

# 1 Introduction

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## 1.1 INTRODUCTION

### Contents

The contents include an introduction to most of the sections in *New Rules of Measurement NRM 2* intended for use by students and practitioners as follows:

1. Introduction
2. The Basics
3. Corners
- 4–21. Individual trades
22. Preliminaries
23. Computer aided taking off
24. Preparation of Bills of Quantities (BQs)

Also included is:

- A detailed worked example of the practical application in each chapter
- A comprehensive exercise for practice at the end of each chapter
- The 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
- A companion website with animated Powerpoint presentations of the chapters to provide further assistance and opportunities to ask real time questions

The first edition of SSM 7 was published in 1988. There are several developments that make the introduction of a new method of measurement appropriate. The first is the decline of trade crafts. Most site work is semi-skilled at best and does not require the complex labour skills that were necessary in the past. NRM 2 has reduced the extent of the 'labour' items that are required to be measured. Another development is the technological development of off site fabrication with site erection and the consequent decline in the 'wet' trades like plastering. Partitioning and curtain walling have become a large proportion of construction work and are now represented in specific sections in the NRM 2 as Section 20 Proprietary linings and partitions and Section 21 Cladding and covering. Finally 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. These developments make a new suite of standard methods of measurement appropriate.

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 BQs and finally the whole life costing maintenance programmes. The intention is to provide an audit trail of the quantities and prices from the beginning to the end of the life cycle of the building. 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.

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

- *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

## **Practical examples and self-assessment exercises**

The pedagogy of quantity surveying is primarily concerned with the nature of the knowledge that is being learned. Technical competencies such as 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). A technical competence like measurement is acquired 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 examples to see the process that is required and how to set out the work. An examination of the practical examples in each chapter will provide the information necessary to carry out the self-assessment exercise which follows after the practical example.

The practical examples and self-assessment exercises are set out on traditional rulings, double dimension paper. Although much work can now be done on spreadsheets and software, 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 double dimension paper. When the competence levels have reached Level 2, an ability to carry out the work comprehensively and accurately without supervision, then the software programmes can be introduced. Software measurement packages require a significant amount of practice before they can be used effectively. Proficiency in the software is best acquired after expertise in measurement has been attained.

## **RICS competence levels**

The Royal Institution of Chartered Surveyors (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 is 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 the knowledge. This is the provision of procedural knowledge of actually being able to undertake the competence to the 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 and will only be available after some time in practice, which is part of the RICS APC programme. In this textbook the provision of worked examples can be followed and replicated and practical exercises at the end of each chapter provide practice at Level 2. The marking scheme provides some level of discrimination on the quality of the work that has been practised. Knowing how to use these NRMs is therefore a necessary step on the route to Level 3 and a professional qualification as a chartered quantity surveyor.

## **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> with full A4 formats of the practical examples and exercises, animated Powerpoint presentations of each trade described in the text and opportunities to ask real time questions, attend workshops, seminars, conferences and courses, and at Wiley Blackwell (<http://www.wiley.com/go/ostrowski/measurement>). It is hoped that the provision of these additional facilities will go some way towards expanding the opportunities for practice in a more useful way than using the printed word alone.

The RICS website includes the NRMs free of charge for members and they are also available on their subscription information service, 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 for building works published by the RICS as follows:

- *The RICS Code of Measuring Practice*. This sets out how to measure floor areas.
- *The RICS new rules of measurement NRM 1: Order of cost estimating and cost planning for capital works*. This provides a method of measurement for quantities on an elemental basis for estimates and a different method of measurement for cost plans.
- *The RICS new rules of measurement NRM 2: Detailed measurement for building works*. This measures quantities on a trade basis.
- *The RICS new rules of measurement NRM 3: Maintenance and operations cost estimating, planning and procurement*. 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 project.

There are other formats for standard methods of measurement for specific purposes, and many countries have their own formats. Examples include the Civil Engineering Standard Method of Measurement (CESMM) and the Principles of Measurement International (POMI).

### Elemental measurement

The first method of measuring quantities is by using the elemental method of measurement in NRM 1 (*Order of cost estimating and cost planning for capital works*). Each element of the building is separately measured, e.g. a reinforced concrete roof will be a separate section comprising 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 uses mainly the superficial floor areas as the basis for measurement. The cost plans use 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 method of measurement is measuring the work by 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 for the measurement of quantities. The progressive measurement and pricing stages for estimates, cost plans and trades provide a structured cost management framework that is more detailed and accurate at each stage. However standardisation, accuracy and consistency will be lost if the prices in 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 (BQs). 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 to provide financial security for the client the measurement of trade BQs using NRM 2 can be priced by the contractor to provide a fully quantified schedule of rates. They are a complete and detailed analysis of the measurement and pricing of all the works and in this way they protect all parties. In this way the perception that the BQs are a barrier to collaboration amongst the stakeholders is removed.

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 and therefore will remain the basic form of measurement. However it is possible to combine the advantages of both NRM 1 and NRM 2 into a single structured set of rules. The appropriate parts of the trade BQs can be allocated to the appropriate elements.

## The relevance of Bills of Quantities

The measurement of the quantities of work in a construction project is an important part of establishing what the cost will be. These quantities were originally prepared by each contractor and then by a separate organisation who sold the quantities to the contractors. Quantity surveying (QS) practices then developed and they provided the BQs

to the client as part of the financial control. The client then sent the BQs to the contractors to provide a tender for the work. Recent developments have seen work packages prepared by the consultants which comprise the drawings and specifications but do not include BQs. The package contractor prepares his own BQs and they may not form part of the contract documentation. The work is still measured and the measurement is often carried out by the same QS practices. The professional practices now prepare the BQs for the subcontractors. This is because a successful contract requires an accurate price and this requires accurate quantities. It can be seen that BQs will continue to be needed. The recent launch of the NRM suite of standard methods of measurements has brought into focus two significant developments. The first is the perceived understanding that BQs act as a barrier between the Client and the professionals. The second is the need to standardise methods of measurement throughout the whole life of the project, from inception to demolition. The merits of an accurate set of quantities from a third party remain considerable; at the same time there are also some disadvantages. They are both rehearsed below.

### **The advantages of BQs**

BQs provide a comprehensive and accurate measurement of the total work necessary to be completed. The pricing of such a document can provide a comprehensive and accurate bid for the work. They provide an excellent method of obtaining competitive prices and they are an excellent vehicle for comparing the tenders. BQs are an excellent check of buildability because the design is examined and measured in such detail. During construction they can be used to measure the amount of work completed as the basis for interim certificates. Variations can be easily priced using the BQs as a schedule of rates. The final account can use the BQs as the basis for the final certificate.

### **The disadvantages of BQs**

The fundamental problem with BQs is that they form a barrier to understanding by the design team. They do not form an integral and seamless transition from the estimate to completion that can be understood by all parties. The rules for the preparation of BQs are not the same as the rules for forming the estimate or cost plan. They are an excellent way of getting the cheapest price and for post-contract financial control but they can only be used and scrutinised by the QS team who have the specialist knowledge required to interrogate the figures. The solution is to amend the structure of trade BQs into a format compatible with that of the estimates and cost plans. They require a large amount of information from the design team and also take time to prepare. Because they are comprehensive and accurate they are expensive to prepare. These costs are incurred before the work has started on site and constitute a significant drain on the developer's cash flow. Much work is now let as work packages which require smaller and discrete amounts of information and measurement. A large proportion of work is now built using design and build contracts where the risk for accurate design and pricing lies with the contractor. The need for comprehensive and accurate BQs is not so important with these contracts.

## 1.3 CONTRACT DOCUMENTATION

### Components

The BQs form part of the contract documentation. The components are as follows:

- Contract
- Drawings
- Specification
- BQs
- Tender
- Statutory requirements
- Employers' requirements
- Site requirements
- Contractor requirements

### Documentary discipline

The documentation is extensive and comprehensive. Such a complex array of documentation requires rigorous discipline to ensure that the information remains relevant and accessible. The use of electronic storage and cut and paste from one contract to the next often leads to duplication and error. The quality of the documentation is often compromised and is superseded by a vast array of disordered documents in the hope that the required clauses will be included somewhere in the documents.

