breakages before fixing								
	Waste – during fixing	**0.05**	**m**	**2.91**			**0.15**		
	Waste – residue from large packs								
Lab	**Unload, store and distribute**	**0.01**	**hr**	**9.50**	**0.10**				
	Craftsman at all-in rate	**0.2**	**hr**	**12.50**	**2.50**				
	Labourer assistance at all-in rate	**0.04**	**hr**	**9.50**	**0.38**				
Plt	**Electric drill and masonry bit**	**0.2**	**hr**	**0.40**		**0.08**			
	(Small tools and equipment usually								
	priced in preliminaries as a small								
	percentage added to all labour costs)								
	Total net rate				**2.98**	**0.08**	**3.06**		**6.12**
ADD	**A proportion of overheads & profit**								
	(the rest will be shown as items								
	in the preliminaries bill)	**10**	**%**		**0.30**	**0.01**	**0.31**		**0.62**
	TOTAL UNIT RATE	**1**	**m**		**3.28**	**0.09**	**3.37**		**6.74**

Fig. 11.2 *Model rate caluculations*

PRICING INFORMATION



GROUNDWORKS
EXCAVATION

SMM7 NOTES **Work section D20** **Excavating and filling**	**CESMM3 NOTES** **CLASS E** **EARTHWORKS**
1 Information given in tender documents:	
a. ground water level	
b. details of trial holes or boreholes	
c. live services and features retained	
2 Working space measured separately	**Excavation deemed to include working space**
3 Excavating below water measured separately	
4 Earthwork support is measured whether needed	**Excavation includes upholding sides**
or not, except to faces ne 0.25 m high and	
faces next to existing structures	
5 Interlocking steel piling must be measured (D32)	**Piling for temporary works not measured**
6 Excavating foundations around piles identified	**Excavating foundations around piles identified**
7 Underpinning measured in Section D50	**Class E includes excavation for underpinning**

Excavation		Average outputs – hr/m³						
		Hand dig	Small		Medium		Large	
			JCB3CX	JCB JS150	JCB3CX	JCB JS150	JCB JS150	CAT225
Topsoil		2–3	0.30	0.20	0.20	0.15	0.10	0.08
Reduce levels & basements	ne 0.25 m	2–3	0.30	0.12	0.20	0.11	0.09	0.05
	ne 1.00 m	2–3	0.20	0.10	0.15	0.09	0.07	0.04
	ne 2.00 m	3–4	0.20	0.10	0.15	0.08	0.06	0.04
	ne 4.00 m	4–5	0.25	0.12	0.20	0.11	0.09	0.05
	ne 6.00 m		0.30*	0.15	0.25*	0.13	0.11	0.07
Trenches/Pits	ne 0.25 m	2–3	0.35	0.22	0.25	0.17	0.11	0.07
	ne 1.00 m	3–4	0.25	0.20	0.20	0.14	0.10	0.06
	ne 2.00 m	4–5	0.25	0.20	0.20	0.12	0.09	0.05
	ne 4.00 m	5–7	0.30	0.25	0.25	0.20	0.12	0.07
	ne 6.00 m		0.35*	0.30	0.30*	0.25	0.15	0.09

* May be beyond range of machine

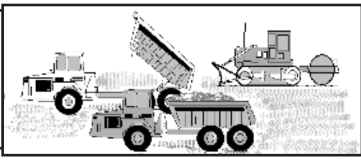
BREAKING OUT EXISTING MATERIALS hr/m³	ROCK	CONC	R CONC	MASONRY	SURFAC'G	These outputs are for breaking only ADD the following:
Compressor & labourers	3.00	2.00	3.50	1.50	0.75	25% for trench work
JCB3CX and breaker	0.50	0.40	0.55	0.25	0.20	25% to excavation rate
JCB812 and breaker	0.35	0.25	0.40	0.15	0.10	25% to loading rate
CAT225 and breaker	0.30	0.20	0.30	0.10	0.08	25% to removal rate

Excavation outputs are normally expressed as m³/h. These tables use decimal constants for computer applications

Excavation outputs depend on:

Quantities	**small, medium and large in the table is a guide to quantity of excavation**	
Ground conditions	**the data above are based on 'normal' ground conditions (firm clay)**	
Bucket size	**outputs based on:**	**JCB3CX [backhoe/loader] with a bucket capacity of 0.30 m³**
		JCB JS150 [backacter] with a bucket capacity of 0.60 m³
		CAT225 [backacter] with a bucket capacity of 1.20 m³
Location	**outputs assume reasonable access for plant and lorries**	
Disposal	**where lorries have clear access, the above outputs are sufficient to excavate & load**	
Trimming	**the outputs provide for trimming if labour is included in the excavation rate:**	
	trimming should be priced separately for large areas and sloping surfaces	

PRICING INFORMATION



GROUNDWORKS
DISPOSAL AND FILLING

SMM7 NOTES **Work section D20** **Excavation and filling**	**CESMM3 NOTES** **CLASS E** **EARTHWORKS**
1 Disposal off site is stated	Disposal of excavated material is deemed to be
2 Disposal on site is stated	off site unless otherwise stated
3 Only design-imposed locations are stated	The location for material for disposal on site is given
4 Only design-imposed handling provisions are stated	Double handling measured where expressly required
5 Kind and quality of fill materials are stated	Materials for imported filling are given
6 Compaction of filling is measured separately	Filling is deemed to include compaction
7 The filling quantity is the volume of void filled	
8 Filling measured m^3 and compaction m^2	Filling to stated thicknesses measured m^2
9 Filling thickness is that after compaction	
	Penetration of filling over 75 mm deep is measured

LOADING OF EXCAVATED MATERIAL

outputs for loading lorries/dumpers

	m^3/h
JCB3CX	10
JCB JS150	15
CAT225	20+

REMOVAL OF EXCAVATED MATERIAL

	Tip located on site	Tip located off site
Average speed to tip	10 mph	15 mph
Average time on tip	3 min	6 min
Average speed to return	15 mph	20 mph

DEPOSITION AND COMPACTION OF FILLING MATERIALS

		Output hr/m^3					
		JCB3CX + 2 Labs & roller		JCBJS150 + 2 Labs & roller		CAT943 + 2 Labs & roller	
Quantities		*Small*	*Medium*	*Small*	*Medium*	*Medium*	*Large*
Filling to excavations	ne 0.25 m	*0.25*	*0.17*	*0.12*	*0.10*	*0.08*	*0.05*
	over 0.25 m	*0.17*	*0.12*	*0.10*	*0.08*	*0.07*	*0.04*
Making up levels	ne 0.25 m	*0.25*	*0.17*	*0.12*	*0.07*	*0.05*	*0.03*
	over 0.25 m	*0.17*	*0.12*	*0.10*	*0.05*	*0.04*	*0.03*
Blinding surfaces		*0.33*	*0.20*	*0.25*	*0.20*		

	Output hr/m^3					
	1 Lab & roller/rammer		1 Lab & tandem roller		CAT943 & towed roller	
Compacting open excavation/ground	*0.10*	*0.05*	*0.05*	*0.03*	*0.02*	*0.01*
Compacting filling (if not priced above)	*0.20*	*0.10*	*0.06*	*0.04*	*0.02*	*0.01*
Compacting under foundations	*0.20*	*0.10*				

Outputs are normally expressed as m^3/h. This table uses decimal constants for computer applications

Material from site spoil heaps will need to be loaded and transported to the filling site

Conversion factors	Ashes	1.30	Gabion stone	1.50
including	Blast furnace slag	2.10	Crushed limestone	1.95
consolidation	Sand	1.75	Scalpings	2.10
t/m^3	Stone dust	1.75	DOT type 1	2.30

				£	p
	<u>D20 EXCAVATING AND FILLING</u>				
	<u>Excavating</u>				
	Topsoil for preservation				
A	275 average depth	380 m^2			
	To reduce levels				
B	1 m maximum depth, commencing 275 below existing ground level	246 m^3			
	Trenches exceeding 300 wide				
C	1 m maximum depth, commencing 600 below existing ground level	38 m^3			
	Extra over excavation irrespective of depth for breaking out				
D	rock (approximate)	26 m^3			
	Working space allowance to excavations				
E	trenches, backfilling with selected excavated material	94 m^2			
	Earthwork support				
	To faces of excavation				
F	2 m maximum depth, distance between opposing faces not exceeding 2 m	140 m^2			
	<u>Disposal</u>				
	Excavated material				
G	off site	237 m^3			
	<u>Selected excavated material</u>				
	Filling to excavations				
H	over 250 thick	47 m^3			
	<u>Hardcore as D20.M010</u>				
	Filling to make up levels				
I	Over 250 thick, obtained off site	252 m^3			

To collection ______________

CB CONSTRUCTION LIMITED PRICING NOTES

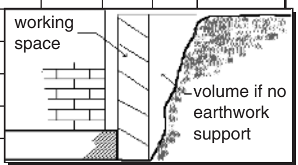
Project		Trade	EXCAVATION Unit rate pricing	Date	
Ref. No.				Sheet No.	1

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
	The type of plant to be used should be selected by examining the								
	nature of the ground and quantities for excavation and disposal								
	Page 3/1 of the bill of quantities would be considered in relation to								
	other excavation in the works such as drainage and external works								
	The total excavation on this page is:								
	topsoil 380 × 0.275 =	105	m^3						
	to reduce levels	246	m^3						
	trenches	38	m^3						
		389	m^3						
	The total disposal on this page is:								
	disposal off site	237	m^3						
	filling to excavations	47	m^3						
	topsoil retained on site	105	m^3						
		389	m^3						
	For a machine excavating at 10 m^3/h (on average) there would appear								
	to be at least a week of work. The additional costs of transporting								
	a larger (backacter) machine is justified because it will be needed								
	to break out rock and place filling materials								
A	Topsoil 275 mm deep								
	JCB JS150	0.15	hr	22.00		3.30			
	Banksman	0.15	hr	9.50	1.43				
	Consider lorry or dumper if spoil								
	to be taken away from building area								
		1	m^3		1.43	3.30			4.73
	Topsoil 275 mm dp (×0.275)	1	m^2		0.39	0.91			1.30
B	Excavating to reduce levels								
	JCB JS150	0.09	hr	22.00		1.98			
	Banksman	0.09	hr	9.50	0.86				
	Excavating to reduce levels	1	m^3		0.86	1.98			2.84

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	EXCAVATION Unit rate pricing	Date	
Ref. No.				Sheet No.	2

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
C	<u>Excavating trenches</u>								
	JCB JS150	0.14	hr	22.00		3.08			
	Banksman	0.14	hr	9.50	1.33				
	Labourer trimming	0.14	hr	9.50	1.33				
	Excavating trenches	1.00	m^3		2.66	3.08			5.74
D	<u>EXTRA breaking out rock</u>								
	Assuming 20% in red lev and 80% in trenches								
	JCB JS150 and breaker [20% .35 hr]	0.07	hr	32.00		2.24			
	JCB JS150 and breaker [80% .44 hr]	0.35	hr	32.00		11.20			
	Add 25% to excavation rates red lev				0.22	0.50			
	Add 25% to excavation rates trench				0.67	0.77			
	Add 25% to disposal rate	0.25	m^3	12.75		3.19			
	EXTRA for breaking out rock	1.00	m^3		0.89	17.90			18.79
E	<u>Working space allowance</u>								
	Excavation as for trenches	1.00	m^3		2.66	3.08			
	Assume 75% filling and 25% disposal								
	JCB JS150 and roller [75% of 0.08 hr]	0.06	hr	25.00		1.50			
	Labourers (2 nr) [75% of 0.16 hr]	0.12	hr	9.50	1.14				
	Additional earthwork support	not priced							
	Additional disposal	0.25	m^3	12.75		3.19			
		1.00	m^3		3.80	7.77			11.57
	Assuming average thickness is 250 mm								
	Working space allowance	1.00	m^2		0.95	1.94			2.89
F	<u>Earthwork support</u>								
	For shallow trenches support may not be required (nil rate)								
	but the trenches may have sloping sides								
	Once an assessment is made of the average over-excavation								
	the working space rate (above) can be used								
	Assuming average thickness is 300 mm								
	Earthwork support	1.00	m^2		1.14	2.33			3.47



CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	EXCAVATION Unit rate pricing	Date	
Ref. No.				Sheet No.	3

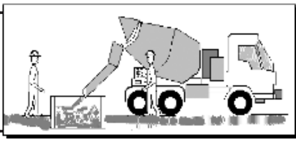
Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
G	Disposal off site								
	In this case it is assumed that 75% of material								
	can be loaded directly into lorries at the time of excavation								
	This means that 25% is loaded as a separate operation								
	JCB JS150 [15 m^3/hr × 25%]	0.017	hr	22.00		0.37			
	The speed of loading is less for material loaded								
	directly at the time of excavation, say 10 m^3/hr								
	The average rate of loading is therefore:								
	25% at 15 m^3/hr and 75% at 10 m^3/hr = 11.25 m^3/hr								
	The other assumptions made for the calculation are:								
	Lorry capacity 16 T	6.4	m^3						
	Distance to tip	5	m						
	Tip charges per load	£22.00							
	Landfill tax (inert material)	£2.00	/T						
	Round trip calculation								
	Load 6.4 m^3 at 11.25 m^3/hr	34	min						
	Haul to tip at 15 m/hr	20	min						
	Time on tip	6	min						
	Return to site at 20 m/hr	15	min						
	Total	75	min						
	So each lorry will achieve 60/75 = 0.80 trips per hr								
	and carry 6.4 × 0.80 = 5.12 m^3/hr								
	If the maximum speed of loading is 15 m^3/hr,								
	three lorries are needed at £22.00 per hour								
	Lorry cost is therefore 3 × 22.00 = £66.00/hr								
	The average rate of disposal is 11.25 m^3/hr								
	Lorries	0.09	hr	66.00		5.94			
	Tip charges £22.00 ÷ 6.4 m^3					3.44			
	Landfill tax 1.5 T/m^3 × £2.00					3.00			
	Disposal off site	1	m^3			12.75			12.75
	Note: Standard rate for Landfill Tax is £15/T 2004/2005								

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	EXCAVATION Unit rate pricing	Date	
Ref. No.				Sheet No.	4

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
H	Filling with selected excavated material								
	Assuming transport over short distances can								
	be provided by a site dumper, and an allowance								
	has been made for this in the preliminaries:								
	JCB JS150 and roller	0.08	hr	25.00		2.00			
	Labourers (2 nr)	0.16	hr	9.50	1.52				
	Filling	1	m^3		1.52	2.00			3.52
I	Hardcore filling								
	Hardcore price from supplier	1.95	T	7.50			14.63		
	Waste	0.19	T	7.50			1.43		
	(Penetration into the ground would be								
	considered for hardcore beds under 250 mm)								
	JCB JS150 and roller	0.05	hr	25.00		1.25			
	Labourers (2 nr)	0.1	hr	9.50	0.95				
	Hardcore filling	1	m^3		0.95	1.25	16.06		18.26

PRICING INFORMATION



IN SITU CONCRETE

SMM7 NOTES **Work section E10** **In situ concrete**	**CESMM3 NOTES** **CLASS F** **In situ concrete**
1 Kind and quality of materials and mixes stated	Concrete mix may be related to BS 5328, or a mix
2 Tests of materials and finished work stated	designed by the contractor, or a mix prescribed
3 Limitations on pouring methods stated	in the specification; with items given separately
4 Methods of compaction and curing stated	for provision and placing of concrete
5 Requirements for beds laid in bays to be given	
6 Concrete assumed to be as struck or tamped finish	Finishes to concrete measured separately
7 Concrete measured net with no deduction for:	Volume of concrete includes that occupied by:
..reinforcement, sections under 0.50 m^2, voids ..under	reinforcement, cast-in items ne 0.1 m^3, rebates,
0.05 m^3	grooves and chamfers ne 0.01 m^2, large and small
8 Details of concrete sections given on drawings	voids, and joints in in-situ concrete
9 Beds include blinding, plinths and thickenings	Placing concrete in blinding measured separately

	Waste %	Output–operative hrs/m^3					
		Small		Medium		Large	
		plain	reinf	plain	reinf	plain	reinf
Mass filling	10.0	*1.45*		*1.25*		*1.00*	
Foundations	7.5	*1.65*	*2.00*	*1.40*	*1.65*	*1.10*	*1.30*
Ground beams	5.0	*2.40*	*2.90*	*2.00*	*2.40*	*1.60*	*1.90*
Isolated foundations	7.5	*1.65*	*2.00*	*1.50*	*1.75*	*1.25*	*1.50*
Blinding beds	35.0	*2.75*		*2.40*		*2.00*	
Beds ne 150 mm	10.0	*1.35*	*1.65*	*1.30*	*1.55*	*1.20*	*1.45*
150–450 mm	7.5	*1.20*	*1.45*	*1.15*	*1.35*	*1.05*	*1.25*
over 450 mm	5.0	*1.10*	*1.30*	*1.00*	*1.20*	*0.90*	*1.10*
Slabs ne 150 mm	5.0		*4.00*		*3.00*		*2.50*
150–450 mm	5.0		*3.00*		*2.50*		*2.25*
over 450 mm	5.0		*2.50*		*2.00*		*1.50*
Troughed slabs	5.0		*3.50*		*3.00*		*2.50*
Walls ne 150 mm	7.5	*3.50*	*4.20*	*2.75*	*3.30*	*2.00*	*2.40*
150–450 mm	5.0	*2.80*	*3.35*	*2.30*	*2.75*	*1.80*	*2.15*
over 450 mm	5.0	*2.00*	*2.40*	*1.80*	*2.15*	*1.60*	*1.90*
Filling hollow walls 50 mm th	20.0	*7.00*	*8.00*	*6.00*	*7.00*	*5.00*	*6.00*
Filling hollow walls 75 mm th	15.0	*6.00*	*7.00*	*5.00*	*6.00*	*4.00*	*5.00*
Beams	7.5	*4.50*	*5.40*	*3.50*	*4.20*	*2.50*	*3.00*
Beam casings	10.0	*4.95*	*6.00*	*3.85*	*4.65*	*2.75*	*3.30*
Columns	7.5	*4.50*	*5.40*	*3.50*	*4.20*	*2.50*	*3.00*
Column casings	10.0	*4.95*	*6.00*	*3.85*	*4.65*	*2.75*	*3.30*
Staircases	7.5	*3.60*	*4.30*	*3.00*	*3.60*	*2.40*	*2.90*
Upstands and kerbs	10.0	*6.00*	*7.00*	*5.00*	*6.00*	*4.00*	*5.00*

SLOPING ITEMS	**Add 5% to labour for concrete laid up to15°, and 10% for concrete over 15°**
LABOUR RATE	**The effective rate for an operative is found by dividing the cost of a concrete gang by the number of operatives in the gang**
WASTE	**Waste includes losses due to small quantities and irregular levels for beds and blinding**
	Part load charges should be considered for very small quantities
CURING	**The ouputs include labour for protecting and curing fresh concrete**
REINFORCEMENT	**Considered concrete saving for members reinforced over 5% by volume**

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	IN SITU CONCRETE Unit rate pricing	Date	
Ref. No.				Sheet No.	

Typical bill description	E10 IN SITU CONCRETE Reinforced in situ concrete; mix B, 20 mm aggregate; beds thickness 150–450 mm ....160 m^3

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
	Hourly rate for concrete gang:								
	Working ganger	1	hr	10.00	10.00				
	Labourers (4 nr)	4	hr	9.50	38.00				
	Carpenter in attendance	1	hr	12.50	12.50				
	* Poker vibrator (2 nr)	2	hr	2.00		4.00			
	* Concrete pump	1	hr	43.00		43.00			
	Rate for concrete gang	1	hr		60.50	47.00			107.50
	Effective rate for one operative (÷5)	1	hr		12.10	9.40			21.50
Mat	Concrete price from supplier	1	m^3	65.00			65.00		
	Waste	0.08	m^3	65.00			5.20		
Lab	Concrete operative	1.25	hr	12.10	15.13				
Plt	* Vibrator and pump	1.25	hr	9.40		11.75			
	Rate for in situ concrete	1	m^3		15.13	11.75	70.20		97.08
*	(Plant may be priced in prelims)								

CB CONSTRUCTION LIMITED PRICING NOTES

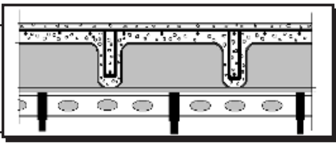
Project		Trade	IN SITU CONCRETE Operational pricing	Date	
Ref. No.				Sheet No.	

Typical bill description

E10 IN SITU CONCRETE

Reinforced in situ concrete; mix B, 20 mm aggregate; beds thickness 150–450 mm ....160 m^3

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
	For a concrete slab 40 × 20 m								
	Assume 1nr bay 4 m wide cast per day								
	Volume cast =								
	40 × 4 m × 0.2 m thick =	32	m^3						
Lab	Ganger	9	hr	10.00	90.00				
	Labourers (4 nr)	36	hr	9.50	342.00				
	Carpenter	4.5	hr	12.50	56.25				
Plt	* Poker vibrator (2 nr)	18	hr	2.00		36.00			
	* Concrete pump	9	hr	43.00		387.00			
Mat	Concrete price from supplier	32	m^3	65.00			2080.00		
	Waste 7.5%	2.4	m^3	65.00			156.00		
	Rate for one bay	32	m^3		488.25	423.00	2236.00		3147.25
	Rate for in situ concrete (÷32)	1	m^3		15.26	13.22	69.88		98.36
*	(Plant may be priced in prelims)								

PRICING INFORMATION		FORMWORK

SMM7 NOTES Work section E20 Formwork for in situ concrete	CESMM3 NOTES CLASS G CONCRETE ANCILLARIES [Formwork]
1 Basic finish is given	Finishes described as rough, fair or other
.... where not at the discretion of the contractor	
2 Plain formwork measured separately	Formwork deemed to be plane areas
.... where no steps, rebates, pockets etc	>1.22 m wide
3 Rules distinguish between left in and permanent	Formwork left in shall be so described
4 Formwork is measured where temporary	Formwork is measured where temporary
support to fresh concrete is necessary	support to fresh concrete is necessary
5 Tender documents give sizes and positions of	
members, and loads in relation to casting times	
6 Radii stated for curved formwork	Radii stated for curved formwork
7 Formwork to members of constant cross section	Formwork to members of constant cross section
measured square metres	measured in linear metres

LABOUR OUTPUTS	Output – carpenter hr/m^2					
	Small		Medium		Large	
	make	F&S	make	F&S	make	F&S
Foundations ne 250 mm	1.10	*1.80*	0.90	*1.60*	0.80	*1.50*
250–500 mm	1.00	*1.70*	0.80	*1.50*	0.70	*1.40*
500 mm–1.00 m	0.90	*1.60*	0.70	*1.40*	0.60	*1.30*
over 1.00 m	0.80	*1.50*	0.60	*1.30*	0.50	*1.20*
Edges of beds ne 250 mm	1.20	*1.90*	1.00	*1.70*	0.90	*1.60*
250–500 mm	1.10	*1.80*	0.90	*1.60*	0.80	*1.50*
Edges of susp slabs ne 250 mm	1.30	*2.40*	1.10	*2.20*	1.00	*2.00*
250–500 mm	1.20	*2.30*	1.00	*2.10*	0.90	*1.90*
Sides of upstands ne 250 mm	1.20	*2.20*	1.00	*2.00*	0.90	*1.90*
250–500 mm	1.10	*2.10*	0.90	*1.90*	0.80	*1.80*
Soffits of slabs horizontal		*1.20**		*1.00**		*0.90**
sloping ne 15°		*1.30**		*1.10**		*1.00**
sloping over 15°		*1.40**		*1.20**		*1.10**
Soffits of troughed slabs		*1.20**		*1.00**		*0.90**
Walls	1.20	*1.70*	1.00	*1.50*	0.90	*1.40*
Walls over 3.0 m	1.20	*1.80*	1.00	*1.60*	0.90	*1.50*
Beams isolated regular shape	1.30	*2.20*	1.10	*2.00*	1.00	*1.80*
irregular shape	1.40	*2.40*	1.20	*2.20*	1.10	*2.00*
Beams attached regular shape	1.40	*2.30*	1.20	*2.10*	1.10	*1.90*
irregular shape	1.60	*2.50*	1.40	*2.30*	1.30	*2.10*
Columns isolated regular shape	1.00	*1.50*	0.80	*1.30*	0.70	*1.10*
irregular shape	1.20	*1.60*	1.00	*1.40*	0.90	*1.20*
Columns attached regular shape	1.20	*1.80*	1.00	*1.60*	0.90	*1.40*
irregular shape	1.40	*1.70*	1.20	*1.70*	1.10	*1.50*

The carpenter rate should include part of a labourer's time for handling materials

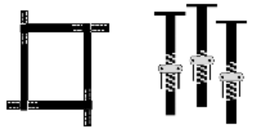
Items marked * need a carpenter rate plus a full labourer's rate to erect falsework

'Make' applies to timber shutters. Reduce for hired equipment or proprietary systems

ADD 0.15 hr/m^2 for fix and strike to walls with formwork one side

A small reduction for formwork LEFT IN is balanced by the labour costs in making

PRICING INFORMATION



FORMWORK
Materials and equipment

Timber formwork		Units	Founds	Edges	Soffits	Walls	Beams	Columns
Sheet material	Plywood	m^2/m^2	1	1	1	1	1	1
Timber		m^3/m^2	0.04	0.06	0.05	0.05	0.05	0.05
ADD 10% waste to plywood and timber								
Bolts and nails		kg/m^2	1.0	1.0		1.0	1.5	1.5
Surface preparation (consider varnish to plywood)								
Number of uses*			high	medium	med/low	medium	medium	high
Falsework and equipment		(see examples)						
Consumables	Mould oil	l/m^2	0.3	0.3	0.3	0.3	0.3	0.3
	Buried fixings	nr/m^2				1.0		
	Nails	kg/m^2	1.0	1.0	1.5	1.0	1.5	0.5

* Number of uses

1. Examine drawings and programme to determine the degree of repetition
2. Consider the standard of surface finish required
3. Consult programme to find time constraints
4. Investigate better quality shutters to increase uses
5. Will there be a salvage value after the work is finished

Key : high = over 6 uses
medium = 3 to 6 uses
low = under 3 uses

Standard timber shutters can be used up to six times without too much repair and maintenance
At tender stage it can be assumed that the saving from additional uses is countered by the additional costs of repairs.

On the other hand, more than six uses can be achieved with higher quality shutter materials or applied protective coatings

Proprietary formwork systems

The following equipment can be hired for concrete work with little repetition, such as a large machine base or a retaining wall which must be cast in one pour.

- Steel or ply-faced panels (pans)
- Angles
- Soldiers, walings and push/pull props
- Tie rods and accessories
- Radius panels and curved waling tubes

Equipment for foundations

Ground beams and machine bases may need telescopic props
Road forms are a useful alternative for strip footings, blinding and edges of beds

Equipment for soffits

A proprietary falsework system is usually used to support soffit formwork. A weekly rate can be obtained as a rate per m² of soffit depending on height and load to be carried

Standard profile GRP trough moulds can be hired
Non-standard profiles are purchased
The choice is dictated by the design

Expanded polystyrene trough moulds are cheaper than GRP but deteriorate quicker

Equipment for walls

Walings, soldiers, push/pull props and shutter ties
Lifting equipment – beam, chains and shackles

Equipment for columns

For a column 0.40 × 0.40 × 3.30 m high
Timber formwork will usually need:

Clamps at ave 500 mm centres	2 sets/m	1.2 sets/m^2
Telescopic props No.3	4 nr/col	0.76 nr/m^2

For a column 400 mm dia there are three options:

1. Cardboard tube for single use
2. GRP shutters for multiple uses
3. Steel shutters for hundreds of uses

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	FORMWORK	Date	
Ref. No.			Foundations	Sheet No.	

Typical bill description	E20 Formwork for in situ concrete Formwork with basic finish specification type A to sides of foundations; 250 to 500 mm high .... 60 m

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
	First calculate cost of 1 m^2 of shutter								
Mat	Plywood	1	m^2	9.50			9.50		
	Waste 10%	0.1	m^3	9.50			0.95		
	Timber	0.04	m^3	210.00			8.40		
	Waste 10%	0.004	m^3	210.00			0.84		
	Bolts and nails	1	kg	1.20			1.20		
	Surface preparation	nil							
Lab	Carpenter	0.8	hr	12.50	10.00				
	Labourer (one for four carpenters)	0.25	hr	9.50	2.38				
	Shutter cost	1	m^2		12.38		20.89		33.27
Mat	Cost per use assuming 6 uses	÷6			2.06		3.48		5.54
	Equipment (say 4 nr props/m^2)	4	nr	0.20		0.80			
	Consumables – mould oil	0.3	l	0.80			0.24		
	Consumables – nails	1	kg	1.00			1.00		
	Consumables – buried fixings	nil							
Lab	Labour fix and strike								
	Carpenter	1.5	hr	9.50	14.25				
	Labourer (one for four carpenters)	0.375	hr	7.50	2.81				
	Formwork rate for one m^2	1	m^2		19.12	0.80	4.72		24.64
	The average height of formwork will be found from an examination of the drawings;								
	on the other hand a shutter may be made to suit the maximum height which								
	is 500 mm								
	Rate for 500 mm high shutter	1	m		9.56	0.40	2.36		12.32

CB CONSTRUCTION LIMITED					PRICING NOTES
Project		Trade	FORMWORK	Date	
Ref. No.			Soffits of troughed floors	Sheet No.	

Typical bill description

E20 Formwork for in situ concrete

Formwork with basic finish type A to soffits of troughed slabs; profile as detail 1 on drawing D338 550 mm thick; ribs at 900 mm crs; 3.0 to 4.5 m high to soffit.... 660 m^2

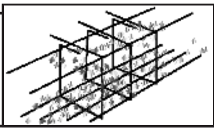
Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
*	Price from supplier for expanded polystyrene core moulds								
	is £40.00/m delivered to site with a maximum of 4 uses								
Mat	Rate for moulds at 900 crs	1.11	m	40.00			44.40		
	Plywood for continuous deck	1	m^2	6.60			6.60		
	Waste 5%	0.05	m^2	6.60			0.33		
	Timber packing and sole plates	0.04	m^3	210.00			8.40		
	Waste 5%	0.002	m^3	210.00			0.42		
	Nails	nil							
	Surface preparation	nil							
	Purchase cost of materials	1	m^2				60.15		
Mat	Cost per use assuming 4 uses						15.04		
Plt	Falsework from specialist	6	wk	1.75		10.50			
Lab	Labourer erect falsework	0.7	hr	9.50	6.65				
	Carpenter f&s deck and troughs	1	hr	12.50	12.50				
	Labourer (one for four carpenters)	0.25	hr	9.50	2.38				
	Labourer dismantle falsework	0.3	hr	9.50	2.85				
	Rate for troughed formwork	1	m^2		24.38	10.50	15.04		49.92
*	This price was calculated by adding the costs of the moulds								
	needed to make a typical pour, including end pieces.								
	The contractor's programme will show that sufficient moulds								
	will be needed to prepare the next bay while the first pour is curing,								
	to allow continuity of work								

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	FORMWORK	Date	
Ref. No.			Colums (operational pricing)	Sheet No.	

Typical bill description	E20 Formwork for in situ concrete Formwork with smooth finish type B to isolated columns; circular 340 mm diameter; 3 to 4.50 m high to soffit; in 74 nr ... 274 m^2

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
	Quotation from supplier for circular column shutters:								
	£750 per shutter 340 mm dia 3.50 m long including delivery to site								
	£105 per kicker shutter 150 mm high								
Mat	The programme requires three column shutters								
	Column shutters	3	nr	800.00			2 400		
	The programme calls for six column kicker shutters								
	Kicker shutters	6	nr	115.00			690		
	Equipment – props (4 × 3 cols)	15	wk	2.60		39			
	Consumables – mould oil	274	m^2	0.60			164		
Lab	Carpenter fixes 3 columns per								
	day (74 nr/3)	25	days	106.25	2 656				
	Labourer (one for two carpenters)	12.5	days	80.75	1 009				
	No credit value taken								
	Total for 74 columns (274m^2)				3 665	39	3 254		6 958
	Rate for circular columns	(÷274)	1	m^2	13.38	0.14	11.88		25.40

PRICING INFORMATION		BAR REINFORCEMENT

	SMM7 NOTES **Work section E30** **Reinforcement for in-situ concrete**	CESMM3 NOTES **CLASS G** **CONCRETE ANCILLARIES (Reinforcement)**
1	Nominal size of bars is stated	Nominal size of bars is stated
2	Bars classified as straight, bent or curved	Bar shapes not given
3	Links are measured separately	Links not separately identified
4	Lengths over 12 m to be given in 3 m stages	Lengths over 12 m to be given in 3 m stages
5	Bar weights exclude rolling margin	Mass of steel assumed to be 7.85 t/m^3
6	Bar weights inc tying wire, spacers & chairs	Reinf items deemed to include supports to bars
	.... only when at the discretion of the contractor	
7	Spacers & chairs measured in tonnes	Mass of reinforcement to include mass of chairs
	.... where not at the discretion of the contractor	
8	Location of bars not given in description	Location of bars not given in description
9	Details of conc members given on drawings	

Bar size mm	MASS kg/m	WASTE %	WIRE kg/t	SPACERS nr/t	UNLOAD BARS hrs/t	FIXING TIMES (total hrs/t) FOUNDS	SLABS & BEAMS	LINKS	SITE CUT AND BEND
6	0.222	4.0	14	60	3.7	40	42	56	28
8	0.395	3.5	13	55	3.4	33	35	48	23
10	0.616	3.0	11	50	3.2	28	29	40	20
12	0.888	2.5	9	45	3.0	24	25	36	17
16	1.579	2.5	8	40	2.8	22	24	32	15
20	2.466	2.5	7	35	2.5	20	22		14
25	3.854	2.5	5	30	2.3	18	21		13
32	6.313	2.0	4	25	2.2	16	20		11
40	9.864	2.0	3	20	2.0	14	19		10
50	15.413	2.0	3	15	1.8	14	18		10

STRAIGHT BARS	Suppliers will quote lower prices for straight bars The fixing times for straight bars can be reduced by approximately 10–15%
DELIVERY COSTS	Basic prices normally include delivery costs Small loads can attract a delivery charge typically £25 for loads under 8 tonnes
SPECIAL SHAPES	Preferred shapes to BS 4466 normally included in bar prices
LONG LENGTHS	Additional charges are made for lengths over 12 m
SITE CUTTING	Bars are rarely cut and bent on site except in the case of late design information An additional cutting waste would be needed for site cut bars
NETT WEIGHTS	Will steel be charged at calculated weight or weight delivered?

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	BAR REINFORCEMENT	Date	
Ref. No.				Sheet No.	

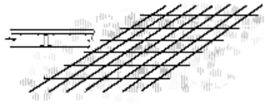
Typical bill description

E30 REINFORCEMENT FOR IN SITU CONCRETE

Reinforcement bars grade 460 to BS 4449
Bars, 16 mm nominal size, bent.....7.82 t

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
Mat	Steel per tonne as quotation	1	T	350.00			350.00		
	Waste	0.025	T	350.00			8.75		
	Wire	8	kg	1.00			8.00		
	Spacers	40	nr	0.30			12.00		
Lab	Unload & distribute (plant in prelims)	2.5	hr	9.50	23.75				
	Skilled fixers	22	hr	12.50	275.00				
	Labourer to assist (non-productive)	5.5	hr	9.50	52.25				
	Rate for bar reinforcement	1	T		351.00		378.75		729.75

PRICING INFORMATION



FABRIC REINFORCEMENT

SMM7 NOTES **Work section E30** **Reinforcement for in-situ concrete**	CESMM3 NOTES **CLASS G** **CONCRETE ANCILLARIES (Reinforcement)**
1 Fabric reference and weight/m^2 is stated	Fabric ref and weight/m^2 stated in 2 kg/m^2 bands
2 Laps are not measured	Laps are not measured
3 Laps between sheets are stated	Laps between sheets not stated
4 Fabric inc tying wire, cutting, bending, spacers	Fabric items deemed to include supports
& chairs when at the discretion of the contract	Supports to top fabric is measured
5 Location of fabric not given in description	Location of fabric not given in description

BS	MASS	UNLOAD FABRIC	FIXING TIMES (total hr/m^2)					FIXING (hr/m)	
Ref.	kg/m^2	hr/m^2	LARGE BEDS	SMALL BEDS	SLABS	WALLS	BEAMS & COLS	RAKING CUTTING	CIRC CUTTING
A393	6.16	0.02	0.06	0.11	0.14	0.20	0.67	0.40	0.67
A252	3.95	0.01	0.05	0.09	0.12	0.17	0.55	0.32	0.53
A193	3.02	0.01	0.04	0.08	0.10	0.13	0.40	0.25	0.40
A142	2.22	0.01	0.03	0.06	0.08	0.11	0.32	0.22	0.32
A98	1.54	0.01	0.03	0.05	0.07	0.08	0.25	0.17	0.25
B1131	10.90	0.04	0.11	0.17	0.25	0.35	0.90	0.70	1.00
B785	8.14	0.03	0.08	0.14	0.18	0.26	0.80	0.50	0.70
B503	5.93	0.02	0.07	0.11	0.14	0.20	0.67	0.40	0.67
B385	4.53	0.02	0.06	0.10	0.13	0.18	0.60	0.36	0.60
B283	3.73	0.01	0.05	0.08	0.10	0.13	0.40	0.25	0.40
B196	3.05	0.01	0.04	0.06	0.08	0.10	0.30	0.20	0.30
C785	6.72	0.02	0.07	0.12	0.15	0.22	0.80	0.45	0.80
C636	5.55	0.02	0.06	0.11	0.14	0.20	0.70	0.41	0.70
C503	4.34	0.02	0.06	0.10	0.13	0.18	0.60	0.36	0.60
C385	3.41	0.01	0.05	0.08	0.10	0.13	0.45	0.30	0.45
C283	2.61	0.01	0.04	0.06	0.08	0.11	0.32	0.22	0.32
D98	1.54	0.01	0.03	0.05	0.07	0.10	0.30	0.18	0.25
D49	0.77	0.01	0.02	0.04	0.05	0.08	0.20	0.14	0.20

ALLOWANCE FOR WASTE	Large areas	2.50%	For a high proportion of cut sheets
	Small areas	5.00%	the waste must be calculated
ALLOWANCE FOR LAPS	150 laps	10%	
	225 laps	16%	
	300 laps	22%	
	400 laps	31%	
WIRE AND SPACERS	Large areas	2.50%	
	Small areas	5.00%	
CHAIRS	Typically	0.3–0.5 kg/m^2	
OPERATIONAL CHECK	Laying fabric reinforcement in some large beds and slabs should be reconciled with labour for laying concrete		

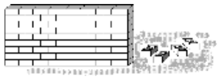
CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	FABRIC REINFORCEMENT	Date	
Ref. No.				Sheet No.	

Typical bill description	E30 REINFORCEMENT FOR IN SITU CONCRETE Fabric reinforcement Ref A252; 3.95 kg/m^2; 225 minimum laps … 556 m^2

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
Mat	Price from supplier	1	m^2	1.95			1.95		
	Laps	0.16	m^2	1.95			0.31		
	Waste	0.025	m^2	1.95			0.05		
	Wire and spacers	0.025	m^2	1.95			0.05		
	Chairs	0.5	kg	0.35			0.18		
Lab	Unload & distribute	0.01	hr	9.50	0.10				
	Labourer	0.05	hr	10.10	0.51				
	Rate for fabric reinforcement	1	m^2		0.61		2.53		3.14
	Fixing gang for fabric in beds may be made up of:								
	4 Labourers @ £9.50/hr	38.00							
	1 skilled fixer @ £12.50/hr	12.50							
	Effective rate (÷5)	50.50	£	10.10	/hr				

PRICING INFORMATION



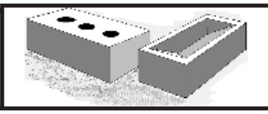
BRICKWORK

SMM7 NOTES **Work section F10** **Brick/Block walling**	CESMM3 NOTES **CLASS U** **BRICKWORK, BLOCKWORK AND MASONRY**
1 Type & nominal size of brick stated	Type & nominal size of brick stated
2 Thickness of construction stated	Thickness of construction stated
3 Type of mortar stated	Type of mortar stated
4 Type of bond stated	Type of bond stated
5 Facework and number of sides stated	Surface finish and fair facing stated
6 Type of pointing stated	Type of pointing stated
7 Bonding to existing wall stated	Bonds to existing measured separately
8 Building overhand is stated	Building overhand not stated
9 Deemed to include all rough and fair cutting	
... where at discretion of contractor	
10 Deemed to include all mortices and chases	Rebates and chases measured separately
11 Deemed to include raking out joints to form key	
12 Deemed to include returns, ends and angles	
13 Deemed to include centring	
14 Walls include skins of hollow walls	Cavity or composite walls stated

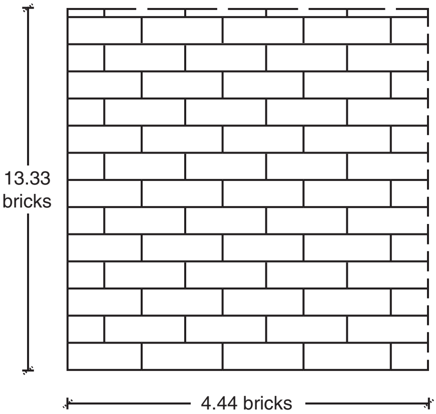
LAYING TIMES for bricks 215 × 102 × 65 mm		COMMONS	SEMI-ENG	FACINGS	MORTAR (m³/m²) Nett exc waste	 No frog 15% waste	 Frog 15% waste
half brick	hr/m²	1.10	1.15	1.30	0.018	0.021	0.023
half brick fair one side	hr/m²	1.30	1.35	1.50	0.020	0.023	0.026
half brick fair both sides	hr/m²	1.50	1.55	1.70	0.022	0.025	0.029
one brick	hr/m²	2.00	2.10	2.40	0.046	0.053	0.060
one brick fair one side	hr/m²	2.20	2.30	2.60	0.048	0.055	0.062
one brick fair both sides	hr/m²	2.40	2.50	2.80	0.050	0.058	0.065
1½ brick	hr/m²	2.70	2.90	3.20	0.074	0.085	0.096
1½ brick fair one side	hr/m²	2.90	3.10	3.40	0.076	0.087	0.099
1½ brick fair both sides	hr/m²	3.10	3.30	3.60	0.078	0.090	0.101
Isolated piers	bricks/hr	30	25	20			
Projections	bricks/hr	45	40	35			
Arches	bricks/hr	25	20	15			
Specials	bricks/hr	25	20	15			
Brick coping	bricks/hr	40	35	30			
Unload by hand (lab) *	hr/thou	1.00	1.25	1.50			
Distribute (lab) **	hr/thou	1.00	1.25	1.50			

1 The above outputs are for a bricklayer in a gang of two bricklayers and one labourer (ratio 1:½)
2 Average waste allowance 5%
3 Waste can be more with facework, but reject bricks can be used elsewhere
4 Bucket handle, weather struck and raked pointing can take longer (add 0.15 hr/m²)
* Unloading can be omitted since most deliveries include mechanical off-loading
** Distribution of materials may be priced in the preliminaries

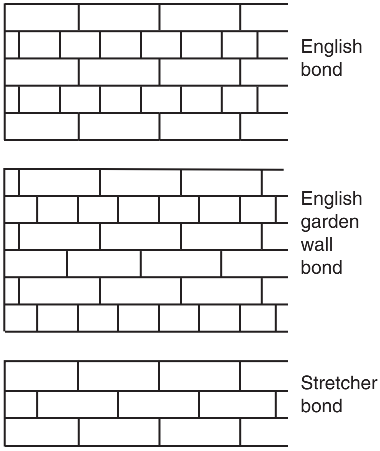
PRICING INFORMATION



BRICKWORK QUANTITIES



one m^2 in stretcher bond



commonly used brickwork

BRICKS	Wall thickness mm	Number of bricks per square metre Total	English bond Facing	English bond Commons to rear	English garden wall bond Facing	English garden wall bond Commons to rear
half brick	102.5	60				
one brick facework one side	215	119	89	30	74	45
one brick facework both sides	215	119	119		119	
1½ brick facework one side	327.5	178	89	89	74	104
1½ brick facework both sides	327.5	178	178		148	30

CONSTITUENTS OF MORTAR

SITE MIX CEMENT/LIME/SAND MORTARS BY VOLUME	Cement T/m^3	Lime T/m^3	Sand T/m^3
Bulk density	1.12–1.60	0.50–0.85	1.35–1.60
Typical dry density	1.44	0.72	1.60
1:3	0.49		1.62
1:4	0.39		1.74
1:5	0.32		1.83
1:6	0.28		1.88
1:1:6	0.26	0.13	1.71
1:2:9	0.18	0.18	1.75
1:3:12	0.12	0.18	1.75

READY MIX LIME/SAND MORTARS BY VOLUME	Cement T/m^3	LSM T/m^3
Typical dry density	1.44	1.85
1:6	0.24	1.75
1:9	0.17	1.85
1:12	0.13	1.85

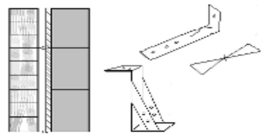
CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	BLOCKWORK	Date	
Ref. No.				Sheet No.	

Typical bill description	F10 BRICK/BLOCK WALLING Facing brickwork (PC £320 per thousand delivered and off-loaded); cement, lime, sand mortar 1:1:6. Vertical walls one brick thick; English bond; facework both sides with weathered joint as work proceeds … 334 m^2

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	S/c	
Mat	For 1m^3 of mortar 1:1:6								
	Cement	0.26	T	85.00			22.10		
	Lime	0.13	T	95.00			12.35		
	Sand	1.71	T	9.00			15.39		
Lab	Unloading by general gang	see prelims							
	Mixing by bricklayer's labourer								
Plt	Mixer and dumper	see prelims							
	Rate for 1:1:6 mortar	1	m^3				49.84		49.84
Mat	Price from supplier (£320/th)	119	br	0.32			38.08		
	Waste	5.95	br	0.32			1.90		
	Mortar inc 15% waste	0.058	m^3	49.84			2.89		
Lab	Distribute bricks (dumper in prelims)	0.17	hr	9.50	1.62				
*	Bricklayers 1 nr	2.80	hr	12.50	35.00				
*	Labourer 0.5 nr	1.40	hr	9.50	13.30				
	Extra for weathered joint both sides	0.3	hr	12.50	3.75				
	Rate for facing brickwork	1	m^2		53.67		42.87		96.54
*	Often an effective rate is calculated as follows:								
	one bricklayer plus half labourer = 12.50 + 4.75 = £17.25/hr								
	in this example the rate for laying bricks would be								
	2.80 hrs @ £17.25 = £48.30/m^2								

PRICING INFORMATION



BRICKWORK SUNDRIES

SMM7 NOTES **Work section F30** **Accessories/Sundry items**	CESMM3 NOTES **CLASS U** **BRICKWORK, BLOCKWORK AND MASONRY**
1 Closing cavities; width of cavities stated	Closing cavities; width of cavities stated
2 Bonding to existing; thickness stated	Bonds to existing work measured 'square'
3 Forming cavities; width and ties stated	Cavity construction stated
4 Damp proof courses measured 'square'	Damp proof courses measured 'linear'
5 Joint reinforcement; width stated	Joint reinforcement; width stated
6 Laps in DPC and joint reinf not measured	Laps in DPC and joint reinf not measured
7 Joints in walls measured where designed	Joints in walls measured where designed
8 Proprietary items	Fixings and ties
9 Pointing flashings incl cutting grooves	

Brickwork labours	
Forming cavities	0.03 hr/m^2
Closing cavities vert	2.00 hr/m^2
Closing cavities horiz	2.00 hr/m^2
Bonding to existing	3.50 hr/m^2
Prepare wall for raising	1.00 hr/m^2
Wedging and pinning	1.25 hr/m^2

Designed joints	
Fibreboard to joint ne 200	0.15 hr/m
Fibreboard to joint >200	0.50 hr/m^2
One-part mastic 10 × 10 mm	0.20 hr/m
One-part mastic 20 × 20 mm	0.40 hr/m
Two-part sealant 10 × 10 mm	0.30 hr/m
Two-part sealant 20 × 20 mm	0.60 hr/m

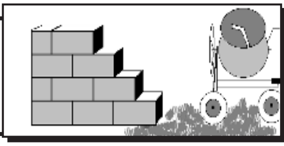
Hoist and bed lintels	
Small precast concrete	0.15 hr/m
Large precast concrete	0.30 hr/m
Small steel	0.20 hr/m
Large steel	0.25 hr/m

Accessories	
Build in butterfly tie	0.01 hr each
Build in twisted tie	0.02 hr each
Build in joist hanger	0.10 hr each
Build in joint reinforcement	0.40 hr/m^2

Insulation	
Fix 25 mm cavity bats (inc clips)	0.20 hr/m^2
Fix 50 mm cavity bats (inc clips)	0.25 hr/m^2
Fix 75 mm cavity bats (inc clips)	0.30 hr/m^2

Damp-courses	ne 250 hr/m	>250 hr/m^2
Vertical	0.05	0.30
Raking	0.05	0.30
Horizontal	0.04	0.20
Stepped	0.08	0.40
Laps and waste	15%	10%
Pointing in flashings	0.40 hr/m	

PRICING INFORMATION



BLOCKWORK

SMM7 NOTES **Work section F10** **Brick/Block walling**	CESMM3 NOTES **CLASS U** **BRICKWORK, BLOCKWORK AND MASONRY**
1 Type & nominal size of block stated	Type & nominal size/thickness of block stated
2 Thickness of construction stated	
3 Type of mortar stated	Type of mortar stated
4 Type of bond stated	Type of bond stated
5 Facework and number of sides stated	Surface finish and fair facing stated
6 Type of pointing stated	Type of pointing stated
7 Bonding to existing wall stated	Bonds to existing measured separately
8 Building overhand is stated	
9 Deemed to include all rough and fair cutting	
... where at discretion of contractor	
10 Deemed to include all mortices and chases	Rebates and chases measured separately
11 Deemed to include raking out joints to form key	
12 Deemed to include returns, ends and angles	
13 Deemed to include centring	
14 Walls include skins of hallow walls	Cavity or composite walls stated

FIXING TIMES for blocks 415 × 215 mm			75	100	150	190	200	215
solid	Lightweight blocks	hrs/m^2	0.45	0.50	0.60	0.65	0.70	0.80
solid	Dense concrete blocks	hrs/m^2	0.60	0.65	0.80	0.90	1.00	1.15
solid	Masonry blocks	hrs/m^2	0.75	0.80	1.00	1.20	1.25	1.40
hollow	Lightweight blocks	hrs/m^2	0.42	0.46	0.55	0.60	0.62	0.65
hollow	Dense concrete blocks	hrs/m^2	0.58	0.61	0.67	0.75	0.80	0.85
hollow	Masonry blocks	hrs/m^2	0.50	0.58	0.61	0.65	0.67	0.75
	Unload and distribute (lab)	hrs/m^2	0.05	0.07	0.10	0.13	0.13	0.14
	Extra for fairface one side	hrs/m^2	0.13	0.13	0.13	0.13	0.13	0.13
	Extra for fairface both sides	hrs/m^2	0.20	0.20	0.20	0.20	0.20	0.20
	Mortar quants (exc waste)	m^3/m^2	0.0050	0.0067	0.0100	0.0127	0.0133	0.0144
	Mortar quants (15% waste)	m^3/m^2	0.0058	0.0077	0.0115	0.0146	0.0153	0.0166

1 The above outputs are for a gang of two bricklayers and one labourer (ratio 1:½)

2 For heavy blocks marked with [shaded box] allow a labourer with every bricklayer (ratio 1:1)

3 Waste allowance 5%–7½% (except 10% for fairfaced blockwork and small areas)

4 Add to labour for high walls (30%) dwarf walls (35%) casings (60%) filling openings (70%)

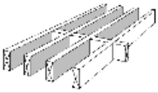
CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	BLOCKWORK	Date	
Ref. No.				Sheet No.	

Typical bill description	F10 BRICK/BLOCK WALLING Dense concrete blocks 7N; cement and sand mortar 1:3; stretcher bond; vertical walls; facework one side; flush pointing; 140 mm thick … 541 m^2

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
Mat	For 1 m^3 of mortar mix 1:3								
	Cement	0.49	T	85.00			41.65		
	Sand	1.62	T	9.00			14.58		
Lab	Unloading by general gang	see prelims							
	Mixing by bricklayer's labourer								
Plt	Mixer and dumper	see prelims							
	Rate for 1:3 mortar	1	m^3				56.23		
Mat	Price of blocks from supplier	1	m^2	6.50			6.50		
	Waste	0.05	m^2	6.50			0.33		
	Mortar inc 15% waste	0.0115	m^3	56.23			0.65		
Lab	Unload & distribute	0.1	hr	9.50	0.95				
*	Bricklayers	0.8	hr	12.50	10.00				
*	Labourer	0.4	hr	9.50	3.80				
	Bricklayer pointing one side	0.13	hr	12.50	1.63				
	Rate for blockwork	1	m^2		16.38		7.48		23.86

PRICING INFORMATION



STRUCTURAL TIMBER

	SMM7 NOTES **Work section G20** **Carpentry/Timber framing/First fixing**	CESMM3 NOTES **CLASS O & Z** **TIMBER**
1	Kind, quality and treatment of timber stated	Grade or species and treatment stated
2	Sawn or wrot timber stated	Sawn or wrot timber stated
3	All sizes are nominal	Nominal gross cross-sectional areas given
	.... unless stated as finished sizes	Thickness of timber stated
4	Method of fixing and jointing given	Method of fixing and jointing not given
	.... where not at the discretion of the contractor	
5	Labours on timbers not measured	Boring and cutting not measured
6	Lengths given if over 6 m	Length of timber given in one of 7 bands Class O

Size of member		Sectional area m²	Plates floor/roof members	Wall or partition members	Pitched roof members	Gutters fascias eaves soffit	Supports: grounds, battens, firrings, fillets, upstands, drips etc		Herringbone and block strutting	
Width	Depth						butted	framed		
			hr/m	hr/m	hr/m	hr/m	hr/m	hr/m	depth	hr/m
38	38	0.001	0.09	0.14	0.12	0.18	0.14	0.28	of joists	measured
	50	0.002	0.11	0.16	0.14	0.11	0.16	0.36	mm	over joists
	75	0.003	0.12	0.20	0.17	0.24	0.20	0.40	75	0.22
	100	0.004	0.13	0.22	0.18	0.26	0.22	0.44	100	0.25
	125	0.005	0.14	0.24	0.19	0.28	0.24	0.48	125	0.26
	150	0.006	0.15	0.26	0.22	0.30	0.26	0.52	150	0.27
	175	0.007	0.16	0.28	0.24	0.32	0.28	0.56	175	0.28
	200	0.008	0.17	0.30	0.25	0.34	0.30	0.60	200	0.30
50	50	0.003	0.12	0.20	0.17	0.24	0.20	0.40	225	0.32
	75	0.004	0.13	0.22	0.18	0.26	0.22	0.44	250	0.35
	100	0.005	0.14	0.24	0.19	0.28	0.24	0.48	300	0.40
	125	0.006	0.15	0.26	0.22	0.30	0.26	0.52		
	150	0.008	0.17	0.30	0.25	0.34	0.30	0.60		
	175	0.009	0.19	0.34	0.28	0.38	0.34	0.68		
	200	0.010	0.21	0.40	0.33	0.42	0.40	0.80		
	225	0.011	0.23			0.46				
	250	0.013	0.25			0.50				
	300	0.015	0.30			0.60				
75	100	0.008	0.17	0.29	0.25					
	125	0.009	0.19	0.34	0.28					
	150	0.011	0.23	0.50	0.40					
	175	0.013	0.25	0.55	0.46					
	200	0.015	0.30							
	250	0.019	0.37							
	300	0.023	0.40							
100	100	0.010	0.21	0.40	0.33					
	150	0.015	0.30	0.60	0.50					
	200	0.020	0.37							
	250	0.025	0.42							
	300	0.030	0.45							
150	150	0.023	0.40							
	200	0.030	0.45							
	300	0.045	0.50							

Nails can be priced in the preliminaries with a sum for sundry fixings. Alternatively, allow 2 kg/m³ of timber. For example: if nails cost £1.20/kg the rate for timber 50 × 100 mm would be 2 × 1.2 × .05 × .10 = 1 p/m

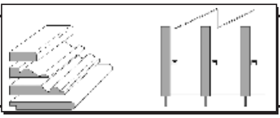
The above outputs are for each carpenter

Labour assisting carpenters can be added to the all-in rate **or** priced in the preliminaries

Average waste for structural timbers generally 7.5%

Outputs will vary significantly depending on the complexity of the work

PRICING INFORMATION



JOINERY

SMM7 NOTES	CESMM3 NOTES
Work section N10 **General fixtures ..** **Work section P20** **Unframed isolated trims ..**	**CLASS Z** **SIMPLE BUILDING WORKS ..** **Carpentry and joinery**
P20 All timber sizes are nominal sizes unless stated as finished sizes	All timber sizes are nominal sizes unless otherwise stated
The work is deemed to include ends, angles, mitres, intersections except hardwood items over 0.003 m^2 sectional area	Boring, cutting and jointing not measured
Kind, quality and treatment of timber stated	Grade or species and treatment of timber stated
Sawn or wrot timber stated	Sawn or wrot timber stated
Method of fixing given .. if not at the discretion of the contractor	Method of fixing not given

Fixing softwood skirtings, architraves, trims window boards etc Hr/m

Size of member		Nailed	Screwed	Plugged & screwed	Screwed & pelleted	Size of member		Nailed	Screwed	Plugged & screwed	Screwed & pelleted
19	**19**	0.10	0.13	0.18	0.23	**38**	**19**	0.12	0.15	0.22	0.25
	25	0.10	0.13	0.18	0.23		**25**	0.12	0.15	0.22	0.25
	32	0.10	0.13	0.18	0.23		**32**	0.12	0.15	0.22	0.25
	38	0.12	0.15	0.20	0.25		**38**	0.15	0.19	0.26	0.29
	44	0.12	0.15	0.20	0.25		**44**	0.15	0.19	0.26	0.29
	50	0.12	0.15	0.20	0.25		**50**	0.17	0.21	0.28	0.31
	63	0.12	0.15	0.20	0.25		**63**	0.19	0.24	0.31	0.34
	75	0.15	0.19	0.24	0.29		**75**	0.23	0.29	0.36	0.39
	100	0.17	0.21	0.26	0.31		**100**	0.29	0.36	0.43	0.46
	125	0.19	0.24	0.29	0.34		**125**	0.31	0.39	0.46	0.49
25	**19**	0.10	0.13	0.19	0.23	**50**	**19**	0.12	0.15	0.23	0.25
	25	0.10	0.13	0.19	0.23		**25**	0.12	0.15	0.23	0.25
	32	0.12	0.15	0.21	0.25		**32**	0.15	0.19	0.27	0.29
	38	0.12	0.15	0.21	0.25		**38**	0.17	0.21	0.29	0.31
	44	0.12	0.15	0.21	0.25		**44**	0.19	0.24	0.32	0.34
	50	0.12	0.15	0.21	0.25		**50**	0.19	0.24	0.32	0.34
	63	0.15	0.19	0.25	0.29		**63**	0.24	0.30	0.38	0.40
	75	0.17	0.21	0.27	0.31		**75**	0.29	0.36	0.44	0.46
	100	0.19	0.24	0.30	0.34		**100**	0.31	0.39	0.47	0.49
	125	0.23	0.29	0.35	0.39		**125**	0.4	0.50	0.58	0.60

The above outputs are for each carpenter

ADD 30% to the outputs for fixing hardwood

Average waste allowance is 7.5%. Varies depending on number of short lengths and mitres

ADD for cost of screws

WC CUBICLES

	fix
Each door	1.25hr
Each partition	2.00hr
Each fascia panel	1.50hr

KITCHEN UNITS

		assemble	fix
Base unit	each	0.65hr	0.50hr
Wall unit	each	0.55hr	0.75hr
Worktop	metre		0.50hr

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	STRUCTURAL TIMBER	Date	
Ref. No.				Sheet No.	

Typical bill description	G20 Carpentry/Timber framing/First fixing Sawn stress graded (SS) timber, pressure impregnated with preservative; pitched roof members; 50 × 175 mm .... 174 m

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
Mat	Timber price from supplier	1	m	2.20			2.20		
	Nails	0.02	kg	1.20			0.02		
	Waste	0.075	m	2.20			0.17		
Lab	Unload & distribute	see prelims							
	Carpenter	0.28	hr	12.50	3.50				
	One labourer assisting four carpenters	0.07	hr	9.50	0.67				
	Unit rate for timber	1	m		4.17		2.39		6.56

PRICING INFORMATION

WINDOWS AND DOORS

SMM7 NOTES **Work section L Windows/Doors/Stairs**	CESMM3 NOTES **CLASS Z SIMPLE BUILDING WORKS ..**
1 Kind and quality of materials given	Shape, size and limits of work given
2 Details given for treatment, tolerances, jointing,	Items are deemed to include fixings and drilling
and fixing to vulnerable materials	
3 Bedding and pointing frames measured	
4 Ironmongery, trims, surrounds, glazing and	Glazing is measured separately
fixings deemed to be included where supplied	Ironmongery and frames may be included in items
with the component	for doors and windows where clearly stated
5 Each leaf of multiple doors counted as a door	
6 Approximate weight is given for metal doors	
7 For glass supplied separately see L40	
8 Ironmongery (P21) includes matching screws	Materials stated for ironmongery
9 Nature of base for ironmongery is given	

FIXING TIMBER WINDOWS		Output – carpenter hr/unit (or perimeter length)					
		casement		box sash		roof windows	
		nr	*m*	nr	*m*	nr	*m*
Windows	ne 2 m girth		*0.35*		*0.45*		*0.50*
	2–4 m girth	1.00		1.40		1.55	
	4–6 m girth	1.40		1.90		2.20	
	over 6 m girth		*0.26*		*0.35*		*0.40*
Bedding frames			*0.10*				
Pointing frames			*0.15*				

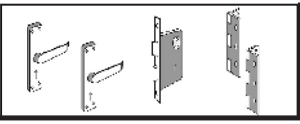
FIXING TIMBER DOORS AND FRAMES			Output – carpenter hr/unit including hinges					
			standard		1 hr fire		ledged & braced	
			door	door set	door	door set	door	door set
Doors	small *	*m²*	*1.10*	*1.70*	*1.35*	*2.10*	*1.00*	
	762 × 1981	nr	1.50	2.60	2.00	3.40	1.40	
	838 × 1981	nr	1.60	2.70	2.20	3.60	1.50	
	large	*m²*	*0.90*	*1.50*	*1.30*	*2.00*	*0.85*	

* minimum 0.75 hr/door or 1.25 hr/door set

			Output – carpenter hr/m		
Frames	(Jambs, heads and sills)		lining & stops	frame & stops	1 hr frame
	38 mm thick	m	0.22	0.24	0.26
	50 mm thick	m	0.25	0.26	0.30
	63 mm thick	m	0.28	0.30	0.35
	75 mm thick	m	0.30	0.34	0.40

SPECIFICATION	Specifiers commonly use manufacturers' references to provide technical requirements
LABOUR RATE	The effective rate for a carpenter is found by dividing the cost of a 'carpentry' gang by the number of carpenters in the gang; typically one labourer can service five carpenters
WASTE	Waste mainly due to damage to manufactured components, typically 2½%
	For lengths of doors stops and linings allow 7½%

PRICING INFORMATION



IRONMONGERY

* Hinges	
75 mm butts	0.13 hr/pr
100 mm butts	0.20 hr/pr
125 mm butts	0.25 hr/pr
Rising butts	0.25 hr/pr
300 mm T hinges	0.30 hr/pr
350 mm T hinges	0.35 hr/pr
Double action spring hinge	1.00 hr each

Door closers	
Perko	1.00 hr each
Overhead door closer	1.50 hr each
Single action floor spring	1.50 hr each
Double action floor spring	2.00 hr each
Door selector stay	0.75 hr each

Bolts	
100 mm barrel bolt	0.25 hr each
150 mm barrel bolt	0.33 hr each
200 mm barrel bolt	0.40 hr each
300 mm barrel bolt	0.50 hr each
100 mm flush bolt	0.55 hr each
150 mm flush bolt	0.65 hr each
200 mm flush bolt	0.75 hr each
300 mm flush bolt	1.00 hr each
single panic bolt	1.50 hr each
double panic bolt	2.00 hr each

Door accessories	
Door security chain	0.20 hr each
Door security viewer	0.35 hr each
Lever handles	0.40 hr/pr
Escutcheon	0.15 hr each
Letter plate (and slot)	1.25 hr each
100 mm cabin hook	0.20 hr each
Numerals	0.10 hr each

Wall fittings		
Shelf bracket	150 mm	0.15 hr each
	200 mm	0.17 hr each
	250 mm	0.20 hr each
Handrail bracket		0.17 hr each
Toilet roll holder		0.17 hr each
Bell push		0.20 hr each
Soap dispenser		0.20 hr each
Hat and coat hooks		0.13 hr each

Locks and latches	
Rim latch	0.75 hr each
Rim dead lock	0.75 hr each
Mortice latch	0.75 hr each
Mortice dead lock	0.75 hr each
Mortice deadlock & latch	1.00 hr each
EXTRA for rebated forends	0.50 hr each
Cylinder/night latch	0.75 hr each
Cabinet lock	0.75 hr each
Padlock, hasp and staple	0.40 hr each
WC/bathroom indicator bolt	1.00 hr each

Door handles and plates	
150 mm pull handle	0.13 hr each
225 mm pull handle	0.17 hr each
300 mm pull handle	0.25 hr each
150 mm flush handle	0.35 hr each
225 mm flush handle	0.60 hr each
300 mm flush handle	0.80 hr each
200 mm finger plate	0.20 hr each
300 mm finger plate	0.25 hr each
740 × 225 mm kicking plate	0.55 hr each
810 × 225 mm kicking plate	0.70 hr each

Window accessories	
Casement fastener	0.25 hr each
Casement stay	0.25 hr each
Mortice casement fastener	0.75 hr each
Sash fastener	0.40 hr each
Spiral sash balance	0.75 hr each
Sash pulley	0.50 hr each
Fanlight catch	0.25 hr each

Furniture accessories	
Cupboard catch	0.25 hr each
Magnetic catch	0.20 hr each
Cupboard knob	0.17 hr each
Cabinet handles	0.20 hr each
Curtain track	0.75 hr/m
Window blind	0.75 hr/m
Mirror 400 × 600 mm	0.60 hr/each

Floor fittings	
Easyclean socket in concrete	0.40 hr/each
Rubber door stop to timber	0.17 hr/each
Rubber door stop to conc	0.30 hr/each

WASTE	Allow 2½% for replacement of damaged ironmongery
FIXINGS	Check that ironmongery is supplied with matching screws
	Allow for sundry items such as cavity fixings for hollow backgrounds
* FIXING DOORS	The outputs for fixing doors include the fixing of hinges

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	DOORS & IRONMONGERY	Date	
Ref. No.				Sheet No.	

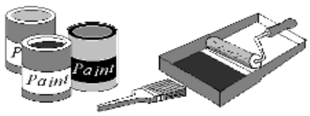
Typical bill description	L20 Timber doors/shutters/hatches Edward Stockley type KL flush doors; plywood faced for painting; 44 × 762 × 1981 mm .. 27 nr

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
Mat	Door price from supplier	1	nr	73.50			73.50		
	Waste	0.025	nr	73.50			1.84		
Lab	Unload and distribute	see prelims							
	Carpenter	1.50	hr	12.50	18.75				
	Labourer assistance	0.20	hr	9.50	1.90				
	Unit rate for door	1	nr		20.65		75.34		95.99

Typical bill description	P21 IRONMONGERY P & M Winfox Ltd Metric Gold range; single action overhead door closers; Ref: 55006 - to softwood .... 27 nr

Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	Net unit rate
Mat	Unit price from supplier inc screws	1	nr	43.25			43.25		
	Waste	0.025	nr	43.25			1.08		
Lab	Unload and distribute	see prelims							
	Carpenter	1.50	hr	12.50	18.75				
	Unit rate for overhead door closer	1	nr		18.75		44.33		63.08

PRICING INFORMATION



PAINTING

SMM7 NOTES **Work section M60 Painting/Clear finishing**	CESMM3 NOTES **CLASS V PAINTING**
1 Kind and quality of materials stated	Material to be used is stated
2 Nature of base & preparatory work given	Preparation normally deemed to be included
3 Priming, sealing & undercoats enumerated	Number of coats or film thickness given
4 Method of application given	
5 Rubbing down deemed to be included	
6 Work is internal unless otherwise stated	
7 Work in staircase areas and plantrooms stated	
8 Work to ceilings over 3.50 m stated (except stairs)	Height of work not given
9 Primary classification is the member painted	Primary classification is the type of paint
10 Secondary classification is the surface features	Secondary classification is the background material
11 No deduction for voids ne 0.50 m^2	No deduction for voids ne 0.50 m^2

	Output–operative hr/unit					
	girth > 300 mm (m^2)		isolated ne 300 mm (m)		isolated ne 0.50 m^2 (nr)	
nr of coats	one	three	one	three	one	three
General surfaces (ADD 10% for ceilings) Emulsion to plaster	*0.09*	*0.24*	*0.03*	*0.08*	*0.08*	*0.22*
to smooth conc	*0.10*	*0.28*	*0.03*	*0.09*	*0.09*	*0.25*
to board	*0.10*	*0.26*	*0.03*	*0.08*	*0.09*	*0.23*
to tex'd paper	*0.10*	*0.26*	*0.03*	*0.08*	*0.09*	*0.23*
to fair blockwork	*0.11*	*0.30*	*0.04*	*0.10*	*0.10*	*0.27*
Prepare and prime	*0.17*		*0.02*		*0.17*	
Undercoat	*0.15*		*0.02*		*0.15*	
Finishing	*0.17*		*0.03*		*0.17*	
1 pr, 1 uc, 1 fin		*0.45*		*0.14*		*0.41*
Glazed units panes ne 0.10 m^2	*0.24*	*0.68*	*0.04*	*0.22*	*0.21*	*0.61*
panes 0.10–0.50 m^2	*0.20*	*0.56*	*0.03*	*0.18*	*0.18*	*0.50*
panes 0.50–1.00 m^2	*0.18*	*0.50*	*0.03*	*0.16*	*0.16*	*0.45*
panes over 1.00 m^2	*0.16*	*0.45*	*0.03*	*0.14*	*0.15*	*0.41*
Structural metalwork	*0.23*	*0.65*	*0.05*	*0.21*	*0.21*	*0.59*
Trusses and girders	*0.18*	*0.50*	*0.06*	*0.16*	*0.16*	*0.45*
Radiators	*0.19*	*0.55*	*0.03*	*0.17*	*0.18*	*0.50*
Fencing Plain open	*0.13*	*0.35*	*0.02*	*0.11*	*0.12*	*0.32*
Close	*0.16*	*0.45*	*0.03*	*0.14*	*0.15*	*0.41*
Ornamental	*0.23*	*0.65*	*0.05*	*0.21*	*0.21*	*0.59*
Gutters	*0.19*	*0.55*	*0.03*	*0.17*	*0.18*	*0.50*
Services (eg. pipes and ducts)	*0.23*	*0.65*	*0.10*	*0.21*	*0.21*	*0.59*

PREPARATION	Washing down, rubbing down, and filling holes included in priming coat
LABOUR RATE	The effective rate for an operative is
HEIGHT ALLOWANCE	ADD 25% for working from ladders
	ADD 15% for working from scaffolding or staging
COVERAGE	Check with paint manufacturer particularly for porous surfaces
	On average 0.07–0.08 litres of emulsion or gloss required per m^2
	but this could double with surfaces such as blockwork or soft boarding
'OLD' WORK	ADD 25% for painting previously decorated surfaces

CB CONSTRUCTION LIMITED PRICING NOTES

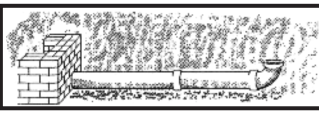
Project		Trade	PAINTING	Date	
Ref. No.				Sheet No.	

Typical bill description	M60 PAINTING AND CLEAR FINISHING Painting concrete – one mist coat and two full coats emulsion paint – as spec M60; general surfaces over 300 girth.. 270 m²

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
Mat	Emulsion paint	0.2	l	2.75			0.55		
	Brushes and sundries	1	item	0.10			0.10		
Lab	Painter	0.25	hr	12.50	3.13				
	Unit rate for emulsion painting	1	m²		3.13		0.65		3.78

Typical bill description	M60 PAINTING AND CLEAR FINISHING Painting wood – one coat primer, one undercoat and one finishing coat – as spec M300; general surfaces; not exceeding 300 girth.. 64 m

Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	Net unit rate
Mat	Paints	0.24	l	3.75			0.90		
	Brushes and sundries	1	item	0.04			0.04		
Lab	Painter – prepare and prime	0.02	hr	12.50	0.25				
	Painter – undercoat	0.02	hr	12.50	0.25				
	Painter – finishing coat	0.03	hr	12.50	0.38				
	Unit rate for oil painting woodwork	1	m		0.88		0.94		1.82

PRICING INFORMATION  DRAINAGE PIPEWORK

	SMM7 NOTES **Work section R12** **Drainage below ground**	CESMM3 NOTES **CLASS I** **PIPEWORK - PIPES**
1	Kind and quality and nominal size of pipes stated	Kind and quality and nominal size of pipes stated
2	Method of jointing pipes stated	Method of jointing pipes stated
3	Excavating trenches includes earthwork support,	Excavating trenches includes earthwork support,
	.. consolidating trench bottoms, backfilling, and	.. suface preparation, pipework, backfilling, and
	.. disposal of surplus excavated materials	.. disposal of surplus excavated materials
4	Backfilling with imported materials stated	Backfilling measured in CLASSES K and L
5	Location for disposal stated	Disposal normally at discretion of contractor
6	Average depth of trench given in 250 mm stages	Average depth to invert given in 500 mm bands
7	Difficult conditions of locations stated	Pipe locations identified in descriptions
8	Breaking out hard materials & reinstatement given	Crossings and reinstatement given in CLASS K
9	Dimensions of bed and surround given	Hard dig and beds/surrounds given in CLASS L
10	Pipe fittings measured extra over pipework	Pipe fittings and valves measured in CLASS J

LAYING PIPEWORK		Labour and plant in laying and jointing pipes in trenches hr/m (pipes) hr/nr (fittings)							
		PVC push fit		CLAY push fit or sleeve		CONCRETE push fit		CHANNEL on mortar bed	
		lab	plt	lab	plt	lab	plt	lab	plt
100	pipe	0.10		0.25		0.25		0.40	
	bend	0.14		0.20		0.20		0.50	
	branch	0.28		0.40		0.40		0.55	
150	pipe	0.15		0.30		0.30		0.50	
	bend	0.18		0.25		0.25		0.65	
	branch	0.32		0.45		0.45		0.70	
225	pipe	0.25		0.40		0.40	0.07	0.50	
	bend	0.25		0.35		0.35	0.07	0.90	
	branch	0.39		0.55		0.55	0.10	1.00	
300	pipe	0.35		0.55	0.10	0.55	0.10	0.90	
	bend	0.39		0.55	0.10	0.55	0.10	1.40	
	branch	0.46		0.65	0.15	0.65	0.15	1.55	
375–450	pipe			0.70	0.25	0.70	0.25	1.05	0.20
	bend			0.80	0.25	0.80	0.25	2.10	0.20
	branch			1.05	0.35	1.05	0.35	2.30	0.30
525–600	pipe			0.90	0.35	0.90	0.35	1.45	0.30
	bend			0.90	0.35	0.90	0.35	2.35	0.30
	branch			1.30	0.45	1.30	0.45	2.60	0.40

LABOUR	Outputs are for drainlayer hours per metre of pipe
PLANT	Outputs are for the machine used to excavate the trench
ADDITIONS	ADD to outputs for filled mortar joints (30%); short lengths (30–50%); deep trenches (30–50%)
DEDUCTIONS	DEDUCT for long lengths (20%), shallow trenches (10%)
JOINTS	For joints which are NOT ‘push fit’, the laying and jointing calculations should be separated.
WASTE	WASTE is normally 5% on pipes and fittings, and 7.5% on short lenghts and channels

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	DRAINAGE EXCAVATION Unit rate pricing	Date	
Ref. No.				Sheet No.	

Typical bill description

R12 Drainage below ground

Excavate trench for pipe not exceeding 200 mm nominal size; average depth of trench 750 mm; backfilling with excavated material; disposal of surplus off site .... 174 m

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
	First calculate the rate for excavating and filling trenches								
	Backacter to excavate at 10 m^3/hr	0.10	hr	22.00		2.20			
	Banksman	0.10	hr	9.50	0.95				
	Backacter to backfill at 8 m^3/hr	0.12	hr	22.00		2.64			
	Two labourers to backfill	0.24	hr	9.50	2.28				
	Plate compactor to backfill	0.12	hr	1.00		0.12			
	EXTRA for taking 25% to tip								
	12.75 − (2.28 + 0.12)	0.25	m^3	10.35		2.59			
	cart away less backfill								
	Total rate	1	m^3		3.23	7.55			10.78
	For a trench 600 × 750 mm deep, assume NO earthwork support								
	but a small over-dig of say 300 mm × 750 mm deep								
	so volume of excavation = 0.90 x 0.75 m = 0.67 m^3								
	Excavate trench	0.67	m^3	10.78	2.16	5.06			
	Trim and compact bottom								
	Labourer 10 m^2/hr × 0.60 m wide	0.06	hr	9.50	0.57				
	Plate compactor to compact btm	0.12	hr	1.00		0.12			
	Additional cart away for the								
	volume of bed and surround								
	should be added here								
	0.75 × 0.45 for example	0.338	m^3	12.75		4.30			
	Rate for drainage excavation	1	m		2.73	9.48			12.21

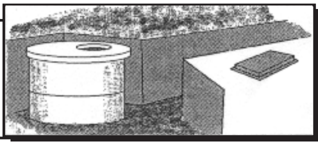
CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	DRAINAGE PIPEWORK Unit rate pricing	Date	
Ref. No.				Sheet No.	

Typical bill description	R12 Drainage below ground A. Granular material type A; bed and surround; to 150 mm pipe; 450 wide × 400 deep .... 174 m B. Clay pipework with flexible joints; in trenches; 150 mm nominal size .... 174 m

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
A.	Bed and surround								
	First calculate the rate per m³								
Mat	Type A aggregate as quote	1.65	T	9.00			14.85		
	ADD 20% for consolidation and								
	penetration	0.33	T	9.00			2.97		
Lab	Labour previously priced in backfilling trenches								
Plt	Plant previously priced in backfilling trenches								
	EXTRA for disposal of volume occupied by								
	imported filling:	1	m³	12.75		12.75			
	Total	1	m³			12.75	17.82		30.57
	For a machine-excavated trench the minimum width is usually 600 mm								
	So the gross volume per metre is 600 × 400 = 0.24 m³/m								
	[larger pipe diameters merit a reduction for the volume occupied by the pipe itself]								
	Rate for bed and surround	0.24	m³			3.06	4.28		7.34
B.	150 mm pipe in trench								
Mat	Pipe from price list with 15% discount	1	m	6.25			6.25		
	Waste 5%	0.05	m	6.25			0.31		
Lab	Drainlayer	0.3	hr	9.50	2.85				
Plt	This method assumes that the excavator								
	can be employed elsewhere when the								
	pipes are laid								
	Rate for 150 mm pipe	1	m		2.85		6.56		9.41

PRICING INFORMATION



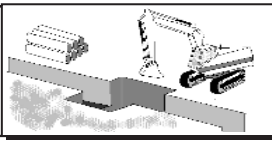
DRAINAGE MANHOLES

SMM7 NOTES **Work section R12** **Drainage below ground**	CESMM3 NOTES **CLASS K** **PIPEWORK – MANHOLES AND PIPEWORK ANCILLARIES**
Excavation, concrete, formwork, reinforcement,	Items for manholes shall be deemed to include:
brickwork and rendered coatings measured	excavation, disposal, backfilling, upholding sides,
in accordance with the rules of the relevant work	concrete work, reinforcement, formwork,
section of SMM7	brickwork, metalwork, pipework inc backdrops
	Manholes enumerated depending on form of construction
Covers, step irons, channels, benching and building	.... and depths which are given in 1.5 m stages
in pipes are enumerated	Depths measured from tops of covers to tops of base slabs
	Types and loading duties of covers are given
	Hand dig is identified in items
	Hard dig given in CLASS L
	Pipe valves measured in CLASS J.

Typical spreadsheet approach to pricing manholes for a specific (civils) project

			diam depth cover	1200 ne 1.50 m A		1350 ne 1.50 m A		1500 1.50–2.00 m B	
Description	Unit	Mat rate	Lab/plt rate	Mat	Lab/plt	Mat	Lab/plt	Mat	Lab/plt
Excavation	m^3		8.50		51.43		58.68		92.97
Disposal	m^3		12.75		22.95		29.05		50.20
Backfilling	m^3		3.50		14.88		16.19		24.50
Side support	m^2	1.00	1.00	24.20	24.20	27.61	27.61	43.75	43.75
Surface prep	m^2		0.60		0.86		1.09		1.35
Blinding	m^3	65.00	22.00	6.55	2.22	8.29	2.81	10.24	3.47
Base slab	m^3	65.00	18.00	18.72	5.18	23.69	6.56	29.25	8.10
Surround	m^3	65.00	15.00	62.40	14.40	70.20	16.20	78.00	18.00
Formwork	m^2		12.00		57.60		64.80		72.00
Chamber rings	nr			75.00	36.00	105.00	48.00	120.00	75.00
Shaft rings	nr								
Reducer slabs	nr								
Cover slabs	nr			60.00	21.00	80.00	25.00	110.00	33.00
Cover	nr			85.00	18.00	85.00	18.00	45.00	15.00
Benching	m^3	65.00	42.00	18.72	12.10	23.69	15.31	29.25	18.90
Channels	item			24.00	16.00	24.00	16.00	33.00	19.00
Brickwork	m^2	36.00	36.00	16.56	16.56	16.56	16.56	16.56	16.56
Sundries	item								
		Totals	£	391.15	313.37	464.05	361.85	515.05	491.80

PRICING INFORMATION



DRAINAGE TRENCHES

Width of trench (m)		Pipe sizes (mm)								
		100	150	225	300	375	450	525	600	750
depth	ne 1.50 m	0.60	0.60	0.70	0.70	0.90	1.10	1.20	1.30	1.45
	1.75–2.25 m	0.70	0.70	0.80	0.80	1.00	1.20	1.30	1.40	1.60
	3.00–4.00 m	0.80	0.80	0.90	0.90	1.10	1.30	1.40	1.50	1.70

Note: These are average widths, the actual widths of drainage trenches will depend on:–

1. The nature of the ground
2. The method of support to the sides of trenches
3. The width of bucket if dug by machine

Outputs for drainage gang excavating and laying drains incl backfill		Pipe sizes (mm)								
		100	150	225	300	375	450	525	600	750
Outputs for a drainage gang of one machine, two drainlayers & one labourer (m/day)										
depth (m)	0.50	35	34	33	30	26	25	23		
	0.75	34	33	32	29	25	23	21	18	
	1.00	32	31	30	28	23	21	19	16	13
	1.25	30	29	27	24	20	18	17	14	12
	1.50	26	25	24	20	16	15	14	12	11
	1.75	21	20	20	17	14	13	12	11	10
	2.00	18	17	16	15	12	11	10	9	8
	2.25	16	15	14	13	11	10	9	9	7
	2.50	15	14	13	12	10	9	8	8	7
	2.75	13	12	11	11	9	8	7	7	6
	3.00	12	11	10	10	8	7	6	6	6
	3.25	10	10	8	8	6	5	5	5	5
	3.50	9	9	8	8	6	5	5	5	5
	3.75	8	8	7	7	5	5	5	5	4
	4.00	7	7	6	6	5	4	4	4	4

Note: These are average production rates, the actual output will depend on:–

1. The nature of the ground
2. The method of support to the sides of trenches
3. The length of drainage runs and location

If trenches need to be supported, the cost of hiring trench sheets can be added to the drainage gang rate.

For 20 m of trench with both sides supported there would be $(20 \times 2)/.33 = 122$ sheets (330 mm wide) required

With a typical hire rate of £0.60 per week for a 2400 mm long sheet, the daily rate would be : $122 \times 0.60/5 =$ £14.65 per day

The use of trench supports would lead to a reduced daily output by the drainage gang.

CB CONSTRUCTION LIMITED PRICING NOTES

Project		Trade	DRAINAGE EXCAVATION	Date	
Ref. No.			Operational pricing	Sheet No.	

Typical bill description

CLASS I PIPEWORK - PIPES

I112 Clay pipes 150 mm dia in trenches, across farmland runs S2-S12; depth not exceeding 1.5 m .... 302 m

L331 150 mm bed and surround with 14 mm single sized granular material to 150 mm dia pipes .... 302 m

Item details					Analysis				Net unit rate
Ref:	Description	Quant	Unit	Rate	Lab	Plt	Mat	s/c	
	For excavating a drain run including pipe, bed and surround								
	assume 25 m can be completed in one day by the following gang:								
Plt	Backacter	8.50	hr	22.00		187.00			
	Road tipper	2.00	hr	22.00		44.00			
	Plate compacter	8.50	hr	1.00		8.50			
	Trench sheets (see below)	1.00	day	18.24		18.24			
Lab	Labourers (3 nr)	25.50	hr	9.50	242.25				
Mat	Pipe from price list with 15% discount	25	m	6.25			156.25		
	Waste 5%	1.25	m	6.25			7.81		
	14 mm stone								
	25 m × 0.60 m × 0.45 m × 2.10 T/m^3	14.18	T	9.00			127.58		
	Rate for one day's work	25	m		242.25	257.74	291.64		791.63
	Rate for drainage (÷25)	1	m		9.69	10.31	11.67		31.67
	Trench sheet for 25 m = (25 × 2)/0.33 = 152								
	At £0.60 per week to hire								
	Daily hire rate would be : 152 × 0.60 ÷ 5 = £18.24								

12 Sub-contractors and nominated suppliers

Introduction

Sub-contractors can be classified in two main categories: nominated and domestic sub-contractors. The way in which a sub-contractor's quotation is incorporated in the tender will depend on the contractual relationship of the specialist with the main contractor, and the definitions given in the standard method of measurement used. During the 1980s and early 1990s, the use of the formal nomination procedure diminished. It has been replaced by lists of approved sub-contractors given in the tender documents, named sub-contractors where the Intermediate Form is used, and the novation of specialists for design and build schemes. (*The word 'novation' means the substitution of a new obligation for an old obligation by the mutual consent of the parties. In construction procurement the term is used where the client has already completed negotiations with a sub-contractor or consultant and invites the contractor to enter the agreement.*)

Domestic sub-contractors

The procedures for despatching enquiries to obtain quotations from sub-contractors were given earlier. Great care must be taken when estimating on the basis of sub-contract quotations because the contractor takes responsibility for all the work. It is therefore for all the parties to ensure that quotations are based on accurate and complete information.

All sub-contract quotations should be checked for arithmetical errors and totalled. To compare them on a like-for-like basis the following checks are carried out by the estimator:

1. All the items for that trade should be priced. If there is enough time, the sub-contractor should be asked to provide missing rates, otherwise the estimator needs to insert his own estimate of their value.
2. The rates should be realistic. If a patent error is detected then the sub-contractor should be advised to amend his quotation and tell all the main contractors who have received it.

3. It is sometimes argued (mainly by quantity surveyors) that rates should be consistent throughout the bill of quantities – like items should be priced at similar rates to avoid possible difficulties when valuing variations. Anyone vetting a tender must realize that the cost of similar items may vary depending on quantities, location, timing and so on.
4. The sub-contractor should accept the contract conditions without amendment. This will enable the estimator to make fair comparisons between quotations, and avoid any misunderstandings brought about by qualified bids. In practice, quotations are sent with many printed and specific conditions which may conflict with the enquiry documents. These details are often resolved at the negotiation stage.
5. The quotation should be based on the documents that form the main contract. The estimator should not accept a lump sum quotation for work, which will be valued on the basis of an approximate bill of quantities or accept a schedule of rates for a plan and specification project. If a sub-contractor has altered the tender documents, in the bill of quantities for example, there may be a mistake, which should be brought to the attention of the client so that all the contractors will correct the bill before the tenders are submitted.
6. There is a growing tendency for sub-contractors and suppliers to retype the bills of quantity usually to accord with their interpretation or individual product range. The estimator must be sure that any changes do not represent a significant change to the contract requirements.

Quotations from specialists often need careful comparison using a standard form. The example sheet shown in Fig. 12.1 can be used to compare 'supply and fix' sub-contractors with labour-only contractors; the difference between the two is usually the cost of materials.

A computer can be a great help in comparing sub-contractors' quotations. Spreadsheet software is particularly useful for listing, and comparing rates, and provides a mathematical check. The spreadsheet method also allows rates to be adjusted before they are put in the estimate. Computer-aided estimating packages offer more powerful facilities, in particular:

1. The software will prompt the estimator by showing items that the sub-contractor should have priced.
2. Average rates can be inserted automatically when one of the sub-contractors fails to price an item. This facility can be very misleading. In some cases one sub-contractor may price an item at 'nil' because his costs have been allocated elsewhere. Figure 12.2 shows a computer comparison system where an average rate has been inserted by the software but the result is a mistake which may lead someone to choose the wrong sub-contractor.

CB CONSTRUCTION LIMITED		Project	LIFEBOAT STATION			Trade	STONEWORK
SUB-CONTRACT COMPARISON SHEET		Ref.no.	T384	Date	6.04	Page	1/1

					Sub 1		Sub 2		Sub 3		LOSC		Materials				
					PRELUDE STONE		DEANSTONE				CASTLE		RENARD QUARRY				
Page	Item	Description	quant	unit	Rate	£	Rate	£	Rate	£	Rate	£	Basic	Sund	Waste	Rate	£
															2.5%		
4/13	C	Coping 550 × 175 mm	23	m	233.30	5 366	265.00	6 095			36.04	829	183.30	1.20	4.61	189.11	4 350
	D	Mitred angle	8	nr	28.00	224	inc				inc		18.00		0.45	18.45	148
4/10	E	Jamb 120 × 160 × 1114 mm	186	nr	107.00	19 902	125.50	23 343			72.10	13 411	56.50	1.00	1.44	58.94	10 963
	F	Jamb 135 × 160 × 111 4 mm	38	nr	110.00	4 180	129.40	4 917			73.20	2 782	57.30	1.00	1.46	59.76	2 271
	G	Cill 225 × 175 × 839 mm	2	nr	165.10	330	173.60	347			90.10	180	102.22	1.80	2.60	106.62	213
	H	Cill 225 × 175× 1014 mm	94	nr	188.58	17 727	195.30	18 358			90.10	8 469	125.70	1.80	3.19	130.69	12 285
	J	Head 230 × 225 × 1014 mm	15	nr	177.96	2 669	235.00	3 525			144.16	2 162	115.08	1.20	2.91	119.19	1 788
	K	Mullion	3	nr	186.25	559	195.30	586			144.16	432	110.00	1.50	2.79	114.29	343
4/11	A	Stainless steel dowels	333	nr	5.40	1 798	4.85	1 615			3.20	1 066	1.80	0.80	0.07	2.67	889
					£	52 755	£	58 786				29 331				£	33 250
												33 250					
											£	62 581					

Fig. 12.1 *Example of a sub-contract comparison sheet*

CB CONSTRUCTION LIMITED **Comparison report**

Trade: **Structural steelwork**

				Index structures		Flake & Mill		Jones Fabrication	
Item ref	Description	Qty	Unit	Rate	Total	Rate	Total	Rate	Total
1.3.27.a	Preliminaries	1	sum	3500.00	3 500	2500.00	2 500	2250.00	2 250
1.3.27.b	Stanchions	33	t	995.00	32 835	900.00	29 700	950.00	31 350
1.3.27.c	Roof beams	31	t	965.00	29 915	900.00	27 900	960.00	29 760
1.3.27.d	Purlins	210	m	10.50	2 205	11.00	2 310	15.00	3 150
1.3.27.e	Holding-down bolts	96	nr	1.25	120	1.50	144	2.00	192
1.3.27.f	Erect steel on site	64	t	320.00	20 480	280.00	17 920	150.00	9 600
1.3.27.g	Prime steel at works	497	m^2	inc	0	5.00	2 485	2.50	1 243
	Totals				89 055		82 959		77 545

average rate inserted by computer –
must be checked by estimator
with sub-contractor

Fig. 12.2 *Computer comparison system showing problem of average rate inserted automatically*

3. The chosen list of rates can be incorporated in the estimate at the touch of a button.

This assumes the estimator wants to insert the rates as they stand. In some cases a lump sum may be added to certain rates or a percentage may be applied to others. The main reasons for changing the sub-contractor's rates are:

1. The sub-contractor might need specific builder's work not measured elsewhere, drilling holes through the building fabric being the most common example.
2. An estimator might decide to add certain attendances to the measured rate, such as scaffolding for an industrial door installer.
3. There may be specific trade requirements, which are customarily provided by the contractor. For example, a piling firm may ask for surplus soil to be removed by the main contractor, and a plasterer often expects the free use of a mechanical mixer.
4. Site overheads may be given as a separate item by a sub-contractor. In this case the estimator might wish to spread this sum across the net rates.
5. A margin for overheads and profit could be added to all or some of the rates; either because the contractor wishes to spread his overheads through the bill or for tactical reasons, such as work which appears to be undermeasured.

There is a slight danger that adding attendances and margin to rates may confuse site surveyors or buyers. This should not be a problem if staff understands the distinction between net allowances and the rates given in the client's (gross) bill. The former are target rates for buying materials and services, the latter being the value the contractor will be paid for his services. To keep matters simple, it is customary to deal with attendances and overheads in the assessment of a main contractor's site overheads.

Figure 12.3 shows the attendances to be provided by the main contractor, without charge to the sub-contractor. These attendances are defined in the form of sub-contract, and are normally priced in the project overheads. There will be some sub-contractors, of course, who will need more than others. A cladding contractor, for example, will need a considerable amount of safety and access equipment whereas a plasterer may only need a small mixer and a supply of clean water.

Whenever a particular sub-contractor is used in the tender, an entry should be made on the summary of domestic sub-contracts (see Fig. 12.4). If a lower quotation is received later in the tender period, an adjustment can be made on this form and carried to the tender analysis reports presented to management at the final review meeting. For some contractors using computer-aided estimating systems, forms are not filled in during the tender period because all data can be manipulated at any stage.

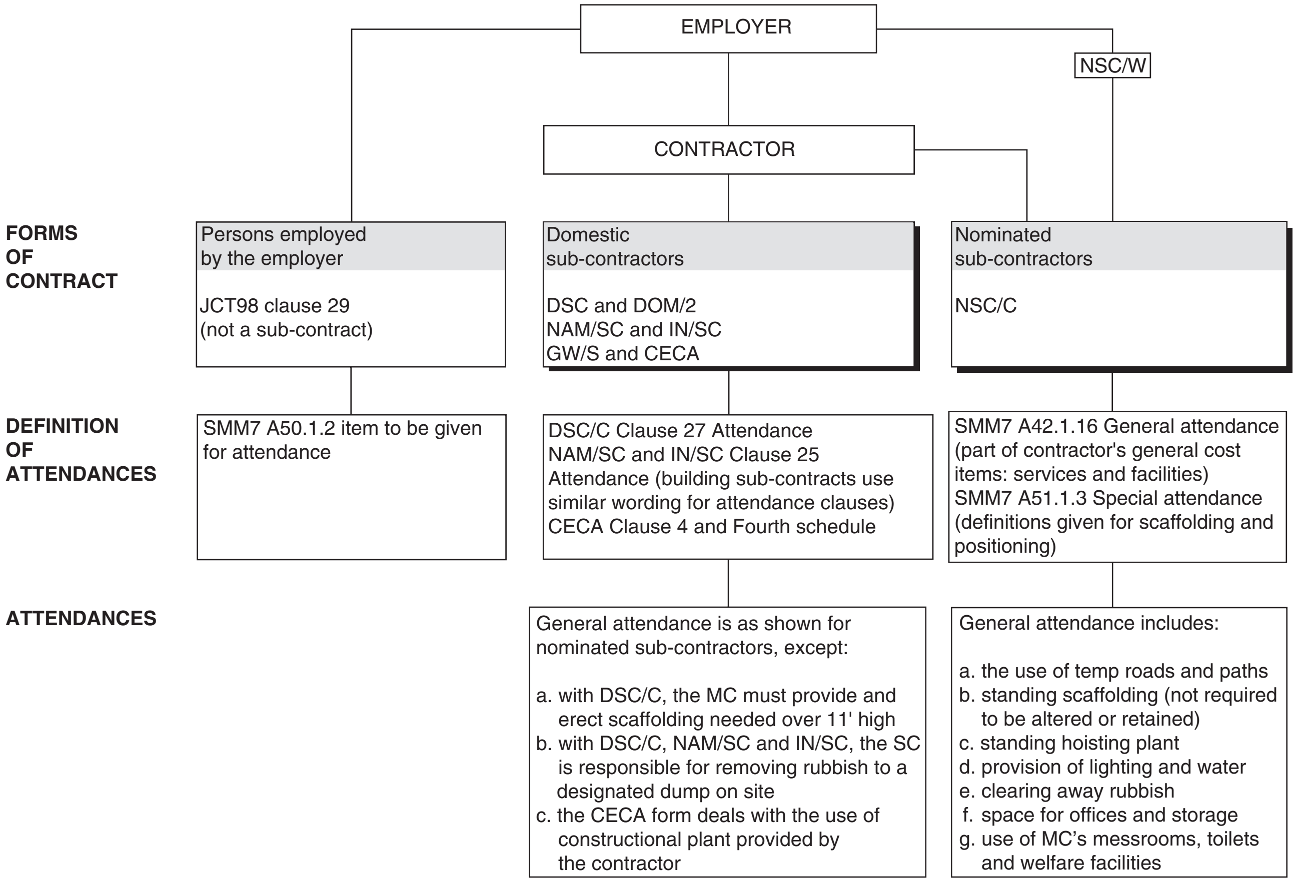


Fig. 12.3 *Sub-contract types and attendances*

CB CONSTRUCTION LIMITED	DOMESTIC SUB-CONTRACTOR'S SUMMARY	Project	Fast Transport		
		Ref. No.	T354	Date	30.6.04

Ref.	Trade	Company	Quotation	Discount offered (%)	Net amount	Firm price Allowance	Alternative/late quotations: Company	Net amount	Saving
S1	Roof covering	Beaufort Roofing	17 672	2.5	17 230	nil			
S2	Windows	Valley Fabrications	30 641	2.5	29 875	1 225	Archiglass	27 550	2 325
S3	Plumbing	Consort	4 550	nil	4 550	nil			
S4	Plastering & partitions	Swift Services	57 990	nil	57 990	nil	Oscar Finishes	46 760	11 230
S5	Joinery	Projoin Site Services	41 900	nil	41 900	1 935	L.P. Monk	38 450	3 450
S6	Suspended ceilings	Hill Systems	19 882	2.5	19 882	nil			
S7	Painting	Tudor Decorations	12 659	2.5	12 343	nil			
S8	Floor coverings	Freedom Finishes	12 615	2.5	12 300	nil			
S9	Electrical installation	Comech Engineering	35 887	2.5	34 990	nil	Beta Technologies	22 860	12 130
S10	Mechanical installation	Comech Engineering	25 667	2.5	25 025	nil			
S11	Surfacing	W. Smith Contracting	11 800	nil	12 450	nil			
S12	Scaffolding	CCG Scaffolding	see prelims						
		Totals		£	268 535	3 160		£	29 135

Fig. 12.4 *Typical summary form for domestic sub-contractors in a tender*

Nominated sub-contractors

The nomination procedure suffers from an elaborate set of conditions in the JCT98 contracts which has had the effect of turning people away from the practice of nominating specialist sub-contractors and suppliers. The general conditions for government contracts, GC/Works/1 Edition 3, is much simpler; clause 63 Nominations starts with the following declaration:

> A nominated subcontractor or supplier means a person with whom the Contractor is required to enter into a contract for the execution of work or the supply of Things designated as 'Prime Cost' or 'PC' items. This requirement may be specified in the contract documents or in any direction or Instruction given under the Contract.

The standard method of measurement gives the rules for items to be included for nominated sub-contractors (SMM7 rule A51) and nominated suppliers (SMM7 rule A52). The following information must be given in the tender documents for each nominated sub-contractor:

1. The nature and construction of the work.
2. A statement of how and where the work is to be fixed.
3. Quantities, which indicate the scope of the work.
4. Any employer's limitations affecting the method or timing of the works.
5. A prime cost sum.
6. General attendance item in accordance with Section A42.
7. An item for main contractor's profit, to be shown as a percentage.
8. Details of special attendance required by the sub-contractor.

SMM7 lists some of the special attendances which might be required and makes it clear that special scaffolding is that which is needed as well as the contractor's standing scaffolding provided for other trades. The companion document 'SMM7 Measurement Code' goes further, suggesting the bill item for special scaffolding should be accompanied by dimensions. One of the biggest problems for estimators is the common practice of quantity surveyors who merely list all the general items given in SMM7 against every nomination. Again the Measurement Code warns against this practice and states that where adequate information cannot be provided a provisional sum should be used. Furthermore, items for positioning should state the expected weight, location and size of the components to be positioned.

The estimator's task is to make sure that the PC sum gets included in the bill calculations, adding a percentage for profit to the PC sum if it is wanted, considering the effect of the work on the programme, and assessing the costs of general and special attendances. Many contractors are reluctant to insert a figure for profit against the bill item because it might be interpreted as representing the contractor's profit on all the work.

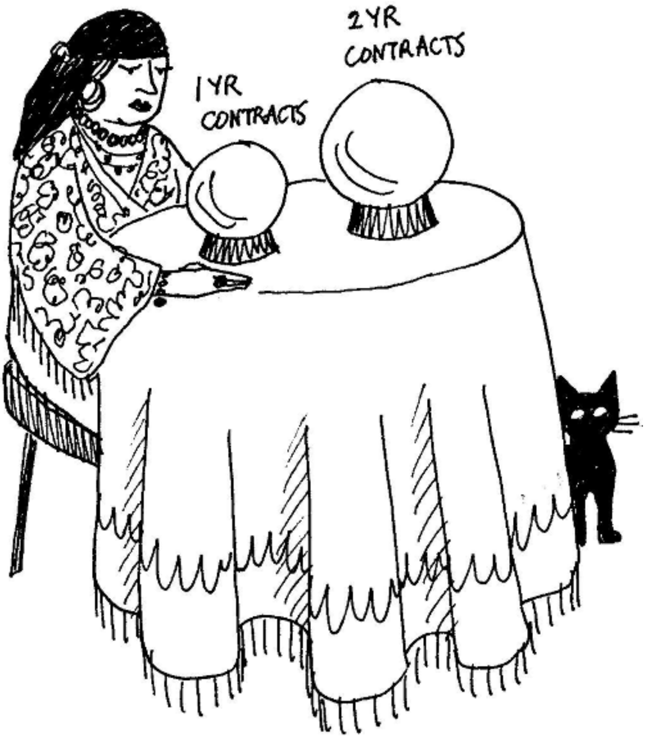
SMM7 defines general attendance in Section A42 coverage rule C3 (see Fig. 12.3). The estimator usually provides for the cost of these attendances in his evaluation of the project overheads since most of the facilities are common to other trades. Special attendances on the other hand need to be priced separately either in the measured bill or as items in the project overhead calculations. If the special attendances are properly described the estimator can price the work; but where general descriptions are used he has great difficulty assessing his obligations. A typical example is a prime cost sum for piling where the type of pile is not given and the special attendances state the need for 'positioning'. SMM7 tells us that positioning means unloading, distributing, hoisting and placing in position. Does the piling contractor expect the contractor to do all this for him?

Nominated suppliers

SMM7 and the standard forms of contract state that a nominated supplier is identified in the tender documents as a prime cost sum. A separate item is given for the contractor to add his profit. JCT98 says that the nominated supplier shall allow the contractor a discount for cash of 5%. Many contractors take out this discount before final review so the meeting can consider the net costs before considering the mark-up required to convert the estimate to a tender. A building estimator must be careful in dealing with GC/Works/1 Edition 3 because clause 63(3) states that the sum paid to the contractor by the authority, for all nominations, is the prime cost after the deduction of 'all discounts rebates or allowances'. No such problem arises with Institution of Civil Engineers (ICE) 6th Edition where the contractor can keep the discount obtainable for prompt payment to firms nominated for services or the supply of goods.

Fixing materials provided by nominated suppliers is measured in the appropriate part of the bill of quantities. GC/Works/1 Edition 3 points out that rates for fixing must include unloading, getting-in, unpacking, return of empties and other incidental expenses. A similar definition was given in SMM6 and was added to SMM7 with amendment No. 2 (New Coverage Rule C1 for section A52.1).

13 Fluctuations



'The inflation calculation'

Introduction

In the majority of cases – all but the largest of projects – contractors must allow for changes in costs that occur during the construction phase. The amount which the estimator adds to the estimate for inflation is a guess, calculated after an examination of price trends over the previous few years, and discussions with suppliers and sub-contractors, in an attempt to predict future trends. If a contract is likely to last for several years then the employer will request a tender based on current prices and any changes will be reimbursed using the methods defined in the contract.

The standard forms of contract have terms for either a *firm or fluctuating* price. A firm price is one which will not be varied for changes in the cost of resources, although labour tax fluctuations are usually reimbursed by the employer. In a fluctuating price tender the price is agreed before the job starts but the contract sum can be adjusted for changes in the costs of resources. An estimator needs to understand the clauses dealing with fluctuations so that he can tell the sub-contractors of the risks and calculate his own forecast of increased costs.

Standard fluctuations clauses

The JCT Standard Form of Building Contract lists three options under clause 37 for dealing with fluctuations. The choice is noted in the Appendix as one of three clauses 38, 39 or 40. The estimator should find this information in the preliminaries section of the bill of quantities. If a method has not been chosen then clause 38 shall apply (firm price). Since only one option is required, fluctuation clauses are published separately from the rest of the contract conditions.

There are, in fact, four possibilities for dealing with fluctuations:

1. No clause – not recognized by the JCT contracts but would produce a firm price regardless of statutory or other changes.
2. Clause 38 – this is the firm price alternative which allows some statutory changes such as levies, taxes and contributions.
3. Clause 39 – is the full fluctuation option allowing variations in prices of labour, and materials using a basic list.
4. Clause 40 – is the 'Formula Method' where changes in costs are calculated by applying average indices prepared by national bodies published in monthly bulletins.

Clause 39 is the traditional method for the recovery of increases in the costs of employing labour and buying materials, but is seldom used today. It is an attempt to calculate the actual increases or decreases in costs incurred by the contractor and his sub-contractors. This method leads to a great deal of work for quantity surveyors because the actual costs of construction must be compared with those at the date of tender. No increases are allowed for:

1. Overheads and profit.
2. Site supervision.

3. Site establishment costs.
4. Plant and temporary works.

The contract allows the contractor to enter a percentage addition in the Appendix for some of the costs which are not recoverable.

Clause 40 (the price adjustment formulae option) is not based on the actual cost changes as in clause 39; instead it uses the changes in indices published by the DOE, which are published monthly. There is therefore no need for a basic list of material prices and the administrative work is reduced. There are 49 work categories covering general building work and many of the common specialist activities. The PQS should assign the bill items to work categories so the contractor can assess the way in which increases will be dealt with when the work is valued. Fluctuations are not calculated for the following:

1. Credit for demolition materials.
2. Unfixed materials on site.
3. Plant paid for on a daywork basis (labour is reimbursed at the rate current when the work is carried out).
4. Claims (normally calculated at full value).
5. A non-adjustable element which is deducted from the increased costs payable under the Local Authorities editions of JCT80. The deduction, which is normally 10%, is made because it could be argued that contractors should not receive an addition on overheads and profit.

The Joint Contracts Tribunal has produced similar conditions for dealing with fluctuations under the Intermediate Form of Building Contract. Clause 4.9 states that the contract sum will be adjusted for contribution, levy or tax matters unless the price adjustment formulae method is given in the Appendix to the contract. There are no fluctuations rules in the Agreement for Minor Building Works because the contract is for work of short duration. The usual clause for contribution, levy and tax changes is written into the contract (clause 4.6) but can be deleted if the contract period is short.

Works contractors engaged by management contractors under the terms of the JCT Works Contract conditions are reimbursed using one of three methods, which are similar to the JCT80 clauses 38, 39 and 40. The JCT Management Contract itself does not have provisions for fluctuations, presumably because the management contractor is paid the prime cost of the work.

The ICE Conditions of Contract include a supplementary clause for Contract Price Fluctuations, attached in looseleaf form. Again the most common arrangement is for a firm price contract without fluctuations but including (under clause 69) provision for statutory labour taxes, levies or contributions. The Central Government form GC/Works/1 uses a similar arrangement for labour tax matters and supplementary conditions for fluctuations using the NEDO formulae method for recovery.

Calculation of non-recoverable increases

In broad terms the calculation shown below is necessary on every contract, including those with fluctuations clauses, because there is usually a shortfall in recovery of increased costs.

A. Forecast increases in costs of resources.
B. Forecast amount recoverable.
C. *Add* non-recoverable element (A–B) to tender.

Now that analytical estimating is widely used by estimators, the fluctuations calculations can be dealt with after the bill of quantities has been rated – all the resources can be examined separately and a forecast of changes can be made. On the other hand, if the labour element is not known, a wage increase adjustment can be made to the all-in rate before pricing begins.

The tender programme is an invaluable aid in forecasting cost increases, not only for the construction phase but also to calculate the effect of the time between date of tender and start on site. The period for which the tender is to remain open for acceptance should be as short as possible if the employer wants to receive an economical price for the work. Figure 13.1 shows the use of a tender programme in assessing fluctuations. No labour increase is expected in this example until the following June which is after completing the project. If the project started in March (Fig. 13.2) there would be a June increase in labour rates but no more costs for staff who have their salaries increased in January.

It can be difficult to forecast changes in costs accurately. A reasonable estimate can be made, however, if individual resources are treated separately, as follows:

Labour The forecast of labour cost increases is the most predictable part of an estimate because wages change on the same date each year and the increase follows political and economic trends. Historical data can be plotted on a graph if a longer-term view is needed. For labour-only sub-contractors changes are difficult to anticipate and, at times of increased activity, change more quickly.

There are three ways to calculate expected labour costs throughout the currency of the contract:

1. Adjust the all-in rate before pricing the bill so all labour is priced on an average rate. This can be done as follows:

May–June	8 weeks at £12.50/hour	£100.00
July–Sept.	12 weeks at £13.00/hour	£156.00
Total		£256.00
Average rate	£256.00/20 =	£12.80/hour

CB Construction Limited **Fluctuations calculation for a project starting in September**

		Estimate of Fluctuations £					August (weeks −7 to −1)	September to March (weeks 1 to 29)
		Lab	Plt	Mat	Sub	Staff		
1	*Pre-construction*						▽tender ▽award	▽start
2	Excavation and filling							
3	Foundations formwork							
4	Foundations concrete							
5	Underslab drainage							
6	Concrete grd floors			320			£16 000 @ 2%	
7	Columns formwork							
8	Columns concrete			48			£3 200 @ 1.5%	
9	Floors formwork							
10	Floors concrete			265			£10 600 @ 2.5%	
11	External walls			1 690			£67 600 @ 2.5%	
12	Roof timbers			220			£8 800 @ 2.5%	
13	Roof covering			75	685		sub: £27 400 @ 2.5%	
14	Windows				780		sub: £31 200 @ 2.5%	
15	Services 1st fix						firm price	
16	Plasterwork						firm price	
17	Partitions						firm price	
18	Joinery			255	744		sub: £24 800 @ 3.0%	
19	Ceilings			110	681		sub: £22 700 @ 3.0%	
20	Services 2nd fix						firm price	
21	Painting						firm price	
22	Floor covering				608		sub: £15 200 @ 4.0%	
23	External works			640			£25 600 @ 2.5%	
24	Surfacing				708		sub: £17 700 @ 4.0%	
	Site overheads							
25	Site manager							
26	Engineer							
27	Foreman							
28	General labour					na	Staff costs after annual review	
	Staff total					576	£14 400 @ 4%	← staff costs plus 4% → (weeks 18–29)
	TOTALS			3 623	4 206	576		

Fig. 13.1 *Calculation of fluctuations for a project starting in September*

CB Construction Limited **Fluctuations calculation for a project starting in March**

		Estimate of Fluctuations £					February (weeks −7 to −1)	March–September (weeks 1 to 29)
		Lab	Plt	Mat	Sub	Staff	−7 −6 −5 −4 −3 −2 −1	March: 1 2 3 4; April: 5 6 7 8 9; May: 10 11 12 13; June: 14 15 16 17; July: 18 19 20 21 22; August: 23 24 25 26; September: 27 28 29
1	*Pre-construction*						▽ tender ▽ award	▽ start
2	Excavation and filling							← estimate of labour increase is 3 % →
3	Foundations formwork							
4	Foundations concrete							
5	Underslab drainage							
6	Concrete grd floors	174		320			Lab: £5 810 @ 3%	
7	Columns formwork							
8	Columns concrete	36		48			Lab: £1 200 @ 3%	
9	Floors formwork							
10	Floors concrete	116		265			Lab: £3 850 @ 3%	
11	External walls	1 860		1 690			Lab: £62 000 @ 3%	
12	Roof timbers	74		220			Lab: £2 480 @ 3%	
13	Roof covering	60		75	685		Lab: £2 000 @ 3%	
14	Windows				780			
15	Services 1st fix							
16	Plasterwork							
17	Partitions							
18	Joinery	132		255	744		Lab: £4 400 @ 3%	
19	Ceilings	51		110	681		Lab: £1 700 @ 3%	
20	Services 2nd fix							
21	Painting							
22	Floor covering				608			
23	External works	708		640			Lab: £23 600 @ 3%	
24	Surfacing				708			
	Site overheads							
25	Site manager					nil		
26	Engineer					nil		
27	Foreman					nil		
28	General labour	228					Lab: £7 600 @ 3%	
	Staff total					nil		
	TOTALS	3 439	0	3 623	4 206	0		

Fig. 13.2 *Calculation of fluctuations for a project starting in March*

2. Increase the total labour costs by a percentage based on the approximate amount of work to be carried out before and after a wage increase.
3. Increase only the trades which are working after the wage increase by examining the tender programme.

Staff The cost of staff can be split between the amounts before and after the annual review. A simple percentage can then be added to the total salaries after the review.
Materials and plant There are two methods commonly used to assess the increased costs of materials and plant:

1. The estimator could assume a constant increase over the time that resources are purchased or hired and determine the increases up to the mean purchase date. As a simple example, if the estimator uses a constant increase of 1% a month for a 12-month contract he might add 6% to the total value of materials.
2. A more accurate assessment can be made by looking at each material or item of plant abstracted in the estimator's summary. A separate decision can then be made for each resource for likely increases and their timing with respect to the programme. If concrete prices are due to increase, for example, during the last third of a building project programme there may be no need to add for inflation, because concrete is generally used for early activities.

Sub-contractors All enquiries to sub-contractors must clearly state the rules for fluctuations. The estimator must check their quotations for compliance with the conditions. For some trades, such as surfacing, the estimator may have difficulty in obtaining offers which fully comply with a request for a firm price tender. He will identify the problem and adjust the sub-contract value when he completes the domestic sub-contract register; an example is given on page 68 of the COEP. On the other hand, the firm price adjustments could be made on a sub-contract summary sheet (see Chapter 12) which lists all the sub-contract values used in the tender.

For a *firm-price* tender, the estimator will add all the increases to his estimate; although in a strongly competitive market he may assume that certain price increases can be avoided or negotiated away.

For a contract, which is based on a *formula method*, the estimator must add the non-adjustable element to his price.

During periods of low inflation (as experienced in the early years of the new millennium) allowances made by estimators for inflation have been reassigned by site teams and added to margin. Unfortunately, when inflation rises faster than predicted at tender stage, losses can occur.

14 Provisional sums and dayworks

Introduction

Contractors have traditionally added the amounts for provisional sums and dayworks after the profit margin has been calculated. This is because, when provisional sums and dayworks are valued during the contract, the contractor receives reimbursement for overheads and profit. This changed in 1988 when SMM7 introduced the use of provisional sums for *defined work* and the Joint Contracts Tribunal (JCT) standard contract forms were amended accordingly.

Provisional sums for undefined work

Where the employer identifies there is likely to be extra work for which there is no information at tender stage or it cannot be measured using the standard method of measurement, a provisional sum can be provided in the bill of quantities. The sum is spent at the direction of the architect (or engineer, Institution of Civil Engineers (ICE) Conditions of Contract) and the work is valued in accordance with the valuation rules. There are two kinds of undefined provisional sum: a contingency sum which is for work which cannot be identified at tender stage, usually for unforeseen circumstances, and sums for specific items the extent of which is not known, such as more landscaping to a courtyard which has not been agreed with the client. The contractor adds these provisional sums to his tender after he has calculated his preliminaries and profit margin. SMM7 makes it clear that the contractor is entitled to any reasonable allowance for programming, planning and preliminaries. This is not just a financial compensation. JCT80 (clause 25.4.5) gives the expenditure of a provisional sum as a relevant event, which may lead to claim for an extension of time. Taken literally, this means that the estimator does not include provisional sums when planning the work.

Provisional sums for defined work

SMM7 recognizes there are certain items of work which cannot be measured using the standard method but could be taken into account by the contractor when he draws up his programme and calculates his project overheads (preliminaries). It could be argued that a proportion of the provisional sum will be used to pay for head office overheads and profit. Simple examples would be providing a concrete access ramp for wheelchairs, or intumescent paint to roof trusses.

Contractors must be given more information about work in this category so that all the temporary works and overheads can be calculated. The question is, how much information must be given in the bill of quantities for a provisional sum for defined work? SMM7 states that the following must be provided:

1. The nature of the work.
2. How and where it is to be fixed.
3. Quantities showing the scope and extent of the work.
4. Limitations on method, sequence and timing.

Estimators have experienced problems with bills of quantities with provisional sums for defined work where the full extent of the temporary works is not clear. A typical case would be a provisional sum to replace defective windows in a multi-storey building. What assumptions should the contractor make for scaffolding? The defective windows could be found at high level, lower levels or throughout the building.

Dayworks

Construction contracts often involve changes from the original scheme. The term *variation* means alteration of the design, quality or quantity of the works, and can include changes in sequence or timing of the works. Where a variation occurs, the cost of the original work is deducted and new work is measured and priced by the quantity surveyor or engineer. The value of variations is determined according to the rules set out in the conditions of contract. The first method is to be by measurement using bill rates or a fair allowance added to the bill rates or by fair rates and prices. Where the work cannot be valued by measurement, it may be valued on a daywork basis, provided it is incidental to contract work. In practice, contractors are often asked to attach a value to a variation before the varied work is started and in some cases a term is incorporated in the contract so that agreement is reached before the work is carried out.

The daywork charges are calculated using the definitions prepared for building works by the Royal Institution of Chartered Surveyors (RICS)/Construction Confederation and civil engineering work by the Civil Engineering Contractors Association. The JCT Standard Form of Building Contract (1998 edition) states that where the valuation relates to additional or substituted work which cannot be properly valued by measurement the valuation shall comprise:

> the prime cost of such work (calculated in accordance with the Definition of Prime Cost of Daywork carried out under a Building Contract issued by the Royal Institution of Chartered Surveyors and the Construction Confederation which was current at Base Date) together with percentage additions to each section of the prime cost at the rates set out by the Contractor in the Contract Bills; or where the work is within the province of any specialist trade and the said Institution and the appropriate body representing the employers in that trade have agreed and issued a definition of prime cost of daywork, the prime cost of such work calculated in accordance with that definition which was current at the Base Date together with percentage additions on the prime cost at the rates set out by the Contractor in the Contract Bills.

A footnote states that the RICS has agreement about the definition of prime cost with two specialist trades associations – electrical and heating and ventilating associations. The contractor's daywork rates (or percentages) must take into account the rates required by the sub-contractors used in the tender.

The two industry definitions of prime cost of daywork state that the component parts which make up a prime cost are: labour, materials and plant with supplementary charges in case of the civil engineering definition. The contractor adds for incidental costs, overheads and profit at tender stage, thus introducing competition into the daywork part of the tender:

1. *Labour* For building works, the hourly base rates for labour are calculated by dividing the annual prime cost of labour by the number of working hours per annum (see Fig. 14.1). The annual prime cost of labour comprises:
   (a) Guaranteed minimum weekly earnings.
   (b) Extra payments for skill.
   (c) Payments for public holidays.
   (d) Employer's National Insurance contributions.
   (e) Annual holiday credits.
   (f) Contributions to death benefit scheme.
   (g) Contribution, levy or tax payable by employer.
2. *Materials* The prime cost of materials is the invoice cost after deducting trade discounts, but include cash discounts up to 5%. For civil engineering and government contracts the cash discount kept by the contractor cannot exceed 2.5%.
3. *Plant* The definitions include schedules for plant charges. They relate to plant already on site and the rates include the cost of fuel, maintenance and all consumables. Drivers and attendants are dealt with under the labour section.

Calculation of prime cost of labour for daywork		Days	Hours		
Working hours per week		39			
Working hours per year (×52)			2 028		
Annual holidays (enter days)		21	−164		
Public holidays (enter days)		8	−62		
Total working hours per annum			1 802		
Calculation for 2003/04		Craft rate	Gen Op	Craft rate	General operative
Weekly wage		299.13	225.03		
Annual costs for working hours		46.2 weeks		13 819.81	10 396.39
Extra for skill/hour	1 802	0.30	0.40	540.54	720.72
Employer's Nat Ins (%) over ET		12.80	12.80	1 311.81	896.68
earnings threshold 46.2 weeks @ £89		*4112*	*4112*		
Holidays with pay (hrs × rate)	226	7.67	5.77	1 734.95	1 305.17
Maximum pension contribution	52	7.50	7.50	390.00	390.00
CITB levy (%)		0.50	0.50	80.48	62.11
Annual prime cost of labour				17 877.59	13 771.08
Hourly base rate	1 802 hours			**£9.92**	**£7.64**

Note the following could be added to the calculation:

Overhead %	Rates incl overheads CRAFT	Rates incl overheads LAB
20	11.90	9.17
30	12.90	9.94
40	13.89	10.70
50	14.88	11.46
60	15.87	12.23
70	16.86	12.99
80	17.86	13.76
90	18.85	14.52
100	19.84	15.29
110	20.83	16.05
120	21.82	16.81
130	22.82	17.58

Fig. 14.1 *Estimator's spreadsheet for calculating the prime cost of building labour for daywork 2003/2004*

In the case of the Civil Engineering definition the rates provide for head office charges and profit.

Overheads and profit

The anticipated value of daywork is included in a bill of quantities as provisional sums for labour, materials, plant and supplementary charges in the case of civil engineering work. The contractor is invited to add a percentage to each section for incidental costs, overheads and profit. The Civil Engineering definition states the percentage additions; but the contractor still has the opportunity to add or deduct from the percentages given.

Labour The estimator must calculate the hourly base rate (see Fig. 14.1) and compare it with an 'all-in' rate which includes overheads and profit. The rate or percentage in a tender is an average for all types of labour regardless of trade or degree of supervision because the estimator has no idea what extra work will arise. One solution is to look at a similar job and compare the net cost of measured work with the tender sum. It might be found that the total mark-up including project overheads was 30%. If the all-in rate for the current estimate is £12.50 then the gross all-in rate would be £12.50 × 1.30 = £16.25/hour. Figure 14.1 shows the comparable hourly base rate to be £9.92. This would suggest a percentage to be added to the hourly base rate of (16.25 − 9.92)/9.92 × 100 = 64%.

Figure 14.2 shows the incidental costs, overheads and profit items listed in section 6 of the RICS definition and highlights the items which need to be added to the all-in rate. The overhead addition could also be found by comparing the daywork base rate with the all-in rate used in the estimate, as follows:

Hourly base rate for labour (Fig. 14.1)	£9.92
All-in hourly rate (Chapter 10, Fig. 10.1)	£12.50
	%
% increase	26
(a) Head office charges	5
(b) Site supervision	8
(h) Travelling allowance	2
(j) Contractor's all risks insurance	2
(o) Scaffolding	2
(p) Site facilities and protection	3
(r) Other liabilities	10
(s) Profit	5
Total to add to standard rate	63%

Abstract from Section 6 of the RICS/Construction Confederation Definition of Dayworks – Incidental Costs, Overheads and Profit

	Item	Included in all-in rate	Not included
(a)	Head office charges	–	X
(b)	Site staff including site supervision	–	X
(c)	The additional cost of overtime (other than authorized)	–	X
(d)	Time lost due to inclement weather	–	X
(e)	Additional bonuses and incentive schemes	–	X
(f)	Apprentices' study time	–	X
(g)	Subsistence and periodic allowances	–	X
(h)	Fares and travelling allowances	–	X
(i)	Sick pay or insurances in respect thereof	X	–
(j)	Third party and employer's liability insurance	–	X
(k)	Liability for redundancy payments	–	X
(l)	Employer's National Insurance contributions	X	–
(m)	Tool allowances	–	X
(n)	Use, repair and sharpening of non-mech tools	–	X
(o)	Use of erected scaffolding, staging, trestles and the like	–	X
(p)	Use of tarpaulins, protective clothing, artificial lighting, safety and welfare facilities storage and the like that may be available on site	–	X
(q)	Any variation to basic rates required by the Contractor in cases where the building contract provides for the use of a specified schedule of basic plant charges (to the extent that no other provision is made for such variation)	Applies to plant section	
(r)	All other liabilities and obligations whatsoever not specifically referred to in this section nor chargeable under any other section	–	X
(s)	Profit	–	X

Fig. 14.2 *Items to be added to the 'all-in' rates for labour*

The first calculation produced an answer of 64% and the second 63%. So why do some contractors want 110% and some specialists ask for over 150%? The reasons for such high percentages (given below) go some way towards answering this question but would not be valid if dayworks were only *incidental* to and not a significant part of contract works:

1. The rates paid by contractors to labour-only sub-contractors are often higher than the all-in rate for direct employees and when the work is plentiful, the market rate for labour can be substantially higher.

2. Introducing variations into a normal work sequence can have a harmful effect on other work and the attitude of the workforce, particularly when changes make it difficult to earn the expected bonuses.
3. The rate quoted by the main contractor, for building work, must include the possibility of work being carried out by specialist sub-contractors; their operatives may be earning higher rates of pay which are not recognized by the agreed definition, and specialist fitters often want a subsistence allowance while working away from home.
4. Contractors, again in the building industry, do not add the full percentages to materials and plant because they assume that labour is the major element of daywork; this means the labour percentage must carry the overheads which have not been added to materials and plant.

Materials Most of the items for incidental costs, overheads and profit, listed in Fig. 14.2, do not apply to materials. Contractors therefore add a small percentage (usually between 10 and 15%) to cover head office overheads (a) and profit (s). The costs incurred in unloading and transporting materials around the site would be fully recoverable.

Plant The rates for plant are given in the definition as provided by the contract. In building work, using the RICS/Construction Confederation definition, it is important to identify when the schedule of plant rates was produced in order to allow an additional percentage if the schedule is out of date. Section 6(q) of the RICS definition provides this opportunity. Schedules of plant charges usually cover a wide range of equipment, and apply to plant already on site. The costs which a contractor can claim are for the use of mechanical plant, transport (if plant is hired specifically for daywork) and non-mechanical equipment (except hand tools) for time employed on daywork. Labour operating plant is dealt with in the labour element.

The estimator must try to assess which are the most likely pieces of equipment to be used and compare the scheduled rates with those quoted by local plant hirers. The allowance for overheads and profit is commonly quoted between 10 and 15%.

15 Project overheads

Introduction

The preliminaries bill gives the contractor the opportunity to price project overheads, which are defined in the Code of Estimating Practice (COEP) as: 'The site cost of administering a project and providing general plant, site staff, facilities and site-based services and other items not included in all-in rates'.

The standard methods of measurement for civil engineering and building give the general items which should be described in a bill of quantities, in two main parts: the specific requirements of the employer and the facilities which would be provided by the contractor to carry out the work. It could be argued that the latter is not really necessary in a bill of quantities because the contractor must provide general facilities whether they are measured or not. Presumably a simple breakdown of a contractor's general cost items is needed to make a fair valuation of the works during the construction phase. This approach to measurement can lead to duplication of descriptions, because an item may be required by a client and is something which a contractor would normally provide. It is common, in building for example, to find preliminary descriptions for security and protection of the works measured twice.

Pricing project overheads

For small repetitive works a contractor or sub-contractor may have a scale of overheads which he can apply to a new project. This may be calculated as a percentage of annual costs and adjusted where jobs deviate from the norm. Typically the site and office overheads for small houses and extensions may be 15%, and for sub-contractors who have facilities provided by main contractors the figure would be nearer 10%.

Traditionally, in building, estimators have allowed for attendant labour, non-mechanical plant and certain items of mechanical plant in the rates inserted against measured work. It is becoming more common for these items to be considered as part of the general site overheads because very often these facilities are available to all trades and should be assessed using the tender programme.

A typical sequence of events for pricing project overheads is:

1. Make notes of general requirements, such as temporary works and sub-contract attendances, when pricing the bill.
2. Prepare a site layout drawing showing the position of accommodation, access routes, storage areas, and services. Inspect site features and check feasibility of proposals during site visit.
3. Use the tender programme for planning staff, plant and temporary works requirements.
4. Read the client's specific requirements and all the tender documents.
5. Price the project overheads sheets.

It is essential that the contractor has standard sheets which give all the main headings for pricing project overheads. He cannot depend on the descriptions given in the tender documents because they are not necessarily complete. The COEP offers the comprehensive set of forms, but some estimators find there is too much detail for the average job and so a simplified checklist is given in Fig. 15.1. A detailed examination of the items in the checklist is presented in Figs 15.2(a)–(j).

A resourced programme is an important aid to the accurate pricing of project overheads because most of the general facilities are related to when the construction activities are carried out. The estimator or planning engineer can superimpose the main elements of the project overheads on the tender programme. The example of a tender programme given in Chapter 9 shows staff and principal plant durations. Other items drawn from the programme are general plant, scaffolding, fluctuations, attendant labour, temporary works, traffic management and so on. There is an opportunity here for the contractor to be innovative and develop methods which might give a competitive advantage over other tenderers. A typical example is for wall cladding to be fixed by men working from mechanical platforms as opposed to standing scaffolding. This not only reduces the equipment costs but also cuts the overall contract duration with shorter erection and dismantling periods. Shorter programmes bring about further savings by reducing the staff, overheads and accommodation costs.

For large projects, contractors will obtain quotations for temporary facilities such as: site accommodation, temporary electrics, scaffolding and cranage. Smaller and medium-sized projects can be priced using a simple spreadsheet template – an example is shown in Fig. 15.3.

Employer's Requirements
SMM7 (A36) CESMM (A2)
Accommodation
Furniture
Telephone
Equipment
Transport
Attendance

Management and Staff
SMM7 (A32,40) CESMM (A3.7)
Site manager
General foreman
Engineer
Planning engineer
Foreman
Assistant engineer
Quantity surveyor
Assistant quantity surveyor
Clerk/typist
Security/watchman

Facilities and Services
SMM7 (A34,42) CESMM (A3.2)
Power/lighting/heating
Water
Telephones
Stationery and postage
Office equipment
Computers
Humidity/temperature control
Security and safety measures
Temporary electrics
Waste skips

Mechanical Plant
SMM7 (A43) CESMM (A3.3)
Crane and driver
Hoist
Dumper
Forklift
Tractor and trailer
Mixer
Concrete finishing equipment
Compressor and tools
Pumps
Fuel and transport for plant

Temporary Works
SMM7 (A36,44) CESMM (A2.3)
Access routes
Hardstandings
Traffic control
De-watering
Hoarding
Fencing
Notice board
Shoring and centring
Temporary structures
Protection

Site Accommodation
SMM7 (A36,41) CESMM (3.1)
Offices
Stores
Canteen/welfare
Toilets
Drying and first aid
Workshops and laboratories
Foundations and drainage
Rates and charges
Erection and fitting out
Furniture
Removal
Transport

Attendant Labour
SMM7 (A42) CESMM (3.7)
Unloading and distribution
Cleaning
Setting-out assistants
Drivers and pump attendance
General attendance
Scaffold adaptation

Contract Conditions
SMM7 (A20) CESMM (A1)
Fluctuations
Insurances
Bonds
Warranties
Special conditions
Professional fees

Non-mechanical Plant
SMM7 (A44) CESMM (A3.6)
External scaffolding
Internal scaffolding
Hoist towers
Mobile towers
Small tools and equipment
Surveying instruments

Miscellaneous
SMM7 (A33,35)
Setting out consumables
Testing and samples
Winter working
Quality assurance
Site limitations
Protective clothing

Fig. 15.1 *Preliminaries checklist*

Pricing the preliminaries bill

Both SMM7 and CESMM3 recommend that 'fixed' and 'time-related' charges are identified separately in a bill of quantities. SMM7 defines them as follows:

1. A fixed charge is for work the cost of which is to be considered as independent of duration.
2. A time-related charge is for work the cost of which is to be considered as dependent on duration.

There are certain items that are difficult to allocate such as the use of specialist plant. A crane, for example, may be on site for two weeks; should this be classed as a fixed or time-related charge? For many schemes, all general plant and facilities are divided by the duration to produce equal sums for monthly payments.

(a) Employer's requirements

Accommodation	Offices, toilets, conference room, stores, laboratories and car parking space may be required depending on client's specific requirements
Furniture	If none stated, assume client providing own furniture
Telephone	Telephone and facsimile equipment can be specified including payment of standing charges (call charges are given as a provisional sum)
Equipment	Technical testing equipment and surveying instruments Protective clothing
Transport	Vehicles for employer's staff or consultants, fuel and maintenance Transport to suppliers to inspect production of components
Attendance	Drivers, chainmen, office cleaners, and laboratory assistants

NOTES:

SMM7 states that, where the employer requires accommodation on site, heating, lighting and maintenance are deemed to be included.

Notice boards are often given as a specific requirement but invariably will be provided by a contractor for information and advertising (see Temporary Works).

Fig. 15.2a *Pricing preliminaries – employer's requirements*

(b) Management and staff

Site Manager	Required on most sites. Calibre of staff depends on size and complexity of project
General Foreman	Day-to-day management of labour and plant. Coordination of labour-only sub-contractors
Engineer	Analysis of building methods, setting-out and quality control. Services engineer to coordinate specialist services contractors
Planning Engineer	Master programme during mobilization. Up-dating exercises and short-term programmes
Foreman	Consider structure, finishings and snagging. Add non-productive time for trades foremen
Assistant Engineer	Setting out work, external works and internal fabric. Scheduling materials and attendance on sub-contractors
Quantity Surveyor	Some involvement on all jobs, particularly at beginning and end
Assistant quantity surveyor	For large contracts with complex valuations and control of sub-contractors' accounts and bonus payments
Clerk/Typist	General admin duties on site. Checkers. Telephone, post and reception duties
Security/Watchman	Usually employing security services. Important when fittings and furniture arrive

NOTES:

All-in average rates for each category of staff will be provided by senior management in a way which ensures that individual salaries are not identifiable. Employment costs for salaried staff are calculated on an annual basis with additional costs which arise from:

- pension scheme (employer's contribution)
- annual bonuses
- overtime
- computer and printer
- training levy
- car and expenses

The choice of site managers will depend on job size, complexity, duration, number of operatives and commitments to nominated and domestic sub-contractors.

Fig. 15.2b *Pricing preliminaries – management and staff*

(c) Facilities and services

Power/lighting/heating	Check availability of supplies, connection charges, temporary housings, fittings and consumption costs. Alternatively generators and gas bottles
Water	Provision of service to site, pipework from supply, distribution system, and charges. Bowsers required if no piped service available
Telephones	Consider number of senior staff in deciding on number of lines, switchboard for larger systems and mobile phone for start of job
Stationery and postage	Average cost per week drawn from analysis of previous projects
Office equipment	Photocopier, facsimile machine and typewriters are commonly required
Computers	Personal computers required for more complex projects. Security can be a problem; consider portable PCs or robust equipment
Humidity and temperature control	Check specific requirements for dehumidifiers, heaters and attendance. Vulnerable materials include seasoned joinery and suspended ceilings
Security and safety measures	Security firm or own labour for watching site at night and at weekends. Intruder alarms, traffic control, fire precautions and fire fighting
Temporary electrics	Transformers, distribution system, boards, leads and site lighting. Electrician may be resident on large building schemes
Waste skips	Regular collection of rubbish skips should be allowed. Dustbins can be used to promote cleaner sites

NOTES:

Computers are used on site for material records, valuations and cost monitoring. Standard databases are often used to produce drawing registers and lists of instructions. Additional costs which include maintenance contracts, software and consumables can be as much as the value of the computers. The consumables and maintenance costs associated with photocopiers can be costly.

Humidity control is a complex requirement. If dehumidifiers are used the hire charges are high and additional costs include transport charges, electric power, attendance in removing water and daily monitoring of humidity levels. These measures can only be put in place when the building is enclosed and damp air is prevented from entering the building.

Fuels are deemed to be included in items for testing and commissioning mechanical and electrical work (SMM7 Y51 and Y81). The contractor should liaise with specialists to ensure the fuel costs are included.

Fig. 15.2c *Pricing preliminaries – facilities and services*

(d) Mechanical plant

Crane and driver	Determine maximum lift in terms of weight, radius and height clearance. Duration and location on site also needed to select a crane (see below)
Hoist	Usually required for multi-storey external access scaffolds. Consider type (goods or passengers), hire, transport, erect, adapt, and dismantle
Dumper	Difficult to dispense with dumpers for moving excavated material, stone, bricks, blocks and mortar. Include transport, hire and fuel
Forklift	Rough terrain forklift is a good all round tool used for unloading, distributing and hoisting palletized materials. May need attachments
Tractor and trailer	Popular for long drainage runs and kerb laying for roadworks
Mixer	Hire, transport and fuel for concrete and mortar mixers, silos and bunkers. Minimum requirement is a mixer for brickwork and drainage
Concrete finishing equipment	Screeding rails and tamping bars. Curing membranes and vibrators
Compressor and tools	Needed for demolitions and alterations, cleaning inside shutters, preparing stop ends in concrete, drilling and vibrating concrete
Pumps	Water pumps, hoses, fuel, transport and attendance (see attendant labour). Concrete pump hire for mobile or static equipment; check quote for extras
Fuel and transport for plant	Static fuel tank or fuel bowser may be required. Assess additional transport costs for plant from yard to site

NOTES:

Quotations should be obtained for long hire or large capacity plant, such as cranes, forklifts and concrete pumps. Consult plant suppliers for advice on running costs and fuel consumption.

Cranes need ancillary equipment such as slings, concrete skips and lifting beams. Mobile cranes need sufficient space for outriggers, and hire charges are usually from time of leaving depot to return.

A tower crane will incur costs to transport, erect, adapt and dismantle, as well as a foundation or rail tracks, power source, fuel and operator. In some instances tower cranes may not be feasible owing to wind limitations or air space rights which cannot be infringed.

Fig. 15.2d *Pricing preliminaries – mechanical plant*

(e) Temporary works

Access routes	Plot layout on site plan taking advantage of hardcore under roads and buildings. Allow for maintenance and making-up levels on completion
Hardstandings	Additional areas are required for storage, site huts, and lay-down areas for materials such as pipes and reinforcement. Reinstatement
Traffic control	Check specification and statutory obligations. Use programme and site layout drawing to determine equipment needed and hire periods
Dewatering	Establish type of system required. Quotation and advice from specialist needed for a well-point system
Hoarding	Serves to protect the public and forms a secure barrier around the site or contractor's compound. Costs to hire, buy, erect, adapt and dismantle
Fencing	Temporary or permanent fencing to maintain security at perimeter of site, protect trees, mark a boundary and to form site compound
Notice board	Notice board and local signage help drivers and visitors find the site, satisfy curiosity and provide cheap advertising. Check client's requirements
Shoring & centring	Consider design, duration, and hire or buy calculations for falsework/shoring (temporary shoring will incur making good costs on completion)
Temporary structures	Temporary bridges, temporary roofs, facade supports, ramps, viewing platforms, accommodation gantries. May need specialist design input
Protection	High value components and all finishes need to be considered. Decorated areas may require additional coats of paint

NOTES:

In poor soil conditions the loss of hardcore under access roads and hardstandings can be substantial. A ground improvement mat may be used with the approval of the contract administrator.

Excavation below ground water level or works affected by rivers or tidal water is normally identified in the bill of quantities. The contractor is therefore responsible for finding an appropriate method for dealing with the problem. Where a full dewatering system is required by a client, the contractors are normally informed at tender stage.

The cost of protection is often undervalued; particularly in the case of building finishes which are difficult to protect during the commissioning and completion of a project. In a large building measures might include laying sheeting and boarding on floors, repainting walls and woodwork, and a security system which detects responsibility for damage by allowing entry to finished areas with a written permit.

Fig. 15.2e *Pricing preliminaries – temporary works*

(f) Site accommodation

Offices	Mobile offices can be established quickly to high standard. Sectional sheds require set-up costs, foundations and finishes
Stores	For secure protection of high value materials. Hire or purchase accommodation, or in the building
Canteen/welfare	Use labour strength from programme and add for sub-contractors. Add for equipment, cooking facilities, furniture and food subsidies
Toilets	Mobile toilet units – check drainage and services available. Allow for sundries such as soap, towels and cleaning materials
Drying and first aid	Accommodation with lockers and heaters. First aid room depending on number of people on site
Foundations and drainage	Concrete or sleepers to support cabins. Wherever possible connect drainage to live sewer
Rates and charges	Local authority charges are payable on temporary accommodation. May need to acquire land for site establishment
Erection and fitting out	Materials for erection and fitting out. Labour may be here or as Attendant Labour
Furniture	Company owned desks, chairs and cabinets usually available. Replacements can be provided from secondhand market
Removal	Consider the need to resite the accommodation during the job. Taking down can be priced as Attendant Labour
Transport	Often priced as transport to site only if follow-on work expected. Cranage off-loading and loading accommodation

NOTES:

The estimator should keep records of hire rates for mobile accommodation and compare with the purchase of sectional buildings. The capital cost of timber buildings can be divided by the life span (plus an allowance for repairs and renovation) to arrive at an equivalent hire rate. There is additional labour in erecting and dismantling timber buildings together with the provision of sundry materials such as sleepers for foundations, felt for roofing, glass, insulation board lining and so on.

Additional hire during the defects liability period may be required for a foreman's office and storage container. Minimum requirements for accommodation and health and welfare are given in the Construction Regulations.

Fig. 15.2f *Pricing preliminaries – site accommodation*

(g) Attendant labour

Unloading and distribution	Envisage an unloading and handling labour gang; adding drivers for dumper and forklift. Balance requirements with attendant labour in bill rates
Cleaning	Daily and weekly tidying-up and cleaning may be carried out by the general gang or casual labour
Setting-out assistants	Each setting-out engineer will need some assistance from a chainman
Drivers and pump attendance	Each item of mechanical plant will need some operator time; for example: a water pump might require 1.5 man hours/day
General attendance	Clearing away rubbish for sub-contractors, adapting scaffolding and materials distribution (may be priced elsewhere)
Scaffold adaptation	An assessment of time is required and rates should be obtained from the scaffolding specialist

NOTES:

A site which relies on scaffold hoists will need more labour than that which has a tower crane. Where multi-storey buildings have blockwork walls internally, a considerable amount of labour for distribution is needed.

It can be argued that general attendance for sub-contractors is already included in the tender by assessing all the site facilities in the preliminaries. Special attendance can also be dealt with in this section, although some estimators prefer to price specific attendances for nominated sub-contractors in the bill of quantities, which is presumably what is envisaged in the standard method of measurement.

Fig. 15.2g *Pricing preliminaries – attendant labour*

(h) Contract conditions

Fluctuations*	Calculation of fluctuation costs includes changes forecast for preliminaries. See fluctuations chapter for factors to be considered
Insurances	A quotation (or guide rate) can be obtained for all-risks insurance. The all-in rate for labour usually includes the Employer's Liability insurance
Bonds	Cost of bond is based on contract value and duration including defects liability period. Check that bond is acceptable and bank facilities are not exceeded
Warranties	More common with contractor-designed elements which are usually backed up with warranties from specialists and designers
Special conditions	Check changes to standard conditions, poor documentation and that form of contract, specifications and SMMs are up to date
Professional fees	Alternative bids which include a design element, tests on materials, QS services, and legal fees to check contractual arrangements. Land surveys

NOTES:

* Most fluctuations in prices will relate to production costs, not preliminaries. It is therefore preferable to calculate fluctuations independently and transfer the result to the tender summary.

Not all losses can be recovered under an insurance policy. There could be many losses on a site which each fall below the policy excess agreed with the insurers. An estimate of an average value of losses should be added to the tender.

Where applicable, a Parent Company Guarantee would provide a measure of protection, at little cost to the client.

Tendering costs are not normally added to an individual tender. They become part of the general company overhead.

Fig. 15.2h *Pricing preliminaries – contract conditions*

(i) Non-mechanical plant

External scaffolding	Quotation needed for erection and hire of scaffold for larger schemes. Programme used to assess duration on each section of work
Internal scaffolding	Birdcage scaffold for large voids, decking for ceilings and ductwork. Consider lift shafts, stair wells, high walls & inner skin of external walls
Hoist towers	Extra cost to provide enclosure for mechanical hoist. Platforms to unload materials at each level
Mobile towers	For short duration and localized work. Consider also platform hoists or scissor lifts (mechanical plant)
Small tools and equipment	Hand tools such as drills, power saws, picks and shovels, rubbish chutes, bending machines, bolts crops and traffic cones
Surveying instruments	Purchase, hire or internal charges, maintenance and consumables. Check requirements of engineering staff listed in supervision section

NOTES:

For scaffolding the following should be considered:

(a) Hire charges
(b) Transport costs
(c) Labour costs
(d) Losses
(e) Adaptation
(f) Safety measures
(g) Baseplate support
(h) Debris netting
(j) Polythene sheeting
(k) Temporary roofing
(l) Platforms to land materials

The loads imposed on scaffolding should be considered, in particular the use of scaffolding for short-term storage of block stone or bricks.

There is a relationship between the amount of labour in a job and the small tools and equipment costs. Some companies add a percentage to the all-in labour rate for small tools; others include a sum in the preliminaries based on a percentage of total labour costs for the job. Clearly feedback from previous contracts is needed so that the estimator has a realistic guide for this item.

Fig. 15.2i *Pricing preliminaries – non-mechanical plant*

(j) Miscellaneous

Setting out consumables	Pegs and profile boards, tapes and refills. Larger projects need concrete and steelwork for site stations
Testing and samples	Concrete cube testing is calculated from the specified frequency of tests. Samples of materials may be supplied free but composite panels have a cost
Winter working	Additional protection for operatives, heating, and site lighting. Reduced productivity, location of work, heated concrete etc.
Quality assurance	For large schemes, a significant proportion of the superviser's time may be dedicated to the control and monitoring systems. See Management and staff
Site limitations	Check employer's requirements such as access restrictions, control of noise, weight of vehicles, protection of services etc. See Temporary works
Protective clothing	Staff and directly employed people will need protective clothing, depending on time of year. Safety hats/clothing for employees and labour-only s/c's

NOTES:

The responsibility for quality assurance remains with all the parties and everyone in the organization. The establishment of a quality system will produce quality statements, a set of company procedures, training, and control mechanisms. The cost is usually carried by the general off-site overhead. It is often argued that the cost of setting up and implementing a quality system is offset by the benefits which result.

Fig. 15.2j *Pricing preliminaries – miscellaneous*

CB Construction Limited	**Student Accommodation**	**Project Overheads**	GFA (m^2)	**1697**
	Steel frame solution	11.59%	Date	**12-Jul-04**
			net trade value	**£1.85m**

	Description	Note	Quant	Unit	Factor	Fixed charges		Time charges		Sub-tot
p	=pre-start						**84 468**		**130 019**	**214 486**
	SUPERVISION						–		–	
p	Site manager pre-constr		10	wk	0.5	950	4 750	–	–	
	Project manager constr		–	wk	1	–	–	–	–	
p	Project coordinator pre-constr		10	wk	0.5	850	4 250	–	–	
	Project coordinator constr		–	wk	1	–	–	–	–	
p	QS pre-constr		10	wk	0.5	760	3 800	–	–	
	Project QS constr		–	wk	1		–	–	–	
	QS		35	wk	0.25		–	760	6 650	
	Site agent (roads)		–	wk	1		–	–	–	
	Site manager (building)		35	wk	1		–	911	31 880	
	Sen engineer (roads)		–	wk	1		–	–	–	
	Sen engineer (building)		–	wk	1		–	–	–	
	Engineer (building)		6	wk	1		–	748	4 489	
	Foreman		30	wk	1		–	650	19 500	
	Secretary		–	wk	1		–	–	–	
	Spare						–		–	
							–		**–**	**75 319**
	SITE FACILITIES						–		–	
	Notice boards		1	it	1	650	650		–	
	Fencing/hoarding		200	m	1	20	4 000		–	
	Gates 10 m wide		2	nr	1	1 500	3 000		–	
	Reinstatement		1	it	1	1 000	1 000		–	
	Set up – foundations		1	sum	1	750	750		–	
	Set up – transport/crane		4	nr	1	275	1 100		–	
	Set up – offices		80	hr	1	10	800		–	
	Set up – fitting out		20	hr	1	10	200		–	
	Dismantle/remove		40	hr	1	10	400		–	
	Install electricity		1	sum	1	2 000	2 000		–	
	Install water		1	sum	1	1 000	1 000		–	
	Install drainage		1	sum	1	650	650		–	
	Install telephone/IT line		1	sum	1	1 000	1 000		–	**16 550**
	SITE RUNNING EXPENSES				1		–		–	
	Electricity charges		35	wk	1		–	50	1 750	
	Water charges		35	wk	1		–	35	1 225	
	Telephone charges		35	wk	1		–	125	4 375	
	LA rates		35	wk	1		–	10	350	
	Postage & stationery		35	wk	1		–	30	1 050	
	Photocg/printing consumbls		35	wk	1		–	30	1 050	
	Canteen/office cleaning		30	wk	1		–	150	4 500	
	Out-of-pocket expenses		35	mth	1		–	20	700	
	Settg-out consumables		1	sum	1	1 500	1 500	–	–	
	Protective clothing		15	sets	1	100	1 500		–	
	Photographs		35	mth	1		–	10	350	
	Materials testing		200	m^3	1	2	400		–	
	Security services		–	wk	1		–	–	–	

Fig. 15.3 *Contd*

CB Construction Limited			**Student Accommodation**			**Project Overheads**	GFA (m^2)		**1697**
			Steel frame solution			11.59%		Date	**12-Jul-04**
							net trade value		**£1.85m**
Description	**Note**	**Quant**	**Unit**	**Factor**	**Fixed charges**		**Time charges**		**Sub-tot**
Fire equipment		1	sum	1	1 000	1 000		–	
Site consumables		1	sum	1		–	2 500	2 500	**22 250**
GENERAL LABOUR				1		–		–	
Chainman		6	wk	1	300	1 800		–	
Gen gang – clear site				1		–		–	
Gen gang – mat distribution		20	wk	1		–	375	7 500	
Snagging		4	wk	1	400	1 600		–	
Protection		100	hr	1	10	1 000		–	
Final clean		0.001		1	2 220 000	2 220		–	
				1		–		–	**14 120**
SITE SET UP				1		–		–	
Offices	2	35	wk	1		–	35	2 450	
Messrooms	1	35	wk	1		–	55	1 925	
Stores	2	35	wk	1		–	30	2 100	
Toilets	1	35	wk	1		–	35	1 225	
Surveying equip – level	1	35	wk	1		–	15	525	
Surveying equip – theo	1	35	wk	1		–	20	700	
Site vehicles				1		–		–	
Lab equipment				1		–		–	
Office equip – photocopier		35	wk	1		–	20	700	
Office equip – fax machine		35	wk	1		–	10	350	
Office equip – computer		2	nr	1		–	1 000	2 000	
				1		–		–	**11 975**
GENERAL PLANT						–		–	
Forklift + (0.5)driver+fuel		20	wk			–	480	9 600	
Skips – general		60	nr			–	100	6 000	
Skips – final clean		8	nr			–	100	800	
Skips – finishes		10	nr			–	100	1 000	
Goods & passenger hoist	setup	–	sum		1 260	–	–	–	
Goods & passenger hoist	hire	–	wk			–	165	–	
Goods & passenger hoist	rem	–	sum		1 250	–		–	
Generator		–	wk			–	80	–	
Mobile crane		3	vsts		350	1 050		–	
Mixers	ave	35	wk			–	25	875	
Mob/demob generally		1	sum		1 000	1 000		–	
Minor plant		1	it			–	5 000	5 000	
Road sweeper		5	wk			–	500	2 500	**27 825**
TEMPORARY WORKS						–		–	
Site hoarding		40	m		55	2 200		–	
Double gates		1	pr		500	500		–	
Scaff – ext ind		1 550	m^2		8	12 400		–	
Scaff – adaptions	incl	100	hr		12	1 200		–	
Scaff – internal		1	it		1 000	1 000		–	
Internal lighting		1	sum		800	800		–	
Power distribution		1	sum		800	800		–	
External lighting		1	sum		600	600		–	
Tempscreens lower floors			m^2		50	–		–	
Make up hardcore roads/site		1 100	m^2		–	–	4	4 400	

Fig. 15.3 *Contd*

CB Construction Limited	**Student Accommodation**	**Project Overheads**	GFA (m^2)	**1697**
	Steel frame solution	11.59%	Date	**12-Jul-04**
			net trade value	**£1.85 m**

	Description	Note	Quant	Unit	Factor	Fixed charges		Time charges		Sub-tot
	Protection materials		1 697	m^2		1.50	2 546		–	
							–		–	
							–		–	**26 446**
COMMERCIAL/FINANCIAL					1		–		–	
	Insurance – all-risks		0.002		1	2 220 000	4 440		–	
	Insurance – hired plant		0.019		1	100 000	1 920		–	
	Insurance – emply liab		0.003		1	2 220 000	6 660		–	
	Insurance – premium tax		0.050		1	15 240	762		–	
	Insurance excesses		2	nr	1	2 000	4 000		–	
	Professional indemnity		0.001		1	2 220 000	2 220		–	
p	Legal advisors pre-constr		–		1		–		–	**20 002**
DESIGN & BUILD FEES AND COSTS							–		–	
	Architectural fees						–		–	
	Structural engineer						–		–	
	M&E advice and coord						–		–	
	QS fees						–		–	
	CAD file on disk						–		–	
	Building regs						–		–	
							–		–	**–**

Fig. 15.3 *Project overheads*

Similarly the staff costs are difficult to share between valuations because they are usually higher at the beginning of a contract and taper off gradually towards the end. Staff costs are often incurred before the start date, when mobilization activities – such as procurement of initial packages – take place.

When the estimate has been reviewed by management the estimator will allocate sums of money to the preliminaries bill. This is an opportunity to ensure that a satisfactory (and possibly positive) cashflow position is secured. In particular the contractor needs to identify setting-up costs that should be claimed in the first valuation as fixed charges. If all site and general overheads were reimbursed in proportion to time the contractor would have more expenditure than income and this poor cashflow position would persist during most of the contract duration.

The early fixed charges often include:

Employer's requirements
Accommodation
Furniture

Install telephone
Provide equipment
Transport charges

Supervision
Hotel expenses
Planning
Procurement

Services
Installation charges
Office equipment

Mechanical plant
Transport of plant
Purchase of plant

Temporary works
Design and purchase of structures
Access routes and hardstandings
Enclosures
Dewatering, piling and formwork

Site accommodation
Transport and cranage
Purchase costs
Foundations and furniture
Erection and fitting out

Contract conditions
Insurance premium
Bond
Professional fees
Initial land/building surveys

Non-mechanical plant
Scaffold erection
Small tools and equipment

Miscellaneous
Setting-out consumables
Samples
Quality planning
Protective clothing

The costs of dismantling site facilities and cleaning are much smaller by comparison and are rarely priced as separate fixed charges.

Example of project overheads

The example of project overheads given in Fig. 15.3 was produced by a regional contractor for a steel-framed three-storey student accommodation building in the UK. Net trade value is the direct cost of construction work excluding design fees, project overheads, risk and margin.

16 Cashflow forecasts

Introduction

At tender stage, a contractor sets up his financial and time objectives by calculating construction costs and producing a project programme. By linking the two sets of data, an estimator can first help a client produce his forecast of payments and second compare this with his likely payments (to suppliers and sub-contractors) to produce his own cashflow forecast. In this way a contractor is in a unique position to give accurate information to the building team.

There is seldom enough time at tender stage to produce detailed cashflow forecasts. The contractor knows the objective is to win the contract, so there must be good reasons for putting in this effort. Obviously if a client has asked for a tender-stage programme and cashflow forecast it must be done. The contractor may also need to assess the cashflow benefit of taking on a job, because this is part of his assessment of risk. A spreadsheet model may be able to answer questions such as: are there any sudden cash commitments? How much early money will be needed to make the contract self-financing?

Construction costs for Private Finance Initiative (PFI) projects are produced by an estimator usually working for one of the parties making up a consortium. Construction is only one constituent of the PFI bid, the others being facilities management, equipment, project management and finance. The estimator must produce his capital costs in the form of a monthly draw down chart. The first payment is usually very large because considerable design and bidding costs need to be refunded early.

Cashflow calculations

There are two methods commonly used to predict the value of project work over time. First, cost models can be used at various pre-contract stages to produce approximate forecasts and second, the estimator's calculations form the basis of a more detailed technique.

If a client needs a schedule of payments, the simplest model would be a straight line relationship of value against time from which the client's commitments can be shown (see Fig. 16.1). The assumption being that all payments are of an equal

Week nos	Gross value	Retention @ 5%	Interim payments
	£1000s	£1000s	£1000s
1	22	1	
2	44	2	
3	65	3	
4	87	4	
5	109	5	
6	131	7	83
7	152	8	
8	174	9	
9	196	10	
10	218	11	165
11	239	12	
12	261	13	
13	283	14	
14	305	15	
15	327	16	269
16	348	17	
17	370	19	
18	392	20	
19	414	21	352
20	435	22	
21	457	23	
22	479	24	
23	501	25	
24	522	26	455
25	544	27	
26	566	28	
27	588	29	
28	609	30	538
29	631	32	
30	653	16	
31			
32			637

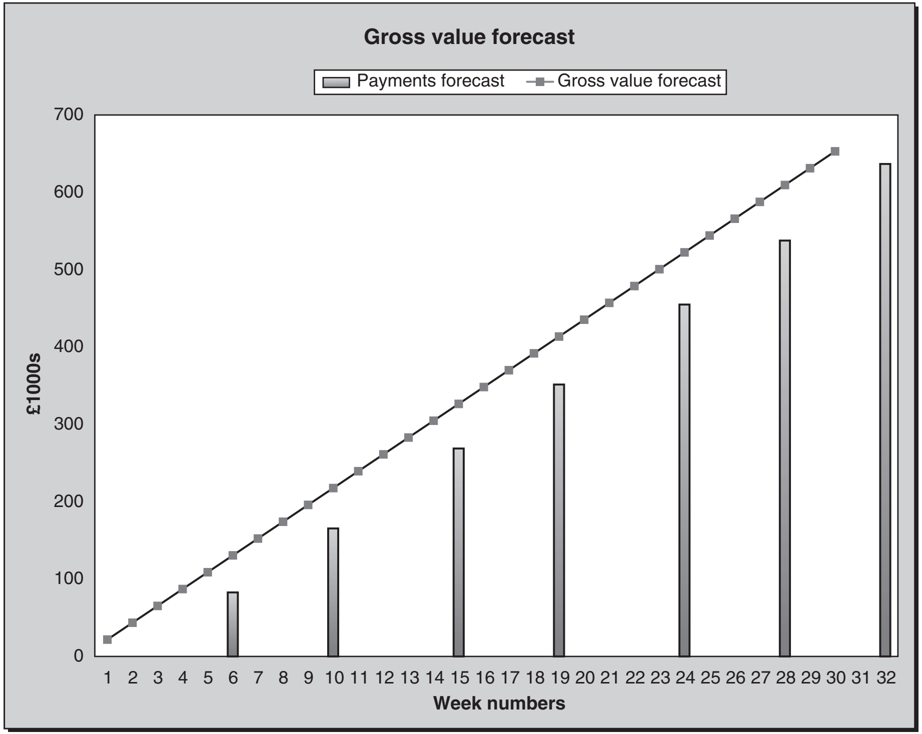


Fig. 16.1 *Simple linear plot of cumulative value*

amount based on the full value divided by the number of payments with a small adjustment for retention money.

A slightly more sophisticated technique assumes that a construction project accumulates costs in a way which can be represented by an S-curve graph (Fig. 16.2). This model is based on the presumption that only one quarter of the costs are incurred during the first third of a project duration, half the costs arise from the second third (in a linear fashion) and the remaining quarter of costs occur in the final third of the project duration. The S-curve can be created manually by drawing a straight line between the first and second 'third' points and sketching the parabolic end portions. The contractor's cumulative cost curve can be superimposed on the chart by deducting the profit margin from the cumulative value curve. The S-curve method is of course a theoretical technique which is difficult to change to take account of the nature of individual projects and contractors' pricing methods, but is successfully used at early stages when detailed pricing information is not available.

The GC/Works/1 Edition 3 form of contract has introduced the S-curve principle as a basis for stage payments. The printed form gives charts for projects with contract values over £5.5 million, and others are available for smaller jobs. Figure 16.3 shows the S-curve produced from the data given for a 100-week project. Clearly, the project manager is able to predict the client's payments and a great deal of time is saved each month in producing valuations. The same is true for the contractor, but there will be a shortfall in payments if the establishment costs are high.

An estimator's calculations and programme are the best starting-point for a contractors' cashflow forecast. The rates calculated by the estimator can be linked with the relevant activities on a tender programme. The total costs associated with each activity are divided by the duration to arrive at a weekly cost. The information used to produce the value curve is simply taken from the sums inserted in the client's bill with adjustments for retention. The contractor's income can be predicted by taking the value at each valuation date and allowing a delay for payments.

To calculate the weekly cost commitment (the contractor's outgoings) each element of cost should be viewed separately. This is because spending on labour, materials, plant and specialist contractors develops in different ways. Direct labour, for example, is a weekly commitment, and credit arrangements for materials can delay payments for up to nine weeks. Expenditure and income can be plotted on a graph against time. The combined effect is a cumulative cashflow diagram which will show the extent to which the job needs financing by the contractor.

Example of a contractor's cashflow forecast

An estimator who was successful in winning a contract for Fast Transport Ltd carried out the following analysis. He received the enquiry, in the form of drawings and a bill of quantities, from a local QS practice. Interim payments are to be made

Week nos	Gross value	Cost forecast
	£1000s	£1000s
1		
2		
3		
4		
5		
6		
7		
8		
9		
10	163	147
11		
12		
13		
14		
15		
16		
17		
18		
19		
20	490	441
21		
22		
23		
24		
25		
26		
27		
28		
29		
30	653	588

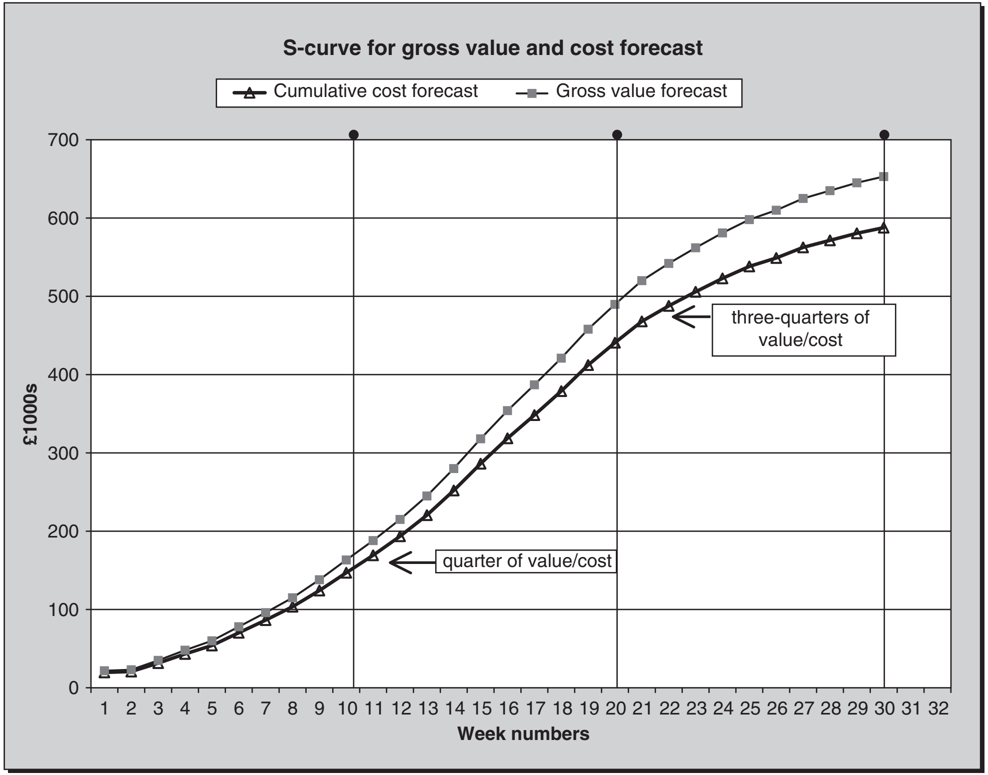


Fig. 16.2 *Simple S-curve for cumulative value and costs, calculated at 'third' points*

Week nos	% Payable before retention
0	0.00
5	0.85
10	2.85
15	5.89
20	9.84
25	14.58
30	19.99
35	25.97
40	32.37
45	39.10
50	46.02
55	53.03
60	59.99
65	66.80
70	73.33
75	79.46
80	85.08
85	90.06
90	94.28
95	97.64
100	100.00

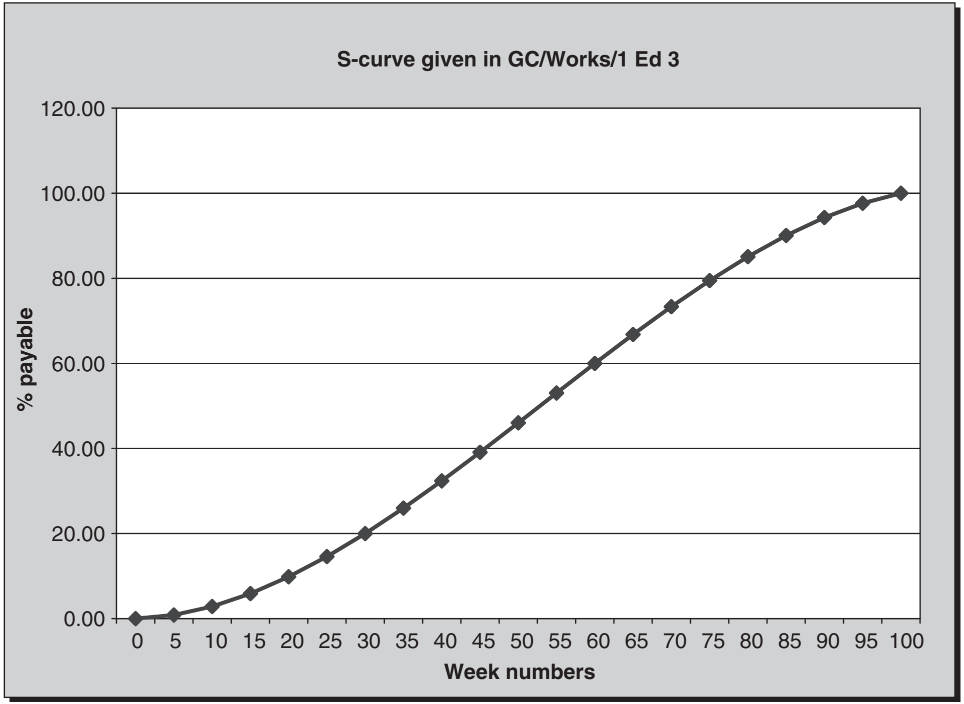


Fig. 16.3 *S-curve based on GC/Works/1 Edition 3 data*

monthly and retention has been set at 5%. A sum of £18 000 has been included for profit, and the rates in the bill of quantities exclude any on-site or off-site overheads. Following a careful review of the estimate, the construction director asked for all sub-contract discounts to be taken from the estimate but made an adjustment to the profit margin.

During the mobilization period, the estimator was asked to produce a forecast of payments for the client and a cashflow forecast for the commercial department. The estimator priced the bill of quantities analytically using estimating software. The first task was to ensure that all the adjustments made at the final review stage had been made to the rates in the bill of allowances. This fully adjusted bill would become the budget for the construction team to monitor the financial progress of the job.

The next stage was to assign sums of money to each activity on the tender programme. This was done using a spreadsheet program because each cell on the screen can hold text, graphics, numbers or formulae. Each row on the spreadsheet can show weekly values with shading used to locate the activity bars. Figure 16.4 shows the tender programme with contract values taken from the bill of quantities, which was submitted, to the client. The main assumptions used for this graph were that:

1. Each activity will be completed on time.
2. Sums are divided equally for the duration of an activity.
3. Provisional sums and daywork are not included.

The total for project overheads has been split equally over the whole duration. This is not a good interpretation for the contractor because he will incur more expenditure setting up his site facilities at the start of a job. The final presentation to the client did not include the costed programme or a graph. The commercial department felt the client would want a simple list of payments, and included it in a letter to the quantity surveyor.

The contractor's cashflow diagram was created on a spreadsheet program which had the facility to use multiple sheets in the same file. Figure 16.5 shows the contents of the costed programmes for labour, plant, materials and sub-contractors. The bottom sheet was used to consolidate the cost commitment drawn from each of the other sheets with the forecast income. The cashflow forecast is simply the difference between income and expenditure. The results were plotted, by the program, on a single diagram (Fig. 16.6) and submitted to the commercial manager in the form of a graph linked to the consolidated costed programme.

Since all the information was held in a single spreadsheet file, the computer was able to answer 'what if' questions which allowed the commercial manager to minimize the borrowing requirement. Clearly this information can be the basis of a cost monitoring system (which is beyond the scope of this book). The cumulative value curve can help the construction team in monitoring progress of their work and that of the sub-contractors. This technique is sometimes adopted by project managers as a check on the progress of contractors.

CB CONSTRUCTION LIMITED **Proposed Offices for Fast Transport Limited** **Tender Programme No: T354/P1**

Activity	Contract Value £	2004 January				February				March					April				May					June				July				August	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1 Mobilization & set up	6 450	3225	3225																														
2 Excavation and filling	21 480		7160	7160	7160																												
3 Foundations formwork	19 260			3852	3852	3852	3852	3852																									
4 Foundations concrete	27 800				6950	6950	6950	6950																									
5 Underslab drainage	5 210					2605	2605																										
6 Concrete ground floors	16 470							8235		8235																							
7 Columns formwork	6 007					1502	1502	1502	1502																								
8 Columns concrete	2 700						1350		1350																								
9 Floors and beams formwork	22 220							2778	2778	2778	2778	2778	2778	2778	2778																		
10 Floors and beams concrete	21 140									7047			7047		7047																		
11 External walls	78 580										9823	9823	9823	9823	9823	9823	9823	9823															
12 Roof timbers	9 350																3117	3117	3117														
13 Roof covering	19 030																		9515	9515													
14 Windows	25 500																6375	6375	6375	6375													
15 Services 1st fix	43 000															7167	7167	7167	7167	7167	7167												
16 Plasterwork and partitions	43 500																		5438	5438	5438	5438	5438	5438	5438	5438							
17 Joinery	41 670																				5209	5209	5209	5209	5209	5209	5209	5209					
18 Ceilings	23 000																								4600	4600	4600	4600	4600				
19 Services 2nd fix	28 000																									5600	5600	5600	5600	5600			
20 Painting	12 300																						2050	2050			2050	2050	2050	2050			
21 Floor coverings	12 300																												4100	4100	4100		
22 External work and drainage	60 920		6092	6092																			6092	6092	6092	6092	6092	6092	6092	6092			
23 Preliminaries	107 450	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582	3582		
Gross weekly value forecast	653.3 k	6.81	20.1	20.7	21.5	18.5	19.8	26.9	9.21	21.6	16.2	16.2	23.2	16.2	23.2	20.6	30.1	30.1	35.2	32.1	21.4	14.2	22.4	22.4	24.9	30.5	27.1	27.1	26	21.4	7.68		
Gross interim valuation	653 337 k					£ 69 095				£ 74 440					£ 93 414				£ 103 924					£ 125 261				£ 104 942				£ 82 261	
Net interim payments	**£ 620 670**					**£ 65 640**				**£ 70 718**					**£ 88 743**				**£ 98 728**					**£ 118 998**				**£ 99 695**				**£ 78 148**	
After completion	**£ 32 667**																															**£ 32 667**	
week number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	>>

Fig. 16.4 *Client's cashflow forecast produced by the estimator*

CB CONSTRUCTION LIMITED **Labour cost forecast**

							2004			
Activity	lab	plt	mat	sub	contract Value	dur	January			
							1	2	3	4
1 Mobilization & set up	2 800				2 800	2	1400	1400		
2 Excavation and filling	7 800				7 800	3		2600	2600	2600
3 Foundations formwork	12 480				12 480	5			2496	2496
4 Foundations concrete	4 600				4 600	4				1150
5 Underslab drainage	1 920				1 920	2				
					0					
6 Concrete ground floors	3 420				3 420	2				
7 Columns formwork	3 907				3 907	4				
8 Columns concrete	750				750	2				
9 Floors and beams formwork	14 570				14 570	8				
10 Floors and beams concrete	3 750				3 750	3				

CB CONSTRUCTION LIMITED **Plant cost forecast**

							2004			
Activity	lab	plt	mat	sub	contract Value	dur	January			
							1	2	3	4
1 Mobilization & set up		2 400			2 400	2	1200	1200		
2 Excavation and filling		7 980			7 980	3		2660	2660	2660
3 Foundations formwork		–			0	5			0	0
4 Foundations concrete		–			0	4				0
5 Underslab drainage		1 750			1 750	2				
					0					
6 Concrete ground floors		1 750			1 750	2				
7 Columns formwork		–			0	4				
8 Columns concrete		250			250	2				
9 Floors and beams formwork		–			0	8				
10 Floors and beams concrete		1 750			1 750	3				

CB CONSTRUCTION LIMITED **Material cost forecast**

							2004			
Activity	lab	plt	mat	sub	contract Value	dur	January			
							1	2	3	4
1 Mobilization & set up			1 250		1 250	2	625	625		
2 Excavation and filling			5 700		5 700	3		1900	1900	1900
3 Foundations formwork			6 780		6 780	5			1356	1356
4 Foundations concrete			23 200		23 200	4				5800
5 Underslab drainage			1 540		1 540	2				
					0					
6 Concrete ground floors			11 300		11 300	2				
7 Columns formwork			2 100		2 100	4				
8 Columns concrete			1 700		1 700	2				
9 Floors and beams formwork			7 650		7 650	8				
10 Floors and beams concrete			15 640		15 640	3				

CB CONSTRUCTION LIMITED **Sub-contract cost forecast**

							2004			
Activity	lab	plt	mat	sub	contract Value	dur	April			
							14	15	16	17
12 Roof timbers					0	3			0	0
13 Roof covering				16 400	16 400	2				
14 Windows				25 500	25 500	4			6375	6375
15 Services 1st fix				43 000	43 000	6		7167	7167	7167
					0					
16 Plasterwork and partitions				43 500	43 500	8				
17 Joinery				34 000	34 000	8				
18 Ceilings				19 800	19 800	5				
19 Services 2nd fix				28 000	28 000	5				
20 Painting				12 300	12 300	6				

Fig. 16.5 *Multiple sheets for cashflow analysis*

CB CONSTRUCTION LIMITED **Priced Programme** **Proposed Offices for Fast Transport Limited**

Activity	lab	plt	mat	sub	contract Value	2004 January				February				March					April				May					June			
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1 Mobilization & set up	2 800	2 400	1 250		6 450	3225	3225																								
2 Excavation and filling	7 800	7 980	5 700		21 480		7160	7160	7160																						
3 Foundations formwork	12 480	–	6 780	–	19 260			3852	3852	3852	3852	3852																			
4 Foundations concrete	4 600	–	23 200	–	27 800				6950	6950	6950	6950																			
5 Underslab drainage	1 920	1 750	1 540	–	5 210					2605	2605																				
6 Concrete ground floors	3 420	1 750	11 300	–	16 470							8235		8235																	
7 Columns formwork	3 907	–	2 100	–	6 007					1502	1502	1502	1502																		
8 Columns concrete	750	250	1 700	–	2 700						1350		1350																		
9 Floors and beams formwork	14 570	–	7 650	–	22 220							2778	2778	2778	2778	2778	2778	2778	2778												
10 Floors and beams concrete	3 750	1 750	15 640	–	21 140									7047			7047		7047												
11 External walls	36 700	–	41 880		78 580										9823	9823	9823	9823	9823	9823	9823	9823									
12 Roof timbers	4 140	–	5 210		9 350																3117	3117	3117								
13 Roof covering	1 350	–	1 280	16 400	19 030																		9515	9515							
14 Windows				25 500	25 500																6375	6375	6375	6375							
15 Services 1st fix				43 000	43 000															7167	7167	7167	7167	7167	7167						
16 Plasterwork and partitions				43 500	43 500																		5438	5438	5438	5438	5438	5438	5438	5438	
17 Joinery	2 360		5 310	34 000	41 670																				5209	5209	5209	5209	5209	5209	5209
18 Ceilings	1 800		1 400	19 800	23 000																								4600	4600	4600
19 Services 2nd fix				28 000	28 000																									5600	5600
20 Painting				12 300	12 300																						2050	2050			2050
21 Floor coverings				12 300	12 300																										
22 External work and drainage	16 700	12 550	19 870	11 800	60 920		6092	6092																			6092	6092	6092	6092	6092
Total for measured work	119 047	28 430	151 810	246 600	545 887	3.2	16.5	17.1	18.0	14.9	16.3	23.3	5.6	18.1	12.6	12.6	19.6	12.6	19.6	17.0	26.5	26.5	31.6	28.5	17.8	10.6	18.8	18.8	21.3	26.9	23.6
23 Preliminaries	57 430	35 490	11 230	3 300	107 450	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Resource cost analysis																															
Cumulative labour value		delayed	1 wk		£ 176 477	–	3	11	20	28	35	43	53	58	65	73	82	91	100	109	116	123	131	135	138	140	142	146	150	154	159
Cumulative plant value		delayed	4 wks		£ 63 920	–	–	–	–	2	9	14	18	20	22	24	25	28	29	30	32	33	35	36	37	39	40	41	42	43	46
Cumulative materials value		delayed	6 wks		£ 163 040	–	–	–	–	–	–	1	6	12	21	30	39	54	57	69	76	82	94	100	112	118	125	133	135	136	137
Cumulative sub-contract value		week after payment received			£ 249 900	(retention ignored)				–	–	3	3	3	3	3	3	3	3	3	4	4	4	4	38	38	38	38	38	133	133
24 **Weekly cost commitment**						–	3.31	10.9	19.6	30.1	43.9	60.7	79.5	92.2	111	130	150	176	189	212	227	243	264	276	326	335	346	358.1	365.9	467	474
Gross weekly value forecast					653.3 k	6.81	20.1	20.7	21.5	18.5	19.8	26.9	9.21	21.6	16.2	16.2	23.2	16.2	23.2	20.6	30.1	30.1	35.2	32.1	21.4	14.2	22.4	22.37	24.92	30.5	27.1
Gross interim valuation					**£ 653 337**					£ 69 095				£ 74 440					£ 93 414				£ 103 924					£ 125 261			
25 **Net interim payments**					**£ 620 670**					**£ 65 640**				**£ 70 718**					**£ 88 743**				**£ 98 728**					**£ 118 998**			
26 **After completion**					**£ 32 667**																										
week number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Fig. 16.6 *Contd*

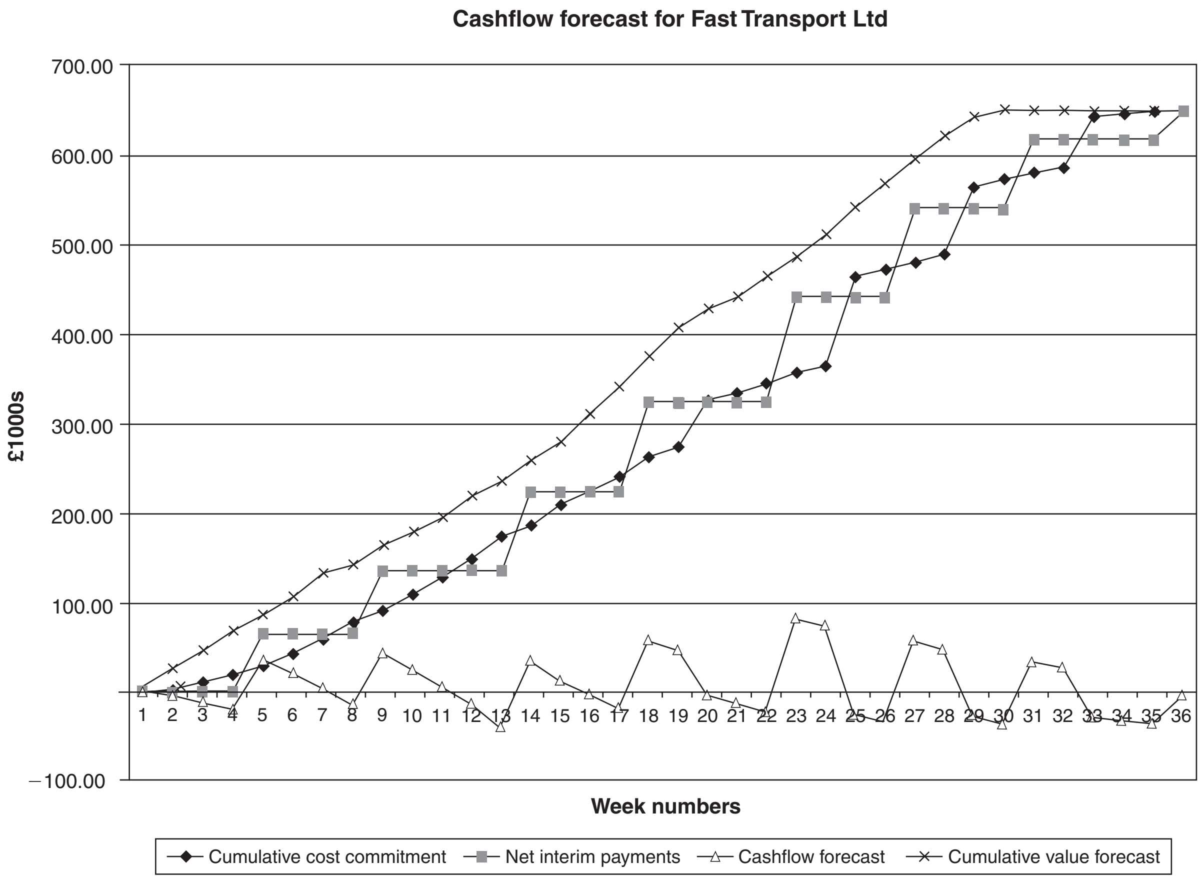
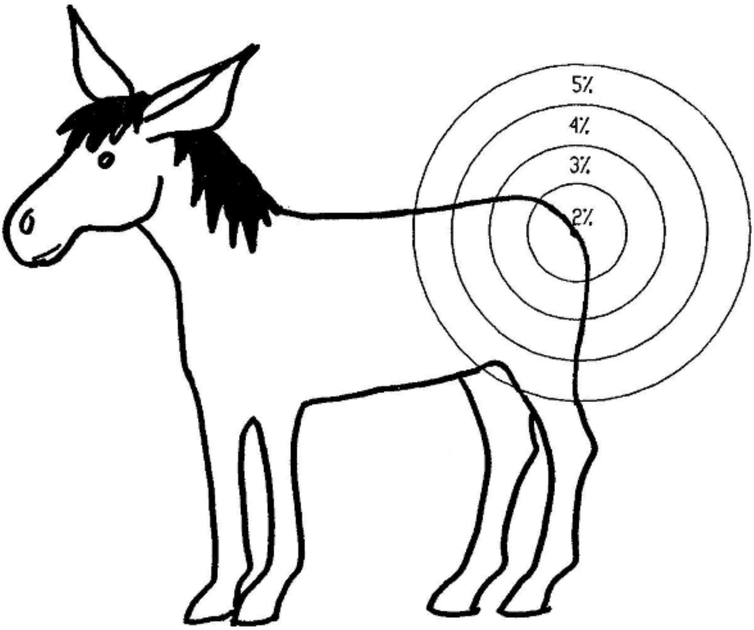


Fig. 16.6 *Contractor's cashflow forecast using priced programme*

17 Completing the estimate and final tender review



'Converting an estimate into a tender'

Completing the estimate

The estimator must assemble clear pricing information so that all the build-ups, assumptions and underlying decisions can be seen and understood by the final-review team and the construction staff if the tender is successful. Bills of quantity should be extended and totalled, with separate subtotals being produced for the four basic elements of labour, plant, materials and sub-contractors. With computer methods, rates will be recorded in a database as the estimator attaches resources to bill items.

All estimating methods (manual or computer) must include reliable techniques to ensure the analysis of the estimate presented to management is correct. Mathematical checks are relatively simple and can be carried out by estimating clerks or computers. It is perhaps more important to develop a method which can identify a mistake in resourcing (particularly the main items), collecting to summaries, and input of quantities if computers are used. Other pricing checks include:

1. Rates must apply to the unit of measurement (for example, an item measured in m^2 is not priced as m^3).
2. All items on each page have been priced or included elsewhere.
3. Major items needing costly resources should be reconciled with resource summary sheets.

The resource summaries given in the CIOB Code of Estimating Practice (COEP) illustrate the information needed by management to assess the costs, which have the most affect on the tender. For example, there is no point discussing formwork valued at £1850 when there are concrete blocks worth £68 000.

With the use of computers for building up rates, it has become more difficult to identify mistakes at the final review stage. An experienced manager would employ some coarse checks such as making a comparison between labour and materials in each trade. For example, if labour costs for formwork amount to £27 700 and this is approximately 60% of the total formwork costs, then the figures appear to be correct. There are 55 000 facing bricks which might cost £380 per thousand to lay, i.e. £20 900. The labour summary shows that the estimator has allowed £13 200, so a closer examination is called for.

Resource summary sheets provide vital information for three reasons:

1. Reconciliation can be made between resource schedules and bill totals for labour, plant, materials and sub-contractors.
2. They give management a breakdown of resources so they know where to focus their efforts at the final review stage.
3. Adjustments to resource costs can be calculated on the sheets before being taken to the tender summary. (This could be done quickly using a computer estimating package but some people prefer to have the full picture on paper before changing the estimate held on the computer.)

A tender programme must be prepared so the estimator can examine the resources estimated in time on the programme with those that he has expressed in cash terms in the estimate. A common problem is the need to maintain excavators on site during groundwork operations. The planner may believe that an excavator is needed on site for 10 weeks whereas the estimator has allowed enough money for only 6 weeks. This reconciliation needs to be carried out jointly by the estimator and planner, and clearly presented to management for final review.

Estimator's report

Once the bill of quantities has been priced and checked, cost summaries and reports can be filled in. Each company has its own standard layout for these forms and a comprehensive example is given in the CIOB Code of Estimating Practice. It would be wrong to make any changes after this stage to the bill, whether produced manually or by computer, because the analysis sheets and summaries would also have to be changed. As long as adjustments are carefully recorded, they can be built back into the bill of quantities later; in particular when the inked-in copy of the bill is called for. This is one reason why priced bills of quantities for building projects are not submitted with the tender.

The estimator's report must show a full breakdown of costs for management. Decisions can then be reached and the summary of the tender can be compiled. The following Estimate Analysis form (Fig. 17.2) and Tender Summary form (Fig. 17.3) will be satisfactory for all sizes of contracts. Each item has a reference number for easy identification within the text. If an estimate report has been produced by a computer system, there should still be an independent check of major resources using the summary sheets.

Computer-aided estimating systems will generate resource summaries and bill totals. Now that most procurement arrangements are based on a contractor's own quantities, a contract sum analysis is usually generated by the estimating software. Building Cost Information Service (BCIS) elemental cost plan headings have become the industry standard for listing building costs and form the structure of a Contract Sum Analysis for design and build, lump-sum, PFI, and many other contracts. An elemental analysis provides management with elemental costs as lump sums and costs per m^2, and this means that data can be compared with other comparable schemes.

There are of course many other supporting documents which are included in the estimator's report, and are crucial for management to understand the full technical and commercial requirements of the project. Very often contractors use the final review agenda to list the contents of the report, and again there is a good example of an agenda in the COEP.

Comments on Estimate Analysis form

Figure 17.1 is a domestic sub-contract summary reproduced from Chapter 12 in order to illustrate how costs from an estimate are transferred to Tender Summary forms.

CB CONSTRUCTION LIMITED	DOMESTIC SUB-CONTRACTOR'S SUMMARY	Project	Fast Transport Ltd		
		Ref. No.	T354	Date	30.6.04

Ref.	Trade	Company	Quotation	Discount offered (%)	Net amount	Firm price Allowance	Alternative/late quotations: Company	Net amount	Saving
S1	Roof covering	Beaufort Roofing	17 672	2.5	17 230	nil			
S2	Windows	Valley Fabrications	30 641	2.5	29 875	1 225	Archiglass	27 550	2 325
S3	Plumbing	Consort	4 550	nil	4 550	nil			
S4	Plastering & partitions	Swift Services	57 990	nil	57 990	nil	Oscar Finishes	46 760	11 230
S5	Joinery	Projoin Site Services	41 900	nil	41 900	1 935	L.P. Monk	38 450	3 450
S6	Suspended ceilings	Hill Systems	19 882	2.5	19 882	nil			
S7	Painting	Tudor Decorations	12 659	2.5	12 343	nil			
S8	Floor coverings	Freedom Finishes	12 615	2.5	12 300	nil			
S9	Electrical installation	Comech Engineering	35 887	2.5	34 990	nil	Beta Technologies	22 860	12 130
S10	Mechanical installation	Comech Engineering	25 667	2.5	25 025	nil			
S11	Surfacing	W. Smith Contracting	11 800	nil	12 450	nil			
S12	Scaffolding	CCG Scaffolding	see prelims						
		Totals		£	268 535	3 160		£	29 135

Fig. 17.1 *Summary of sub-contractors (reproduced from Chapter 12)*

CB Construction Limited	Project:	Fast Transport Ltd
ESTIMATE ANALYSIS	Date:	Jul 2004
	Tender no:	T354

			Bill totals	Estimator's Adjustments	Estimate
1	Bill total		664 705	−56 288	608 417
	DEDUCT				
2	Dayworks		14 600		14 600
3	Provisional sums		30 500		30 500
4	Domestic sub-contractors		268 535	−29 135	239 400
5	Nominated sub-contractors		20 000		20 000
6	Nominated suppliers		3 800		3 800
7	Own measured work		327 270	−27 153	300 117
8	Breakdown:	Lab	136 960	−21 333	115 627
9		Plt	31 330		31 330
10		Mat	158 980	−5 820	153 160
	LABOUR STRENGTH				
11	Contract period	stated/offered	30	wks	
12	Labour total		£115 627		
13	Average weekly earnings	£11.0 40	£440.00		
14	Man weeks		262.8	nr	
15	Average labour strength		8.8	men	
	CASH DISCOUNTS				
16	Nominated sub-contractors		500		500
17	Nominated suppliers		190		190
18	Domestic sub-contractors		6 713	−728	5 985
19	Materials		7 949	−291	7 658
20		Total	15 352	−1 019	14 333

Fig. 17.2 *Estimate Analysis form*

CB Construction Limited	Project:	Fast Transport Ltd
TENDER SUMMARY	Date:	Jul 2004
	Tender no:	T354

				Estimate	Review changes	Tender	Analysis
1 Own measured work	Lab			115 627		115 627	18.2% of 11
	Plt			31 330	−5 300	26 030	4.1% of 11
	Mat	nett		145 502	−2 411	143 091	22.5% of 11
2 Domestic sub-contractors		nett		233 400	−12 480	220 920	34.8% of 11
3 Nominated sub-contractors		nett		19 500		19 500	3.1% of 11
4 Nominated suppliers		nett		3 610		3 610	0.6% of 11
	Total			548 969	−20 191	528 778	83.2% of 11
5 Provisional sums	Defined						
6 Project overheads	Lab			12 960		12 960	2.0% of 11
	Plt			36 090	1 800	37 890	6.0% of 11
	Mat			5 780		5 780	0.9% of 11
	Sub			3 300		3 300	0.5% of 11
	Staff			32 219	5 400	37 619	5.9% of 11
7 Price fluctuations	Lab		*	620		620	0.5% of 1
	Plt		*				
	Mat		*				
	Sub		*	3 160	−3 160	0	
	Staff		*	1 675		1 675	4.5% of staff
8 Water charges		%	*	650		650	0.1% of 11
9 Insurances		%	*		5 000	5 000	0.8% of 11
10 Bond		%	*	1 050		1 050	0.17% of 11
11	Total			646 473	−11 151	635 322	
12 Risk/opportunity				12 000	−2 000	10 000	1.6% of 11
13 Overheads				10 667	−2 691	7 976	1.1% of 17
14 Profit				12 000	−1 976	10 024	1.4% of 17
15 Dayworks				14 600		14 600	
16 Provisional sums	Undefined			30 500		30 500	
	Total			726 240	−17 818	708 422	
17 Professional fees		%	*	–		–	
18	TENDER £			726 240		708 422	

* may be priced in prelims

Fig. 17.3 *Tender Summary form*

The Estimate Analysis form shown in Fig. 17.2 is an intermediate step towards filling in the Tender Summary form (Fig. 17.3). If a computer estimating system is being used, most of this information will be available in printout form, and this manual exercise would not be necessary.

Item 1. For a manual system, transfer the total of all measured work from the extended priced bills, include provisional sums and dayworks and take special care to include any provisional sums given in the preliminaries bill.

Items 2–6. From the relevant resource sheets enter the totals incorporated in the measured bills under their respective headings. PC sums drawn from the bill of quantities include discounts at this stage but will be reduced to net values on the tender summary form. The value of the contractor's own measured work is then found by deducting the sub-contracts and PC and provisional sums from the bill total.

Items 8–10. The breakdown of measured work can be prepared in four ways:

1. By applying an approximate ratio such as 40% labour, 10% plant and 50% materials.
2. By keeping accurate records of the resources used in pricing the works.
3. By analytical pricing and extending each part of the rates to a total.
4. By using the computer printout of resource totals.

It is no longer safe to examine resources using ratios or percentages because so much work today may be carried out by sub-contractors. It is not unusual for an estimator to price the earthwork himself on one contract and use a sub-contractor's quotation for another similar scheme. The estimator's adjustments are shown in the middle column so that if late prices or mistakes are found they can be recorded before the final review meeting.

Item 11. The estimator must clearly state the duration used in calculating project overheads and say whether this is the period given in the enquiry document or one which the tender programme has yielded.

Items 12–14. Dividing the labour value by the average earnings will give the number of man weeks included in the estimate.

Item 15. The average labour strength is calculated by dividing the number of man weeks, arrived at in 14, by the contract period. The peak labour strengths can be found by reference to the programme, because the size of the workforce on site may well be double the average figure and this does not allow for people employed by the domestic and nominated sub-contractors. An attempt should be made to assess the size of the labour force to calculate certain project overheads such as welfare facilities, transport, and protective clothing.

Items 16–19. All discounts offered by suppliers and sub-contractors should be identified because the net value of the resources must be calculated. For nominated suppliers and sub-contractors, refer to the contract conditions for the discounts included in the prime cost sums. Joint Contracts Tribunal (JCT) contracts have in the past allowed 2.5% on nominated sub-contractors and 5% on nominated suppliers sums but could change. GC/Works/1 Edition 3 has dispensed with the discounts, which has set an unwelcome trap for the unwary estimator.

Discounts for domestic sub-contractors and material suppliers will be calculated on the summaries of quotations used. Not all firms are prepared to offer discounts because the benefit of prompt payment is often ignored by main contractors.

Each time an adjustment is made, care must be taken to make a corresponding change to the discount. In the example shown in Fig. 17.2, the estimator has reduced the value of domestic sub-contractors (item 4) by £29 135 and reduced the total discount from £6713 to £5985 in item 18.

Comments on Tender Summary form

Before the final review meeting the estimator will complete the left-hand column of the Tender Summary which gives management an outline of the whole job. In this example the estimator has perhaps gone further than necessary and suggested a total margin of £22 667 comprising £10 667 for overheads and £12 000 for profit. In the event, the margin was reduced to £18 000. The 'review changes' column shows the financial effect of the decisions made by management during the meeting. The most significant changes are to the contractor's own work and domestic sub-contractors, where potential savings have been identified. On the other hand, senior managers are also prepared to add to the estimate and in this case have increased staff costs and insurances. These last two points may have been the subject of a company policy change, which the estimator would not have known. Clearly an aggressive stance has been taken with sub-contractors, because the inflation allowance made by the estimator has been removed.

Items 1–4 are taken from the Estimate Analysis and project overheads (item 6) come from a separate summary of project overheads.

Item 5. Provisional sums must now be split between those which are defined (contractor to allow for programming, planning and preliminaries) and those which are undefined (the contractor will be able to recover overhead costs).

Item 7. Fluctuations were dealt with in an earlier chapter. This example highlights the treatment of staff costs that are the most difficult to control. Price bargaining may produce savings with suppliers and sub-contractors but cannot be applied to supervisory staff.

Water charges, insurances and bonds (items 8–10) may have been priced in the site overheads schedule, but can be more accurately calculated when the full estimate is known. Each of these items are governed by the contract sum.

Item 8. Water charges are made by the water company for water consumed during the construction period. The estimator should contact the local water company to establish the charges. These may be a straightforward percentage or scale of charges based on the contract value. Alternatively the water may be metered.

Item 9. The employer's liability insurance is rarely included in the average labour rate today. This is because labour can be drawn from several sources and a global calculation is carried out in the project overheads, or at this stage when all the parts of the estimate are known. Contract conditions should be examined carefully and changes to the standard conditions noted. Since insurance provisions are notoriously difficult to interpret, the estimator will ask for help from his insurance adviser; and in some cases obtain a quotation before completing the estimate. When a job is on site, there are often many small losses suffered by the contractor, which are not recovered by an insurance policy. The estimator should ask for records of what the average shortfall may be for the work envisaged. In the example, management decided to add £5000 which was the excess given in the all-risks policy.

Item 10. Performance bonds and parent company guarantees are often required in today's construction market. The cost of a bond will depend on the suggested wording, duration and value, and creditworthiness of the contractor. The quotation for a bond is usually expressed as a percentage of the contract value per annum, and extends into the defects liability period. This means that a bond for a 12-month contract with a 12-month defects liability period will require twice the annual cost.

Risks, overheads and profit must be added to the total given in line 11; dayworks and provisional sums (undefined) are added afterwards because they carry their own overheads.

Risks and opportunities

Item 12. An examination of the risks to be borne by the contractor may be considered at this stage. These can be divided between technical and commercial:

1. Technical risks are dealt with by defining construction methods before costing the work. If the cost of failure is high in relation to the value of the project, it may be possible to insure against the loss, or increase the control. When uncertainties have been assessed they are priced by adding lump sums, which are a proportion of the possible losses. Contractors usually take an optimistic view on the unknown events, which can plague a construction project, hoping that costs can be held within the overall risk 'pot'.

2. Commercial risks are those imposed by the form of contract and additional obligations forming part of the agreement. The most common problems arise from failure to finish by the date for completion, and commercial relationships with sub-contractors. If management feel that the contract period could be exceeded, they should consider adding a sum equal to the liquidated damages, which might be claimed.

Risk management

Risk management is the process associated with identifying, analysing, planning, tracking and controlling project risks. In some modern forms of procurement, clients ask for risk schedules to be submitted with tender documents. The aim is to consider which risks are best managed by each party to the main contract. In framework agreements, for example, where contractors are reimbursed actual building costs (with a pain and gain share arrangement) the client might wish to manage the technical risk fund and the contractor is expected to manage commercial risks. This is because individual sites are chosen by the client (leading to variable technical risks) and contractual links in the supply chain are under the direct control of the contractor.

In any tender, risk management starts when the tender documents are received by identifying possible risks and allocating responsibilities to team members for managing risks and looking for opportunities. As an example, it might be found that there is a risk that skilled labour will not be available in an area, and a large project is being planned on an adjacent site. The risk can be reduced by making an allowance for transporting labour from outside the area. Alternatively, the design could be modified to accommodate off-site manufactured elements of the building. Another solution would be to provide training in advance of the programmed activities. In this example the risk has been reduced (mitigated) but a residual risk will need to be managed.

A mitigation plan will decrease risk by lowering the probability of an occurrence. The residual risk could lead to a sum of money and a probability of its occurrence. So, if, for example, the labour problem is not fully eliminated, a sum of money will be added to the risk log and a probability applied.

An opportunity is a future event, that should it occur, would lead to a favourable impact upon the project. As with risks there is an uncertainty with the possible occurrence of the event.

With both risks and opportunities, it is important to structure the tender submission in such a way that the risk mitigation and opportunities may be secured. As an example, if a contractor has assumed that a gas tank can be sited at ground level in a car park, he will make this statement as a condition of his offer. The risk of burying the tank is thus transferred to the client.

The submission document is also an opportunity to transfer a risk to the client. This is achieved through a carefully worded qualification in the tender documents.

Overheads and profit

There are three main stages in reviewing a tender. It is management's responsibility to:

1. Understand the nature and obligations of the work.
2. Review the costs given in the estimate, and if necessary adjust the costs for market conditions and errors.
3. Add to the estimate sums for general overheads and profit.

Overheads and profit should be evaluated separately because they are calculated in different ways for different purposes.

Item 13. The term 'overheads' relates to off-site costs, which need to be recovered to maintain the head office and local office facilities. Items to be covered include:

- Salaries and costs to employ directors and staff;
- Rental fees, rates and maintenance of offices, stores and yards;
- Insurances;
- Fuel and power charges;
- Cars and other vehicles costs for office staff;
- Printing, stationery, postage and telephone;
- Advertising and entertainment;
- Canteen and consumables;
- Office equipment including computers;
- Finance costs and professional fees.

These charges are compared with turnover to arrive at an overhead percentage. Most organizations will know the figures for previous years, but both overheads and turnover should be predicted for the future when the project is under way.

Unfortunately, when work is scarce and turnover drops, contractors look for ways to reduce tender mark-ups. The temptation is to reduce the amount for overheads at a time when they are rising in proportion to turnover. The alternative is to win less work and suffer large losses. Another solution would be for some contracts to make a greater contribution to head office costs than others.

Item 14. The profit figure is a combination of discounts and additional profit required by management. Long gone are the days when discounts could be thought of as a small reserve fund. In a competitive market all discounts are taken out before a small profit margin is added, to help in winning the work.

The profit calculation is the responsibility of senior managers (and ultimately the directors). In fact it is not strictly a calculation but a view or hunch about what margin would give the maximum profit for the company with the likelihood of winning the contract.

There are, nevertheless, some important issues which must be considered before a tender can be completed, these include:

1. The desire to win the contract; perhaps to increase turnover or the job might be the first in a number of similar schemes.
2. Whether the project will involve contractor's finance; cashflow calculations will show the net finance needed or benefit available.
3. The effect of winning the contract on the present workload; is there sufficient turnover to meet the company's objectives and are the company's resources being used efficiently.
4. Knowledge of the client and his consultants; the attitude and competence of other parties can have an impact on the smooth running of a project.
5. The local market conditions; consider the strength of competition for the type of construction in the area (this is often the single most important criterion for choosing a winning profit margin).
6. An evaluation of previous bidding performance; knowledge is gained of profit margins by an examination of results from previous tenders.
7. There is a theory that contractors may be influenced by the client's budget; this target is found from 'intelligence' information, it may be given in the preliminary invitation to tender, or deliberately released by the client to keep the price down; in practice this seldom changes the profit margin.

Where the tender appears to exceed the sum that would win the contract, there are two refinements that can be used:

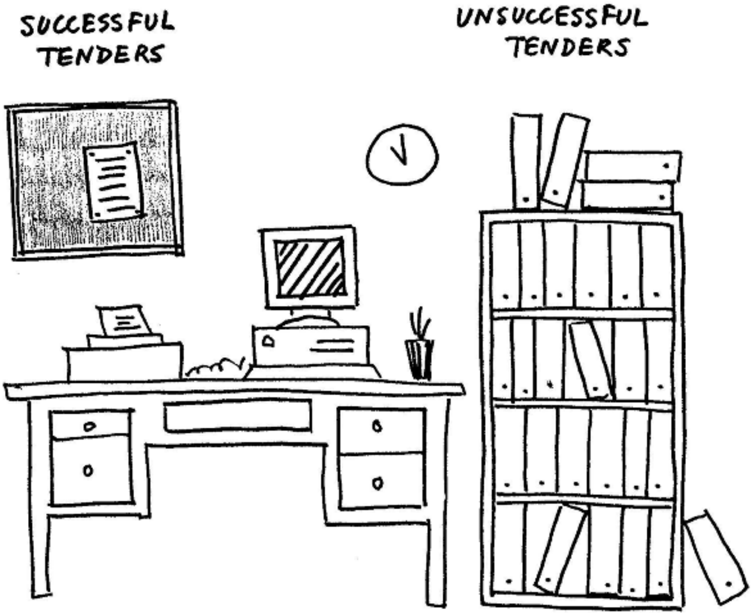
1. Re-examine the suppliers' and sub-contractors' quotations for any evidence that lower prices may be available after the main contract is awarded, and
2. Consider different profit margins for direct work and that for which sub-contractors will be responsible.

Further approaches can be made to 'preferred' suppliers and trade specialists to negotiate and secure the best market price. This arrangement would include an undertaking that should the contractor be successful then the supplier or specialist would have no further negotiations and would be awarded the contract.

Finally, once the overheads and profit are settled, the amounts can be put on the summary form. All that remains is to add daywork (item 16) and undefined provisional sums (item 16) to arrive at the overall total, and where applicable add professional fees to produce the tender figure.

When the final review meeting is over, it is important for the estimator to return to his desk and check all the figures on the summary sheet once again. Even better, enter the estimator's adjustments and final review changes into the bills of quantities and ensure the bill total is the same as the agreed tender figure. This fully adjusted bill will form the basis of a set of allowances for the construction team and can be adapted for presentation to the client.

18 Tender submission and results



'An assessment of tender performance'

Introduction

How do you submit a tender? The answer was simple: filling in the tender form and making sure that it is delivered on time. Today, however, the winning of a contract can be more than simply giving the lowest price. The style of presentation, for example, is important for design and build contracts, and method statements are commonly required by construction managers. There is, of course, a balance to be achieved between what the client wants and appearing to be too clever; different clients have different expectations.

The contractor needs to consider the criteria the client will use for selection. These can be:

1. Price; will the lowest price alone be the basis for selection?
2. Time; will a programme show the client that the contractor has thought about how the job can be finished on time, or ahead of time?
3. Allocation of money; will the way in which money is distributed in the priced bills help or irritate the client?
4. Method statement; would the client wish to know the methods to be adopted before accepting the offer?
5. Safety and quality; does the client expect a statement of safety or quality showing how the contractor will manage this particular contract?
6. Construction team; is the contractor proposing to supervise the job with experienced staff who will work as an effective team with the consultants?
7. Presentation; how important is an accurate, well-presented offer?

The follow-up to a tender can affect the outcome – the estimator will contact the client soon after submitting a tender, not only to find the result but also to ensure there are no questions arising out of the submission.

Completion of priced bills

The Tender Summary form produces a tender sum which must be transferred to the bills of quantities for submission. If a priced bill of quantities has to be submitted with the tender, then the way in which money is spread in the bill should be decided at the final review meeting. The contractor often changes the actual breakdown of prices in a priced bill of quantities to:

1. Produce a reasonable cashflow from interim valuations.
2. Apportion monies in a way which the client will find acceptable.
3. Increase the money set against undermeasured items and decrease the price of overmeasured items.

The example tender analysis forms given earlier show the first bill total was £664 705 before the project overheads were added and any adjustments were made. The tender sum arrived at after final review was £698 437. If the bill was inked in using the first pricing level, the amount remaining for project overheads would be:

£698 437 − £664 705 = £33 732

This is not the true project overheads sum but is the amount needed to bring the bill total up to the tender sum. If the parties agreed to proceed on this breakdown (and they probably will) a part of the project overheads, overheads and profit would remain in the measured work portion of the bill. In particular, the items to be carried out by domestic sub-contractors would carry a considerable mark-up.

Taking the example a stage further, if the estimator had the use of a computer and had made the tender adjustments *before* inking in the bill for the client, the breakdown would be in line with the tender summary below:

	£	£
Measured work and provisional sums: (including £620 fluctuations on labour)		**529 398**
Project overheads		
Labour	12 960	
Plant	37 890	
Materials	5 780	
Sub-contracts	3 300	
Staff	37 619	
Fluctuations	1 675	
Water	650	
Insurances	5 000	
Risk/opportunity	10 000	
Bond	1 050	
Overheads and profit	18 000	**133 924**
Provisional sums and dayworks		45 100
Tender total		**708 422**

The client should not be surprised to see this large sum (£133 924) for project overheads because it is based on the true allowance. If the contractor anticipates a problem with this breakdown, he can move some money, either:

1. Into 'safe' items in the measured work portion of the bill, looking for work which will be carried out early in the contract (safe items are those which appear to be measured correctly or are judged to be undermeasured at tender stage), or
2. By using a computer system to add a percentage to all the rates in a bill of quantities.

The project overheads total should be broken down in the bill of quantities with sums for fixed and time-related items. A surprising number of contractors ignore this breakdown and prefer to insert a lump sum in the collection; they assume that if their tender is the lowest, more details can be submitted to meet the needs of the quantity surveyor (or engineer) for valuation purposes. The contractor also knows that if there are some small queries raised by the client then his tender is (probably) being considered for acceptance.

When contractors are tendering in a competitive market in which work is scarce, they know that their bids must be close to the predicted cost of carrying out the work, with little mark-up. Sometimes tenders can be slightly below cost. The contractor, in taking a calculated risk on how the contract will turn out, may price some items in a way which appears to be inconsistent. As an example, assume that a bill of quantities has two equal amounts in items for breaking out rock: one in reducing the site levels and the other in excavations for drains. Contractor A priced both items at £18.00/m^3 and contractor B priced the rock in open excavations as nil and in drains at £36.00. The overall effect on the tender sum was the same but contractor B had discovered a serious undermeasurement in the drainage bill; he was therefore hoping the drainage bill would be remeasured and valued at the higher rate. This might appear to make sense but, as many contractors have learned to their cost, plans can go wrong. If the quantity of rock in open excavation increased substantially, the contractor would suffer a serious financial loss.

Tender presentation

Most tenders are submitted on a pre-defined form which has the effect of standardizing the offers and discouraging exclusions, alternative bids and other qualifications. For traditional procurement methods, the tender presentation normally includes the form of tender and a covering letter.

With design and build projects, the contractor submits his tender in the form of 'the Contractor's Proposals'. This is the contractor's response to the Employer's Requirements and is explained in detail in the Supplement Number Two to the CIOB Code of Estimating Practice. The common elements of a design and build offer are: drawings to illustrate the proposals, a detailed specification and a tender sum broken down into its major elements. In order to avoid confusion later, the employer should stipulate the form and extent of information needed. The Contract Sum Analysis should be adequate for both valuing work executed and changes after the contract is awarded.

Instructions to tenderers should include a date, time and location for submitting a tender. The contractor is responsible for presenting the documents by the time given and in some cases may be permitted to send a tender by e-mail or facsimile transmission, followed up by first-class post. Contractors rarely submit their tenders early for two reasons:

1. They might receive a lower quotation from a sub-contractor or supplier which could improve the bid, and
2. A tender price cannot be communicated to a competitor in time for him to better the price.

Clearly, if a form of tender is required, the contractor must enter the price in the space provided, and ensure that the document is signed and dated by a person authorized to act for the tenderer. The estimator must carefully check the instructions to tenderers for any other documents to be submitted with a tender. Many public organizations would not expect to see additional documents, but sometimes ask for an outline programme and method statement. Contractors commonly attach a letter to the form of tender and priced bills of quantities, but are careful not to add statements or conditions to their offer which might be seen as qualifying the tender.

There are times, of course, when qualifications are unavoidable. The following examples show how a contractor may have no choice but to bring matters to the client's attention either before submission or in the tender:

1. A contractor may decide that the wording of a performance bond is unacceptable.
2. Having examined all the resources needed for a job, the contractor may find the contract duration is too short.
3. Late amendments can impose extra responsibilities, which the contractor is unable to resolve.
4. The contractor may wish to add to the list of three named sub-contractors following the failure of one of the firms on the list.

There is a theory (which is not sensible in a competitive market) that all such problems can be resolved by 'throwing money at them'. A short duration, for example, can be overcome by adding liquidated damages for the expected overrun. The JCT Practice Note No. 6 'Main Contractor Tendering' replaces the Code of Procedure for Single Stage Selective Tendering (CPSSST). It suggests that the tenderer should tell the client if there are any matters needing clarification as soon as possible and preferably not less than 10 days before the tenders are due. If the tender documents need to change, the tender date may be extended. The Practice Note takes a strong line on qualified tenders by stating that qualifications should be withdrawn otherwise the tender may be rejected. With this in mind, qualifications are sometimes written in general terms so the contractor can delay his decision on which issues he wants to qualify. Typical statements used are:

1. 'During the tender period, we identified some savings which can be brought about by small technical changes …'
2. 'We would need to clarify some of the contractual matters before entering into an agreement, but do not expect this to affect our price …'

Another approach, more common in civil engineering contracts, is to submit an alternative tender. In this way a contractor is able to comply with the tender conditions by submitting a 'clean bid' and at the same time reveal an alternative offer which usually reduces the construction costs with only minor specification/contractual changes. An alternative tender may also be the vehicle to propose a shorter duration, submit a programme and impress the client with technological expertise. Another form of alternative tender is to offer an amended contract where the contractual risks can be shared by open and frank problem solving in an atmosphere of trust. This produces a contractor-led partnership or alliance between the parties as envisaged by Sir Michael Latham in his 1994 report, *Constructing the Team*.

There is a growing practice of submitting company brochures, technical literature and other publicity material with the tender. This 'window dressing' is often unnecessary. The client is more interested in the price and approach to *his* job; in any case the company profile has been examined at the pre-selection stage.

The letter accompanying the tender can be used to confirm the amendments to the tender documents received during the tender period. The basis of the offer is after all the tender documents and all amendments received by and not sent to the contractor before the tender date. The main rule for this letter is to keep it short, no more than one page. The rules of letter writing should be applied to all correspondence, particularly during the tender stage, when for some clients this is the first business contact. In writing to his clients, the estimator must remember that every letter sent to the client, or his advisers, is selling the company.

Vetting of tenders

If bills of quantities are not required with the tender form, the contractor who has submitted the lowest bid is asked to submit his priced bill of quantities for examination (and adjustment where errors are found). The unsuccessful contractors should be told immediately that their tenders were unsuccessful. Once the contract has been let, all the tenderers should be notified of the results so that they can measure their performance against others in the industry. The results must remain confidential before a contract is made because the lowest contractor could negotiate higher prices if he knows the tenders made by his competitors. There have also been instances of higher tenders being reduced below the lowest price received on the tender date.

The Joint Contracts Tribunal (JCT) Practice Note No. 6 2002 has introduced the concept of best value, as an alternative to lowest priced bid. For a best-value tender, the criteria to be used to assess best value should be stated in the pre-qualification or tender documents. Once a choice has been made using this assessment criterion (sometimes referred to as 'score card') the pricing documents of the preferred tenderer can be opened and checked.

An examination of a contractor's bill of quantities may reveal different kinds of errors. Some errors should be corrected using the JCT Practice Note, Alternative 1 or 2. Alternative 1 gives the contractor the choice of standing by his tender or withdrawing it. Alternative 2 gives the contractor the opportunity to confirm his offer or amend it to correct genuine errors. The term 'genuine errors' is not defined in the Practice Note, but normally means:

1. 'Errors of computation' caused by mistakes in multiplying quantities by rates or totalling pages;
2. Patent errors in pricing such as pricing hardwood joinery at the same rates given for softwood earlier in the bill, or pricing steel reinforcement at a rate per kilogram where the unit is tonnes;
3. Inking-in errors are usually simple to correct because the summaries will be correct even if an individual rate has been entered wrongly.

Some patent errors can be difficult to spot because the contractor may have his own commercial reasons for distributing the money in a certain way. A common difficulty is the pricing of similar items at different prices. A quantity surveyor may wonder why concrete in a ground floor slab is priced at £71.55 per m^3 in the workshops and at £82.15 in the office area of a factory development. There are many logical reasons for this apparent mistake. It could be to do with continuity of work, perhaps the latter case involved a high extra cost for part load charges from the concrete supplier. If the office area was programmed for the beginning of the contract, the quantity surveyor might think the contractor had 'front-loaded' the bill to produce an early income. The contractor cannot be required to change the rates but the quantity surveyor may not be able to recommend the tender to the client. If the contractor has priced the bill in such a way that considerable sums of money are overpaid at the beginning of a project, the client might be at risk if the contractor fails to meet his obligations, or becomes insolvent.

Post-tender negotiations and award

Each tenderer will want to know the result as soon as possible in order to plan the construction phase of successful bids, or file away the documents and redeploy resources involved in unsuccessful ones. The direct approach is usually the most productive. A telephone call to the person carrying out the vetting process is often enough to know whether the tender documents can be archived and the computer files backed up on CD-ROM.

The next stage for the lowest tenderer could be meeting the client, or his advisers. This is often necessary before an award can be made. The matters discussed are mainly financial and contractual although methods can be important. Any errors or discrepancies in the bill of quantities can be resolved at the meeting and contractual details can be discussed and agreed. This allows both parties to understand their obligations before the formal agreement comes into effect.

The contractor should be represented by the estimator and senior construction staff. The estimator should ask for an agenda and a list of those attending. The agenda will allow him to brief his team in advance and take relevant documents to the meeting. The list of client's representatives and advisers is important. The contractor will try to respond to questions with staff who have the necessary specialization. Above all, an estimator must avoid the situation where he alone enters a room where all the consultants and client's representatives are assembled confidently expecting to get the best deal for the client.

There are some pre-award meetings where the estimator may not be the best person to lead the contractor's team. The approach must be robust with a firm commitment to carrying out the work to a high standard and on time. Unfortunately estimators often get bogged down in detail and have been known to highlight small errors in the documents or be pessimistic about aspects of the programme. If this happens, a senior manager can present a wider view and suggest positive remedies which have been successful on other projects. Above all the client must have confidence and believe the contractor can carry out the work with a willingness to solve problems and work closely with the client's team at all times.

Tendering performance and analysis of results

There are several ways in which the performance of an estimating department can be measured. The simplest method would be to count the number of successful bids compared with the number of tenders submitted. Figure 18.1 shows the cumulative ratio of tenders to contracts won in eight months. This is a crude technique, which does not help the firm to improve its tendering performance.

If a contractor's business strategy is to increase turnover, then a simple graph showing the value of contracts awarded would be useful. Figure 18.2 shows the value of contracts won, with the total for tenders submitted. This graph is made more effective by showing the performance related to a target set by the board of management.

The CIOB Code of Estimating Practice offers a suitable form for recording the results and subsequent analysis of tenders. Figure 18.3 illustrates three methods which can be used to produce a ratio analysis for a tender; each contractor will pick the method which helps him to evaluate his tender performance. The underlying principle is that, in general, cost category ratios of similar jobs remain approximately the same. If there are significant changes in these ratios, the estimator should be able to explain the reasons for the deviations, at the final review meeting.

Column A of Fig. 18.3 has been calculated with each element being expressed as a percentage of the total tender sum. This is the least refined measure because the elements are being compared with a figure which includes overheads and profit. Column B shows the elements expressed as percentages of direct costs excluding

CB CONSTRUCTION LIMITED **TENDER PERFORMANCE** **2004**

	Tenders Submitted	Contracts Awarded	Cumulative Tender ratio
Jan	3	0	
Feb	5	1	8.0
Mar	2	1	5.0
Apr	5	0	7.5
May	6	1	7.0
Jun	4	0	8.3
Jul	3	2	5.6
Aug	5	1	5.5
Sep	4		
Oct			
Nov			
Dec			

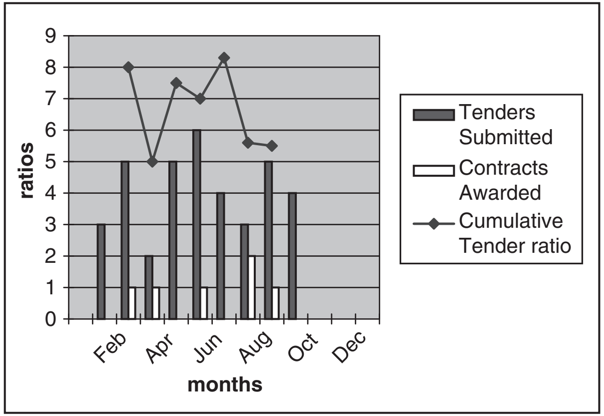


Fig. 18.1 *Cumulative tender ratio*

CB CONSTRUCTION LIMITED **TENDER PERFORMANCE** **2004**

	Tenders Submitted	Contracts Awarded
Jan	2.50	0.00
Feb	5.95	2.15
Mar	6.62	4.10
Apr	9.09	4.10
May	12.25	4.70
Jun	14.12	4.70
Jul	15.37	6.58
Aug	18.58	7.65
Sep	20.81	
Oct		
Nov		
Dec		

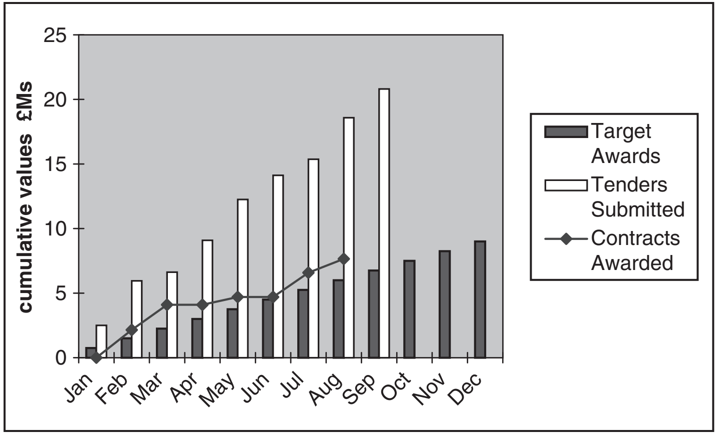


Fig. 18.2 *Cumulative value of tenders and awards*

CB CONSTRUCTION LIMITED	**Tender analysis**	Project name:	Fast Transport Limited
		Tender date:	Jul 2004
		Tender no:	T354

	Tender summary Description	£	Column A % of 13	Column B % of 6	Column C % of 9
1	Own measured work – Labour	115 627	16.6	22.7	18.3
2	– Plant	26 030	3.7	5.1	4.1
3	– Materials nett	143 091	20.5	28.2	22.7
4	Domestic sub-contractors nett	220 935	31.6	43.5	35.1
5	Price fluctuations	2 295	0.3	0.5	0.4
6	Direct costs	507 978		100	
7	Project overheads	104 249	14.9		16.5
8	Overheads, profit and discounts	18 000	2.6		2.9
9	Tender less fixed sums	630 227			100
10	PC Sums–Nom sub-contractors	19 500	2.8		
11	PC Sums–Nom suppliers	3 610	0.5		
12	Provisional sums and contingencies	45 100	6.5		
13	TENDER	698 437	100		

Fig. 18.3 *Alternative methods for tender ratio analysis (relates to data given in Tender Summary form)*

PC and provisional sums. This has the advantage of removing the sums fixed by the client but fails to bring the project (site) overheads into the calculation. Perhaps the best solution would be to include project overheads and take out all sums set by the client (see column C).

The next stage is to examine bid results in more detail. Figure 18.4 lists the tenders submitted and shows the effect of subtracting the sums set by the client. The percentage over lowest bid gives a measure of the margin by which the job was lost, and the percentage over mean bid provides the contractor with a guide to the deviation from the average prices set by other contractors. As a rough rule of thumb, many contractors would feel confident in their estimating performance if their percentage over mean bid fell within the range ±10%. Figure 18.5 gives a summary of tender results for a three-month period.

CB CONSTRUCTION LIMITED	Project name:	Fast Transport Ltd
	Tender date:	Jul 2004
	Tender no:	T354

	Tender list	Tender	Tender less set sums	% over lowest bid	% over mean bid
1	Baldwin Bros	764 780	696 570	14.4	6.2
2	Javelin Construction	707 990	639 780	5.0	−2.4
3	Barry and Hardcastle	677 250	609 040 L	0.0	−7.1
4	CB Construction	698 437	630 227	3.5	−3.9
5	Wessex Contracting	718 415	650 205	6.8	−0.8
6	Newfield Building	756 410	688 200	13.0	5.0
7	Simpson	743 382	675 172	10.9	3.0
	Mean tenders	723 809	655 599	7.6	0.0

Sums set by client	
PC Sums – nom subs	19 500
PC Sums – nom suppliers	3 610
Prov sums	45 100
Total	68 210

Margin lost by	£21 187.00

Fig. 18.4 *Tender results*

It would be unwise to change a bidding strategy using a small amount of data. The analysis of performance must start with:

1. A period of consistent net pricing.
2. A steady tendering policy in terms of adjustments to direct costs and the percentage mark-up.
3. A determination to obtain tender results from consultants and clients.

Bidding strategy

A bidding strategy can be defined as a broad framework of methods and timing to achieve stated objectives. It is interesting to note that in military terms, the word 'strategy' means the skilful management of an army in such a way as to deceive an enemy and win a campaign. In business the stated objectives can sometimes

CB CONSTRUCTION LIMITED	**Summary of tender results**					2004
	Project title	Tender date	No. of Tenderers	Rank	% over lowest bid	% over mean bid
T351	Renton Cakes	Jun 04	3	1	0.0	−2.3
T352	Warland Access Road	Jun 04	6	5	11.0	4.9
T353	Retail units, Swindon	Jun 04	6	1	0.0	−3.1
T354	Fast Transport Limited	Jul 04	7	2	3.5	−3.9
T355	Star Tyres	Jul 04	5	2	5.0	−3.8
T356	Cinema Roof	Jul 04	6	4	12.3	2.2
T357	Fire Station	Aug 04	6	3	6.7	1.2
T358	Railway workshops	Aug 04	7	1	0.0	−7.7
T359	British Coal underpinning	Aug 04	13	5	15.0	1.0

Fig. 18.5 *Summary of tender results*

be achieved by deceiving the opposition but principally the specific objective is to be successful in winning contracts at prices which would allow the organization to carry out work profitably. A tendering strategy can be developed as a statement of aims, as follows:

1. To identify a suitable market in terms of type of work, size of contracts and geographical location.
2. To develop a reputation for safety, quality and speed of construction within economic limits.
3. To secure stated targets for turnover.
4. To evaluate the company's performance, and compare with that of its competitor.
5. To compare the financial performance of a project with the costs predicted at tender stage.

A contractor can improve his tendering efficiency with better marketing, and only accepting invitations to tender which meet clear guidelines. Most companies have criteria which include: for type of work, size and location of the project, risk to be transferred to the contractor and status of the client.

Finally, it is worth considering a different approach; that is to ignore the tender levels set by your competitors. Produce pricing levels which are right for your company and avoid playing the market. If prices fall below what you consider to be an economic level, look for other markets where margins can be preserved.

19 Action with the successful tender

Introduction

Gone are the days when the award of contract signalled the end of the estimator's contribution to a project. There are two important tasks to be performed: first, helping the construction team with procurement and technical advice during the mobilization period, and second, producing cost information which will form the budget for the job. The transfer of information has been improved dramatically with the introduction of computers. There are many estimating packages available, which can be used to produce tender allowances and later assist during the construction phase to control sub-contractors' payments and produce valuations for the client. The main advantage of using a computer is that an estimator can adjust his estimate to take account of the decisions made at the final review meeting and make post-tender adjustments which are sometimes agreed with the client following the vetting stage. For close financial control of a project, the site manager should be trusted with the detailed budget; he can then control the resources efficiently and contribute to a simple feedback system.

Information transfer

The estimator must take great care to produce accurate information in a form that is simple to understand. A checklist can be used to ensure the handover information is complete, such as:

1. Correspondence with the client.
2. Form of tender.
3. Priced bill of quantities.
4. Tender drawings and specifications.
5. Contractor's bill of allowances (adjusted rates).
6. Tender stage programme.
7. Pricing notes and resource schedules.
8. Project overheads schedule (adjusted following final review).

9. Sub-contractors' and suppliers' quotations.
10. Any other findings or assumptions which might include temporary works drawings, photographs, site layouts, minutes of meetings with specialists and the client, technical literature and site visit reports.

The item which needs the most effort is the contractor's bill of allowances because this gives the site manager the fully adjusted rates for the work. The changes made during the tender period must be applied to all the rates affected. It is not satisfactory, for example, to say to a site manager that the budget for concrete is as given in the client's bill less 5% which was an additional discount taken during the final review meeting plus a 20% addition to the waste allowance for concrete poured against the sides of excavations. No site manager has the time to trace such changes made by the estimator.

There has been a cynical view in the industry that an estimator's figures should not be made available to construction staff on site. There are three main reasons for this attitude:

1. The construction team should get the resources for the job at the lowest possible rates and not just beat the tender target figures.
2. There may be a security problem if the rates are open to view on site; a competitor may steal an advantage and sub-contractors could be upset if they had sight of the real allowances.
3. There may be problems with interpreting data, and staff can become confused when confronted with bills produced for different purposes.

A more subtle reason might be that some organizations like to adjust the financial targets as more is known about the job. As an example, a contracts manager might decide that a concrete pump will not be necessary for placing concrete and hopes the site manager has not seen this provision in the tender. This clearly shows a lack of confidence in the site manager and could adversely affect the financial control of the project.

The important point is that the site manager must appreciate the cost implications of the decisions made on site, particularly with the use of direct labour, the costs of materials and equipment and the value of sub-contracted work. The information provided by the estimator can be used:

1. To set bonus levels.
2. To produce forward costing data.
3. To quantify resources for planning exercises.
4. To examine the financial performance of a contract through historical costing methods.
5. To compare the final building costs with the tender budget.

The person on site will perform better if trusted with important information; he is then more likely to accept greater responsibility for the financial success of a project and contribute more effectively to the evaluation of future projects.

The extract from a bill of allowances given in Fig. 19.1 was produced by a computer package that was used by the estimator during the tender stage and the quantity surveyor during construction. It gives the true allowances to the site manager (columns a to d) and the rates submitted to the client in column e. The rates given to a client will differ from the tender allowances for many reasons. These include:

1. Changes are made to rates after the submission bill is inked in. For example, a site might be found for tipping surplus material, which reduces the rate for disposal. In extreme cases, the bill can be inked-in before the final review meeting. This would lead to many differences.
2. A proportion of overheads and profit may be included in the rates submitted to the client.
3. Money may have been moved to ensure early payments or to take advantage of mistakes in the bill; the true rates must be given to the site manager for cost control purposes.

There are, in effect, two bills of quantities – the client's bill for valuation purposes, sometimes called the 'selling' rates, and the contractor's bill for costs control, referred to as the budget, site allowances, buying rates or internal bill.

Before work can start on site, the construction manager will bring together all those associated with the contract. This internal pre-contract meeting is an opportunity for the estimator to introduce the scheme to the construction team and personally explain the contents of the handover package, and expand on the methods of construction, resources and organization used as the basis of the tender. The estimator will be given certain duties at this meeting, mainly to do with the transfer of information described earlier, checking the contract documents and he may be asked to take part in negotiations with sub-contractors appointed at the start of the project.

The CIOB Code of Estimating Practice recommends procedures for checking contract documents. The estimator must ensure the contract documents received for signature are identical to those which were used as the basis of the tender, and any amendments issued by the client during the tender stage have been correctly incorporated. Correspondence confirming post-tender negotiations may also be included if it helps clarify the basis of the agreement.

Feedback

Feedback is the weakest part of the estimating function. In practice, an estimator receives information about the actual costs of construction in a haphazard way

CB CONSTRUCTION LIMITED	**BILL OF ALLOWANCES**	Project name:	Fast Transport Ltd		
		Contract no:	94022	Date:	Aug 2004

Bill Ref:		Short description	Quantity	Site Allowances Lab (a)	Plt (b)	Mat (c)	Sub (d)	Rate	Total	Margin/ adjustmt	Client's bill Rate (e)	Total
3/9	A	Filling to excavations	18 m^3	2.13	2.06	14.23		18.42	331.52	−1.59	16.82	302.82
	B	Filling to soft spots	100 m^3	1.50	1.75	14.23		17.48	1 748.00	−2.19	15.29	1 529.40
	C	Level & compact exc	224 m^2	0.56	0.31			0.88	196.00	0.02	0.89	199.84
	D	Dust blinding and compact	2 890 m^2	0.30	0.30	0.60		1.20	3 468.00	−0.49	0.71	2 062.65
	E	Grout under baseplate	21 m^2	30.00		4.00		34.00	714.00	−0.86	33.14	695.88
	F	Plain conc 15N trench	76 m^3	15.25		52.20		67.45	5 126.20	1.37	68.82	5 230.55
	G	Plain conc 15N isol founds	4 m^3	16.25		53.60		69.85	279.40	0.25	70.10	280.39
		Page total	3/9	£3 035	£1 149	£7 679			£11 863	−£1 562		£10 302
3/10	A	Reinf conc 35N founds	52 m^3	14.31		60.75		75.06	3 903.25	−10.00	65.06	3 383.29
	B	Reinf conc 35N isol founds	5 m^3	15.81		62.53		78.34	391.71	−11.75	66.59	332.96
	C	Reinf conc 35N col casing	12 m^3	32.88		65.20		98.08	1 176.90	−10.71	87.37	1 048.40
	D	Fabric D49 wrapping	40 m^2	1.75		0.94		2.69	107.50	0.94	3.63	145.29
	E	Fabric A393 in slab	2 765 m^2	1.25		4.13		5.38	14 861.88	0.42	5.80	16 034.17
		Page total	3/10	£4 744		£15 697			£20 441	£503		£20 944

Fig. 19.1 *Extract from contractor's bill of allowances*

CB CONSTRUCTION LIMITED	Project name:	Fast Transport Limited
Sub-contracts placed	Date:	Mar 2005
	Contract no:	94022

	Trade	**Tender allowance**		**Contract placed**			
		Name	Allowance	Name	Order value	Projected value	Buying gain
1	Roof covering	Grange Roofing	16 400	Grange Roofing	14 760	14 760	1 640
2	Windows	Aliframe	25 500	Westpoint Windows	23 455	24 150	1 350
3	Plasterwork	McLaughlin	23 450	McLaughlin	25 670	25 670	−2 220.0
4	Partitions	Port Drylining	20 050	Port Drylining	20 050	20 050	–
5	Joinery	Robin Joinery	34 000	Robin Joinery	29 550	29 550	4 450
6	Ceilings	Wignall Hampton	19 800	Shrimpton Ceilings	18 600	18 600	1 200
7	Painting	T & G Jackman	12 300	not yet placed			
8	Floor coverings	ABA Furnishings	12 300	not yet placed			
9	Surfacing	Gatwick Plant	4 200	not yet placed			
10	Landscaping	no quote	7 600	not yet placed			
11	Mechanical	Moss and Lamont	39 100	Hutley Engineers	35 887	37 145	1 955
12	Electrical	Tate Electrics	31 900	Tate Electrics	31 900	31 900	–
		Total	**£2 46 600**			Total	**£8 375**

Fig. 19.2 *Comparison of sub-contracts placed with sub-contract allowances*

and usually hears, through a third party, about underestimated costs – rarely will he be told about high rates. So why are companies slow to set up procedures which would ensure feedback information is available to estimators? The following problems are often quoted:

1. Feedback information is historical.
2. Each project is different from the next.
3. Financial performance is determined by the effectiveness of the site management team.
4. An estimator uses constants, which are not always job specific.
5. A feedback system would be expensive to implement.
6. Market prices can change dramatically with little notice.
7. Confidential information is not available to site staff.

Buyers and site staff are sometimes reluctant to divulge the low prices they have achieved through aggressive procurement. Their fear is that if the estimator priced further work at these levels, it would be difficult to improve on the budget if the tender was successful.

It may be there is a middle course whereby a company can report on certain aspects of a job in progress, as follows:

1. The actual costs associated with project overheads could be written in a spare column on the schedule produced by the estimator.
2. Individual investigations can be carried out to find the actual waste of high value materials.
3. The average cost of employing certain categories of labour could be compared with the all-in rate used at tender stage.
4. The value of sub-contracts (and major material orders) which have been let can be entered on a comparison sheet (see Fig. 19.2). This would give management, and estimators, evidence of the buying margins which are available in the current market.
5. For small repetitive jobs, where detailed feedback is needed, an extra column could be inserted in the bill of allowances for the eventual costs to be added to each item. This is an obvious application for a computer using a tailor-made package or a spreadsheet program.

The relative importance of these investigations will depend on the estimator's need for information and the size of each contract. The benefits are that future estimates become more reliable and more accurately reflect the cost of construction work.

20 Computer-aided estimating

'*The paperless office*'

Introduction

The use of computers by estimators has grown steadily since the early 1980s when stand-alone computers were introduced to the desks of estimators. It has been difficult to measure improvements computers have brought to estimating performance. This is probably because the benefits come from additional facilities, which manual systems cannot provide. For example, resource costs can quickly be changed at any time with a computer system. If an estimate is produced manually, the estimator will know the approximate quantities of the significant resources and could make adjustments. Unfortunately these adjustments could not be made to all the items in a bill of quantities prior to submission with a tender.

For many projects, the estimating process begins with the receipt of tender documents. Despite many attempts to introduce standard formats for the exchange of information, contractors continue to receive bulky documents and are often denied bills of quantities either on electronic media or as electronic mail. Scanners can be used for inputting bills of quantities, but more sophisticated data transfer should be used in a modern construction industry. When contractors commission bills of quantities for plan and specification or design and build tenders, the estimator lays down appropriate protocols.

Early examples of computer-aided estimating software have been replaced with flexible systems, which do not attempt to replace the estimator's skills but allow the calculations to be structured and controlled with the added benefits of rapid calculations and computer-generated reports. If there is a standard piece of application software, it would be the spreadsheet, which has been adopted throughout the construction industry.

For larger organizations, computer-aided estimating systems are best implemented on 'central' computers, which allow estimators to work simultaneously on a project. Local networks can be installed using a Windows interface, which runs general-purpose software and specialist packages linked to shared printers.

The most exciting opportunities will come from a greater use of the Internet and online services. The estimator will no longer be restricted to the information on his desktop PC. Day-to-day correspondence is sent by e-mail, lists of suppliers can be accessed from interactive business directories, up-to-date technical libraries are available on a 'pay-as-you-view' basis and tender documents will be exchanged electronically.

Aims of computer-aided estimating

The computing debate has raised questions about the role of the estimator and whether estimators should change their methods to conform to computing techniques or should computers be used to mimic the way estimators have worked in the past? What appears to have happened is that estimators have developed their computing skills, not just in using estimating systems but adopting spreadsheet and database packages where appropriate; and the software specialists are beginning to respond to the needs of estimators with more flexible systems. There is still a market for the large database of standard items, probably in the bill production phase whether created by the private QS or contractor.

So why has it been so difficult to implement computer-aided systems in construction? There are certainly fewer packages available and many estimators have migrated to spreadsheets.

Estimators need to make decisions throughout the pricing stage, mainly because each project is different. The standard labour and plant outputs which the estimator has in mind are adjusted to suit the circumstances. The circumstances might include many variables such as distance from compound, ground conditions, depth below ground, plant available on site, item sizes, quality of workmanship, quantity (scope of work), degree of repetition, access and so on. The estimator clearly needs skills, which are judgement based, as well as the ability to work consistently at mechanical processes. The software must allow the estimator to exercise his judgement particularly when he is building up his rates for each job.

The general aims of computer-aided estimating are:

- To provide the estimator with a kit of tools which will enable him to save time and exercise his personal judgement within a given framework, with reasonable scope for flexibility and user ingenuity.
- To help the estimator in his role as the person who calculates the total net cost of the project, and those who have to make decisions based on the estimator's reports and allowances.
- To provide the opportunities for contractors to gain a commercial advantage over their competitors.
- To handle information electronically in order to produce less paperwork, provide faster access to data and costs summaries.
- To give access to up-to-date information from internal and external networks.
- To implement company procedures through standardization.

Software

Spreadsheets, word processors and databases are commonly used in an estimating office. Spreadsheets provide the framework for price lists, calculations and cost planning. A range of software is needed for tender presentations, which are much more sophisticated today. Clients expect contractors to demonstrate their capacity to work not only to a fixed price but also to a resourced programme and quality plan. Increasingly clients call for these details at tender stage. Fortunately this information can be produced quickly with word-processing, desktop publishing and graphics packages. But the real advantage is the facility to edit text and graphics in order to produce polished presentations.

In the past, the best buying advice given to anyone entering the computer marketplace was to choose the software first and then find the hardware to run it. Finding the right software is notoriously difficult because the benefits are intangible, especially in relation to your particular needs. So the answer must be to consider what you want to do; in other words start with what you know and work towards what you need to know. Then talk to other users to check reliability, customer support and functionality. The following list shows how software is used for common estimating tasks:

Application	Spreadsheet	Word processor	Database	Specialist package
Cost planning	X		X	X
Tender register	X	X	X	
List sub-contractors and suppliers	X	X	X	X
Enquiry letters		X	X	
Resource price lists	X		X	X
Calculate all-in rates	X			X
Produce standard bills for repetitious work	X			X
Bar schedules	X			X
Rate build-ups	X			X
Extend and total bills of quantity	X			X
Lists of company staff costs and plant	X			X
Calculate costs of fluctuations	X			X
Adjust for late quotations	X			X
Calculate/plot cashflow analysis	X			
Reports for management	X			X
Adjust individual resources				X
Adjust/distribute mark-up on rates	X			X
Gross bill for client	X			X
Bill of allowances for construction	X			X

- Spreadsheet (limited scope in comparison with a specialist package for estimating, but more flexible).
- Word-processor package.
- Database programme or package with database facilities.
- Specialist package for computer-aided estimating.

Electronic exchange of information

For traditional contracts, those based on drawings, specifications and bills of quantities, estimators will continue to receive printed documents, for the following reasons:

1. Contractors have various computer applications which are often incompatible with the source files.

2. Contract practice often dictates that the terms of an offer – the tender documents – are in writing, and signed.
3. There is a reluctance to pioneer the procedures needed to implement the electronic equivalent of tender documents.

Most effort has been concentrated on the main pricing document – the bill of quantities. This is because bills are generally produced on a computer and time can be saved, in the short tender period, by loading bill pages directly into contractors' systems.

In order to improve compatibility between PQS and estimating systems at tender stage, a collaborative project was set up in the mid-1990s to establish tender exchange standards. The Construction Industry Trading Electronically (CITE) initiative, as it is known, publishes a very simple set of rules for those writing (and electronically reading) bills of quantities. The format is based on a plain text file which can be loaded into general purpose software and specialist packages. CITE now provides standards for a range of applications including: invoices, orders and despatch notes.

In the absence of 'electronic' bills of quantity, contractors can feed pages into a scanner, and using text recognition software, load a complete document in far less time than can be achieved manually.

If an estimator does not need descriptions on his screen at tender stage, a printed bill can be input manually with the minimum amount of information needed to build up and control the estimate. The essential data are bill and page references, item references, quantities and units. It is common to enter a 'trade' or 'sort' code at the same time. The trade codes developed for coordinated project information (such as E10 for in-situ concrete) are very convenient because a bill of quantities measured under SMM7 uses the same system. A sort code gives the estimator the facility to print similar items, analyse them and price them together. This procedure is often referred to as 'trade' pricing, and allows others to help an estimator by pricing different trades for a project.

Some clients produce protected spreadsheets, which must be returned in support of a bid. The contractor must input his selling rates but is unable to change the text or formulae. In a similar way, cost plans submitted with bids for NHS Procure 21 and MOD Prime contracting must be based on standard spreadsheet templates. This ensures a consistent approach by all bidders, tenders are easier to compare and the templates can be used to develop cost plans, guaranteed maximum prices and cost control on site.

For design and build and plan and specification contracts a contractor will ensure that a bill of quantities is produced in a form which is wholly compatible with his estimating package. In many cases, the computer-aided estimating system will be used to generate the bill of quantities – a paper copy will not exist.

Reverse auctions

Organizations reduce costs through online reverse auctions. The auctions work by inviting suppliers to bid for contracts online. Bidders then try to undercut each other's offers, while maintaining the technical requirements of the products or services.

The construction industry has been criticized in the past for being slow to adopt electronic solutions to business needs, but in the case of reverse auctions construction companies have been purchasing goods and services since the late 1990s. Examples include the supply of company cars, mobile phones, and stationery. For large projects, this bidding method has been used for plant, building materials, joinery and standard components such as doors and windows.

Another leader in online bidding is the MoD which spends £9 billion a year through its logistics organization, and could become one of the largest procurers to use reverse auctions. The Royal Mail has started using electronic auctions to cut costs and improve value. The organization wants to process half of its annual £1.5 billion procurement spend through online auctions, but has initially set more modest targets of between £30 million and £100 million for 2003 as it starts to use the technology.

What are the features of reverse auctions?

- Reverse auctions are online competitions, with the bid prices (or relative positions in the bid) visible during the auction.
- Simple products or services where the marketplace is highly competitive are most suitable for reverse auctions, yet any item with clearly defined requirements and more than one source of supply should be considered.
- It is essential that advertisements for competitions to be run on a reverse auction basis state this clearly, along with the criteria for selection.
- The auction, when it takes place, should be conducted on the basis of price only.
- EU public procurement directives do not currently recognize the technique of reverse auctions, but are being amended to do so.

Reverse auctions, also known as 'online bidding', are a means of buying items or services against a published specification where pre-selected supply chain partners are invited to bid in an online auction. All bids made during the auction are published anonymously online, in the expectation that competitive pressure, when bidders see the prices bid, will force prices lower as the auction proceeds. With the exception of ranked auctions in which the bid amounts are not known to other bidders. The auction is time limited, but arrangements may be put in place to ensure that if a 'leading' bid is made very close to the timed completion of the auction further time is provided to allow other bids to ensure that the lowest price is obtained. A contract is then awarded to the lowest bidder based on the terms and conditions published at the outset, during the contractor pre-selection phase of the reverse auction.

Reverse auctions rely on competition driving prices down and it therefore follows that the less complex or specialized the goods or service being procured, the greater the chance for a successful auction. Simple commodity items or services which can be clearly defined and have a wide range of potential suppliers will be best suited to the auction process. However, in considering the use of reverse auctions, it is important to ensure that the principles underlying the existing procurement process, namely those of confidentiality, fairness and equity, are maintained.

It is essential that an advertisement for goods or services, where a reverse auction is being considered, clearly states:

- That the ultimate selection may be made on the basis of a reverse auction;
- The evaluation criteria, including any weighting between fixed elements and the variable element of price;
- Information on the process itself including details of any third party service provider;
- Conditions of bidding including the minimum decrements permitted;
- Equipment/technical issues.

Prior to conducting an auction it is necessary to state clearly the specification of the goods or services to be purchased and to pre-select supply chain partners. Pre-selection should cover issues such as technical ability, financial viability, previous industrial supplier history, quality etc. The purchaser must ensure that they are confident that any industrial supplier taking part in the auction will be able to meet their business commitments should they win the auction. Since it would be unreasonable to conduct further checks or negotiations once the auction commences this pre-selection process is crucial and should be undertaken with considerable rigour and well before the auction is due to take place.

The terms and conditions that will apply to the prospective contract must be stated at the outset and accepted by all prospective bidders. For overseas industrial partners, particular attention will be needed to deal with the issues of currency and timing. If the bid is not to be in sterling, the exchange rate will need to be agreed in advance of the auction using an exchange rate calculated in accordance with a pre-agreed mechanism.

EU directives tend to discourage repeat tendering, although it is unclear how this method should be classified. When the EU updates its policies for e-procurement, it is likely that they will make changes to directives to recognize this process.

The customer and supplier should be aware of the benefits of an electronic trading environment but recognize the commitment and responsibilities that arise from a powerful form of procurement. The customer needs to act fairly with accurate information and provide assistance with the invitation to tender; and the supplier must understand the process, and commitment if successful. It is therefore important that the customer selects an experienced IT service provider to assist in the conduct of the auction.

Computer-aided estimating packages

Estimators and their managers have not been slow to recognize the potential of computers to increase the efficiency of the estimating process, but during the 1980s and early 1990s were disappointed with the systems on offer and the problems of implementation. It could be said that contractors and software providers were looking at the problems from opposite perspectives. Contractors wanted software which would mimic their methods when in fact the systems were being developed to make best use of the hardware and programming techniques available. The result was a false start in computing because computers did not match users' expectations.

Some argue that software providers tackled the estimating challenge in the wrong way by creating huge databases of work items in order to mirror all the possible items that could be envisaged in a bill of quantities. This 'price library' approach is fine for taking off and pricing but is at conflict with the way estimators work, particularly when faced with pricing printed bills of quantity.

It is important to distinguish between contracts based on bills of quantities prepared by the client's quantity surveyor and those where only drawings and specifications are available and the estimator needs to assemble his own pricing document.

Printed bills of quantities often have thousands of work items which need to be matched with the coded descriptions in a computer library. This tedious task must be done by an experienced estimator who is also able to recognize and deal with rogue items. The library method can delay the pricing of printed bills of quantities. The counter-argument is that where a contractor carries out work in a certain sector of the construction market many of the work items repeat. The library can be used to build up a series of standard bills of quantities which would need minor changes on each estimate. Perhaps the best use of the library is the production of bills where the tender is based on a specification and drawings. The database of work items prompts the estimator with descriptions and guide prices. The items can be taken off in any order because the software will put the items into the sequence recommended by the standard method of measurement, and print trade bills for sub-contract enquiries.

By the end of the 1980s attempts were being made to answer many of the criticisms, as follows:

1. The software reverted to a 'shell' arrangement whereby estimators could create a database for the items in the current job only. They no longer attempt to build a comprehensive database for future projects (some standard bills will be kept if similar projects are expected).
2. The complex price build-ups have been replaced by simple resource calculations which have a common method of entry for all items of work, for example:

Amount	×	**Resource type**	×	**Cost**	=	**Rate**
0.14 (hours)		carpenter		12.50	=	1.75
1.00 (m)		100 × 50 wallplate		1.10	=	1.25

   The individual resources can be priced either during the entry of the work item or all the resources can be dealt with separately.
3. A system of menus is used to guide the estimator around the system and context-sensitive help screens bring relevant advice to the user whenever he needs it. 'Context-sensitive' refers to the way in which software will display helpful information about the command that is about to be carried out or may advise a user who is uncertain about how to continue.
4. More powerful computers are available with the latest microprocessors and high capacity storage devices with fast access times.
5. Menus, help screens and utilities can be called up on the screen using windows of information. Switching between windows allows the estimator to undertake various subsidiary tasks while he is working on the estimate. Data can be copied from one 'Windows' application to another.

The number of packages available to estimators has reduced since the start of the new millennium: there were too many providers in the market. Choosing software is still a very difficult process. There are few independent test reports. Claims made in the construction press for estimating packages give similar specifications but users know that their functionality, speed and reliability vary considerably and are very difficult to confirm. A short demonstration by a salesperson is not a reliable way to evaluate a system because deficiencies will be glossed over. It is important to ask about the facilities being offered by various suppliers, and write down which facilities will be of most benefit, see Fig. 20.1. It is unlikely that the software will meet all the needs of a company but some are more flexible in use than others. For example, there are some systems which store their data in database format, which can be output to other databases or sent to a word processor to produce high quality presentations.

Estimating systems may not be able to offer all the features listed in Fig. 20.1 and many estimators will not need all the features. An optical character recognition system will not be needed, for example, by an estimator who inputs bill items by reference to page and item numbers; a Direct Labour Organization may not need facilities for adding labour-only sub-contractors; a small company might not need a multi-user system; a trade specialist may not need a powerful sub-contract comparison system.

Clearly, estimating systems store a great deal of information about a project which can be linked to project planning, buying, valuation and accounting packages; in many ways this is what makes the use of computers worthwhile. The information

Main characteristics	Subsidiary characteristics
Hardware requirements	• Compatibility • Memory requirements • Muti-user systems • Optical character recognition • Digitizer facilities
Price	• Initial and annual charges • Upgrades • Telephone support
Method	• Entry of bill items (speed and convenience) • Data can be imported from spreadsheets • Library of standard text and build-ups • User-definable library
Help	• Free online help • Context-sensitive help screens • User manual
Reports	• Outputs fixed by software • Output designed by estimator • Speed of recalculation
Specific facilities	• Sub-contract and materials comparisons • Labour-only rates substitution for direct labour rates • Data can be transferred to a spreadsheet • On-screen calculator • Sort items by trade or user codes • Windows environment • Detection of unpriced items • Nested work assemblies • Recalculation/reporting speeds • Checking procedures

Fig. 20.1 *Features checklist for estimating packages*

produced at tender stage may need to be changed once a tender is successful. It would be unsafe to order materials, for example, from tender stage bills of quantities because the drawings may have changed. A project quantity surveyor would wish to insert item descriptions where the estimator did not.

Although many packages use a text-based environment, the Windows interface has become the accepted standard and for some organizations is the principal criterion in selecting a system. Many estimators have expressed their concern at the change to mouse driven software, because they believe it will slow down the entry of data. They may be blind to the advantages such as:

1. The facility to pick work items from a list which has been created for standard building types.
2. Multiple windows which can be opened within a program to show how changing the figures in one part of the program affect another. In Fig. 20.2 an estimator can see in one window the items he can select for his tender; in the other the selected items are growing into a bill of quantities.
3. A number of applications can be 'open' at any time. This means that information produced in one program can be copied into another. For example, an estimator

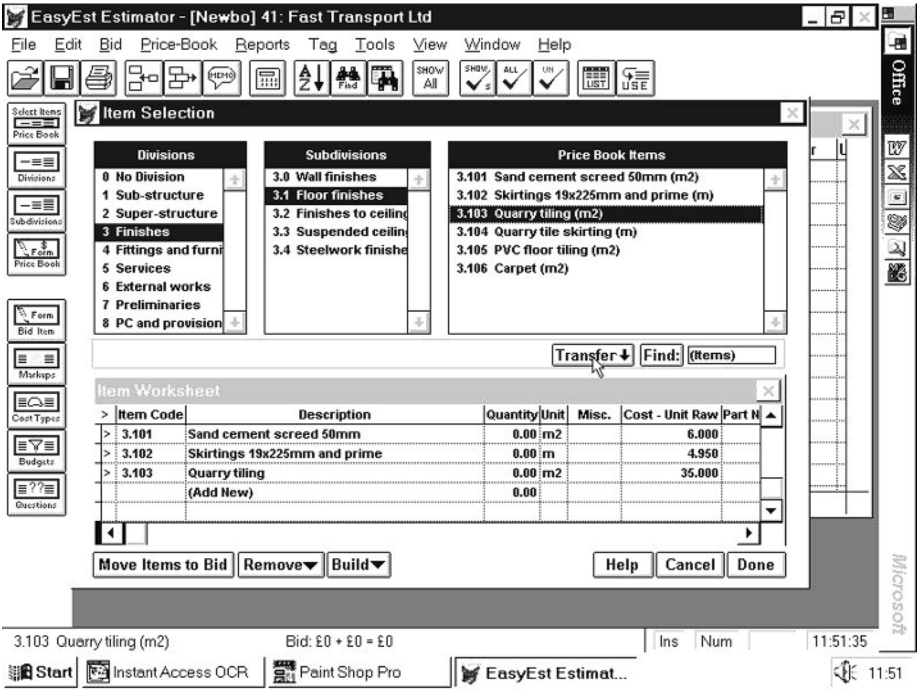


Fig. 20.2 *Creating a bill of quantities using a Windows program*

may price a bill of quantities using estimating software and list the items needed for project overheads in a spreadsheet designed for the purpose.
4. Estimators in future will develop skills in working within a single user interface where the instructions, menus and help facilities have a similar 'look and feel'.

There is a danger that people can be too concerned with generating data for its own sake. It is commonly said that 'information is an organization's most valuable asset', but do we always need so much information? Estimators are resigned to the fact that most of their reports are ignored once a job is won. There is nevertheless a clear advantage to be gained by making pricing data available to construction staff. The computer will produce the properly priced (net) bill, the commercially priced (gross) bill, and any number of (package or trade) bills for negotiations with sub-contractors. A schedule of material resources can be used by the purchasing department to set up orders with suppliers always remembering that the actual quantities will be determined on site when the construction drawings have been issued. It is worth remembering that computers reduce the clerical effort, reproduce data in a sorted form, but above all cannot do anything that you cannot do manually (in time).

General purpose software

A desktop computer can handle a vast range of programs and carry out thousands of different tasks. Most software can be purchased off-the-shelf either from a specialist producer or retailer. There are two main types of software: applications programs and systems programs. The kinds of programs available in each category are:

Applications programs
1. General purpose packages (e.g. word processors, spreadsheets, databases and document readers for pdf files).
2. Specialist packages (e.g. estimating, accounts and expert systems).

Systems programs
1. Operating systems (e.g. MS-DOS, Windows and UNIX).
2. Utility programs (e.g. anti-virus software).

One of the most difficult decisions for computer users is whether to buy specialist software which has been tailored for a particular application, or use general purpose programs such as spreadsheets and databases. For example, if an estimator wants to produce a small bill of quantities he can use a word processor, database or spreadsheet. He could alternatively decide to use a specialist bill production package.

Word processors, spreadsheets and databases are the most popular products in the general purpose software market, closely followed by computer-aided design and project planning.

Word processors

Word processing is an electronic means of making the task of writing easier than using a typewriter or pen and paper. The ease with which changes can be made to a document has helped estimators prepare professional-looking presentations without being competent typists. Any word processor software can reduce the time required to produce a complex typed document, because initial drafts can be edited and corrected so easily. The production of standard documents for enquiry letters, method statements and design/build presentations is much quicker since the introduction of computers and correspondence can be personalized with little effort.

It is not difficult to decide which program to buy. Most well-known packages are suitable for day-to-day use and offer many of the features listed above. Often the safe answer is to choose the market leader because the files will be compatible with many other systems and staff prefer to develop skills which will be widely accepted.

The estimator can make use of the basic word processor features for letters, method statements, quality statements and safety plans, and has particular needs for specification writing and bill production. In building, the National Building Specification is available as simple text files from NBS Services. The subscriber will find that most computer systems are supported by this service, both in terms of disk medium and software. Small bills of quantities are easier to produce using spreadsheet software but where a large unpriced bill is to be written, a word processor will accept many more pages of information. Normally, bill production packages use a database method which overcomes the size limitations.

Spreadsheets

The key ingredient which has led to the widespread acceptance of the personal computer, as something more than a clever typewriter, is the spreadsheet. It is simple to use, and does not try to change the way people undertake their calculations. Most of the repetitious work of an estimator could be computerized without the help of a programmer. The immediate benefit is the fast recalculation of cost plans, priced bills of quantities and data tables. Estimators can test the effect of changing parameters, often referred to as 'what if' calculations.

Some clients issue bills of quantities, or activity schedules, in spreadsheet format so that priced tender documents can be returned with the tender on CD-ROM or by e-mail.

Someone new to spreadsheets should start with those applications that lend themselves to the tabular presentation of data. The most elementary would be:

1. Look-up charts for reinforcement, brickwork, drainage and fixing ironmongery.
2. Small bills of quantities for composite items such as manholes, kerbs and simple house extensions.
3. Domestic sub-contractors' quotation analyses.
4. Early cost plans using costs from previous schemes.

After a little practice, the following could be attempted:

4. All-in hourly rate calculation.
5. Plant rate build-ups.
6. Bills of quantities for standard house types.
7. Look-up charts for more complex rates, such as formwork and disposal of surplus excavated material.

More advanced applications include:

1. Cashflow forecasts.
2. Project overheads schedules.
3. Bills of quantities for uncomplicated commercial and industrial buildings, and plant foundations.
4. Reinforcement schedules.

The examples shown in Figs 20.3 and 20.4 were produced by a groundworks sub-contractor to create quick look-up charts for pricing bills of quantities. The item highlighted in Fig. 20.3 shows the total rate for formwork to beams where the fix and strike time is 1.70 hours and the estimator expects four uses of the shutter. The highlighted cell in Fig. 20.4 is a rate for excavating 1 m of trench for a 150 mm diameter pipe, 1.75 m deep to invert including disposal to a tip 8 km from site.

The estimator can change any of the data at the top of the page and the total rates change within seconds. These applications show that a spreadsheet can closely mimic the traditional methods used to produce rates, but do so at much greater speed, with clear presentation; however, as with all computer methods these still need careful interpretation by an experienced estimator.

Anyone who is used to dealing with figures will soon be charmed with the power of such sophisticated software, and will be able to test various theories to arrive at the best condition or price. There are, however, many dangers awaiting the unwary estimator. The problems arise when:

1. The estimator who builds a spreadsheet model fails to produce a foolproof design, or carries out inadequate checks.

FORMWORK	Project:	LIFEBOAT STATION	DATE: JUN 04

ENTER BASIC DATA	
Carpenter (all-in rate/hr)	£12.50
Labourer (all-in rate/hr)	£9.50
Plywood cost per sheet	£20.00
Softwood cost per m^3	£200.00
Percentage additions	
LAB for travelling	0.00
for fluctuations	5.00
for o/heads & profit	10.00
for discount to MC	2.50
Total mark up on labour =	1.18
MAT/PLT for fluctuations	5.00
for o/heads & profit	10.00
for discount to MC	2.50
Total mark up for MAT/PLT =	1.18

ASSUMPTIONS

Waste %		9.00 ..%
Consumables	making	0.08 ..xcraft rate
	fixing	0.07 ..xcraft rate

	Founds	Soffit	Beams	Walls	Columns
make	0.80	0.50	1.00	0.95	0.80 ..hrs/m^2
timber	0.04	0.04	0.05	0.05	0.04 ..m^3/m^2
plant	0.44	4.00	1.10	1.05	0.85 ..£/m^2

Lab assist handling (hrs) 0.15 ..hrs/m^2

HOURS TO FIX AND STRIKE		1.20	1.30	1.40	1.50	1.60	1.70	2.00
ONE USE	Founds	46.88	49.23	51.59	53.94	56.29	58.94	64.25
	Soffits	47.39	49.76	52.13	54.50	56.87	59.53	64.86
	Beams	52.37	54.89	57.41	59.93	62.44	65.31	70.79
	Walls	51.70	54.19	56.69	59.19	61.69	64.52	69.98
	Columns	48.49	50.89	53.29	55.69	58.09	60.80	66.16
TWO USES	Founds	35.79	37.63	39.47	41.31	43.15	44.99	49.97
	Soffits	37.89	39.77	41.65	43.54	45.42	47.30	52.34
	Beams	39.26	41.17	43.08	44.99	46.90	48.81	53.90
	Walls	38.85	40.75	42.65	44.56	46.46	48.36	53.43
	Columns	36.92	38.78	40.64	42.50	44.37	46.23	51.24
THREE USES	Founds	31.18	32.80	34.41	36.03	37.64	39.25	43.83
	Soffits	33.94	35.58	37.23	38.87	40.51	42.15	46.75
	Beams	33.82	35.46	37.10	38.74	40.38	42.02	46.62
	Walls	33.52	35.15	36.79	38.43	40.07	41.70	46.30
	Columns	32.11	33.73	35.36	36.98	38.60	40.23	44.81
FOUR USES	Founds	28.76	30.24	31.72	33.20	34.68	36.16	40.60
	Soffits	31.87	33.35	34.83	36.31	37.79	39.27	43.71
	Beams	30.96	32.44	33.92	35.40	36.88	$\boxed{38.36}$	42.80
	Walls	30.72	32.20	33.68	35.15	36.63	38.11	42.55
	Columns	29.59	31.07	32.55	34.03	35.51	36.99	41.43
FIVE USES	Founds	27.21	28.69	30.17	31.65	33.13	34.61	39.05
	Soffits	30.54	32.02	33.50	34.98	36.46	37.94	42.38
	Beams	29.12	30.60	32.08	33.56	35.04	36.52	40.96
	Walls	28.92	30.40	31.88	33.36	34.84	36.32	40.76
	Columns	27.97	29.45	30.93	32.41	33.89	35.37	39.81
SIX USES	Founds	26.18	27.66	29.14	30.62	32.10	33.58	38.02
	Soffits	29.65	31.13	32.61	34.09	35.57	37.05	41.49
	Beams	27.90	29.38	30.86	32.34	33.82	35.30	39.74
	Walls	27.72	29.20	30.68	32.16	33.64	35.12	39.56
	Columns	26.89	28.37	29.85	31.33	32.81	34.29	38.73

Fig. 20.3 *Example of a spreadsheet template for formwork*

DRAINAGE	**Project:**	LIFEBOAT STATION	**Date:** JUN 04

ENTER BASIC DATA	rates/hr
Margin %	10
Labourer	£9.50
NWRA	£0.20
Excavator	£6.50
Fuel	£3.65
Operator plus rate	£0.40
Pump	£1.50
Compactor	£1.50
16t lorry (all-in)	£21.00

Assumption (can be changed)

	0–1.5m	1.75–2.75	3m+
Rate of dig m^3/hr	12	8	6
Earth support cost	£1.80	£2.10	£2.50
Grade and ram cost	£0.40	£0.45	£0.50

Distance to tip	....	8	km
Tip charges (or work to tip)	....	£7.00	/m^3

DRAIN EXCAVATION		Pipe sizes (mm) 100–150	225–300	375–450	525–600	675–750
DEPTH	width >	0.60	0.70	1.10	1.25	1.45
0.50		4.94	5.43	7.40	8.14	9.13
0.75		7.28	7.99	10.86	11.94	13.38
1.00		9.61	10.56	14.32	15.74	17.62
1.25		11.95	13.12	17.78	19.53	21.87
1.50		14.29	15.68	21.24	23.33	26.11
	width >	0.70	0.80	1.20	1.40	1.60
1.75		21.18	23.05	30.53	34.27	38.01
2.00		24.15	26.28	34.81	39.07	43.33
2.25		27.13	29.52	39.08	43.86	48.65
2.50		30.11	32.76	43.36	48.66	53.96
2.75		33.08	35.99	47.64	53.46	59.28
	width >	0.80	0.90	1.30	1.50	1.70
3.00		45.33	48.93	63.35	70.55	77.76
3.25		49.07	52.97	68.57	76.36	84.16
3.50		52.81	57.00	73.78	82.17	90.56
3.75		56.55	61.04	79.00	87.98	96.97
4.00		60.29	65.08	84.22	93.80	103.37

Fig. 20.4 *Example of a spreadsheet template for drainage excavation*

2. Another estimator inadvertently changes data in a model or erases a formula by entering a number in a formula cell.

Often a user is unable to spot mistakes in his own spreadsheet; he is more inclined to believe the results when they are presented on a computer printout. The effect of using inaccurate answers from such calculations could be ruinous in a tender. The following guidelines will help to prevent such errors:

1. Start by planning the general requirements with a sketch showing the labels and layout of the spreadsheet. The optimum size of a spreadsheet will depend on sensible file size for sending to recipients by e-mail, and the data an operator will want to see either on the screen or close to the edges. Information can be broken down into a number of worksheets within a single workbook.
2. Adopt a modular approach whereby the layout will include separate identifiable sections, such as:
   (a) An instruction portion.
   (b) An area where the user can change data freely.
   (c) The results or summary section.

   These sections could be created in different (but linked) files, on pages of a multiple spreadsheet, or in different parts of the screen display.
3. Protect formulae from accidental erasure or amendment, by putting them in the results area of the spreadsheet. It is also possible to make a formula secure by using the password protection feature found on most versions of the program.
4. Check that the numbers representing money are not only rounded to two decimal places for display purposes but also for subsequent calculations in the model. The reason for this check is that although the spreadsheet has been instructed to show two decimal places it usually keeps a more accurate number in the computer's memory.
5. Carry out simple checks using data from previous manual systems. Other estimators could be asked to test the model to find any bugs or misleading instructions.

Above all, where more than one person is going to use the spreadsheet, keep the design simple.

Spreadsheet programs now offer a safe choice for organizations which recognize the need to introduce computers to their staff cautiously and at low cost. They are powerful in the rapid production of cost information which is usually in tabular form. The estimator can create spreadsheets which are an amalgam of his expert knowledge by holding the production information which he has collected.

Once a format has been created (and saved) for a particular purpose, it is referred to as a template. This is because the layout and formulae will usually be fixed, but the data variables can be changed.

Most estimators will be inspired to extend the range of applications and build a valuable selection of templates, to suit their own needs and methods of working. On average an estimator will take about six hours to build a template if he is familiar with the software.

Databases

A database is a computerized filing system, the electronic equivalent of a card index or filing cabinet. A database program allows the user to file information and retrieve it in many ways. Perhaps the most common example is a list of names and addresses. When a list has been built up it is called a *file* of data. A file can be displayed as a list on the screen, sorted into order, searched for individual pieces of information and printed. Figure 20.5 shows a typical *record* which is the basic building block of a database. Each record contains a number of *fields* of information, such as the name field or postcode field.

A simple database can be set up in a few hours. The user first designs the layout for the record screen defining the fields which are needed. Second, the program can be used to produce printouts in different formats. For example, an address file could be printed with a list of names in the first column and telephone numbers in the next. Before printing lists of data, the program could be asked to sort all the records into alphabetical order; or search for all the suppliers in a particular town or district. The program can also create and store a standard letter so that names and addresses can be merged with text to prepare letters for a selective mail shot, for example. More powerful packages offer much greater scope for

Fig. 20.5 *Terms used in a simple database program*

manipulating and analysing data and include their own programming language used to develop more sophisticated applications.

The range of applications is large in an estimator's office, from elementary filing tasks to the complex manipulation of data. Examples include:

1. Address lists for suppliers and sub-contractors.
2. Drawing registers.
3. Tender registers.
4. Marketing information.
5. Cost planning data.
6. Bill production and pricing.

There are many national databases available to construction organizations using an Internet connection. Usually the user is expected to pay an annual subscription. Estimators seldom develop database applications because the most common database functions (sort and search, for example) are readily provided in spreadsheets.

Planning

It would be quite straightforward to produce tender programmes using paper, pencil and a calculator. An estimator's programme is rarely used during the construction phase but will be an important tool to assess project overheads and undertake a cashflow analysis. Where a planning engineer produces the preliminary programme, the continuity is likely to be stronger and the programme may well form the basis of a control/monitoring document.

There are several reasons for using project planning software to aid manual systems at tender stage:

1. It may be easier to keep complex projects under control.
2. The program will calculate resource loadings and plot resource histograms.
3. The critical activities can be identified which might affect the workforce levels used for pricing.
4. High quality charts and clear presentations could impress a client at tender stage.

There are many planning packages available today; some such as CS Project give a wide range of powerful features and flexibility to implement the software in different ways. There are others that offer the most common features at lower cost. 'PowerProject' or 'MS Project', for example, both have excellent presentation features and yet are easy to use. The estimator will look for software which will show the overall project duration (starting from submission of tender) highlight critical activities and allow labour and plant resources to be analysed.

Graphics

Graphical software is used for three main purposes:

1. Business graphics – the graphical representation of data drawn from information in a spreadsheet or database.
2. Desktop publishing – the in-house design and publication of leaflets and forms, usually with the aid of a laser printer.
3. Computer-aided design (CAD) usually output to high quality plotter.

It is estimated that 60% of the total cost of design work is attributable to freehand drawing and detailed line drawing. For this reason CAD has become popular with consultants and contractors alike. The production gain depends on the type of work being designed and the degree of repetition; the estimate for construction is in the range 2:1 to 15:1. The main problem is that the initial investment can be very high. On top of the cost of workstations and plotters must be added a large investment in training. Training and lost productivity can cost as much as hardware and software.

There are many software packages available for desktop computers, to do simple line drawing, rendering and 3D modelling. Industry leaders AutoDesk produce the AutoCAD design package with an architectural add-in, which incorporates the symbol and layering conventions of BS1192. Most packages offer features such as the ability to scale drawings up and down in size, adding text and dimensions, keeping shape libraries, and of interest to an estimator is the ability to attach prices to certain items within a drawing.

Document readers

The most common type of document reader is free software for viewing and printing Portable Document Format (PDF) files. Adobe Reader® version 6.0, for example, can also be used for viewing high fidelity *ebooks* for Windows, Palm and Pocket PC platforms.

Portable document format is widely used for issuing tender documents on CD-ROM or by e-mail. As a means of communicating formal documents it has the following advantages:

1. Information cannot normally be edited.
2. Pages can be indexed and accessed by hyper-links embedded in text.
3. Password protection prevents unauthorized access.

Shareware and low-cost software

Choosing an estimating system for an organization is a difficult task which fills some purchasers with fear. A few system providers lend their prospective clients a system for on-site evaluation and a small number sell a demonstration disk. There is another group of software, called shareware, mainly written in the USA, which is distributed on a 'try before you buy' basis. Shareware software may be copied and distributed freely, but if after trying the program, you find a need for it, you are asked to contribute towards the cost of development by registering your copy with the author. Because shareware authors have low advertising budgets and few employees, the registration fee is low and always lower than comparable commercial software. For educational establishments, the attractions of shareware are obvious. Students can copy the software which they use on the college computers for use at home, and for a small fee can register their program and receive a manual and the latest update. Great care is needed, though, where software is exchanged freely because this is a cause of viruses infecting computers.

For general purpose use there are some excellent shareware and low cost estimating systems, spreadsheets and word processors available which can be evaluated and used with very little financial outlay. The quality of specialist estimating (bidding) software is questionable for construction in the UK. Many of the programs have been written for specialist trades such as sheet metal workers or electrical sub-contractors. When you find a comprehensive program, such as PC-Estimator, you will not be able to use the cost database because it uses the American CSI format and prices. This will be of interest to anyone looking into the cost of building in the US, and all the rates can be changed if you wish to tailor the system to your needs. The most serious omissions from low-cost software are:

1. Sub-contractors' quotations cannot be entered against a group of items (comparison system) and the software will not transfer sub-contract rates to the tender automatically.
2. There are no material schedules. Rates for materials are entered into standard build-ups, or when the estimate is produced.
3. The facility to add a waste factor is missing; presumably waste must be part of the basic material rates.

These are significant problems. There are, however, some useful functions which are not always available in full-price packages.

Hardware

A basic computer system is made up of the computer itself, a keyboard, monitor and storage devices including at least one floppy disk drive and a hard disk drive.

An estimator will need to add some 'peripheral' devices to suit the demands of the software he is going to use and the need to produce quality presentations. A 'desktop' personal computer (PC) is characterized by the 'three-box' design; the system unit, monitor and keyboard. Laptop computers now offer the power of a PC including a 3.5″ disk drive, hard disk, high resolution LCD screen and CD-ROM.

A typical specification for a desktop computer is shown in Fig. 20.6. Most of these facilities are available in a laptop computer, but at a higher price. A laptop computer can be justified for an estimator working at different offices and at home.

The most important part of a computer system is the software, because it is this that dictates what can and cannot be done. On the other hand, now that there is a vast range of software which can run on a standard microcomputer, people prefer to select the PC first. Of the distinct groups of computer available today, the most popular is the IBM compatible. In design offices, there is still a loyal band of Apple Mac users who require enhanced graphic production facilities. As computers continue to become more powerful, and new software is written to make use of the increased power, a computer buyer should consider getting an upgradable PC. Many manufacturers offer PCs designed to allow the motherboard and the processor to be easily removed and replaced.

The optional devices, called 'peripheral' because they operate outside the central processing unit, will depend on what the computer will be used for, what software will be run on it, and to some extent the PC configuration such as the type of display. The most important output device is the printer, which will be either an inkjet (colour) or laser (black and white) printer. For estimating reports, laser printers offer quicker printing (up to 12 pages per minute) and higher capacity refills. Laser printers take data from the PC and build up an image of the page in their own internal memory. When the image is complete, the page is printed by firing a laser on a photosensitive drum. The process is then similar to that of a photocopier.

There has been much interest in input devices which can save estimators time. The obvious solution would be to send contractors bills of quantities in a standard format, on a CD-ROM or as a file sent electronically with an e-mail. Efforts have been made to use optical character recognition software, but checking and correcting documents can be very time consuming.

If an estimator wants to input a printed bill of quantities into an estimating system he will usually enter the item references and a shortened description. Sometimes a full copy of a bill is input using an optical character reader. Optical character recognition (OCR) software is able to recognize characters on a piece of paper and reproduce the text in an estimating program, database or word processor. There is some concern in the construction industry that time must be set aside for checking the computer version of the bill and the use of an OCR device is not worthwhile until the benefits are clear and the technology improves. Others have predicted that scanners will gradually disappear from use because electronic data transfer is so much quicker.

1	3600 MHz processor
2	1024 MB DDR RAM
3	1.44 MB 3.5" floppy disk drive
4	160 GB 7200 rpm hard disk drive
5	DVD-ROM drive/52 × CD Re-writer drive
6	128 MB graphics card
7	17" TFT flat screen monitor
8	5 free PCI expansion slots
9	350 W power supply
10	56k V92 Modem
11	10/100 ethernet for networking
12	4 USB2 ports
13	Microsoft compatible wheel optical mouse

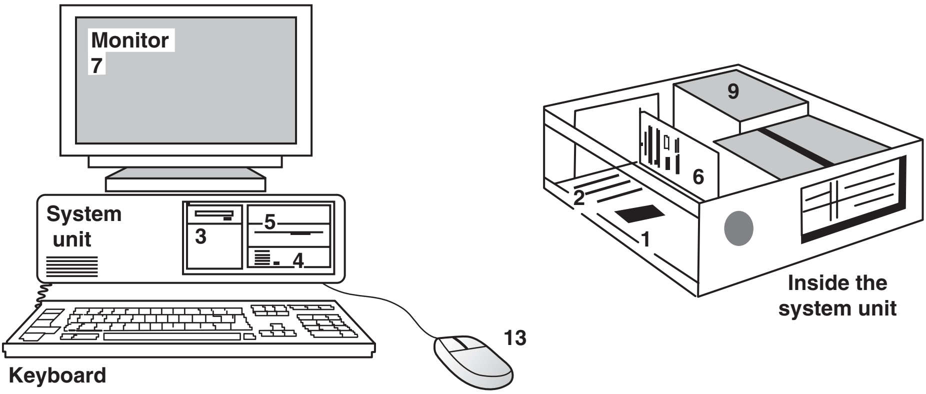


Fig. 20.6 *Typical specification for a desktop computer*

A digitizer is used to take measurements from a drawing. Some of the features of a digitizer are:

1. Automatic scale adjustment – useful if the software with a digitizer can accurately compensate for reduced or photocopied plans based on known dimensions found on a drawing.

2. Calculation modes to measure irregular shapes and angles.
3. Compatibility with existing equipment and spreadsheets.
4. Automatic transfer of measurements to quantity field in database.
5. Switchable between imperial and metric scales.

The digitizer software is usually menu-driven using an overlay window over the taking-off program. An audit trail can be kept of every measurement so the take-off can be checked manually.

Mass-produced software is distributed on CD-ROMs. 'CD-ROM', which is an acronym for Compact Disc Read-Only Memory, uses the same technology as audio music discs. A 12 cm disc can hold up to 600 Mbytes of data – the equivalent of over 400 average capacity floppy disks. The term Read-Only Memory means the user cannot modify the CD to add or change data. CD-ROM drives, which can write and read data, are generally available but many use disks that can only be used once. The potential of CD-ROM technology is exciting, not only because of the vast amounts of data which can be stored on a single disc, but the data can represent anything from basic text files and graphics to moving video images and sound, making CD-ROM a powerful information medium.

Networking

What is the networking revolution and how does it affect businesses today? The aim is to maintain a competitive edge by making use of the latest information through investing in new technology. A network can be seen as two or more computers linked together, sharing data files, software applications, hardware (including printers and backup devices) and links outside the office.

Electronic mail can be received while the estimator is working on a tender; other estimators can be inputting data for the current estimate and the buyer can access relevant items for enquiries to be sent to suppliers and sub-contractors – electronically. This is all achieved by storing information electronically with a corresponding reduction in handling and sending copies of project documents.

Where networks link computers within a limited area, such as within an estimating department, or head office building, it is called a Local Area Network (LAN). If an organization is linked to outside networks, the transition is seamless, and information can be shared with anyone, regardless of location across the world. By linking the network in this way, a Wide Area Network (WAN) is created.

There were many examples in the 1980s and early 1990s of estimators and buyers creating their own databases of names and addresses, for example, but other PC users could not share the information. For a large company, the benefits of networking include rapid communication throughout the organization (usually by e-mail) and the sharing of equipment such as printers, scanners and backup devices. In addition this leads to lower maintenance and IT management costs.

Electronic mail (e-mail) is a cheap and quick means of sending messages to colleagues, customers and suppliers. Messages can be left for others to read either because they are not available or the information is urgently required in written form. With a couple of simple menu selections e-mail can also be copied to a number of people within an organization. Estimators can obtain late specifications or bill pages as an attachment to an e-mail message. This facility is commonly used by estimators to assemble specifications and in-house designs for design and build tenders. There may be a project programme to incorporate in a presentation document and CVs can be sent from the personnel department. All this data can be received electronically and assembled on a computer, to produce a presentation document to accompany a tender.

Voice mail, although not strictly networking, provides for the storage of simple messages when people are away from their desks for holidays or meetings. Telephone answering can be provided for all extensions in an office, each person providing an individual greeting.

For any system, hardware components can be added to existing desktop PCs to create a network. Most networks have a central computer called a 'server' and all desktop computers connect to it. The server stores the application software and data files. Each desktop computer (client) is linked to the server in order to access files and applications. In a busy estimating office it is important that each estimator has access to any tender – from his desk – and the software is installed on the server. It is therefore far simpler to install updated software in one location and anyone who has difficulty meeting tender dates can call for help from colleagues. The network can reduce investment in a wide range of peripherals including printers, scanners, CD-ROM drives and backup devices since very often only one of each is required.

For access to millions of computers throughout the world, and information provided by millions of organizations, the Internet represents an enormous resource, in two ways:

1. By access to the World Wide Web (WWW) a contractor can access 'pages' which can contain all sorts of media including: pictures, text, sounds and video. The WWW provides a service which is open and easily accessible to anyone. In order to assist users in finding information on a particular subject, in such a vast system, there are search engines such as Google, which will help to locate web pages with relevant data. Estimators often need up-to-date directories in order to find company information and technical literature. They no longer need shelves filled with telephone directories and technical libraries.
2. By expanding a local e-mail service beyond the company network, communication can be made with any customer, consultant, supplier, trade contractor or satellite office which has Internet access.

The construction industry has been slow to embrace e-commerce (business carried out by means of networks, mainly the Internet). The UK Government and national trade associations are looking at strategies to educate all members in the supply chain to embrace the benefits of trading electronically. As with most initiatives, the Government has to lead by example, and has started by making most of its services available online. As a major client of the construction industry, the Government has set targets for procuring its goods electronically.

Implementation

Computer-aided estimating is not a single program or technique but the development of opportunities provided by the computer and software providers. This development will take place under the guidance of an information technology strategy produced by the organization's business managers.

A chief estimator needs to look at what the company is doing now and what it hopes to achieve in the future. He might ask himself these questions and put the answers in order of priority:

1. Why use computers?
   - To communicate with clients, consultants and suppliers.
   - To produce post-tender data.
   - To build up an accurate estimate of cost.
   - To allow tender adjustments to be made to an estimate, conveniently and accurately.
   - To reduce manual calculations.
   - To store standard models of bills and cost plans.
2. What are the basic needs?
   - Flexibility with different tender documentation.
   - Flexibility for projects with different time-scales.
   - Networking including access to e-mail and the Internet.
   - Hardware/software compatibility.
   - Uniformity of reports for basic resources, review meetings and post-tender allowances.
3. How do I select a system?
   - Attend a sales exhibition.
   - Ask for technical literature.
   - Find out what the estimators want.
   - Tell a supplier what you want.
   - Consult an independent expert.
   - Speak to other chief estimators.

4. What is *not* wanted?
   - Long, meaningless item code numbers.
   - Too many menus to change resources.
   - Long recalculation times.
5. What *is* wanted?
   - Company-specific reports.
   - Windows.
   - Context-sensitive help windows.
   - Rapid editing and deleting of bill items and prices.
   - Powerful sub-contract comparison system.
   - Laser printer support.
   - Checking for unpriced items.
   - Clear reference manual.

One of the most difficult decisions is the scope of implementation. Should all estimators be introduced to new software, at the same time? Can there be a combination of general purpose and specialist packages? No one solution will suit all organizations. Early attempts at implementation brought many difficulties and a cautious, flexible and evolutionary approach became the favoured solution. Now a full commitment is needed to install a networked system linked to valuation, costing and reporting software.

There will be some estimators who readily take to computers with the minimum of help; others might need training which can be conducted in-house or at a local college. A general understanding of desktop computing is a valuable skill, which is beginning to appear in new entrants to the industry. Estimators have not been slow to recognize the benefits of computers as an aid to their work but have been cautious about the systems offered in the early days of personal computing.

The future

Computers are already an integral part of the estimating process. They help with the calculations and analysis of estimates, and produce clear reports for the construction team where the tender has been successful. Computer systems for estimating will gradually develop with the introduction of better hardware and user-friendly software. The first dramatic change will happen when tender documents (drawings, schedules or bills of quantities) are communicated to the contractor electronically. The two obstacles are training and compatibility of consultants' and contractors' systems.

Training is as important for the client's advisers as it is for estimators. Now that general purpose software is available in most offices, the most successful developments are where people's enthusiasm is channelled to speed up the operation of the company's procedures. Since computing skills are better taught through practical examples, training can take place at work without the need for time off at college. Clearly all estimators must have some computing skills and should feel comfortable using general purpose software.

Both quantity surveyors and estimators have made a start but have approached the tender process from different standpoints. Quantity surveyors are naturally concerned with describing and quantifying the items of work for a project and the contractor needs to attach resources and prices to it. So quantity surveying software is designed to handle lists of work items in a structured form, whereas the estimator uses lists of resources which he can assign to the work. Coding methods have been tried but no common numbering system has emerged for general use and people resist codes as a way of entering and finding items. The answer might be for consultants to list activities using database software, and the database program would be distributed with the data. The contractor could then select items for sending to sub-contractors and price the rest of the work without the need for his own software. The main benefits would be:

1. The time saved by the contractors entering bills of quantities into their computers.
2. Amendments could be sent on disk or by electronic mail.
3. Priced bills could be returned with the tender in the form of a database file which would be transferred to a spreadsheet for checking and analysis of rates, and cashflow predictions.
4. The database file would be used for valuation purposes during construction.

This idea is not new, and has been pioneered by some consultants, mainly in civil engineering. The main obstacle is the use by contractors of different computer-aided estimating software which is often linked to cost reporting systems. Contractors would also be reluctant to submit all their calculations used to build up a tender.

There are several questions for the future which are constantly raised:

1. *Will computers replace estimators?*
   There have not been any reports of computers successfully replacing estimators but the information produced by estimators can be more comprehensive, and complex changes can be made to the estimate before the tender is submitted. There are many duties of an estimator which computers cannot replace: in particular the many decisions made at each stage of a tender, site visits, discussions with sub-contractors, interpretation of ground conditions, access restrictions, best use of resources, and so on. Clearly the role of the estimator and his assistant is changing to adapt to the use of computers (see Fig. 20.7). The estimator will have time to produce more estimates or look in greater depth at the methods and resources for the contracts he wants to win.

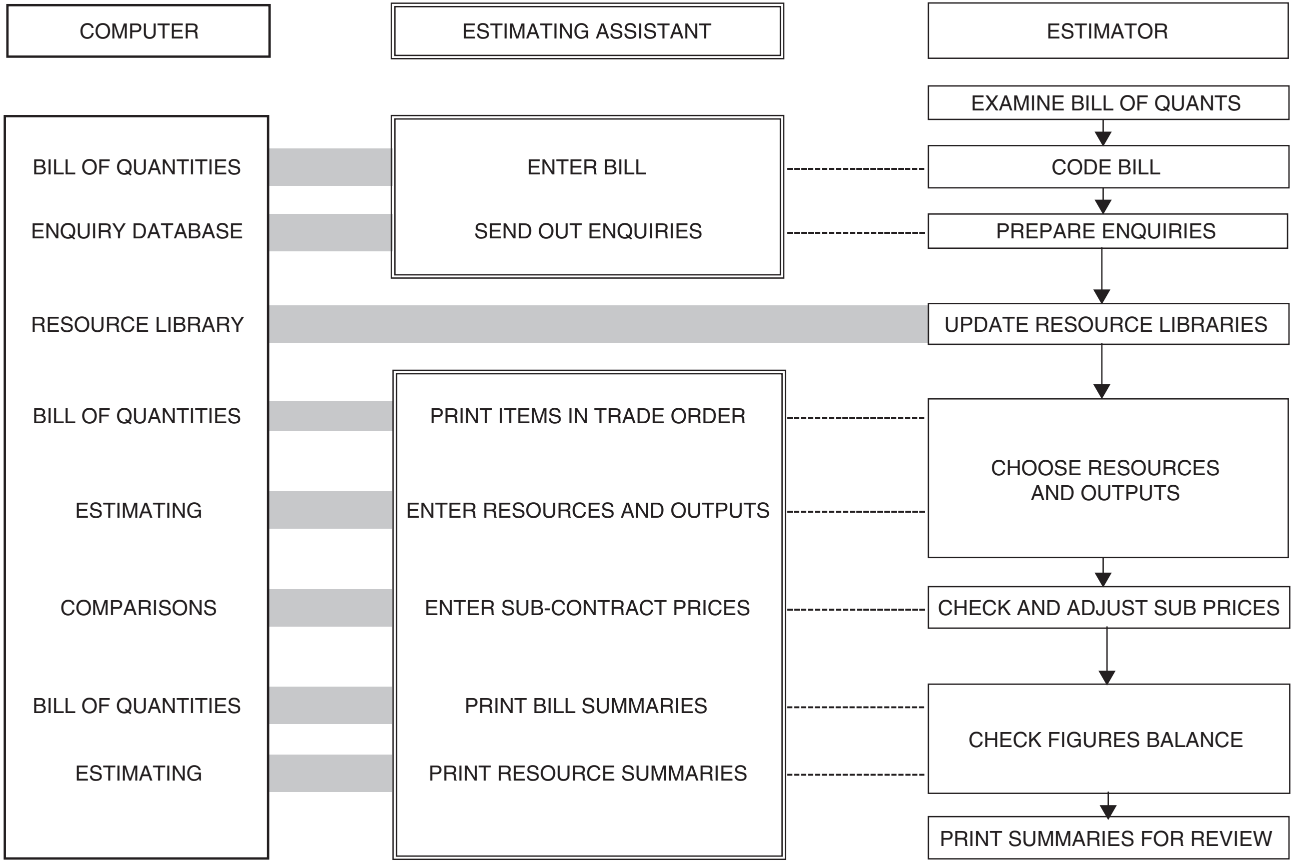


Fig. 20.7 *The roles of the estimator and estimating assistant using computer systems*

2. *Are computer systems appropriate for operational estimating?*
   At the heart of most computer-aided estimating systems is the facility to price individual items of work, as listed in the bill of quantities. This method is well understood for building work but is difficult to use when a group of items must be priced as a single operation. An alternative approach for some civil engineering projects may be the use of resourced programmes generated with planning software. In this way, resources attached to each activity are scheduled and costed without the need to produce unit rates. If a conventional estimating package is used, it will produce resource summaries, which can be compared with a resourced programme. For example, the computer might show that an excavator has been allowed for one and a half weeks on a contract which clearly needs an excavator for two weeks. This information was difficult to draw out of the pricing notes using manual methods.

3. *How will expert systems aid the estimator?*
   In simple terms, an expert system can be described as having three parts: a user interface, a knowledge base (containing facts, rules and questions) and an inference engine which can draw on the knowledge base to make deductions about a particular problem. There have been few off-the-shelf expert system shells designed for the PC. A shell, comprising the user interface and inference engine, enables the user to input the knowledge part of a system.

   In estimating, expert systems have been developed for early cost planning of industrial and commercial buildings. A client or his professional adviser can build up a cost model of a proposed building by answering a series of preselected questions, in a similar way to the many fault diagnosis systems used in engineering and medicine. This approach could be used for some of the important decisions made by estimators and managers. The construction industry has been slow to exploit expert systems and it is unlikely that they will replace general purpose and estimating software. Estimators will continue to use spreadsheets and database systems to schedule and price construction work.

4. *What do estimators want?*
   Advances in technology will please estimators when large flat screens will replace CRT monitors; CD-ROMs and the Internet will be used to look up supplier and sub-contractor's details and price lists; bills of quantities will be received electronically or on disk and tenders will be submitted in the same way. Journals will print independent test reports of estimating software, and eventually voice recognition systems will allow estimators to talk to their computers doing away with the typewriter keyboard and other electronic input devices. This could be impractical, of course, in open-plan offices.

Clearly, the implementation of computers to aid the estimating function has not been easy. In fact there is evidence that some contractors have abandoned their early attempts at introducing estimating systems and are now waiting for evidence of clear improvements before making a new start in computer-aided estimating. What they must recognize is that with greatly enhanced hardware many of the drawbacks of database estimating software have disappeared.

For some contractors, estimating software is used to produce site budgets only on those tenders that are successful, that is after the tender has been submitted. This is not as absurd as it seems. The effort required to get the bill of quantities in the computer is much more worthwhile if the bid is successful and every part of the tender can be allocated to sub-contract or direct work packages. All the adjustments made during the final review meeting can be incorporated in the costs and clear printouts can be produced for the construction team.

It is perhaps ironic that many of the industry's commentators greeted the last two decades of the twentieth century as the time when the construction industry would see an end to the use of bills of quantities and the emergence of computer systems which could replace much of the work of estimators. We now know that both these predictions were wrong. Bills of quantities remain in everyday use and it is still difficult to form a clear computing strategy for estimating.

Estimators will continue to develop their computing skills but they will not have one computer system which will meet all their needs. Experience now tells us that computers will not replace estimators; they will always be needed to predict with a reasonable degree of accuracy the costs of construction. What might change is their name and in some instances their status. With the drive towards greater economy, some estimating duties will be carried out by clerks, assistants and specialist buyers. On the other hand, the range of skills required by an estimator has grown. He needs to manage a team which includes quantity surveying, operational and purchasing staff, for projects using a variety of contracts. The aim is to establish the sum of money, time and other conditions required to complete the specified construction work.

For bigger projects, estimating is undergoing two changes:

1. Cost planning is taking the place of bills of quantities and analytical pricing.
2. Projects managers are managing bids and providing the interface with the client.

With these changes, estimating software needs to provide for the needs of approximate estimating techniques, there will be far less form-filling during the tender period, and all written communications will be by e-mail.

Further reading

Aqua Group (1999) *Tenders and Contracts for Building*, 2nd edition, Blackwell Science

Aqua Group (2002) *Pre-contract practice and contract administration for the building team*, 8th edition, Blackwell Science

Ashworth, A. and Skitmore, R.M. (1982) Accuracy in estimating. Occasional Paper No. 27, the Chartered Institute of Building

Ashworth, A. and Willis, J. (2002) *Pre-contract studies development economics, tendering and estimating*, Blackwell Science

Ashworth, A. (1999) *Cost studies of buildings*, Pearson Higher Education

Buchan, R., Grant, F. and Fleming, E. (2003) *Estimating for Builders and Quantity Surveyors*, 2nd edition, Butterworth-Heinemann

Chartered Institute of Building (1978) *Information required before estimating: a code of procedure supplementing the code of estimating practice*

Chartered Institute of Building (1981) *The Practice of Estimating* (compiled and edited by P. Harlow)

Chartered Institute of Building (1997) *Code of Estimating Practice*, 6th edition. Co-published with Addison Wesley Longman

Chartered Institute of Building (1987) *Code of Estimating Practice*, Supplement No. 1, *Refurbishment and modernization*

Chartered Institute of Building (1988) *Code of Estimating Practice*, Supplement No. 2, *Design and build*

Chartered Institute of Building (1989) *Code of Estimating Practice*, Supplement No. 3, *Management contracting*

Chartered Institute of Building (1993) *Code of Estimating Practice*, Supplement No. 4, *Post-tender use of estimating information*

Civil Engineering Standard Method of Measurement (1991) 3rd edition, Thomas Telford

Co-ordinating Committee for Project Information (1987) *Co-ordinated Project Information for Building Works, a guide with examples* (this and other CPI documents may be obtained from BEC Publications, RIBA Publications or Surveyor's Bookshop)

Cook, A.E. (1991) *Construction Tendering: Theory and practice*, Batsford

Cross, D.M.G. (1990) *Builders' Estimating Data*, Heinemann-Newnes

Department of the Environment PSA (1987) *Significant Items Estimating* (produced by the Directorate of Building and Quantity Surveying Services), HMSO

Farrow, J.-J. (1984) *Tendering – an applied science*, Occasional Paper, 2nd edition, the Chartered Institute of Building

Franks, J. (1996) *Building Procurement Systems*, the Chartered Institute of Building

Griffith, A. (2003) *Best practice tendering for design and build projects*, Thomas Telford

Kwakye, A.A. (1994) *Understanding Tendering and Estimating*, Gower

Latham, Sir Michael (1994) *Constructing the Team* (joint review of procurement and contractual arrangements in the United Kingdom construction industry), HMSO

McCaffer, R. and Baldwin, A. (1991) *Estimating and Tendering for Civil Engineering Works*, 2nd edition, BSP

Ministry of Public Building and Works (1964) *The placing and management of contracts for building and civil engineering work* (report of the committee. Chairman: Sir Harold Banwell), HMSO

Ministry of Works (1944) *The placing and management of building contracts* (report of the committee. Chairman: Sir Ernest Simon), HMSO

Sher, W. (1997) *Computer-aided Estimating: A Guide to Good Practice*, Addison Wesley Longman

Skitmore, R.M. (1989) *Contract Bidding in Construction: Strategic management and modelling*, Longman Scientific & Technical

Smith, A.J. (1995) *Estimating, Tendering and Bidding for Construction*, Macmillan

Smith, R.C. (1986) *Estimating and Tendering for Building Work*, Pearson Higher Education

Standard method of measurement of building works (1988) 7th edition, BEC and RICS

Schedule of dayworks carried out incidental to contract work (2002) Civil Engineering Contractors Association

Whitehead, G. (1990) *Guide to Estimating for Heating and Ventilating Contractors*, HVCA

The Chartered Institute of Buildings Technical Information Papers, 1982–1991:

Paper No. 7 Potter, D. and Scoins, D. (1982) Computer-aided estimating

Paper No. 9 Holes, L.G. and Thomas, R. (1982) A general-purpose data processing system for estimating

Paper No. 11 Harrison, R.S. (1982) Practicalities of computer-aided estimating

Paper No. 15 Skoyles, E.R. (1982) Waste and the estimator

Paper No. 37 Harrison, R.S. (1984) Pricing drainage and external works

Paper No. 39 Braid, S.R. (1984) Importance of estimating feedback

Paper No. 59 Uprichard, D.C. (1986) Computerised standard networks in tender planning

Paper No. 64 Ashworth, A. (1986) Cost models – their history, development and appraisal

Paper No. 65 Ashworth, A. and Elliott, D.A. (1986) Price books and schedules of rates

Paper No. 75 Harrison, R.S. (1987) Managing the estimating function

Paper No. 77 Ashworth, A. (1987) General and other attendance provided for sub-contractors

Paper No. 81 Ashworth, A. (1987) The computer and the estimator

Paper No. 97 Brook, M.D. (1988) The use of spreadsheets in estimating

Paper No. 113 Senior, G. (1990) Risk and uncertainty in lump sum contracts

Paper No. 114 Emsley, M.W. and Harris, F.C. (1990) Methods and rates for structural steel erection

Paper No. 120 Cook, A.E. (1990) The cost of preparing tenders for fixed price contracts

Paper No. 127 Harris, F. and McCaffer, R. (1991) The management of contractor's plant

Paper No. 128 Price, A.D.F. (1991) Measurement of construction productivity: Concrete Gangs

Paper No. 131 Brook, M.D. (1991) Safety considerations on tendering – management's responsibility

The Chartered Institute of Building, Construction Papers, 1992

Paper No. 2 Massey, W.B. (1992) Sub-contractors during the tender period – an estimator's view

Paper No. 11 Hardy, T.J. (1992) Germany – a challenge for the estimator

Paper No. 16 Milne, M. (1993) Contracts under seal and performance bonds

Paper No. 17 Young, B.A. (1993) A professional approach to tender presentations in the construction industry

Paper No. 19 Harrison, R.S. (1993) The transfer of information between estimating and other functions in a contractor's organization – or the case for going round in circles
Paper No. 23 Emsley, M.W. and Harris, F.C. (1993) Methods and rates for precast concrete erection
Paper No. 32 Morres, R. (1994) Negotiation in construction
Paper No. 33 Harrison, R.S. (1994) Operational estimating
Paper No. 49 Borrie, D. (1995) Procurement in France
Paper No. 54 Pokora, J. and Hastings, C. (1995) Building partnerships
Paper No. 55 Sher, W. (1995) Classification and coding of data for computer-aided estimating systems

The National Joint Consultative Committee for Building (RIBA and BEC)
Standard form of tendering questionnaire select list of contractors (1994)
Code of Procedure for Single Stage Selective Tendering (1989)
Code of Procedure for Two Stage Selective Tendering (1983)
Code of Procedure for Selective Tendering for Design and Build (1985)
Code of Procedure for the Selection of a Management Contractor and Works Contractors (1990)
Code of Procedure for the Letting and Management of Domestic Sub-contract Works (1989)
Guidance Note 1. Joint venture tendering for contracts in the United Kingdom (1985)
Guidance Note 2. Performance bonds (1986)
Guidance Note 3. Fire officers' recommendations (1987)
Guidance Note 4. Pre-tender meetings (1986)
Guidance Note 5. Reproduction of drawings for tender purposes (1990)
Guidance Note 6. Collateral warranties (1990)
Guidance Note 8. Construction management – selection and appointment of construction manager and trade contractors (1994)
Guidance Note 9. Charges for admission to approved and select lists and for tender documents (1995)
Procedure Note 9. Tendering periods

Laxton's Building Price Book (2004) Butterworth-Heinemann

JCT Practice Note 6 – Series 2 – Main contract tendering (2002) (*Intended to replace the NJCC codes of procedure and the subsequent CIB code of practice listed below*)

Documents produced by working groups of the Construction Industry Board published by Thomas Telford Publishing (1997)
- Briefing the team: a guide to better briefing for clients
- Code of Practice for the selection of main contractors
- Code of Practice for the selection of subcontractors
- Constructing success: code of practice for clients of the construction industry
- Framework for a national register for contractors
- Partnering in the team
- Selecting consultants for the team: balancing quality and price

This page intentionally left blank

Index

Abstracting materials, 109
ACA Project Partnering Contract, 37
Acceptance, 36
  period, 36
  qualified, 36
Access to the site, 113
Activity schedules, 37
Agenda, start-up meeting, 247
Agreement – basis of, 35
Agreement for Minor Building Works, 17
  fluctuations, 187
Agreement to tender, 94
All-in rates, 78
Alternative:
  bids, 243
  contract duration, 117
  design, 119
  methods, 3, 117
  tender, 64, 244, 245
Analytical bills, 81
Analytical estimating, 78, 81, 82
Analytical pricing, 78, 126
  estimator's report, 233
Anti-competitive behaviour, 97
Appendix, standard forms of contract, 38
Approved lists of contractors, 87
Approximate:
  estimating, 290
  quantities, 45, 52, 73, 76
Approximate bill of quantities, 60, 89
Architect, 20, 38, 48
  duty to nominate, 42
  provisional sums, 53
  role, 13, 40, 78
  specification, 49
Articles of agreement, 36, 41
Assessment criteria, 245
Attendances, 180, 181
  for sub-contractors, 41
  priced in preliminaries, 199
  special scaffolding, 183
Award of contract, 246, 254

Banwell report, 10, 34, 46, 90
Basic lists of materials, 65
Best value, 245
Bidding performance, 238
Bidding strategy, 251, 252
Bill descriptions, 56, 91
Bill diagrams, 48
Bill format, 50, 81
Bill of allowances, 222, 254, 255, 257, 263
  example, 256
Bill of approximate quantities, 37, 59, 74, 89
Bill of quantities, 58, 59, 81
  pricing, 125
Bills of quantities, 6, 37, 43, 45, 46, 48, 50, 51, 52, 54, 55, 59, 67, 74, 83, 91, 100, 103, 109, 229, 241, 290
  as specification, 52
  computer, 267
  computer packages, 54
  computer system, 56
  construction management, 22
  cost planning, 50, 68
  description of the work, 51
  descriptions, 57
  dimensions, 52
  electronic, 264, 270, 271, 287

Bills of quantities (*contd*)
  elemental format, 50, 54
  external works, 54
  firm, 59
  formats, 54
  item references, civil engineering, 56
  list of drawings, 51, 61, 96
  material purchasing, 50
  materials and workmanship, 52
  preliminaries, 51, 52, 95, 199
  priced, 61, 88, 241, 244, 254
  pricing, 78
  principal quantities, 51
  provisional sums, 192
  purpose, 50
  reference to codes, 50
  sectionalised trade format, 54
  standard descriptions, 55
  submission, 242, 256
  tender sum, 52
  text file, 264
  trade format, 54
  unit rates, 134
  use of computers, 56
  valuation, 256
Bonus, 255
  systems, 50, 79
British Property Federation, 10
BS EN ISO 9000, 8
Buildability, 12, 17
Builder's quantities, 67, 76
Builder's work, 180
Building estimator, 107
Building Project Information Committee (BPIC), 47
Business development, 3
Business directories, 261
Business strategy, 247
Buyer, 2, 3, 104, 111, 180, 283

Cartel, 97
Cashflow, 81
  borrowing requirement, 222
  calculation, 217, 238
  cumulative value, 219
  diagram, 219, 222
  estimating software, 222
  forecast, 78, 118
    example, 219
    spreadsheet, 273
  mobilization period, 222
  positive, 217
  preliminaries, 222, 241
  priced programme, 226
  provisional sums, 222
  resource analysis, 224
  retention monies, 222
  schedule of payments, 217
  S-curve, 219
  self-financing contract, 217
  spreadsheet, 217, 222
  tender programme, 222
CD-ROM, 6, 272, 283
CD-ROM drives, 283
CDM Regulations, 38
CESMM3, 134
Check:
  final review, 229
  procedures, 228
  resource summaries, 228
  unit of measurement, 228
Checking contract documents, 256
Chief estimator, 1, 3, 93, 102
  computers, 285
CI/SfB, 49
CIOB Code of Estimating Practice, 6, 78, 103, 115, 125, 131, 199, 228, 256
  number two, 243
  preliminaries, 200
  supplement
  tender results, 247
Civil engineering, 3, 59
  alternative tenders, 244
  engineer, 13
  estimator, 107
  pricing with computers, 289
  roles, 16
Civil engineering contracts
  specifications, 49
Civil engineering standard method of measurement, 51, 56, 82

Civil engineering work, 117
Client, 2, 3
  ability to pay, 86, 93
  brief, 19
  needs, 11, 17
  professional team, 8
  requirements, 8, 13, 58, 83
  satisfaction, 8
Code of practice for the selection of:
  main contractors, 65, 87
  sub-contractors, 115
Code of procedure:
  for design and build, 89
  for selective tendering for design and build, 18
  for single stage selective tendering, 61, 63, 87, 244
    correction of errors, 245
  for the selection of main contractors, 6
  for two stage selective tendering, 89
Collusive tendering certificate, 65
Common arrangement of work sections, 54, 55
Company:
  objectives, 238
  policy, 234
  procedures, 109, 131, 262
  profile, 245
  strategy, 3
Company Directors Disqualification Act, 96
Competition, 18, 89, 242, 253
  final cost, 68
  open, 86
  public contracts, 89
  strength, 238
Competition Act, 96
Competition and negotiation, 86
Competitive advantage, 13, 200
Competitive market, 238
Completing the estimate, 227
Completion:
  early, 17
  on time, 14
Completion dates, 12, 51
Component drawings, 53
Composite items, 74
Computer, 260, 281
  applications, 55
  databases, 126, 287
  digitiser, 282
  hardware, 280
  implementation, 285
  job library, 132
  laptop, 281
  local area network, 283
  network, 284
  networking, 283, 286
  packages, 55
  peripheral devices, 281
  printer, 281
  reports, 135
  skills, 287
  specification, 281, 282
  strategy, 290
  summaries, 227
  system, 242
  system selection, 285
  the future, 286
  training, 286
  up-grade, 281
  wide area network, 283
Computer-aided billing, 55
Computer-aided design, 279
Computer-aided estimating, 55, 132, 180, 260, 261
  aims, 261, 262
  characteristics, 269
  packages, 254, 267
  recalculation times, 289
  rogue items, 267
  sort code, 264
  standard bills of quantities, 267
  sub-contract comparison, 177
  system test reports, 289
  systems, 81, 261
  test reports, 268
  trade codes, 264
Computing:
  adjustments, 261
  electronic data transfer, 281
  estimating performance, 260

Computing (*contd*)
  implementation, 267, 286, 290
  operational estimating, 289
  technical libraries, 284
  voice recognition, 289
Constants, 84
Constructing the Team, 13, 245
Construction (Design and Management) regulations 1994, 9, 65
Construction Drawing Practice, 48
Construction industry, 10, 14
Construction Industry Board, 65, 87, 115
Construction Industry Trading Electronically (CITE), 264
Construction management, 11, 12, 13, 15, 16, 21, 22
  standard contract, 22
Construction manager, 21
Construction process, 12
Construction team, 10
Consumerism, 68
Contingency, 76
  contractor's, 58
Contingency sum, 53, 77, 90, 192
Contract:
  appendix, 51
  bills of quantities, 43
  compliance, 87
  conditions, 36, 77
  construction, 34
  cost reimbursement, 38
  drawings, 43
  duration, 118, 244
  executed as a deed, 37
  formal documents, 35
  in writing, 35
  law, 36
  legal capacity, 35
  lump sum, 37
  negotiatiated, 35
  offer and acceptance, 35
  remeasurement, 37
  selection, 44
  sum, 59
  under seal, 36
Contract Administrator, 20
Contract documents, 35, 43
  checking, 256
  specification, 49
Contract sum analysis, 18, 19, 43, 59, 243
Contractor:
  bill of quantities, 78, 79, 83
  involvement, 12
Contractor selection, 85
  financial standing, 86
  national register of contractors', 87
  negotiation, 89
  reputation, 86
Contractor's direct work, 109
Contractor's bill of quantities, 83
Contractor's experience, 12
Contractors' overheads, 19
Contractor's proposals, 18, 43, 243
Contracts:
  comparison of forms, 43
  standard forms, 43
Contractual risks, 236
Co-operation, 13, 46
Coordinated project information, 47, 91
Cost:
  breakdown, 109
  certainty, 70
  control, 50, 255, 256
  limit, 16, 68
  monitoring, 82
  plan, 68
  range, 67
  reimbursement, 15
  target, 255
  yardstick, 71
Cost plan, 71
  elemental, 73
Cost planning, 67, 290
  computer systems, 73
  expert systems, 289
  spreadsheet, 73
  spreadsheets, 262
Cost planning volume method, 71
Cost plus fixed fee, 60
Cost plus percentage, 60

Cost reimbursement
  contract, 58, 60
CPI, 109
CPI and the estimator, 55
Cumulative value, 222

Database, 6, 263, 277
  applications, 277
  design, 277
  estimating, 268
  marketing information, 278
  on-line, 278
  work items, 267
Date for completion, 236
Daywork, 54, 192, 193
  all-in rate for labour, 196
  base date, 194
  civil engineering definition, 194
  civil engineering plant, 196
  definition, 194, 197
    of prime cost, 6
  head office overheads, 198
  incidental Costs, 197
  labour percentage, 198
  labour rates, 194
  labour-only sub-contractors, 197
  overheads and profit, 196, 198
  payments for skill, 194
  percentage on labour, 196
  plant operator, 198
  plant schedules, 6
  prime cost, 53, 194
  rates for labour, 197
  schedule, 51
  schedule of plant charges, 194, 198
  subsistence allowance, 198
  supplementary charges, 194, 196
  trade discounts, 194
  transporting materials, 198
Decision to tender, 3, 85, 92, 93, 100
  future workload, 93
  risks, 93
Delay, 10
  avoiding, 12
  costs, 124
Design:
  development, 21
  responsibilites, 22
Design and build, 10, 14, 17, 18, 19, 45, 59, 67, 83, 89, 91
  computer systems, 264
  contractor, 18
  Joint Contracts Tribunal, 19
  single point responsibility, 19
  submission, 240
  systems, 12
Design team, 10
  experience, 93
Desktop publishing, 3, 262, 279
Development budget, 68, 69
Digitizers, 54
Dimensioned description, 48
Dimensioned diagrams, 48
Discount fiddle, 41
Discounts:
  prompt payment, 234
  suppliers and sub-contractors, 233
Documents
  claims, 46
  electronic, 263
  production guidelines, 47
DOM/1, 40
DOM/2, 41
Domestic sub-contract, 40, 176
Domestic sub-contractor, 40, 113
  named, 61
Drawings, 46, 91
  as-built, 48
  code, 47
  CPI guidelines, 47
  numbers, 96
  preliminary, 48
  production, 48
  record, 48
  survey, 48
Drawings and specification, 40, 49, 58, 60, 76

E-commerce, 285
Egan report, 116
Electronic Data Interchange, 38

Electronic mail, 283, 284
Elemental bill, 55
Elemental cost plan, 59, 66, 67, 71, 72, 74, 75
  headings, 229
E-mail, 261, 284
Employer role, 40
Employer's requirements, 18, 43, 59, 89, 214, 243
Engineering and Construction contract, 10, 34
Engineering and Construction sub-contract, 41
Enquiries:
  abstracting, 109
  approximate quantities, 111
  bills of quantities, 115
  computer-aided estimating, 109
  contract period, 113, 115
  databases, 111
  delivery periods, 113
  discount, 113
  domestic sub-contractors, 114
  drawings and specifications, 111
  firm price, 113
  materials, 111
  programme, 113
  sample letter, 114
  specification, 111
  sub-contractors, 56, 109, 113
  suppliers, 54, 56, 90, 100, 109
Enquiry:
  documents, 36
  letter, 113
  letter to sub-contractors, 40
  schedules, 100
Enterprise Act, 96
Errors:
  arithmetical, 176
  correction, 245
  genuine, 88
  in tenders, 88
  inking-in, 246
  mathematical, 246
  patent, 176, 246
Establishment charges, 81
Estimate, 35
Estimate analysis form, 229, 231
Estimate timetable, 100, 102
Estimating:
  analytical, 66
  assistant, 2
  department, 2
  department structure, 2
  flowchart, 4
  function, 1
  information sources, 6
  methods, 66
  procedures, 8
  programme, 5
  skills, 6
  software, 271
  team, 2
  workload, 3, 61
Estimating packages:
  features, 269
Estimating team, 103, 117
  co-ordination, 106
Estimator:
  computing needs, 286
  experience, 6
  needs, 290
  role, 261, 262, 287, 290
  skills, 68
  trainee, 135
Estimator's notes, 255
Estimator's report, 229, 262
  provisional sums, 233
Evaluation criteria, 266
Examination and adjustment of priced bills, 88
Extension of time:
  sub-contractor, 42
  sub-contractor's right, 41

FCEC Form of Sub-contract, 41
Feasibility studies, 18
Feedback, 118, 125, 238, 254–256, 259
  information, 50
  waste, 130

Final review meeting, 2, 6, 34, 78, 81, 106, 107, 134, 135, 180, 184, 227, 233, 234, 239, 241, 247, 255, 256
adjustments, 222, 229, 233, 239, 254
checking procedures, 228
Final review stage, 83, 103, 126
Final tender review
build-ups, 227
Finance:
project, 238
Financial advice, 13
Firm price, 58, 186
contract, 187
tenders, 78, 121
Fixed and time-related items, 51
Fixed charges, 202
early, 214
Fixed price contract, 58
Floor area method, 71
Fluctuating price, 186
Fluctuations, 38, 51, 185, 186, 234
all-in rate, 188
analytical estimating, 188
basic list materials, 186
calculations, 188
clause, 58
contract clauses, 186
demolition materials, 187
formula method, 191
historical data, 188
ICE conditions, 187
labour cost increases, 188
labour-only sub-contractors, 188
local authorities contract, 187
material costs, 191
minor works, 44
NEDO formulae, 187
non-adjustable element, 187
non-recoverable costs, 187
non-recoverable element, 188
overheads and profit, 187
plant costs, 191
price adjustment formulae, 187
staff costs, 188, 191, 234
sub-contract quotations, 191
tax, 186
tender programme, 188, 191
unfixed materials, 187
wage increases, 191
work categories, 187
Forms of contract, 34
Formula Method, 186
Functional units, 70

GC/Works/1, 17, 37, 183, 184
cashflow, 219
fluctuations, 187
stage payments, 219
sub-contract discounts, 234
General attendance, 184
nominated sub-contractor, 183
General labour, 118, 132
General plant, 132
Goodwill, 3
Ground conditions, 52
Grouped items, 55
Guaranteed maximum cost, 116
Guaranteed maximum price, 19
spreadsheets, 264
Guarantees, 21
GW/S Standard form of sub-contract for use with GC/Works/1, 41

Handover information, 254, 256
Hardware requirements, 269
Head office:
charges, 237
overheads and profit, 193
Health and safety plan, 65, 119
Historical data, 66, 68, 73, 77
Holiday periods, 121
Hourly rate, labour, 125
Housing Grants, Construction and Regeneration Act, 38, 41

ICE Conditions of contract, 17, 37
fluctuations, 187
Inception stage, 70

Inclement weather, 121
Inflation, 71, 185
  price trends, 186
Inking-in errors, 246
Institution of Civil Engineers, 34
Instructions to tenderers, 243, 244
Insurance, 38, 43
  adviser, 235
  contract conditions, 235
  employer's liability, 235
Integrated supply chains, 116
Intermediate Form of Building Contract
  fluctuations, 187
Internet, 261, 284, 289
Investment, 11
Invitation to negotiate, 24
Invitation to tender, 92, 95
  letter, 61
Invitation to treat, 36
Item coverage, 77, 82

JCT Agreement for Minor Building Works, 37
JCT Intermediate Form of Building Contract, 17, 37
JCT Major Project Form, 37
JCT Management Contract, 13, 20
JCT practice Note No.6, 245
JCT Standard Form of
  Building Contract, 17, 186
  daywork, 193
  Employer/Nominated Sub-contractor, 42
  Management Contract, 37
  Nominated Sub-contract, 42
  Nomination, 42
JCT Standard Form with Contractor's Design, 37
JCT Work Contract/2, 52
Job satisfaction, 8
Joint Contracts Tribunal, 34, 37
  fluctuations, 187
  website, 45

Labour resources, 233
Labour costs, subsistence, 126
Labour only sub-contracts, 78
Labour outputs, 135
Labour rate:
  build up, 126
  insurances, 235
  used in tables, 128
Labour rates, 125, 135
  all-in rate, 126
    calculation, 126
  attraction money, 126
  bad weather, 126
  bonus
  attraction, 126
  bonus payments, 126
  employer's liability insurance, 128
  holidays, 125
  normal working hours, 126
  overtime, 125
  project overheads, 126
  skilled labour, 126
  spreadsheets, 126, 128
  subsistence allowance, 126
  trade supervision, 126
  travelling costs, 126
  union agreements, 126
  wage awards, 126
  Working Rule Agreement, 128
Labour-only sub-contractor, 113, 115, 177
  rates, 134
Landfill Tax, 38
Large tender lists, 90
Letter of intent, 35
Liquidated damages, 21, 38, 51, 77, 236, 244
List of tender prices, 88
Local authorities, 87, 90
  forms, 37, 45
Low maintenance, 12
Lump sum, 58
  contract, 15, 37
  tenders, 45

Maintenance:
  contracts, 40, 68
  work, 52

Management contract, 52
fluctuations, 187
prime cost, 20
Management contracting, 11, 15, 19, 20, 21
contractor's discount, 21
Joint Contracts Tribunal, 20
margins, 21
professional team, 20
prompt payments, 21
standard form of contract, 20
Management contractor, 20, 61, 119
Management fee, 15, 20, 60
Management of risk, 236
Management structure, 1
Margin, 14
Marketing, 3, 92, 253
Material rates, 128
alternative products, 128
conversion factors, 130
distributing materials, 130
haulage, 128
mechanical off-loading, 130
net quantities, 130
off-loading, 130
part loads, 128
small load charges, 128
specification, 128
testing of materials, 130
theft and vandalism, 130
unloading materials, 130
waste, 130
Material schedules, 271
Mathematical checks, 228
Mathematical errors, 246
Measured contracts, 60
Measurement contract, 58
Measurement rules, 55
Meeting, post tender, 246
Method of measurement, 76, 134
preamble, 76
Method statement, 2, 20, 83, 117–119, 135, 240, 241, 244
construction management, 22
demolition, 119
example, 120
Method-related charges, 52
Methods of estimating, approximate, 66
Minor Works agreement, 43
Mobilization period, 254
Model rate, example, 135
Multiple rate approximate estimating, 71

NAM/SC Conditions for named sub-contractors, 41
Named sub-contractor, 40, 176, 244
National Building Specification, 49
text files, 272
National Joint Consultative Committee for Building, 18, 87, 89
National Working Rule Agreement, 6, 131
NEC Engineering and Construction contract, 37, 86
Negotiated contract, 6, 89
Negotiation, 18
post tender, 245, 246
Net allowances, 180
Net cost estimate, 233
Net unit rates, 78
New Engineering Contract, 13, 34
Nominated sub-contractor, 38, 40, 42, 103, 176, 183
approximate quantities, 53
attendances, 103
delay, 42
design, 42
discount, 234
nomination, 119
programme, 53
special attendance, 53
Nominated supplier, 176, 184
coverage rules, 184
discount, 184, 234
fixing materials, 184
Nomination, 42
documents, 42
procedure, 183
Non-mechanical plant, 215
Non-standard forms of sub-contract, 41
Notification of results, 246
Novated design team, 59
Novation, 18, 176
specialist contractors, 176

Offer:
  counter offer, 36
  termination, 36
  withdrawal, 36
Office of Fair Trading, 96
'On demand' bonds, 41
On-line bidding, 265
Open competition, 90
Open tendering, 87
Operational estimating, 82, 83, 107
  civil engineering, 82
  programme, 83, 117
  resources, 84
Optical character recognition, 269, 281
Organization, 1
Outline programme, 244
  example, 124
Output specification, 24
Outputs, 78, 82
  planning, 118
Overheads, 53
Overheads and profit, 60, 81, 237, 239
  daywork, 192

Package contractors, 15, 61
  construction management, 22
Package deal, 17
Parent company guarantee, 41, 235
Partnering, 13, 14
  agreement, 14
  alternative bid, 245
  contract, 14
  cost savings, 14
Partnership, 13, 14, 82
  agreement, 86
Patent errors, 246
'Pay when paid', 41
Payments forecast, 217
PC and provisional sums, 100
  summary, 103
PC sum, 40, 53
  nominated sub-contractors, 43
Performance bond, 21, 43, 77, 86, 90, 215, 244
  defects liability period, 235
  pricing, 235
Performance guarantees, 42
PFI:
  affordability, 30
  benefits, 26
  best and final offer, 23
  business case, 28
  commercial aspects, 26
  consortium, 19, 23
  electronic documents, 29
  estimating process, 28
  final invitation to tender, 29
  financial model, 30
  invitation to negotiate, 28
  pricing strategy, 30, 32
  process, 25
  procurement strategy, 31
  public sector scheme, 28
  risks, 27
  schedule of accommodation, 30
  special purpose vehicle, 23
  special purpose company, 28
  submission document, 29, 32
  target area, 30
  target cost plan, 31
  tender procedures, 27
  terminology, 23
  Treasury report, 23
  value for money, 23, 26
Plan and specification, 83
Planning engineer, 2, 107, 117, 200
  role, 117
Planning software, 278
Planning Supervisor, 65
Plant:
  dismantling, 131
  handling equipment, 131
  hire rates, 125
Plant Quotations Register, 131
Plant rates, 130
  all-in hourly rate for plant, 131
  depreciation, 131
  fuel and lubricants, 131
  mechanical plant, 131
  plant operator, 131
  programme, 131
  quotations, 131

sources of plant, 131
transport to site, 131
Post tender:
adjustments, 254
meeting, 246
negotiations, 256
Practical completion, 43
Practice Note CD/1B, 19
Preamble, 51, 52, 77
bills of quantities, 134
civil engineering, 51
Pre-award meeting, 247
Pre-contract meeting, 256
Preliminaries, 51, 59, 73, 77, 81
bonds and insurances, 234
checklist, 200, 201
fixed and time-related, 242
fixed charge, 51, 202, 214
lump-sum, 242
mechanical plant, 215
pricing, 103, 117, 118, 200
pricing spreadsheet, 212
professional fees, 215
resourced programme, 200
site accommodation, 215
staff costs, 214
submission, 242
supervision, 200, 215
temporary works, 200, 215
time-related charge, 51, 202
Preliminaries bill, 134, 199, 214
cashflow, 214
pricing, 202
Preliminary:
enquiry, 88, 93, 94
form, 96
invitation to tender, 95, 238
Pre-qualification, 87
Pre-selection, on-line bidding, 266
Pre-tender health and safety:
file, 8
plan, 65
Price:
fixing, 97
library, 267
lists, 113
Priced bills of quantities, 229
Pricing:
build-up, 133
checks, 243
coverage rules, 134
data, 271
decimal constants, 135
examples, 135, 136
methods, 103
preliminaries, 108
repair work, 83
strategy, 102, 103
unit rates, 134, 135
working space, 134
Pricing notes, 132, 134, 135, 254
example, 134
spreadsheets, 276
Pricing preliminaries, 53, 199
attendant labour, 208
contract conditions, 209
employer's requirements, 202
facilities and services, 204
management and staff, 203
mechanical plant, 205
non-mechanical plant, 210
site accommodation, 207
temporary works, 206
Prime contracts, 116
Prime cost, 39, 60
nomination, 183
Prime cost and provisional sums, 51
Prime cost of building labour, 195
Prime cost sum, 53, 54, 103, 183
nominated sub-contractor, 53
nominated supplier, 53, 184
nomination, 184
Principal quantities, 96, 100
Private Finance Initiative, 19, 22
Private sector, 11
Problem solving, 14
Process engineering, 13
Procurement
alternative methods, 12, 16
BPF method, 10
methods, 12, 14
price certainty, 11

Procurement (*contd*)
primary objectives, 11
traditional method, 10, 16, 17
Product literature, 2
Professional team, 12, 16, 19, 20
Profit, 81
calculation, 238
contractor's, 183
in bill of quantities, 184
provisional sums and daywork, 192
Profit margin:
changes, 238
Programme, 83, 121
cashflow, 217
costed, 222
nominated sub-contractor, 42
submission, 241
tender, 78
to produce tender, 100
Project:
appreciation, 100
management, 11, 16
Project manager, 10, 16, 21
Project overheads, 78, 124, 184, 193, 199, 200
feedback, 259
schedule, 254, 273
Project overheads (*see also* preliminaries), 212
Project Specification Code, 50
Protection clauses, 50
Provisional sum, 52–54, 59, 103, 193
attendances, 183
daywork, 192
defined, 52, 57, 192
estimator's report, 234
extension of time, 192
planning, 192
preliminaries bill, 233
statutory authorities, 53
temporary works, 193
undefined, 52, 192
Public Private Partnership, 25
Public sector, 11
Public sector comparator PSC, 24
Qualification document, 87
Qualified bids, 177
Quality:
assurance, 8
management, 8, 118
plan, 120
Quantity surveyor, 2, 10, 40, 48, 54–57, 66, 78, 106, 183, 186, 222, 242, 246, 287
role, 13, 16
variations, 193
Quotation, offer, 35
Quotations:
materials, 128
monitoring receipt, 109

Rates:
consistent, 177
spread monies, 81
Receipt of tender documents, 95
Reconciliation, resources, 228
Reference data, 8
Refurbishment work, 59
contract, 45
Reinforcement schedules, 263, 273
Remeasurement, 59, 243
Reputation, 252
Resource:
costs, 78, 125, 132
histograms, 118
levelling, 82
library, 132
prices, 125
schedules, 228
summaries, 81, 134, 135
Resourced programme, 50, 117
Resources, 83, 121, 268
adjustments, 228
Retention, 43, 51
bond, 38
construction management, 22
management contract, 20
Reverse auctions, 265, 266
Invitation to tender, 267
Right of objection, 39
Right of set-off, 21

Risk, 14, 90, 235
  apportionment, 14, 15
  commercial, 236
  construction management, 22
  financial, 45, 86, 91
  insurance, 235
  management, 236
  management contracting, 21
  mitigation, 236
  reduction, 12
  register, 106
  shared, 245
  sub-contracting, 113
  technical, 236
  transfer, 237
Rogue items, 55
Role of management, 1

Safety, 120, 241
  method statements, 119
Scanner, 264
Schedule of rates, 15, 43, 60
  ad-hoc, 60
  standard, 60
Scope of work, 53, 91
Securing work, 13
Security information on site, 255
Selection criteria, 86, 241
Selective tender list, 93
Selective tendering, 18, 87
  list of tenderers, 15
Sequence of work, 107, 120
Serial tender, 89
  master bill, 89
Set-off clauses, 42
Shareware, 280
  estimating software, 280
Short tender periods, 90
Single point responsibility, 17
Single rate approximate estimating, 70
Sir Michael Latham, 10, 13, 14, 34, 47, 86, 87, 245
Site accommodation, 121
Site allowances, 256
Site investigation, 91, 108
Site layout, 83
  drawing, 118
  preliminaries, 200
Site location, 120, 252
Site manager, 3, 84
  cost information, 254
Site security, 108, 130
Site staff, 3
Site visit, 61, 100, 107, 111
  alterations, 107, 108
  demolitions, 107, 108
  location, 108
  photographs, 107
  report, 255
  report form, 107
  site boundary, 108
  site plan, 107
  spot items, 108
  use of plant, 108
  utility services, 108
Small plant, 132
SMM7 Measurement Code, 53, 54, 183
Software, 262, 268
  applications programs, 271
  bill production, 272
  compatibility, 272
  database, 290
  design, 279
  digitizer, 283
  document readers, 279
  expert systems, 289
  general purpose, 271, 286
  operating systems, 271
  presentation, 272
  project planning, 278
  systems programs, 271
  utility programs, 271
Special attendance, 103, 184
Specialist contractors, 16, 41
Specification, 49, 56, 57, 58, 59
  clauses, 52, 91
  code for specification writing, 49
  contract document, 49
  page numbers, 57
  preambles, 49
  priced specification, 49

Specification (*contd*)
problems, 50
reference numbers, 57
schedule of works, 49
valuations, 49
writing, 46
Speculation, 85
Spreadsheet, 76, 78, 80, 177, 261, 262, 263, 272, 273
activity schedules, 272
checking, 276
design, 276
errors, 273, 276
feedback information, 259
look-up charts, 273
pricing notes, 276
Procure 21, 264
template, 274, 277
Staff structure, 118
Stage payment chart, 43
Standard:
contracts, 34
form of building contract, 37
forms of contract, 6, 12, 34, 36, 38, 88
forms of sub-contract, 40
method of measurement, 6
specifications, 6
Standard Form of Nominated Sub-contract, 42
Standard Form of tendering questionnaire, 87
Standard Form with Contractor's Design, 45
Standard method of measurement, 49, 51, 52, 56
building contract, 52
coverage rules, 56
nomination, 183
preliminaries, 199
provisional sums, 192
Start-up meeting, 103, 247
Statutory authorities, 53
Sub-contract:
fluctuations, 191
adjusted rates, 180
allowances, 258
comparison, 178
comparison system, 177, 269
conditions, 177
enquiry abstract, 104
enquiry documents, 177
firm-price quotations, 191
forms, 38
mathematical checks, 177
negotiation, 177
plan and specification, 177
quotations, 57, 176, 234
resource summary, 180, 182
schedule of rates, 177
Sub-contractor, 40, 176
approved, 176
attendances, 180
enquiries, 56, 57
offer, 36
overheads and profit, 180
payments, 41
prices, 78
quotation analysis, 273
quotations, 100, 177, 238, 255
unit rates, 134
Sub-letting, 40, 113
Submission:
date, 100
document, 14, 284
programme, 123
Success rate, 3
Success ratio, 6
Successful tender, 3, 254
Superficial floor area method, 71
Supervision, 120
costs, 51
Suppliers
database, 261
preferred, 238
reverse auctions, 265
Supply chain, reverse auctions, 265

Taking-off quantities, 61
Target:
cost, 70, 89
price, 58
success, 6

Technical risks, 235
Telephone enquiries, 93
Temporary works, 37, 83, 91, 107, 119, 121
Tender:
- acceptance period, 188
- adjudication, 245
- adjustments, 242
- allowances, 239, 254
- alternative, 13, 14, 64, 65, 107
- alternative bid, 91, 92
- amendments, 244
- confirmation, 245
- analysis form, 241
- budget, 255
- civil engineering, 14
- confidentiality, 266
- cost to tender, 93
- costs: design and build, 91
- cover letter, 243
- design and build, 243
- discounts, 238
- documents, 91, 96, 100
- follow-up, 241
- form, 63, 65, 240, 243
- formal invitation, 61
- handover, 119
- handover meeting, 35
- information form, 96
- invitation letter, 62
- letter, 245
- lists, 87
- mark-ups, 237
- negotiated reduction, 88
- negotiation, 89
- notification of results, 245
- opportunities, 85
- performance, 92, 247
- period, 90, 91, 93, 95, 100
- planning, 117
- preparation stages, 3
- presentation, 240
- publish results, 92
- qualifications, 243, 244
- qualified, 88, 91, 119
- ratio analysis, 250
- register, 6, 7, 263
- results, 92, 240, 246, 250, 251, 252
- return envelope, 65
- submission, 8, 61, 240, 243
- sum, 58, 241
- summary, 228, 229, 232, 234
- unsuccessful, 245
- withdrawal, 88, 95, 176

Tender documents, 36, 46, 58, 61, 87, 88, 90, 93, 95, 107, 245, 263
- bills of quantities, 61
- drawings, 53, 57, 61
- electronic, 264
- inspection, 95
- late receipt, 92
- maintenance, 47
- minor works, 47
- poor, 12
- problems, 47

Tender performance, 245
- project overheads, 250

Tender presentation, 243
- software, 262

Tender programme, 119, 121, 124, 200, 228
- cashflow, 219
- fluctuations, 188
- preliminaries, 200

Tender register, database, 278
Tender stage programme, 254
Tender summary, 234, 239, 241
Tendering:
- abuse of procedures, 90
- analysis of results, 247
- cost of tendering, 87, 90
- costs, 3, 91
- EU directives, 266
- good practice, 90
- period, 88
- tender period, 90

Time-related charges, 202
Time-related costs, 118
Track record, 14
Trade abstract, 103
Trade discounts
- management contracts, 21

Trade pricing, 264
Traditional bill of quantities, 10
Trust, 13, 86
Turnkey, 17
Turnover, 238
Two stage selective tendering, 89

Undermeasurement, 180, 241, 242, 243
Unit of accommodation method, 70, 71
Unit rate, 78, 132, 134
  calculation, 130
  direct work, 78
  pricing, 81, 132
Unitary payment, 25, 26

Valuations, 82
Value of tenders and awards, 249
Value-for-money, 68
Variant bid, 25
Variations, 52, 59, 177
  dayworks, 193
  value, 78, 81
Visits to consultants, 107
Voice mail, 284

Wall to floor ratio, 73
Warranties, 22
Warranty agreement
  nominated sub-contractor, 42
Waste:
  feedback, 259
  materials, 84, 130
  prime cost sum, 53
Water charges, 235
Weather, 121
Windows interface, 270
Win-win solutions, 13
Withdraw tender, 246
Word processor, 113, 263, 272
Work packages, 21
Workforce levels, 121
Workload, 238
Works contractors, 19, 21
  fluctuations, 187
World Wide Web, 284