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Introduction

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1.1 INTRODUCTION

Buildings have become complex machines for specialist functions and the materials and construction processes for the construction of these buildings have become largely the erection of prefabricated materials and components. The need for the construction process to be integrated by the collaboration of all the parties involved is now the major management requirement. The skill levels of craftsmen has been superseded by the management resources necessary to ensure a coordinated approach across the interfaces between the client, designers, cost management, contractors and subcontractors.

The cost management part of this process should also reflect this development with a comprehensive framework which is consistent from the beginning to the end of the construction cycle and is transparent enough to be understood at any time by all the stakeholders. This need for collaboration has not been a priority until recently. Seeley (1976) described approximate estimating as: ‘. . . techniques which attempted to give a forecast of the probable tender figure, although the basis of the computation often left much to be desired’. (p. 1). He went on to explain that the method of approach was often dictated by the nature of the development and the nature of the promoter. There were different kinds of estimates for different kinds of projects. Every professional practice and contractor had its own rules. This helps to explain why there have been no rules on how to

prepare estimates. This has led to complaints from client organisations that they receive a different estimate at different stages and from different consultants. Many client bodies have become active partners in the construction process and these knowledgeable employers administer the contracts from beginning to end. They have become aware of the inconsistencies in financial reporting throughout the construction cycle.

The Royal Institution of Chartered Surveyors (RICS) now provides the following documents that will help to provide comprehensive, accurate and consistent financial reporting:

- *The RICS Code of Measuring Practice*, 6th edition, 2007
- *The RICS New Rules of Measurement NRM 1: Order of Cost Estimating and Cost Planning for Capital Works*, 2nd edition, April 2012
- *The RICS New Rules of Measurement NRM 2: Detailed Measurement for Building Works*, April 2012
- *The RICS New Rules of Measurement NRM 3: Maintenance and Operations Cost Estimating, Planning and Procurement*, to be published in 2013
- *BCIS Elemental Standard Form of Cost Analysis*, 4th edition, 2012

The New Rules of Measurement (NRM) provide an accurate and consistent approach through the full life cycle of the building at each stage of development: the estimate; the cost plans; the work packages and bills of quantities and finally the whole life costing maintenance programmes. The intention is to provide a transparent audit trail of the measurement and the pricing that is available from the beginning to the end of a building's life cycle. There is an expectation that the NRM will have a wide appeal with an opportunity for countries around the world to adopt a common set of rules for the measurement of building works.

Contents

This textbook examines and explains how to use the *RICS New Rules of Measurement, NRM 1: Order of Cost Estimating and Cost Planning for Capital Works*, 2nd edition April 2012 and includes an introduction to all the major components of estimating necessary to produce an anticipated cost for a contract. It is intended for use by students and practitioners. The contents are:

1. Introduction
2. A practical introduction to measurement
3. The Code of Measuring Practice
4. How to use the NRM
5. NRM estimates
6. NRM cost plans
7. Information
8. Preliminaries, risk, overheads and profit
9. Unit rates
10. Cost analysis

Also included is:

- A detailed worked example of the practical application in most chapters
- A comprehensive exercise for practice at the end of most chapters

- A detailed answer with the calculations
- A self-assessment marking sheet to provide an indication of the standard achieved in technical and managerial competence and cognitive development

RICS competence levels

The RICS Assessment of Professional Competence (APC) comprises the demonstrable acquisition of a series of competencies after a period of time in the profession. This includes the provision of a diary showing a structured training programme and a final assessment interview. Two of the competencies are: ‘design economics and cost planning’ and ‘quantification and costing of construction works’. The first concerns estimating and cost planning and the second concerns measurement. They are core technical competencies that are mandatory for the successful completion of the APC. Each competence has three levels. Level 1 is knowledge about the subject. This is the provision of propositional knowledge about the subject. Level 2 is being able to apply that knowledge. This is the provision of procedural knowledge, actually being able to undertake the competence to a level of skill that is both comprehensive and accurate. Level 3 is being able to discriminate the quality of the work and advise the client. This will only be available after some time in practice, which is part of the RICS APC programme. This textbook provides worked examples can be followed and replicated. Practical exercises at the end of the chapters provide practice at Level 2. The marking scheme provides some level of discrimination on the quality of the work that has been practised. How to use these NRMs is therefore a necessary step on the route to Level 3.

Practical examples and self-assessment exercises

The pedagogy of quantity surveying is primarily concerned with the nature of the knowledge that is being learnt. Technical competencies, like estimating, measurement and contract administration are procedural knowledge. Practice is the most useful method of teaching procedural knowledge (Gagne, 2002) and teaching, in the form of telling or demonstrating to the student how to do it, is not effective (Wood, 2001). The acquisition of a technical competence like measurement is learnt by practice. The use of textbooks, lectures or demonstrations only provides an introduction to how to measure. The most effective way of learning how to measure is to practise and to receive prompt answers to questions as they arise. However, before the practice can take place it is helpful to examine previous examples to see the process that is required and how to set out the work. An examination of the examples at the end of each chapter will provide the information necessary to carry out the self-assessment exercises.

The practical examples and self-assessment exercises are set out on the traditional rulings used for estimating paper. Although much work can now be done on spreadsheets the need to understand the construction technology, the use of side casts and the conversion calculations to enable the measurement to be compliant with the NRM are all easier to understand if set out on estimating paper. Several of the examples and exercises refer to a set of common drawings for the London Road office project. These drawings will be used in Chapters 4–6. This enables the vocabulary, technology and dimensions to be

acquired progressively. When the competence levels have reached Level 2, an ability to carry out the work comprehensively and accurately without supervision, then the alternative technologies can be introduced. Software measurement packages require a significant amount of practice before they can be used effectively. Proficiency in using the software is best acquired after expertise in measurement has been attained.

Companion websites

Many students, particularly at the outset, find the subject difficult. The printed word in the form of a textbook has a limited usefulness in providing the appropriate teaching for these technical competencies. The most effective method of acquiring expertise in these disciplines is by practice and the contemporaneous answers to questions as they arise. To provide further assistance there are dedicated websites at <http://ostrowskiquantities.com> and at Wiley Blackwell (<http://www.wiley.com/go/ostrowski/estimating>). It is hoped that the provision of this will go some way towards expanding the opportunities for practice in a more useful way than using the printed word alone.

The RICS website (www.rics.org) includes the NRMs free of charge for members and they also available on the RICS subscription information service (ISurv) (www.rics.org/uk/knowledge/more-services/professional-services/isurv/). Most practices, contractors and universities are subscribers. This means that a screen-based version is available to most individuals free of charge and hard copies can be obtained for the cost of the printing.

1.2 STANDARD METHODS OF MEASUREMENT

There are currently several different methods of measurement published by the RICS as follows:

- The RICS Code of Measuring Practice. This sets out how to measure floor areas.
- NRM 1, The RICS New Rules of Measurement for Estimating and Cost Planning. This provides a method of measurement for quantities on an elemental basis for estimates and a different method of measurement for cost plans.
- NRM 2, The RICS New Rules of Measurement for Building Works. This measures quantities on a trade basis.
- NRM 3, The RICS New Rules of Measurement for Whole Life Costs Concerning Maintenance, Renewal and Inspection. This measures quantities on an elemental basis as NRM 1.

The introduction of the full suite of NRMs means that there are accurate forms of measurement that will need to be prepared to reflect the design and specification at the end of significant stages of the design process. They should also provide accurate prices from the information made available.

Elemental measurement

The first task is to measure the work using an elemental method of measurement such as NRM 1 (Order of Cost Estimating and Cost Planning for Capital Building Works). Each element of the building is measured, eg a reinforced concrete roof will comprise several trades, *viz.* concrete, formwork, reinforcement, screed, asphalt, metalwork, balustrading etc. Within this elemental method there is a different method of measurement for the estimate and the cost plan. The estimate uses preparatory design information and mainly uses the superficial floor areas as the basis for measurement. The cost plans uses a progressively more developed design and measure quantities using units that are cubic superficial, enumerated and itemised for a larger range of elements.

Trade measurement

The second task is to measure the work using the trade method of measurement in NRM 2 (Detailed Measurement for Building Works). Each trade is measured separately wherever it occurs in the building, using a technically complete design. This enables the efficient collection of trade works into separate bills of quantities and ease of pricing by the contractor.

Compatibility

The goal of a strong, seamlessly linked, cost control pathway has commenced with the publication of NRM 1 and 2 which provide sets of rules that are accurate and consistent. It can also be seen that NRM 1 and 2 provide more than one set of rules which are alternative and overlapping methods to measure quantities. The progressive measurement and pricing stages, for estimates, cost plans and trades provides a structured cost management framework that is more detailed and accurate at each stage. However, standardisation, accuracy and consistently will be lost if the prices in the estimates and cost plans which have been prepared on an elemental basis using NRM 1 are not compatible with the tendered prices which have been prepared on a trade basis using NRM 2. The audit trail will be disconnected and the transparency that the client requires may not be possible. The measurement and pricing in the cost plans cannot be compared with the measurement and pricing in the trade bills of quantities and the client may consider that going out to tender on the elemental measurements included in the cost plans will provide adequate early stage prices. However, comprehensive financial security for the client can be made available with the measurement of trade bills of quantities using NRM 2 to be priced by the contractor to provide a fully quantified schedule of rates. In this way the perception that the bills of quantities are a barrier to collaboration amongst the stakeholders is removed.

It is possible to combine the advantages of both NRM 1 and NRM 2 into a single structured set of rules. The advantage of elemental measurement is the relevance of the costs to a particular part of the building. The advantage of trade measurement is that this is the basis of the pricing for the contractors and subcontractors who construct the work. Weights and volumes will remain the basis of pricing substantial parts of all construction work. The appropriate parts of the trade bills of quantities can be allocated to the appropriate elements.

1.3 PRICING

Accurate prices

The perennial problem with estimates is that they are not accurate enough. Despite the vast amount of information that is available this problem remains. Some research has been carried out by an eminent cost engineer in the USA. Hackney (1992) refers to a Rand study in Chapter 53 concerning the quantified effects of management decisions. He states that: *'Estimates prepared by groups with a vested interest in having the projects approved were found to be associated with added cost growth. Cost growth for their project averaged 49%, compared with 22% for estimates prepared by estimators independent of the group sponsoring the project . . .'* (p. 456).

This confirms our impression that all estimates are problematical. He goes on to state the reasons why: *'The primary reason for this difference appears to be that the average estimate prepared by project champions were less well defined than the average estimate prepared by independent estimators The difference may also reflect the tendency of sponsor groups to provide their estimators with optimistic assumptions.'* (p. 456–7).

Complex buildings require complex estimates and this is often in advance of sufficient information being made available. The ability to predict an accurate price is restricted to the quality and quantity of the information available and the expertise and experience of the surveyor. As a consequence the anticipated costs should be expressed as a range rather than a single target figure.