

## PART 2

# Measurement Risk

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# Chapter 5

# New Rules of Measurement: NRM1

NRM1 is part of the suite of documents that make up the RICS New Rules of Measurement. Its full title is *NRM1: Order of cost estimating and cost planning for capital building works*. It was first published in 2009 as *NRM1: Order of cost estimating and elemental cost planning* and is now in its second edition which became operative on 1 January 2013. The NRM suite of documents is also part of the RICS ‘Black Book’, which is *a suite of guidance notes that define good technical standards for quantity surveying and construction professionals* (RICS).

NRM1 is the ‘sister’ to two other RICS New Rules of Measurement, namely, *NRM2: Detailed measurement for building works* and *NRM3: Order of cost estimating and cost planning for building maintenance works*. Together, the three documents are intended to provide measurement rules for the effective cost management of construction projects throughout their life cycle.

## 5.1 New rules: New approach

It is a common theme in the NRM suite of documents that explanations, guidance and ‘how-to’ examples are included in what is, ostensibly, a set of measurement rules. Historically, methods of measurement have not adopted this approach and have been limited to providing measurement rules that practitioners and other users simply have to learn, understand and apply according to their own interpretation and judgement.

In one sense, the authors of the NRM suite are to be applauded for this novel approach but, in other respects, could be criticised because the documents overall lack precision, contain mistakes and, in some cases, are not very clear.

The authors of NRM1 claim that:

1. The RICS New Rules of Measurement have been written in such a way as to be *understandable by all those involved in a construction project*.
2. The new rules should assist the quantity surveyor/cost manager *in providing effective and accurate cost advice*.

The first of these claims is questionable, to say the least, and the second is debatable. Rules of measurement need to be precise and clear, and NRM1 is neither, but, whatever the case, it is crystal clear that the status of NRM1 as an RICS guidance note should be uppermost in the thoughts of those involved in giving cost advice.

## 5.2 The status of NRM1

The applicability of the status of NRM1 is more narrowly drawn than that of its sister document, NRM2, as NRM1 refers only to ‘member(s)’ and ‘surveyor’, whereas NRM2 also includes the wider term ‘user’ in the scope of its legal and disciplinary applicability.

NRM1: *Introduction* explains that *these rules* have the status of an RICS guidance note. This means that NRM1 is *recommended good practice* because an RICS guidance note is defined as a *document that provides users with recommendations for accepted good practice as followed by competent and conscientious practitioners*.

However, NRM1: *Introduction* also states that *where recommendations are made for specific professional tasks*, such recommendations shall represent *best practice*.

Consequently, ‘members’ who use NRM1 will be judged by two standards:

1. **Good practice**, as followed by competent and conscientious practitioners.
2. **Best practice** when it comes to following recommendations made for *specific professional tasks* within NRM1.

NRM1: *Introduction* additionally explains that **best practice** is defined by the RICS as representing a *high standard of professional competence* and that where recommendations are made in NRM1 for *specific professional tasks*, these are intended to represent best practice.

The meaning of the phrase *specific professional tasks* is not explained in NRM1, nor are any *specific professional tasks* identified in the document. The RICS Rules of Conduct (RICS, 2007a, b) are more explicit and impose upon members, and member firms, two specific obligations with regard to their *professional work*:

- **Competence** – to work with *due skill, care and diligence and with proper regard for the technical standards expected...*
- **Service** – to work in a *timely manner and with proper regard for standards of service and customer care expected...*

Ashworth et al. (2013) shed no light on this issue. They refer to professional ‘roles’ and ‘activities’ but not tasks.

It can only be assumed, therefore, that *specific professional tasks* relate to tasks expressly identified in a contract for professional services. If this is the case, then these tasks would be judged to the higher standard of professional competence, that is, best practice.

### 5.2.1 Professional competence

The status of NRM1 is very important in the context of the increasing tendency towards litigating against construction professionals, such as architects, engineers and surveyors, and there have been a number of cases whereby quantity surveyors have been involved in multimillion £ claims for negligent cost planning and cost advice. A number of landmark cases have arisen from actions brought against quantity surveyors (and others) following significant cost overruns, including *Cophthorne Hotel v Arup* [1997] 58 Con LR 105 and *George Fischer Holdings v Multi-Design Consultants* [1998] 61 Con LR 55.

Quantity surveyors have obligations and duties of care that originate from a number of sources. They are based in statute law, including the Building Act 1984 and the Building Regulations 2000, regulation, common law, contract and tort. Other regulatory obligations and codes of conduct further define the professional standards expected of a quantity surveyor. In particular, the RICS Rules of Conduct set out standards for its members who are required to carry out work with reasonable care, skill and expertise.

The courts understand the standards expected of professional people and apply the definitive common law test, where the use of some special skill or competence is involved, of *the standard of the ordinary skilled man exercising and professing to have that special skill. A man need not possess expert skill... it is sufficient if he exercises the ordinary skill of the ordinary competent man exercising that particular art.*<sup>1</sup>

This, however, is a standard lower than the *best practice* referred to in NRM1.

Knowles (2012) suggests that where a quantity surveyor provides cost advice to an employer that proves to be incorrect, the employer must demonstrate either that the accuracy of the estimate was warranted or that the reason for its inaccuracy stemmed from a lack of reasonable skill and care on the quantity surveyor's part. Again, this learned interpretation appears to refer to the lesser standard of *good practice* rather than *best practice*.

### 5.2.2 Negligence

NRM1: *Introduction* makes it clear that conforming to the practices recommended in the document should provide *at least a partial defence to an allegation of negligence* and that non-compliance with recommended practice should only be undertaken with justification as a court, a tribunal or the RICS Disciplinary Panel may ask for an explanation as to why recommended practice was not adopted.

The test applied in cases of professional negligence is, as Patten (2003) suggests, **whether the quantity surveyor acted with the skill and care expected of a reasonably competent member of his profession** and NRM1 confirms that a court or tribunal may take account of the contents of guidance notes as being indicative of 'reasonable competence'.

However, NRM1: *Introduction* also states that *where, within NRM1, recommendations are made for specific professional tasks, these are intended to represent 'best practice' which, in the opinion of the RICS, meet a high standard of professional competence*, that is, a higher standard than that demanded by the courts.

#### Risk issue

NRM1: *Introduction* is clearer as to who needs to comply with an RICS guidance note than NRM2, as NRM1 refers only to 'member(s)' and 'surveyor' and not to 'users'.

The most likely litigant in cases of negligent cost advice is, of course, the employer who, having engaged a professional quantity surveyor, feels that he has received inadequate professional advice or services.

### 5.2.3 Pre-action protocol

The importance of the issue of negligence is not to be understated in that the UK Ministry of Justice has seen fit to publish the *Pre-Action Protocol for the Construction and Engineering Disputes* (Ministry of Justice, 2012) that applies to construction and engineering disputes, including those

involving professional negligence claims against architects, engineers and quantity surveyors. The intention of the Protocol is to ensure that:

- The parties are clear as to the issues in dispute.
- Information has been exchanged in a timely and efficient manner.
- The parties have met and have attempted to arrive at a resolution without resort to litigation.
- Should litigation ensue, it can proceed in an efficient manner.

The status of NRM1 as a guidance note is not to be taken lightly!

## 5.3 Structure of NRM1

NRM1 has four parts and seven appendices:

- **Part 1** contextualises approximate estimating and cost planning in terms of the RIBA and OGC process models and also explains certain symbols and abbreviations. The important aspects of this part are the definitions of terms used in the rules (Paragraph 1.6.3).
- **Part 2** is largely explanatory as regards order of cost estimates – what they are, how they are made up and how they are prepared. It also *sets out the rules of measurement for the preparation of order of cost estimates* using cost per m<sup>2</sup>, cost per functional unit and the elemental method of approximate estimating. Order of cost estimating is beyond the scope of this book, but the measurement rules relating thereto are considered later in the chapter.
- **Part 3** is again largely explanatory as regards the purpose and processes of elemental cost planning along with rules of measurement that apply to putting an elemental cost plan together. Cost planning is also beyond the scope of this book, but the measurement rules relating thereto are considered later in the chapter.
- **Part 4** consists of 5 pages of dialogue explaining how the tabulated rules are to be used and how items are to be codified, as well as 253 pages of measurement rules applicable to the preparation of cost plans.
- **Appendices:**
  - Appendix A – defines ‘gross internal floor area’ (GIFA) and explains how this is measured and what it includes and excludes. Diagrams C, D and M provide practical (if somewhat limited) examples of dimensions used for the measurement of quantities.
  - Appendix B – lists commonly used functional units.
  - Appendix C – defines ‘net internal floor area’.
  - Appendix D – special definitions for shops.
  - Appendix E – sets out the logic and arrangement for an elemental cost plan. Useful as an *aide memoire* for identifying the sub-elements that are included within each element and group element.
  - Appendix F – identifies information requirements for the preparation of formal cost plans. Very useful *aide memoire* to establish a list of tender documents should NRM1 be used to formulate a bill of quantities.
  - Appendix G – template for elemental cost plan.

### 5.3.1 Measurement rules

At first glance, NRM1 is a daunting document, extending as it does to some 369 pages plus index.

However, of this number, 262 pages are taken up by the detailed measurement rules for cost planning, and there are 41 pages for the bibliography and appendices. The remaining 66 pages appear at the ‘front end’ of NRM1 in Parts 1, 2 and 3.

It is at the ‘front end’ where most of the problems with NRM1 lie, the main difficulty being finding the ‘measurement rules’ – they are there, but it takes a lot of reading to find them. The ‘measurement rules’ within NRM1 Parts 1–3 are interspersed amongst a variety of descriptions, definitions and explanations which, whilst being relevant and useful, mask the actual ‘rules’. Consequently, within Paragraph 2.15: *Measurement rules for risk*, for example, there are 2½ pages of text but only one measurement rule.

### 5.3.2 *Measurement rules for order of cost estimating*

The measurement rules for order of cost estimating are contained in NRM1 Part 2, Paragraphs 2.5, 2.6, 2.8 and 2.11–2.16.

However, the problem is that these paragraphs also contain explanatory and other general text concerning the constituents of an order of cost estimate and other related general matters. Added to this is that other paragraphs contain what appear to be ‘rules’, but it is not clear whether or not they are ‘rules’.

This may appear to be ‘picky’, but the expression ‘rules is rules’ is important in the context of a set of rules of measurement that are meant to be standardised, understood and followed by users of the document and recipients of the output generated by the measurement process.

### 5.3.3 *Measurement rules for cost planning*

Part 3 is equally a ‘jumble’ of descriptions, definitions and explanations, this time concerning cost planning, the constituents of a cost plan and other related general matters.

The actual ‘rules’ are given in Paragraphs 3.10, 3.11 and 3.14–3.19 albeit that these paragraphs also contain explanatory and other general text.

### 5.3.4 *Distinguishing the rules of measurement*

In order to assist the reader to clearly identify the ‘rules’ of measurement from other text in NRM1, this chapter is structured as follows:

- Measurement rules for order of cost estimates and for cost plans have been collected and presented together in a box under the heading ‘NRM1: Measurement rules’.
- Each NRM1 paragraph that contains an obvious measurement rule is listed in the box (e.g. Paragraph 2.6.1 (a) (ii) is a ‘measurement rule’ which is to be found at NRM1 Paragraph 2.6.1 (a) (ii), and Paragraph 3.11.3 is a ‘measurement rule’ which is to be found at NRM1 Paragraph 3.11.3).

In all other respects, the headings in this chapter generally follow those of NRM1.

### 5.3.5 *Types of measurement rules*

There are two basic types of standardised measurement rules in NRM1 that form the basis of a system of design cost control. One of these is intended for developing order of cost estimates and the other for cost planning purposes.

The measurement rules in NRM1 consist of:

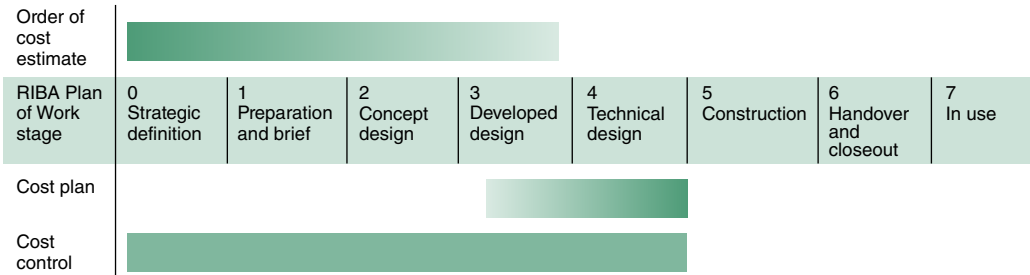
1. Measurement rules relating to techniques of approximate estimating (i.e. for establishing a budget or cost limit):
  - Expressed in m<sup>2</sup> of GIFA.
  - Expressed in functional units (e.g. seats in sports stadium, hospital bed spaces, prison places).

## 2. Measurement rules relating to elemental cost planning:

- Expressed in units of measured quantities (i.e. m, m<sup>2</sup>, m<sup>3</sup>, nr, tonne).

The point at which the *measurement rules for elemental cost planning* are used instead of the *measurement rules for order of cost estimating* is determined by the design process.

This is likely to be during or towards the end of Stage 3 – Developed Design of the RIBA Plan of Work 2013 when the drawings have become sufficiently developed to make the transition from cost/m<sup>2</sup> of GIFA, or functional units, to detailed measurement of individual items of building work. This is illustrated in Figure 5.1.



**Figure 5.1** Design cost control.

In this context, the main message from Paragraph 1.4 of NRM1 is that the New Rules of Measurement *represent the essentials of good practice* and provide:

- A *structured basis* for measuring building work.
- A *consistent approach* for dealing with other components of the cost of buildings:
  - Contractors' preliminaries.
  - Overheads and profit.
  - Risk factors.
  - Fees.
  - Inflation.

## 5.4 Design cost control: Introduction

Essentially, the purpose of NRM1 is to provide formalised measurement rules for use in the cost control, or cost management, of building design.

This process begins with a 'high-level' estimate, or **order of cost**, which is then developed, alongside the maturing design, into an **elemental cost plan**. The cost plan is then reconciled (or compared) with tenders received from contractors in order to establish any differences between the amount that the employer can afford to pay and what the prevailing market deems to be the right price at the time of tender.

In some respects, NRM1 is stuck in the 'time warp' of traditional procurement, where an employer-engaged professional quantity surveyor (PQS) provides cost advice during the design stages of a project.

Admittedly, NRM1 was rolled out before the RIBA Plan of Work 2013 was published, and whilst written from the employer-PQS perspective, it may be interpreted in different ways to suit different users and different procurement arrangements. In fact, NRM1 Paragraph 3.6.1 refers to the use of the cost plan as a *cost control mechanism* where a project is to be procured using work packages, but this only relates to the *pre-construction* and *construction* stages and not to the design development stages.

Many projects nowadays are procured on a non-traditional basis, and it is not uncommon to find contractors appointed, even for public sector contracts, at very early stages in the maturity of a project, often as early as the concept design stage. This is not recognised in NRM1, but despite its frailties and mistakes, it provides a rich source of guidance and well-structured measurement rules, which should prove attractive to a wider community than the somewhat narrow fraternity of the PQS.

It would be a shame if main contractors, specialists and subcontractors felt that there was little point in looking at NRM1, because it offers the opportunity to take a structured approach to developing cost estimates for design–build projects, early-stage contractor/specialist appointment and target/pain–gain contracts and much more.

Failing to recognise that the cost control of modern construction projects has a much wider purview than the provision of early cost advice and cost planning services by PQSs to employers would be to miss out on a great opportunity.

### 5.4.1 Symbols, abbreviations and definitions

Paragraphs 1.6.1 and 1.6.2 clarify the measurement symbols and abbreviations used in NRM1, respectively. They are self-explanatory, but the five pages of Paragraph 1.6.3: *Definitions* are more interesting because they contain lots of useful definitions of terms, used in the cost estimating and cost planning process, that help the user to understand what cost estimating and cost planning is about.

NRM1 defines **cost control** as *the process of planning and controlling the cost(s) of buildings...throughout [the] complete duration of the construction project*. Ashworth et al. (2013) concur with this definition and point out that cost control is a feature of the construction process that extends from the inception of a project to final account.

NRM1, however, is intended to provide guidance for cost control during design and up to acceptance of the contractor's tender. Conventionally, this is called **design cost control**, but NRM1 offers no definition of this term.

**Order of cost estimate** is defined as *the determination of possible cost of a building(s) early in the design stage in relation to the employer's functional requirements... and forms the build-up to the cost planning process*. The order of cost estimate forms the basis for deciding on the **cost limit**, which is *the maximum expenditure that the employer is prepared to make for the building(s) required*.

Once the cost limit has been established, the design team can proceed with producing the detail required to satisfy the employer's functional and aesthetic requirements, but this needs to happen within a control framework. This is the function of the cost plan, or more correctly the **elemental cost plan**, which is defined as *the critical breakdown of the cost limit... into cost targets for each element of the building(s)*.

Mention of the 'design team' leads to consideration as to the members of this team and what they do. In NRM1, **design team** means *architects, engineers and technology specialists* who have responsibility for the conceptual design of a building or structure and for its development into drawings, specifications and instructions for construction and associated purposes.

This is the same definition as that used in NRM2, and inexplicably, it excludes the quantity surveyor/cost manager. Considering the importance of the role played by the PQS in the cost planning and cost control of the design and, usually, the construction stages of a project, this is quite simply a bizarre exclusion.

The 'design team' is defined as being part of the 'project team', which, unlike in NRM2, is defined in NRM1. The **project team** is the *employer, project manager, quantity surveyor/cost manager, design team and all other consultants* with the responsibility for the delivery of the project, together with *the main contractor where the main contractor has been engaged by the employer to provide pre-construction services*.



This is an even more breathtaking definition than ‘design team’. It smacks of the ‘old club’ which excludes contractors and subcontractors unless they have been involved in the design process. This is not a helpful definition as it perpetuates the traditional division between design and construction and between the employer’s ‘side’ and the contractor’s ‘side’ of the project ‘fence’ and is hardly in the spirit of ‘partnering’.

The definition begs the question as to just which ‘team’ do contractors and subcontractors belong? Obviously, not the ‘exclusive’ project team!

### 5.4.2 NRM1 in context

NRM1 Part 1: *General* places early cost estimating and cost planning in the context of two well-known process models – the RIBA Plan of Work and the OGC Gateway Process. These process models provide a diagrammatic explanation of how the project initiation, design, construction and post-tender reconciliation phases work. The RIBA Plan of Work referred to in NRM1 is the 2007 version which has now been superseded by the RIBA Plan of Work 2013 albeit it is understood that some practitioners do not intend to adopt the 2013 version!

Other than that, NRM1 Part 1 is largely explanatory; it explains the purpose of NRM1 and its intended use and structure and provides details of symbols and abbreviations used in the document.

It is clear that order of cost estimates relate to the early appraisal and briefing stages of the design process and that cost planning comes along later when design work proper has been commenced. As the design develops, NRM1 contemplates three formal cost plan stages, culminating in **Formal Cost Plan 3** at the completion of the technical design. This is the point at which the pre-tender estimate is formulated in anticipation of tenders being received from the competing contractors. The tenders received are then compared (reconciled) with the cost plan as part of the tender adjudication process prior to choosing the successful contractor.

### 5.4.3 Purpose of NRM1

Paragraph 1.3 identifies the purposes of NRM1, the extent of its application and what it is not intended for:

#### Paragraph 1.3.1

- *To provide a standard set of measurement rules that are understandable by all those in a construction project, including the employer.*
- *The RICS New Rules of Measurement should assist the quantity surveyor/cost manager in providing effective and accurate cost advice.*

#### Paragraph 1.3.2

- *To provide rules of measurement for the preparation of order of cost estimates and elemental cost plans.*
- *To provide direction on how to describe and deal with costs and allowances forming part of the cost of a building, but which are not reflected in the measurable building work items....*

#### Paragraph 1.3.3

- *The RICS New Rules of Measurement do not explain estimating methods, cost planning techniques, procurement methods or contract strategies.*

#### Paragraph 1.3.4

- *The RICS New Rules of Measurement are based on UK practice but *have worldwide application.**

Paragraph 1.3.3 is, perhaps, the most revealing in the context of the status of NRM1, because ‘members’ can only be judged, in the context of NRM1, on what the guidance note is concerned with but not on the methods and techniques used when applying NRM1 or on the contractual or procurement advice provided, which are all issues that NRM1 is not concerned with.

Consequently, the *specific professional tasks*, which form the basis of the higher professional standard of **best practice**, must be limited to those with which NRM1 is concerned.

The provision of a standard set of measurement rules for the preparation of order of cost estimates and cost plans (Paragraph 1.3.2) is self-evidently the main purpose of NRM1, but further purposes of the measurement rules in NRM1 are provided elsewhere in the document:

- Paragraph 2.1.4 states that the rules of measurement for element unit quantities (EUQ) can be used as a basis for measuring EUQ for the cost analysis of building projects. The phrase (*elemental*) *cost analysis* is defined in NRM1 Paragraph 1.6.3: *Definitions as a product-based cost model which provides a full appraisal of costs involved in previously constructed buildings*. Ashworth (2010) casts further light on this by explaining that a cost analysis is based on *data received from an accepted tender* (Ashworth 2010), that is, as opposed to an agreed final account.
- Paragraph 3.1.4 of NRM1 adds that *the measurement rules for elemental cost planning can also be used as a basis for measuring quantities for the application to whole life cycle costing*. This is sensible guidance that should add consistency and reliability to the collection and analysis of such data. If, however, NRM1 can be used for measuring such quantities, it is strange that no mention is made of measuring other sorts of quantities using NRM1 (e.g. bills of quantities/approximate quantities).

## 5.5 Design cost control: Techniques

Essentially, NRM1 provides standardised measurement rules – where none existed before – which introduce consistency into the preparation of **order of cost estimates** (aka first estimate, budget, cost limit) and **elemental cost plans**.

Order of cost estimates and elemental cost plans are the output of the design cost control process which rely upon the input generated by the estimating methods used.

NRM1 Part 2.1: *Introduction* usefully categorises the three main estimating methods used for preparing order of cost estimates:

- Floor area method.
- Functional unit method.
- Elemental method.

Anyone unused to cost planning will find these estimating methods somewhat alien compared to the more familiar bills of quantities that most people in the industry are used to. All three methods use the familiar **quantity × rate = price** formula, but the items measured and the rates used will not be so familiar.

These methods of approximate estimating are clearly explained in NRM1 itself and by Bengé (2014) in a definitive guide to measurement and estimating using NRM1.

Primary sources of cost data for use with approximate methods of estimating include major price books, such as Spons (Langdon, 2014) and Griffiths (Franklin + Andrews, 2014), and the BCIS Cost Information Service.

BCIS, available by subscription from the RICS, supplies rates/m<sup>2</sup> for a wide variety of building types and detailed elemental cost analyses of previous tenders, as well as locational and inflation adjustment indices, building cost and tender price indices and market information. BCIS has produced a new *Standard Form of Cost Analysis* (Fourth Edition) specifically for use with NRM1.

### 5.5.1 Floor area method

The floor area method of approximate estimating relies on the measurement of the GIFA of a building to which a suitable rate per m<sup>2</sup> is applied to arrive at a price.

The RICS *Code of Measuring Practice* (Sixth Edition) is the ‘standard method of measurement’ for calculating GIFA which is defined as *the area of a building measured to the internal face of the perimeter walls at each floor level*.

The *Code of Measuring Practice* is reproduced in Appendix A of NRM1 wherein details of what is included and excluded from the GIFA, together with details as to when and how to use the GIFA method of measurement, may be found.

#### NRM1: Measurement rules

*NRM1 Appendix A: Core definition of gross internal floor area (GIFA)*

|                               |  |
|-------------------------------|--|
| 2.0                           | GIFA   |
| 2.1–2.17                      | Included in the GIFA   |
| 2.18–2.22                     | Excluded from the GIFA   |
| APP 4–8                       | Applications   |
| GIFA 1–7                      | Notes  |
| Supplementary definitions 1–4 | Definitions adapted from the BCIS <i>Standard Form of Cost Analysis</i> (Fourth Edition) |

Once the GIFA has been determined, the building works estimate is given by the formula:

|   |   |   |   |                         |
|---|---|---|---|-------------------------|
| GIFA (m <sup>2</sup> )  | × | Cost per m <sup>2</sup>   | = | Building works estimate |
| Floor area measured inside external walls (see NRM1 Appendix A) |   | Derived from: <ul style="list-style-type: none"> <li>■ BCIS cost analysis</li> <li>■ Spon’s or other builders’ price book</li> <li>■ Internal database</li> </ul> |   |                         |

#### Example:

*New factory unit with internal office*

|                         | Quantity | Unit           | Rate (£) | Total (£) |
|-------------------------|----------|----------------|----------|-----------|
| Building works estimate | 2000     | m <sup>2</sup> | 1750     | 3 500 000 |

#### Caveat:

It must be pointed out that the unit rate used in this method of estimating is subject to a great deal of adjustment to reflect differences between the data source and its use.

Location of the works, base date of the price data, contract type, prevailing market conditions, the morphology of the building, quality of construction and other factors will influence the quantity surveyor/cost manager’s judgement as to what the unit rate should be.

### 5.5.2 Functional unit method

Certain building types/functions (e.g. schools, hospitals, football stadia) may be given an associated unit of measurement (e.g. per child/student, per bed space, per seat) as an alternative method of approximate estimating, used where cost/m<sup>2</sup> is more difficult to measure or not appropriate.

The basis of this method of measurement is that the functional units are measured (e.g. number of beds in a nursing home) and a rate per functional unit is applied to this quantity which includes ancillary areas of the building (e.g. office, kitchen, public areas)

The various functional units are set out in NRM1 Appendix B which includes the more usual functional units (e.g. per car parking space, per bed space) and the functional unit of per m<sup>2</sup> of net internal area (NIA). Appendix C provides the measurement rules for NIA, reproduced from the RICS *Code of Measuring Practice* (Sixth Edition), and Appendix D provides special measurement rules for shops, again reproduced from the RICS *Code of Measuring Practice* (Sixth Edition).

| <b>NRM1: Measurement rules</b>  |                       |
|---|-----------------------|
| <i>Appendix B: Commonly used functional units and functional units of measurement</i> |                       |
| <i>NRM1 Appendix C: Core definition of net internal area (NIA)</i>                    |                       |
| 3.0   | NIA                   |
| 3.1–3.10  | Included in the NIA   |
| 3.11–3.21   | Excluded from the NIA |
| APP 9–11  | Applications          |
| NIA 1–9   | Notes                 |
| <i>NRM1 Appendix D: Special use definitions for shops</i>                             |                       |
| 16.0  | Retail area (RA)      |
| 17.0  | Storage area (StoA)   |
| 18.0  | Ancillary areas (AA)  |
| 19.0  | Gross frontage (GF)   |
| 20.0  | Net frontage (NF)     |
| 21.0  | Shop width (SW)       |
| 22.0  | Shop depth (SD)       |
| 23.0  | Built depth (BD)      |
| APP 19  | Applications          |
| RA 1–3; AA 1; GF 1; NF 1; NF 2; SW 1; ShD 1–3   | Notes                 |

**Part 2**

Once the building function and units of measurement have been determined, the building works estimate is given by the formula:

|   |   |   |   |                         |
|---|---|---|---|-------------------------|
| Functional units (nr)   | × | Cost per functional unit  | = | Building works estimate |
| Number of places, beds, seats, etc. including circulation space (see NRM1 Appendix B) |   | Derived from: <ul style="list-style-type: none"> <li>■ BCIS cost analysis</li> <li>■ Spon’s or other builders’ price book</li> <li>■ Internal database</li> </ul> |   |                         |

| <b>Example:</b>                         |                 |             |                 |                  |
|---|-----------------|-------------|-----------------|------------------|
| <i>New 20 000-seat football stadium</i> |                 |             |                 |                  |
|   | <b>Quantity</b> | <b>Unit</b> | <b>Rate (£)</b> | <b>Total (£)</b> |
| Building works estimate                 | 20 000          | nr          | 2 750           | 55 000 000       |

**Caveat:**

It must be pointed out that the unit rate used in this method of estimating is subject to a great deal of adjustment to reflect differences between the data source and its use.

Location of the works, base date of the price data, contract type, prevailing market conditions, the morphology of the building, quality of construction and other factors will influence the quantity surveyor/cost manager's judgement as to what the unit rate should be.

### 5.5.3 Elemental method

NRM1 Paragraph 2.7 is devoted to an explanation of a further method of approximate estimating – the elemental method. This method of approximate estimating is normally used for elemental cost planning (i.e. later on in the design process) but can also be used for order of cost estimates in a simplified form.

The elemental method of approximate estimating can be used as an extension of the cost/m<sup>2</sup> and functional unit methods:

- The order of cost estimate is calculated using either the cost/m<sup>2</sup> or functional unit methods.
- The figure produced is then analysed into elements (usually using the coarse subdivision of group elements) using either:
  - Predetermined percentages for each element or
  - Percentages calculated from a study of previous similar buildings sourced from the BCIS or an internal database.

Alternatively, if sufficient design information is available, quantities for each group element, and if possible, each element, may be calculated and suitable unit rates applied to derive the order of cost estimate.

The elemental method is explained in NRM1 Paragraph 2.7.1. This lists the elements commonly employed, as shown (in part) in Table 5.1. At the early stages of the design process, it is likely that only the group elements will be used due to the lack of information needed for a more detailed breakdown.

**Table 5.1** Elements.

| Group element                                 | Elements                   |
|---|----------------------------|
| 0. Facilitating works                         |                            |
| 1. Substructure                               |                            |
| 2. Superstructure                             |                            |
| <b>3. Internal finishes</b>                   | <b>1. Wall finishes</b>    |
| 4. Fittings, furnishings and equipment        | <b>2. Floor finishes</b>   |
| 5. Services                                   | <b>3. Ceiling finishes</b> |
| 6. Prefabricated buildings and building units |                            |
| 7. Work to existing buildings                 |                            |
| 8. External works                             |                            |

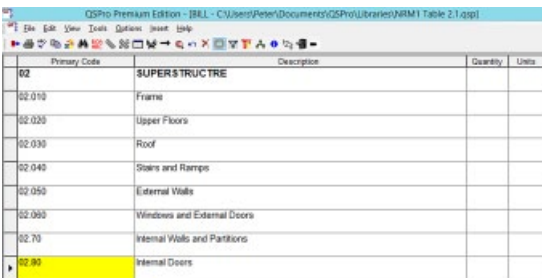
Paragraph 2.7.7 further explains that the elemental method can be used at the concept design stage which then provides a frame of reference for developing the first of the formal cost plans – **Formal Cost Plan 1**. It also explains that the initial EUQ and element unit rates (EUR) will eventually be replaced by more detailed measured quantities and unit rates once sufficient design information becomes available. In practice, this would mean using the Part 4: *Tabulated rules of measurement for elemental cost planning* rather than the EUQ.

The elements used for the **elemental method** are taken from the BCIS *Elemental Standard Form of Cost Analysis*, Fourth (NRM) Edition, which is based on nine group elements:

NRM1 Table 2.1: *Rules of measurement for elemental method of estimating* is the place to find these elements, and Paragraph 2.8.2 explains its structure. NRM1 Table 2.1 provides measurement rules and units of measurement for each individual element, within the relevant group element, together with useful notes that explain areas of potential uncertainty.

It shows, for instance, that the **frame** may be expressed in m<sup>2</sup> by measuring the gross internal floor area (GIFA) of the building, whereas **external walls** may also be expressed in m<sup>2</sup>, but this time by measuring the area of the walls less the area of the windows. The NRM1 units of measurement for the Superstructure element are summarised in Table 5.2.

**Table 5.2** Superstructure: units of measurement.

|  |  | Element                         | Unit   |
|--|--|---------------------------------|--|
|  |  | 1 Frame                         | m <sup>2</sup> – the area of the floors related to the frame                           |
|  |  | 2 Upper floors                  | m <sup>2</sup> – the total area of the upper floors                                    |
|  |  | 3 Roof                          | m <sup>2</sup> – the area of the roof on plan  |
|  |  | 4 Stairs and ramps              | Nr – the number of staircases × the number of floors served excluding the lowest floor |
|  |  | 5 External walls                | m <sup>2</sup> – the area of the walls less the area of the windows                    |
|  |  | 6 Windows and external doors    | m <sup>2</sup> – the area of the windows and external doors measured over frames       |
|  |  | 7 Internal walls and partitions | m <sup>2</sup> – gross area with no deductions for doors and the like.                 |
|  |  | 8 Internal doors                | Nr – giving the total number of doors  |

At order of cost estimating stage, this presumes that a great deal of design detail will be available from which to measure, such as floor plans and elevations at least. Paradoxically, an order of cost estimate is needed at precisely the time when such design information is not available. This doesn't change the fact that the employer needs order of cost information at the earliest possible stage to be able to make a decision on whether to proceed with the project, whether to modify it or whether to not proceed at all.

The choice of measurement unit will depend on the extent of design information available:

**NRM1: Measurement rules**

|                  |   |
|------------------|---|
| Paragraph 2.8    | An order of cost estimate may be expressed in several units of measurement according to the availability of suitable information (refer to Paragraphs 2.8.4 and 2.8.5)  |
| Table 2.1        | Various rules for measuring individual elements within group elements 0 – 8 + 9 (main contractor’s preliminaries) and 10 (main contractor’s overheads and profit)   |
| Paragraph 2.7.3* | <ul style="list-style-type: none"> <li>■ If suitable information is available, then the element unit quantities (EUQ) are measured for an element in accordance with the rules</li> <li>■ Where insufficient information is available for a particular element, the EUQ (element unit quantity) for the element is based on the GIFA</li> </ul> |
| Paragraph 2.7.5  | Where measurement is based on the gross internal floor area (GIFA), this shall be determined in accordance with the RICS Code of Measuring Practice (reproduced in NRM1 Appendix A)   |
| Paragraph 2.7.6  | Where there is more than one building, each building is to be shown separately  |

\*This rather clumsy rule means that Table 2.1: Rules of measurement for elemental method of estimating shall apply in circumstances where an element has been designed in sufficient detail as to enable it to be measured individually. If not, the GIFA is used.

As mentioned previously, Paragraph 2.7.7 explains that *the initial* element unit quantities (EUQ) will eventually be superseded by more detailed measurement of elements, sub-elements and components once the design has been developed in more detail.

This may sound a little strange but remember that the order of cost estimate is just that – an outline of the likely cost for each group element possibly subdivided into elements. This merely establishes a budget per m<sup>2</sup> of GIFA, but when the drawings become available, quantities may be measured in more detail in m, m<sup>2</sup> or m<sup>3</sup> and priced accordingly.

The cost target for an element is derived from the formula:

$$\text{Element unit quantity (EUQ)} \times \text{Element unit rate (EUR)} = \text{Cost target}$$

Derived from:

- BCIS elemental cost analysis
- Spon’s or other builders’ price book
- Internal database of cost analyses/ composite rates

**Example:**

*External wall element for a new house*

|  | Quantity | Unit           | Rate (£) | Total (£) |
|--|----------|----------------|----------|-----------|
| Cost target (based on gross internal floor area) | 150      | m <sup>2</sup> | £480*    | 72000     |
| or alternatively                                 | Quantity | Unit           | Rate (£) | Total (£) |
| Cost target (based on area of external walls)    | 240      | m <sup>2</sup> | £300**   | 72000     |

\*This rate is a proportion of the cost per m<sup>2</sup> for building a complete house (in this case, 30% of £1600/m<sup>2</sup>).

\*\*This rate is the rate per m<sup>2</sup> for a complete wall (e.g. external facing bricks, insulated cavity and internal blockwork).

In the initial stages of a project, the only quantities available will normally be the GIFA, and this will be, therefore, the EUQ for each group element or element in the order of cost estimate.

The EUR will be taken from a previous cost analysis of a similar building and will be a proportion of the total rate per m<sup>2</sup> of GIFA for such a building. The proportions used will be informed by the previous cost analysis used, but the quantity surveyor will also make a judgement based on experience as to what proportions would be suitable in the circumstances (see Table 5.3).

**Table 5.3** Proportion method.

| Group element                                   | Cost (£)<br>per m <sup>2</sup> | %   | Allowance<br>(£) per m <sup>2</sup> | Gross internal<br>floor area (m <sup>2</sup> ) | Totals (£)       |
|---|--------------------------------|-----|-------------------------------------|--|------------------|
| 1 Substructure                                  | 1400                           | 15  | 210                                 | 6000   | 1 260 000        |
| 2 Superstructure                                | 1400                           | 25  | 350                                 | 6000   | 2 100 000        |
| 3 Internal finishes                             | 1400                           | 10  | 140                                 | 6000   | 840 000          |
| 4 Fittings, furnishings and<br>equipment        | 1400                           | 5   | 70                                  | 6000   | 420 000          |
| 5 Services                                      | 1400                           | 35  | 490                                 | 6000   | 2 940 000        |
| 6 Prefabricated buildings and<br>building units | 1400                           | 0   | 0                                   | 6000   | 0                |
| 7 Work to existing buildings                    | 1400                           | 0   | 0                                   | 6000   | 0                |
| 8 External works                                | 1400                           | 10  | 140                                 | 6000   | 840 000          |
| <b>Totals</b>                                   |                                | 100 | 1 400                               |  | <b>8 400 000</b> |

This all sounds a bit arbitrary, but the idea is to provide the employer (and the architect) with an ‘order of cost’ so that they may make informed decisions about the project and its design.

### 5.5.4 Unit rates and EUR

Unit rates and EUR are used in approximate estimating and cost planning.

Unit rates are used to price unit measurements of:

- Floor area (e.g. £ × per m<sup>2</sup> of GIFA).
- Functional units (e.g. £ × per bed space).
- Elements (e.g. £ × per m<sup>2</sup> of roof).
- Sub-elements (e.g. £ × per m<sup>2</sup> of roof covering).
- Components (e.g. £ × per linear metre of roof flashing).

EURs are calculated by the formula:

$$\text{Element unit rate} = \frac{\text{Cost of element}}{\text{Element quantity}} \quad \text{For example} \quad \frac{\text{Cost of roof}}{\text{Quantity of roof}} = \frac{£40\,000}{1\,600\text{ m}^2} = £26 \text{ per m}^2$$

NRM1 Paragraph 2.9 is largely devoted to matters concerning the basis and use of the unit rates used for producing order of cost estimates and should be read in conjunction with Paragraph 1.6.3: *Definitions*.

The majority of Paragraph 2.9 is ‘textbook’ material covering issues such as the use, interpretation and updating of cost analyses. This is a welcome element of ‘added value’ in NRM1 – it’s just a pity that all such material has not been kept separate from the rules of measurement.



## NRM1: Measurement rules

- Paragraph 2.9.1 This rule requires that unit rates shall exclude allowances for inflation or deflation which means that separate item must be provided for in accordance with Paragraph 2.16: *Measurement rules for inflation*
- Paragraph 2.9.2 This rule requires that the unit rates applied to measured quantities must be applicable to the method of measurement used, that is, per m<sup>2</sup> of GIFA and per functional unit or using element quantities (i.e. count the number of oranges and multiply by the price per orange and not per lemon!)
- Paragraph 2.9.3 This rule stipulates that unit rates (whether cost per m<sup>2</sup> of GIFA or cost per functional unit or EUR) shall:
- Include:**
- Materials, labour and plant
  - Subcontractors' or suppliers' design fees
  - Subcontractors' preliminaries
  - Subcontractors' overheads and profit
- Exclude:**
- Main contractor's preliminaries
  - Main contractor's overheads and profit
  - Project/design team fees
  - Other development/project costs
  - Risk allowances
  - Inflation

The essential meaning of Paragraph 2.9 is that separate items need to be provided for the excluded items in the order of cost estimate. Logically, this is a sensible provision as all these items are risk issues that need to be managed.

Practically, however, complying with this rule is another issue. Cost data used for order of cost estimating comes from historic analyses of priced tenders, and BCIS, private QS practices and others have accumulated many years worth of such data that might not be a good fit with the New Rules of Measurement:

- Main contractor's preliminaries have always been shown separately in cost analyses, but contractors often include preliminaries in measured work items as well (e.g. scaffolding could be priced in the prelims or in the measured rates).
- Project/design team fees and other development/project costs are not usually included in cost analyses, but this may not be the case with design and build tenders, for example.
- Main contractor's overheads and profit have always been included in the measured rates, and to some extent in the preliminaries, and are therefore not transparent enough to be extracted in the manner suggested in Rule 2.9.3.
- Design risk allowances (to allow for design changes during construction) have always been catered for in the contingency figure that is usually stated under 'Provisional Sums' in the tender BQ, but they usually include contractor's overheads and profit because provisional sums, if expended, are paid for at prevailing BQ rates (which normally include overheads and profit).
- Price risk allowances (inflation) from tender date to contract completion in firm price tenders are usually included somewhere in the contractor's pricing (in the unit rates, in the preliminaries or both) but are not necessarily shown separately.
- Price risk allowances (inflation) in fluctuating price tenders have always been included in the cost plan by the quantity surveyor, but the contractor also makes provision for under-recovery of inflation on disallowed costs (such as temporary materials, formwork and the like), and such allowances are not necessarily divulged by the contractor.

Consequently, it is not possible to comply completely with Rule 2.9.3 because not all of the information required is transparent from the contractor's tender.

Even if historic cost data could be disaggregated in the fashion required, it would be an enormous task to redo all past analyses to bring them into line with NRM1 Rule 2.9.3 (there are some 18 500 cost analyses in the BCIS database alone). In addition, it is highly unlikely that future cost data may be collected under these headings because contractors habitually price their tenders to suit their own purposes and not to suit future cost planners.

### Risk issue

When asked to produce an order of cost estimate in accordance with NRM1, the quantity surveyor/cost manager may need to draw the employer's attention to the aforementioned limitations as it would be misleading to give the impression that the order of cost estimate is capable of being drafted in the manner required by NRM1.

Allowances for the contractor's overheads and profit and for design and inflation risks may be seen as predictable, but if they cannot be isolated from other costs in the cost analysis data, then they cannot be effectively assessed or controlled.

This may impact on the confidence limits of the cost estimate and on the employer's risk exposure to the project.

#### 5.5.5 Updating unit rates and other costs to current estimate base date

The majority of the data used for order of cost estimating is historic and is, therefore, out of date to some extent. Paragraph 2.10 is concerned with the process of updating such historic cost data to *the current estimate base date*, but there are no measurement rules in this paragraph.

The main focus of Paragraph 2.10, therefore, is on the use of a variety of indices, such as tender price and building cost indices, as a means of converting the base cost data from its original base date to the current base date of the order of cost estimate using the formula:

$$\frac{\text{Current index}}{\text{Base index}} \times 100 = \% \text{ change } (\pm)$$

Paragraph 2.10.2 (Footnote) warns not to update items added to the estimate as a percentage in this way, such as preliminaries and fees. They will be automatically updated when the percentage change is applied.

## 5.6 Order of cost estimates

NRM1 Part 2 explains the purpose of order of cost estimates and prescribes the information needed from both the employer and the architect to enable order of cost estimates to be prepared. A pro forma layout for an order of cost estimate is also provided which shows how design team fees, risk allowances and inflation allowances may be added to a basic cost estimate.

Also in NRM1 Part 2 are a number of 'measurement rules', some of which relate to the methods and units to be used for measuring quantities when using a variety of order of cost estimating techniques and some of which relate to the manner in which the order of cost estimate is to be laid out or presented.

Whilst NRM1 is intended to provide a consistent approach to the preparation of order of cost estimates, there is, in practice, no compulsion to comply with the NRM1 measurement rules because order of cost estimates are not intended for publication as a tender document or as a document that may lead to a contract coming into existence.

### Risk issue

An important caveat to this statement is that RICS members are bound by the status of NRM1 as a 'guidance note', and this conditions their freedom to adopt other practices that may not be viewed as equivalent 'best practice'.

However, other users of NRM1 are not bound by the same rules as RICS members.

Notwithstanding this, should the NRM1 rules of measurement for order of cost estimating be intended as a means of producing bills of quantities or other similar tender documents, it might be considered wise to follow the rules implicitly.

This is because such documents will almost certainly need to be interpreted at some stage if there is a 'grey area' or disagreement as to what was intended to be included in the tender price.

In common with NRM2, it is hard work to disassociate measurement rules from guidance and explanatory text in NRM1 Part 2. Even where there is a heading entitled 'Measurement rules...', definitions and other text mask the measurement rules that must be followed.

#### 5.6.1 Purpose of order of cost estimates

Paragraph 2.2.2 explains that order of cost estimates are necessary in order to:

- Establish whether or not a proposed building project is affordable.
- Establish a realistic cost limit for the project.

As this process takes place very early in a project, and it is most likely that several options may be open to the client, Paragraph 2.2.3 goes on to emphasise that alternatives need to be considered at this stage. This would include consideration of alternative types of buildings, whether to refurbish or replace existing buildings or move to a new site. Paragraph 2.2.3 explains that such considerations are called *option costs* or *option costings*.

#### 5.6.2 Information requirements

In order to prepare order of cost estimates, the quantity surveyor relies upon information from various parties involved in the project. NRM1 Paragraph 2.3.1 specifies what information will be required from the employer (Paragraph 2.3.1), the architect (2.3.2), the mechanical and electrical services engineer (2.3.3) and the structural engineer (2.3.4) so that an order of cost estimate may be prepared.

### Risk issue

Despite the requirements stated in NRM1:

- There is no guarantee that such information will be forthcoming.
- There is no sanction if it isn't.
- There is no guarantee that the information received will be fully in accordance with NRM1 requirements.

Paragraph 2.3.5 makes the valid point that the accuracy of the order of cost estimate will be *dependent on the quality of information supplied to the quantity surveyor/cost manager* and that *the more information provided, the more reliable the outcome will be*.

Paragraph 2.3.5 adds that *where little or no information is provided, the quantity surveyor/cost manager will need to qualify the order of cost estimate.*

In view of the potential for litigation should the order of cost estimate prove to be inaccurate or misleading, the quantity surveyor/cost manager would be well advised to consider what protocols should be put in place in order to deal with shortcomings in the supply of information from the employer, the architect and others.

### 5.6.3 Constituents of order of cost estimates

Paragraph 2.4.1 lists the key constituents of an order of cost estimate. These are illustrated in Table 5.4 as an MS Excel spreadsheet, but CATO QuickEst or other methods could equally be used.

**Table 5.4** Constituents of an order of cost estimate.

|    | A          | B   | C             | D                 | E             |
|----|------------|---|---------------|-------------------|---------------|
| 1  |            | <b>ORDER OF COST ESTIMATE</b>                   |               |                   |               |
| 2  |            |   |               |                   |               |
| 3  | <b>Ref</b> | <b>Constituent</b>                              | <b>Totals</b> | <b>Sub-totals</b> | <b>Total</b>  |
| 4  |            |   | £             | £                 | £             |
| 5  | a          | Facilitating works estimate                     |               |                   |               |
| 6  | b          | Building works estimate                         |               |                   |               |
| 7  | c          | Main contractor's preliminaries estimate        |               |                   |               |
| 8  | d          | Sub-total                                       |               | =SUM(C5:C7)       |               |
| 9  | e          | Main contractor's overheads and profit estimate |               |                   |               |
| 10 | f          | <b>Works cost estimate</b>                      |               | =SUM(D8:D9)       |               |
| 11 | g          | Project/design team fees estimate               |               |                   |               |
| 12 |            | Sub-total                                       |               | =SUM(D10:D11)     |               |
| 13 | h          | Other development/project costs estimate        |               |                   |               |
| 14 | i          | <b>Base cost estimate</b>                       |               | =SUM(D12:D13)     |               |
| 15 | j          | Risk allowances estimate                        |               |                   |               |
| 16 | k          | Design development risks estimate               |               |                   |               |
| 17 | l          | Construction risks estimate                     |               |                   |               |
| 18 | m          | Employer change risks estimate                  |               |                   |               |
| 19 | n          | Employer other risks estimate                   |               | =SUM(C16:C19)     |               |
| 20 | o          | Cost limit (excluding inflation)                |               | =SUM(D14:D19)     |               |
| 21 | p          | Tender inflation estimate                       |               |                   |               |
| 22 | q          | Cost limit (excluding construction inflation)   |               | =SUM(D20:D21)     |               |
| 23 | r          | Construction inflation estimate                 |               |                   |               |
| 24 | s          | Cost limit (including inflation)                |               |                   | =SUM(D22:D23) |
| 25 | t          | VAT assessment                                  |               |                   |               |
| 26 |            |   |               |                   |               |

It will be noted from Table 5.4 that the authors of NRM1 have departed somewhat from convention:

- The main contractor's overheads and profit have been shown as a separate item in the order of cost estimate.
- The usual 'contingency' allowance to allow for design and price (inflation) risk has been replaced by two separate risk estimates:

- A *risk allowance estimate* within which design risks, construction risks, employer change risks and other employer risks have been disaggregated so that separate estimates for each may be calculated.
- Inflation estimates which have been separated into *tender inflation* and *construction inflation* risk estimates.

In many respects these are sensible ideas and the separate inflation estimates reflect normal practice anyway, which is to:

- Update the cost data used for the estimate from the base date (i.e. the tender date of the cost analysis used) to the tender date of the project in hand.
- Project the extent to which construction prices are expected to increase from the tender date to the conclusion of the contract.

However, it is quite fanciful to imagine that estimates of the main contractor's overheads and profit will be any more than educated guesswork because:

- Publicly available cost data (e.g. BCIS and the well-known price books) include overheads and profit in the rates per m<sup>2</sup> or per functional unit because the data is derived from historic tender prices which do not disaggregate these items.
- No self-respecting contractor is ever going to divulge his overheads and profit allowances, and even if he does, the figures will be more fiction than fact.
- Even if future cost data is collected in the new NRM1 format, it is hardly likely to be accurate or reliable as contractors will only divulge the information that they want to divulge.

#### 5.6.4 Facilitating works

NRM1 Paragraph 2.5.1 identifies facilitating works as *specialist works* required prior to the commencement of building works such as demolition work, ground remediation, removal of hazardous material, and soil stabilisation.

Such works should not be confused with 'enabling works' which is commonly taken to mean a package of works that includes facilitating works as well as intrusive site investigations, access roadworks, the provision of main services and so on. Paragraph 2.5.1 also emphasises that facilitating works may be part of an enabling work package but that the two are not synonymous.

Should it be desired that an item for enabling works, including facilitating works, is to be included in the order of cost estimate, presumably the quantity surveyor/cost manager is at liberty to change the heading in the 'pro forma' order of cost estimate accordingly, as there is no indication to the contrary in NRM1 Paragraphs 2.4 and 2.5.

### NRM1: Measurement rules

- Paragraph 2.5.2
1. *The site area* which is defined as either:
    - a. *The total area of the site within the site title boundaries*
    - or**
    - b. *The total area within the site title boundaries defined by the employer as the site for the building or buildings*
    - less**
    - c. *The footprint of any existing buildings, measured on a horizontal plane.*
  2. *The area affected* measured in m<sup>2</sup>, linear metres, enumerated (No) or itemised (item) as deemed appropriate.

Whilst measurement units are provided for *the area affected*, no units of measurement are stipulated for measuring the site area. The *site area* is defined in Paragraph 2.5.2 and reiterated in Paragraph 1.6.3: *Definitions*, but no measurement units are mentioned.

It is to be assumed that the unit would be  $m^2$ , as this is the unit used for measuring facilitating works under the elemental method of estimating and for measuring like items under Part 4: *Tabulated rules of measurement for elemental cost planning*.

The measurement of the quantities for facilitating works, as detailed in Paragraph 2.5.2, is not exactly crystal clear. From close inspection, it would appear that there are two choices:

1. Measure the site area as one item.
2. Measure individual items, for example, general site clearance ( $m^2$ ), hazardous waste removal ( $m^2$ ), removal of boundary walls (m) and demolition (nr or item).

### Risk issue

Although not required by the rules of measurement, where alternative 2 is used to measure the facilitating works, and *the area affected* is measured in units other than  $m^2$ , *the area affected* may need to be defined or indicated on a drawing in order to distinguish the limits of the site of the facilitating works to be undertaken.

### Example:

#### ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM

| Ref | Constituent                 | Quantity | Unit | Rate    | Totals    | Subtotals | Total |
|-----|-----------------------------|----------|------|---------|-----------|-----------|-------|
|     |                             |          |      | £       | £         | £         | £     |
| a   | Facilitating works estimate | 8        | ha   | 250 000 | 2 000 000 |           |       |

#### 5.6.5 Building works: Floor area method

The measurement rules used for the building works part of the order of cost estimate depend upon which estimating method is used; they are defined in Paragraph 2.6.1 as:

1. Floor area method – *the total GIFA*.
2. Functional unit method – *by projecting the number of functional units*.

Paragraph 2.6.1 also states that a combination of both methods may be required in certain circumstances.

The measurement rules for the **floor area method** are:

### NRM1: Measurement rules

- Paragraph 2.6.1 (a) (ii) The gross internal floor area (GIFA) is measured in accordance with the RICS *Code of Measuring Practice*
- Paragraph 2.6.1 (a) (iii) Where there is more than one building, *each building is to be shown separately*

- Paragraph 2.6.1 (a) (iv) Where more than one user function is included within a single building (e.g. residential, retail, offices), the GIFA for each separate function is to be calculated and quantified separately using the centre line of the party wall in order to distinguish the various functions concerned  
The total GIFA for the building is to equal the sum total of the GIFA for each separate function
- Paragraph 2.6.1 (a) (v) Where external works are to be measured separately, the site area, as defined in Paragraphs 1.6.3 and 2.5.2, is to be measured **less** the footprint of the new building(s), measured on a horizontal plane

### 5.6.6 Building works: Functional unit method

The measurement rules used for the building works part of the order of cost estimate depend upon which estimating method is used; they are defined in Paragraph 2.6.1 as:

1. Floor area method – *the total GIFA*.
2. Functional unit method – *by projecting the number of functional units*.

Paragraph 2.6.1 also states that a combination of both methods may be required in certain circumstances.

The measurement rules for the **functional unit method** are:

#### NRM1: Measurement rules

- Paragraph 2.6.1 (b) (ii) A suitable functional unit of use for the building is to be selected. This could be a unit of space measured in m<sup>2</sup> or a unit of capacity measured by number (No) of places or seats
- Paragraph 2.6.1 (b) (iii) If the functional unit of measurement is to be the 'net internal area' (NIA), this shall be determined in accordance with the RICS *Code of Measuring Practice* (reproduced in NRM1 Appendix C)
- Paragraph 2.6.1 (b) (iv) If the functional unit of measurement is to be the 'retail area', this shall be determined in accordance with the RICS *Code of Measuring Practice* (reproduced in NRM1 Appendix D)
- Paragraph 2.6.1 (b) (v) A functional unit is deemed to include *all circulation (space) necessary*

#### Example:

#### ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM

| Ref | Constituent                 | Quantity | Unit | Rate    | Totals     | Subtotals | Total |
|-----|-----------------------------|----------|------|---------|------------|-----------|-------|
|     |                             |          |      | £       | £          | £         | £     |
| a   | Facilitating works estimate | 8        | ha   | 250 000 | 2 000 000  |           |       |
| b   | Building works estimate     | 20 000   | nr   | 2 750   | 55 000 000 |           |       |

### 5.6.7 Main contractor's preliminaries

NRM1 Paragraph 2.11 deals with the measurement of main contractor's preliminaries in the order of cost estimate.

The allowance for subcontract preliminaries, overheads and profit and for associated design fees and risk allowances are to be included in the cost per m<sup>2</sup> of GIFA used for the estimate.

This also applies where the cost per functional unit or EUR is used.

#### NRM1: Measurement rules

Paragraph 2.11.1 The main contractor's preliminaries *are to be added* to the order of cost estimate as a percentage of the total cost of the building works

Consequently, any bill of quantities prepared on the basis of the measurement rules for order of cost estimates should include an item for this purpose, but there is no requirement to list separate preliminaries components as would be the case under NRM2.

#### Example:

#### ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM

| Ref | Constituent                              | Quantity | Unit | Rate    | Totals     | Subtotals  | Total |
|-----|--|----------|------|---------|------------|------------|-------|
|     |  |          |      | £       | £          | £          | £     |
| a   | Facilitating works estimate              | 8        | ha   | 250 000 | 2 000 000  |            |       |
| b   | Building works estimate                  | 20 000   | nr   | 2 750   | 55 000 000 |            |       |
| c   | Main contractor's preliminaries estimate | 12       | %    |         | 6 600 000  |            |       |
| d   | Subtotal                                 |          |      |         |            | 63 600 000 |       |

### 5.6.8 Main contractor's overheads and profit

Main contractor's overheads and profit are to be added to the order of cost estimate as a separate item.

Paragraph 2.12.4 refers to a *list of items* to be found within group element 10 in Part 4: *Tabulated rules of measurement for elemental cost planning*. This is meant to provide a guide as to what is typically included within the main contractor's overheads and profit but *is not meant to be definitive or exhaustive*.

The 'list' in group element 10 is painfully short.

#### NRM1: Measurement rules

Paragraph 2.12.1 The main contractor's overheads and profit are to be based on a percentage addition. The estimated cost of the contractor's overheads and profit *is to be calculated* by applying the percentage additions to the total cost of the building works and the main contractor's preliminaries



**Example:****ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM**

| Ref | Constituent                                     | Quantity | Unit | Rate    | Totals     | Subtotals  | Total |
|-----|---|----------|------|---------|------------|------------|-------|
|     |   |          |      | £       | £          | £          | £     |
| a   | Facilitating works estimate                     | 8        | ha   | 250 000 | 2 000 000  |            |       |
| b   | Building works estimate                         | 20 000   | nr   | 2 750   | 55 000 000 |            |       |
| c   | Main contractor's preliminaries estimate        | 12       | %    |         | 6 600 000  |            |       |
| d   | Subtotal  |          |      |         |            | 63 600 000 |       |
| e   | Main contractor's overheads and profit estimate | 8        | %    |         |            | 5 088 000  |       |
| f   | <b>Works cost estimate</b>                      |          |      |         |            | 68 688 000 |       |

**5.6.9 Project/design team fees**

Project/design team fees are defined in Paragraph 2.13.1 as fees for specialist consultants which may also include the main contractor's pre-construction fees.

A typical list of such fees is given as a guide in NRM1 Part 4: *Tabulated rules of measurement for elemental cost planning* (group element 11). This list is not meant to be definitive or exhaustive, but is simply a guide.

Paragraph 2.13.3 recommends that a single allowance is made for such fees.

**NRM1: Measurement rules**

Paragraph 2.13.2 *Project/design team fees are to be included in order of cost estimates unless the employer specifically requests that they be omitted*

**Example:****ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM**

| Ref | Constituent                                     | Quantity | Unit | Rate    | Totals     | Subtotals  | Total |
|-----|---|----------|------|---------|------------|------------|-------|
|     |   |          |      | £       | £          | £          | £     |
| a   | Facilitating works estimate                     | 8        | ha   | 250 000 | 2 000 000  |            |       |
| b   | Building works estimate                         | 20 000   | nr   | 2 750   | 55 000 000 |            |       |
| c   | Main contractor's preliminaries estimate        | 12       | %    |         | 6 600 000  |            |       |
| d   | Subtotal  |          |      |         |            | 63 600 000 |       |
| e   | Main contractor's overheads and profit estimate | 8        | %    |         |            | 5 088 000  |       |
| f   | <b>Works cost estimate</b>                      |          |      |         |            | 68 688 000 |       |
| g   | Project/design team fees estimate               | 10       | %    |         |            | 6 868 800  |       |
|     | Subtotal  |          |      |         |            | 75 556 800 |       |

### 5.6.10 Other development/project costs

Paragraph 2.14.1 defines ‘other development/project costs’ as indirect costs that *form part of the total cost of the building project to the employer*, including insurances, planning fees and fees in connection with party wall awards, and so on.

#### NRM1: Measurement rules

Paragraph 2.14.1 This rule requires that such costs *are to be included in order of cost estimates unless the employer specifically requests that they be omitted. Other development/project costs are to be added as a lump sum allowance*

Paragraph 2.14.4 *The total estimated cost of other development/project costs is added to the combined total of the works cost estimate and the project/design team fees estimate*

#### Example:

#### ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM

| Ref | Constituent                                     | Quantity | Unit | Rate    | Totals     | Subtotals  | Total |
|-----|---|----------|------|---------|------------|------------|-------|
|     |   |          |      | £       | £          | £          | £     |
| a   | Facilitating works estimate                     | 8        | ha   | 250 000 | 2 000 000  |            |       |
| b   | Building works estimate                         | 20 000   | nr   | 2 750   | 55 000 000 |            |       |
| c   | Main contractor's preliminaries estimate        | 12       | %    |         | 6 600 000  |            |       |
| d   | Subtotal  |          |      |         |            | 63 600 000 |       |
| e   | Main contractor's overheads and profit estimate | 8        | %    |         |            | 5 088 000  |       |
| f   | <b>Works cost estimate</b>                      |          |      |         |            | 68 688 000 |       |
| g   | Project/design team fees estimate               | 10       | %    |         |            | 6 868 800  |       |
|     | Subtotal  |          |      |         |            | 75 556 800 |       |
| h   | Other development/project costs estimate        |          |      |         |            | 2 000 000  |       |
| i   | <b>Base cost estimate</b>                       |          |      |         |            | 77 556 800 |       |

### 5.6.11 Risk

Quite bizarrely, in 2½ pages of text under the heading ‘Measurement rules for risk’, there is only one measurement rule.

The remainder of Paragraph 2.15 concerns itself with an explanation of the risk management process together with recommendations and advice as to how risk may be considered, managed and allowed for in the context of individual projects. Paragraph 2.15.5 recommends that separate allowances be made for the following risks:

- Design development risks.
- Construction risks.
- Employer change risks.
- Employer other risks.

## NRM1: Measurement rules

Paragraph 2.15.7 *Risk allowances are to be included in order of cost estimates*

### Example:

#### ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM

| Ref | Constituent                                     | Quantity | Unit | Rate    | Totals     | Subtotals  | Total |
|-----|---|----------|------|---------|------------|------------|-------|
|     |   |          |      | £       | £          | £          | £     |
| a   | Facilitating works estimate                     | 8        | ha   | 250 000 | 2 000 000  |            |       |
| b   | Building works estimate                         | 20 000   | nr   | 2 750   | 55 000 000 |            |       |
| c   | Main contractor's preliminaries estimate        | 12       | %    |         | 6 600 000  |            |       |
| d   | Subtotal  |          |      |         |            | 63 600 000 |       |
| e   | Main contractor's overheads and profit estimate | 8        | %    |         |            | 5 088 000  |       |
| f   | <b>Works cost estimate</b>                      |          |      |         |            | 68 688 000 |       |
| g   | Project/design team fees estimate               | 10       | %    |         |            | 6 868 800  |       |
|     | Subtotal  |          |      |         |            | 75 556 800 |       |
| h   | Other development/project costs estimate        |          |      |         |            | 2 000 000  |       |
| i   | <b>Base cost estimate</b>                       |          |      |         |            | 77 556 800 |       |
| j   | Risk allowances estimate                        |          |      |         |            |            |       |
| k   | Design development risks estimate               | 7        | %    |         | 5 428 976  |            |       |
| l   | Construction risks estimate                     | 5        | %    |         | 3 877 840  |            |       |
| m   | Employer change risks estimate                  | 3        | %    |         | 2 326 704  |            |       |
| n   | Employer other risks estimate                   | 2        | %    |         | 1 551 136  | 13 184 656 |       |
| o   | Cost limit (excluding inflation)                |          |      |         |            | 90 741 456 |       |

### 5.6.12 Inflation

Paragraph 2.16.1 states that *the rules divide inflation over a period of time into two categories, namely:*

- To date of tender (i.e. tender inflation).*
- During the construction period (i.e. construction inflation).*

*Tender inflation* is defined in Paragraph 1.6.3 as representing cost fluctuations from the estimate base date to the date of tender. *Construction inflation* is an inflation allowance calculated from the date of return of tenders to the midpoint of the construction period.

There appear to be no real rules in Paragraph 2.16, and the remainder of the paragraph largely consists of explanations, calculations and recommendations.

**NRM1: Measurement rules**

Paragraphs 2.16.4 and 2.16.6

The amount of inflation is ascertained by applying a single percentage rate to the cost limit which can be computed using published indices

**Example:****ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM**

| Ref | Constituent                                     | Quantity | Unit | Rate    | Totals     | Subtotals  | Total             |
|-----|---|----------|------|---------|------------|------------|-------------------|
|     |   |          |      | £       | £          | £          | £                 |
| a   | Facilitating works estimate                     | 8        | ha   | 250 000 | 2 000 000  |            |                   |
| b   | Building works estimate                         | 20 000   | nr   | 2 750   | 55 000 000 |            |                   |
| c   | Main contractor's preliminaries estimate        | 12       | %    |         | 6 600 000  |            |                   |
| d   | Subtotal  |          |      |         |            | 63 600 000 |                   |
| e   | Main contractor's overheads and profit estimate | 8        | %    |         |            | 5 088 000  |                   |
| f   | <b>Works cost estimate</b>                      |          |      |         |            | 68 688 000 |                   |
| g   | Project/design team fees estimate               | 10       | %    |         |            | 6 868 800  |                   |
|     | Subtotal  |          |      |         |            | 75 556 800 |                   |
| h   | Other development/project costs estimate        |          |      |         |            | 2 000 000  |                   |
| i   | <b>Base cost estimate</b>                       |          |      |         |            | 77 556 800 |                   |
| j   | Risk allowances estimate                        |          |      |         |            |            |                   |
| k   | Design development risks estimate               | 7        | %    |         | 5 428 976  |            |                   |
| l   | Construction risks estimate                     | 5        | %    |         | 3 877 840  |            |                   |
| m   | Employer change risks estimate                  | 3        | %    |         | 2 326 704  |            |                   |
| n   | Employer other risks estimate                   | 2        | %    |         | 1 551 136  | 13 184 656 |                   |
| o   | Cost limit (excluding inflation)                |          |      |         |            | 90 741 456 |                   |
| p   | Tender inflation estimate                       | 2.5      | %    |         |            | 2 268 536  |                   |
| q   | Cost limit (excluding construction inflation)   |          |      |         |            | 93 009 992 |                   |
| r   | Construction inflation estimate                 | 7.5      | %    |         |            | 6 975 749  |                   |
| s   | <b>Cost limit (including inflation)</b>         |          |      |         |            |            | <b>99 985 742</b> |
| t   | VAT assessment                                  |          |      |         |            |            |                   |

**5.6.13 Value added tax assessment**

Paragraph 2.17.1 states that value added tax (VAT) *in relation to buildings is a complex area and is, therefore, best excluded from order of cost estimates.*

The pro forma order of cost estimate provided in Paragraph 2.4.1 does, in fact, provide a space for the VAT assessment, but following the recommendation of Paragraph 2.17.2, specialist

advice should be sought on the matter, and presumably, therefore, it is not the quantity surveyor/cost manager who is meant to carry out the assessment.

#### 5.6.14 Other considerations

Paragraph 2.18 is concerned with issues such as taxation allowances, taxation relief and grants and, in common with VAT, is the province of specialists whose advice should be sought on the matter.

#### 5.6.15 Reporting of order of cost estimates

Paragraph 2.19 provides useful suggestions for the contents of an order of cost report along with advice as to issues that should be emphasised and brought to the employer's attention.

Paragraph 2.19.1 is categorical in that *costs are to be expressed as 'cost/m<sup>2</sup> of GIFA'*. However, the following Paragraph 2.19.2 states that functional units may be used as an alternative to, or in conjunction with, cost/m<sup>2</sup> of GIFA.

#### Risk issue

In terms of measurement, Paragraph 2.19.4 is perhaps the most significant in that the employer is to be clearly informed as to what is included in, and excluded from, the order of cost estimate.

The quantity surveyor/cost manager would be well advised to ensure that the correct protocols are put in place to ensure that the order of cost estimate is crystal clear to the employer.

#### Example:

#### ORDER OF COST ESTIMATE FOR NEW 20 000-SEATER FOOTBALL STADIUM

| Ref | Constituent                             | Quantity | Unit  | Rate | Totals | Subtotals | Total           |
|-----|---|----------|-------|------|--------|-----------|-----------------|
|     |   |          |       | £    | £      | £         | £               |
| s   | <b>Cost limit (including inflation)</b> |          |       |      |        |           | <b>99985742</b> |
| t   | VAT assessment                          |          |       |      |        |           |                 |
|     | Cost per functional unit                | 20 000   | Seats |      |        |           | <b>4999</b>     |

In practice, there is no way that the employer would be given such precise figures. A budget of £99 985 742 and a cost per seat of £4999 are simply the output from the estimating process. More realistically, figures would always be rounded and, in all probability, would be given as a range or 'bracket', within specified confidence limits, especially in the early stages of a project.

## 5.7 Cost planning

NRM1 Part 3 explains the purpose of cost planning and prescribes the information needed from both the employer and the architect to enable a cost plan to be prepared. A pro forma layout for a cost plan is also provided which shows how design team fees, risk allowances and inflation allowances may be added to a basic works cost estimate.

NRM1 Part 3 also provides a number of ‘measurement rules’, some of which relate to the methods and units to be used for measuring quantities for cost planning and some which relate to the manner in which the cost plan is to be laid out or presented.

Whilst NRM1 is intended to provide a consistent approach to the preparation of cost plans, there is, in practice, no compulsion to comply with the NRM1 measurement rules because cost plans are not intended for publication as a tender document or as a document that may lead to a contract coming into existence.

### Risk issue

An important caveat to this statement is that RICS members are bound by the status of NRM1 as a ‘guidance note’, and this conditions their freedom to adopt other practices that may not be viewed as equivalent ‘best practice’.

However, other users of NRM1 are not bound by the same rules as RICS members.

Notwithstanding this, should the NRM1 rules of measurement for cost planning be employed as a means of producing bills of quantities or other similar tender documents, it might be considered wise to follow the rules implicitly.

This is because such documents will almost certainly need to be interpreted at some stage if there is a ‘grey area’ or disagreement as to what was intended to be included in the tender price.

In common with NRM2, it is hard work to disassociate measurement rules from guidance and explanatory text in NRM1 Part 3. Even where there is a heading entitled ‘Measurement rules...’, definitions and other text mask the rules that must be followed.

The only paragraph of interest in 3.1 *Introduction* in a measurement context is Paragraph 3.1.4 which states that *the measurement rules for elemental cost planning can also be used as a basis for measuring quantities for the application to whole life costing.*

#### 5.7.1 Purpose of cost planning

Paragraph 3.2 contains no measurement rules but gives a succinct overview of cost planning in the context of the RIBA Plan of Work and the OGC Gateway Process.

The purpose of cost planning is given in Paragraph 3.2.2, and Paragraph 3.2.3 emphasises a key issue – that is, that elemental cost planning is *a budget distribution technique* that breaks down the cost limit into *cost targets for each element of the building*. This is like having a weekly food budget and deciding what to spend it on before going shopping. Anyone who goes shopping without a priced shopping list will risk an overspend!

Paragraph 3.2.4 explains that the cost plan is a statement of how the budget will be spent on each element of the building, and Paragraph 3.2.5 makes the point that this process is repeated several times as more and more design information becomes available.

#### 5.7.2 Constituents of a cost plan

The make-up of a cost plan is given in NRM1 Paragraph 3.3.1 in the same pro forma style as for an order of cost estimate.

The only difference between the order of cost estimate pro forma and that of the cost plan is that the latter shows a detailed breakdown of the **project/design team fee estimate**.

**Table 5.5** Constituents of a cost plan.

|    | A                | B   | C             | D                 | E             |
|----|------------------|---|---------------|-------------------|---------------|
| 1  | <b>COST PLAN</b> |   |               |                   |               |
| 2  |                  |   |               |                   |               |
| 3  | <b>Ref</b>       | <b>Constituent</b>  | <b>Totals</b> | <b>Sub-totals</b> | <b>Total</b>  |
| 4  |                  |   | £             | £                 | £             |
| 5  | a                | Facilitating works estimate                                     |               |                   |               |
| 6  | b                | Building works estimate   |               |                   |               |
| 7  | c                | Main contractor's preliminaries estimate                        |               |                   |               |
| 8  | d                | Sub-total   |               | =SUM(C5:C7)       |               |
| 9  | e                | Main contractor's overheads and profit estimate                 |               |                   |               |
| 10 | f                | <b>Works cost estimate</b>                                      |               | =SUM(D8:D9)       |               |
| 11 | g                | Project/design team fees estimate                               |               |                   |               |
| 12 | g1               | Consultants' fees   |               |                   |               |
| 13 | g2               | Main contractor's pre-construction fee estimate (if applicable) |               |                   |               |
| 14 | g3               | Main contractor's design fees estimate (if applicable)          |               |                   |               |
| 15 |                  | Sub-total   |               | =SUM(C12:C14)     |               |
| 16 | h                | Other development/project costs estimate                        |               |                   |               |
| 17 | i                | <b>Base cost estimate</b>                                       |               | =SUM(D15:D16)     |               |
| 18 | j                | Risk allowances estimate  |               |                   |               |
| 19 | k                | Design development risks estimate                               |               |                   |               |
| 20 | l                | Construction risks estimate                                     |               |                   |               |
| 21 | m                | Employer change risks estimate                                  |               |                   |               |
| 22 | n                | Employer other risks estimate                                   |               | =SUM(C19:C22)     |               |
| 23 | o                | Cost limit (excluding inflation)                                |               | =SUM(D17:D22)     |               |
| 24 | p                | Tender inflation estimate                                       |               |                   |               |
| 25 | q                | Cost limit (excluding construction inflation)                   |               | =SUM(D23:D24)     |               |
| 26 | r                | Construction inflation estimate                                 |               |                   |               |
| 27 | s                | Cost limit (including inflation)                                |               |                   | =SUM(D25:D26) |
| 28 | t                | VAT assessment  |               |                   |               |
| 29 |                  |   |               |                   |               |

Table 5.5 shows the pro forma layout with the fee estimate (g) subdivided into g1, g2 and g3. The cost plan is presented as an MS Excel spreadsheet (with formulas), but there are other ways to do this, including the use of software such as CATO Cost Planning.

### 5.7.3 Formal cost planning stages

Paragraph 3.4 is purely explanatory and positions the formal cost planning stages within the RIBA Plan of Work and OGC Gateway Process Models.

The point is made in Paragraph 3.4.4 that formal cost plans may not be necessary at each and every stage of the design process as this will depend on the procurement arrangements for the project. The example of a design and build contract strategy is given where it may not be necessary to develop the cost plan to the production information stage of the process.

Paragraph 3.4.3 explains the chronology of the cost plan and emphasises that Formal Cost Plans 2 and 3 are reiterations of Formal Cost Plan 1 which is prepared at the point *where the scope of work is fully defined* but where *no detailed design has been commenced*.

### 5.7.4 Reviewing and approving cost plans

Paragraph 3.5.1 implies that protocols are needed for reviewing the cost plan *which is to be reviewed by the employer and the project team* before proceeding to the next design stage.

This is to verify that:

- The project is affordable.
- Elemental cost targets are reasonable.
- The cost limit has not been exceeded.

#### Risk issue

Following the review meeting, NRM1 suggests that the employer:

- Will sign off the cost plan.
- Give any necessary instructions.
- Authorise commencement of the next design stage.

Whilst the provisions of Paragraph 3.5.2 fall short of qualifying as ‘rules’, it is clear that protocols are needed to formally record these employer actions in the best interests of all concerned.

### 5.7.5 Cost control in procurement

Paragraph 3.6.1 relates to the preparation of cost plans where the work is to be procured on the basis of work packages.

The importance of coding the elemental cost plan is stressed so as to enable *the components allocated to each element and sub-element* to be recoded and allocated to the appropriate work package. This will then create a cost target for each work package, as opposed to each element, which can then be used for the cost management of the project.

Paragraph 3.6.2 refers the reader to the explanation of the coding system given in NRM1 Paragraph 4.5.

### 5.7.6 Building projects comprising multiple buildings

Paragraph 3.7.1 is a recommendation that a separate cost plan is prepared for each building when a project comprises more than one building.

It is also recommended that a ‘summary cost plan’ is prepared for the entire project.

### 5.7.7 Information requirements for formal cost plans

Information is the key to developing a cogent cost plan, and this is emphasised in Paragraph 3.8.1 which recognises that more information becomes available as the project develops and as more interaction takes place between the members of the project team.

Paragraph 3.8.2 points the reader to Appendix G (this is a mistake – it should be Appendix F) wherein lists of information required from the employer, the architect and other consultants at the formal cost planning stages – Formal Cost Plans 1, 2 and 3 – may be found.



## Risk issue

Unlike Paragraph 2.3.5 relating to order of cost estimates, there is no suggestion in Paragraph 3.8 that the quantity surveyor/cost manager should qualify the cost plan if the necessary information is not forthcoming.

Presumably, Paragraph 3.5 should be referred to in such circumstances, as it deals with the review and approval of cost plans by the employer and the project team at the various formal cost planning stages. Missing information could then be raised as an issue before the formal cost plan is signed off.

The quantity surveyor/cost manager would do well to remember that:

- There is no guarantee that the required information will be forthcoming.
- There is no sanction if it isn't.
- There is no guarantee that the information received will be fully in accordance with NRM1 Appendix F requirements.
- Protocols may be needed in order to deal with shortcomings in the supply of information from the employer, the architect and others.

### 5.7.8 Format, structure and content of elemental cost plans

There is no particular standard required by NRM1 for the layout of cost plans, but Paragraph 3.9.1 points to Appendices G and H for exemplar templates.

Appendix G shows a condensed template based on Level 1 codes, whereas Appendix H is an expanded version based on Level 2 codes. Level 1 is the group element level, whereas Level 2 is the element level (refer to NRM1 Paragraph 4.4.2).

A great deal more work goes into preparing a cost plan than is obvious from the examples provided in NRM1, even at the expanded level illustrated in Appendix H.

Taking element 2.7: *Internal walls and partitions* as an example, a cost target for the element has firstly to be established. This will be based on the quantities required for the project in hand and rates taken from a previous project or elemental cost analysis. Once the EUR has been adjusted for time, location and quality of specification, the elemental unit quantities can be priced and a cost target established. Table 5.6 illustrates this process.

At a later stage, when more design information becomes available, cost targets need to be checked to see whether they are valid or not, and this requires a different type of measurement as illustrated in Table 5.7.

**Table 5.6** Cost target.

| Element                              |               | Cost target |                |        |                   |
|--------------------------------------|---------------|-------------|----------------|--------|-------------------|
| <b>Internal walls and partitions</b> |               |             |                |        |                   |
| Rates taken from analysis No. 16443  |               | EUQ         | Unit           | EUR, £ | Total, £          |
| EUR                                  | <u>83.65</u>  |             |                |        |                   |
| Price level                          |               |             |                |        |                   |
| $\frac{219}{172} \times$             | 106.51        |             |                |        |                   |
| Quality +15%                         | <u>15.98</u>  |             |                |        |                   |
| <b>Total</b>                         | <u>122.49</u> |             |                |        |                   |
|                                      |               | 9 000       | m <sup>2</sup> | 122.49 | <b>£1 102 410</b> |

**Table 5.7** Cost check.

| <b>Cost check</b>                         |              |                |                |                   |
|---|--------------|----------------|----------------|-------------------|
| <b>Rates taken from BQ 1679 (current)</b> |              |                |                |                   |
| <b>Item</b>                               | <b>Quant</b> | <b>Unit</b>    | <b>Rate, £</b> | <b>Total, £</b>   |
| 100 mm block walls                        | 8 000        | m <sup>2</sup> | 36.00          | 288 000           |
| Stud partitions dry lined<br>both sides   | 10 000       | m <sup>2</sup> | 45.00          | 450 000           |
| Hardwood glazed screens                   | 1 500        | m <sup>2</sup> | 375.00         | 562 500           |
|   |              |                |                | <b>£1 300 500</b> |

In the cost check, quantities are measured from the drawings, and unit rates are applied to arrive at a total for the element. The unit rates may come from a variety of sources – previous priced bills of quantities, an internal database or a builders' price book – or they may be built up from first principles based on current rates for labour, materials, plant and so on.

Once the cost check has been established, this needs to be compared to the initial cost target to see whether or not there is any variance (see Table 5.8). If the difference is significant, this could result in several implications, such as the need to redesign the element, to redesign other elements to save money or to spend contingency.

**Table 5.8** Variance.

| <b>Element</b>   |  | <b>Cost target</b> |                 |                   |                   |
|--|--|--------------------|-----------------|-------------------|-------------------|
| <b>Internal walls and partitions</b>                           |  |                    |                 |                   |                   |
| <b>Rates taken from analysis<br/>No. 16443</b>                 |  | <b>EUQ</b>         | <b>Unit</b>     | <b>EUR (£)</b>    | <b>Total (£)</b>  |
| EUR<br>Price level<br>$\frac{219}{172} \times$<br>Quality +15% | <u>83.65</u><br>106.51<br><u>15.98</u> |                    |                 |                   |                   |
| <b>Total</b>   | <b><u>122.49</u></b>                   | 9 000              | m <sup>2</sup>  | 122.49            | <b>£1 102 410</b> |
| <b>Cost check</b>  |  |                    |                 |                   |                   |
| <b>Rates taken from BQ 1679 (current)</b>                      |  |                    |                 |                   |                   |
| <b>Item</b>  | <b>Quant</b>                           | <b>Unit</b>        | <b>Rate (£)</b> | <b>Total (£)</b>  |                   |
| 100 mm block walls   | 8 000                                  | m <sup>2</sup>     | 36.00           | 288 000           |                   |
| Stud partitions dry lined<br>both sides                        | 10 000                                 | m <sup>2</sup>     | 45.00           | 450 000           |                   |
| Hardwood glazed screens  | 1 500                                  | m <sup>2</sup>     | 375.00          | 562 500           |                   |
|  |  |                    |                 | <b>£1 300 500</b> |                   |
| Underspend   |  |                    |                 |                   |                   |
| Overspend  |  |                    |                 | <b>£198 090</b>   |                   |

The measurement rules in Part 4: *Tabulated rules of measurement for elemental cost planning* need to be scrupulously applied, as it must be demonstrable that they have been followed,

because the cost planning process will almost certainly be subject to internal audit through the office quality assurance régime.

### 5.7.9 Facilitating works

NRM1 Paragraph 3.10 is a little unclear, but it appears to mean that there are two sets of measurement rules that apply to facilitating works (which is group element 0) – ‘general rules’ and ‘specific rules’. The ‘general rules’ are those contained within Paragraph 3.11: *Measurement rules for building works*, and the ‘specific rules’, relating to the measurement of sub-elements and components, are in NRM1 Part 4, the part that makes up the bulk of NRM1.

Without wishing to appear pedantic or obtuse, NRM1 seems to have been written in such a way as to distinguish between ‘measurement rule’ and ‘rule of measurement’ in that the former appears to refer to general rules and the latter to rules for measuring specific elements or components of work. Whether or not this distinction is intentional is unclear.

#### **NRM1: Measurement rules**

|                  |   |
|------------------|---|
| ‘General rules’  | <i>Shall be the same as those for the measurement of building works as detailed in Paragraphs 3.11.2–3.11.5 inclusive (refer to Paragraph 3.10.2). These rules explain the method of measuring quantities for Formal Cost Plans 1–3</i>   |
| ‘Specific rules’ | <i>Relating to the measurement of building work as detailed in Part 4: <i>Tabulated rules of measurement for elemental cost planning</i>, which determine how work shall be described for group elements 0–14 inclusive and what units it shall be measured in (e.g. m, m<sup>2</sup>, m<sup>3</sup>, nr)</i> |

### 5.7.10 Building works

NRM1 Paragraph 3.11.1 states that the rules of measurement for building works (i.e. group elements 1–8) are to be found in Part 4: *Tabulated rules of measurement for elemental cost planning*. Group element 0 (facilitating works) is dealt with separately in Paragraph 3.10.

There is no clear guidance in Paragraph 3.11 regarding the development of the various formal cost plans save to say that:

- Formal Cost Plan 1 begins with a condensed list of elements which is then *developed into a full list of elements, sub-elements and components* as more design information becomes available (refer to Paragraph 3.11.4 (iv)).
- *Cost-significant items are to be measured by means of approximate quantities* (Paragraph 3.11.2).

Judging by the units of measurement used in NRM1 Part 4: *Tabulated rules of measurement for elemental cost planning*, it would be logical to assume that, at some point, the formal cost plan will eventually resemble a bill of approximate quantities albeit that elemental cost plans are to be reported to the employer on the basis of cost/m<sup>2</sup> of GIFA. This is logical as the cost plan report is likely to be presented in summary form.

Paragraph 3.11 contains a number of ‘general rules’ for the measurement of building works for the purposes of Formal Cost Plans 1–3 and for contractor-designed work. In the inimitable style of NRM1, these ‘general rules’ are somewhat ‘lost’ within the explanations and other guidance provided.

**NRM1: Measurement rules**

- Paragraph 3.11.2
- Cost-significant items *are to be measured* by approximate quantities where possible
  - Non-cost-significant items *are to be ignored*, but unit rates are to be increased appropriately (e.g. by adding a suitable percentage)
  - Composite items consisting of several work items that individually may have different units of measurement are to be measured using *common forms of measurement*:
    - Example – basement
      - Excavation and disposal – m<sup>3</sup>
      - Earthwork support – m<sup>2</sup>
      - Concrete slab – m<sup>3</sup>
      - Brick retaining walls – m<sup>2</sup>
      - Common unit of measurement – m<sup>2</sup> of GIFA

**NB:**

A composite rate is derived by pricing the individual components using appropriate unit rates and then dividing the resultant total amount of money by the GIFA to give a rate expressed in £/m<sup>2</sup> of GIFA

- Paragraph 3.11.3
- Quantities *shall be given* to nearest whole unit (or unity if less than one)
  - Quantities for rebar, steelwork and the like *shall be given* to two decimal places

Paragraph 3.11.4 **Formal Cost Plans 1–3**

- Quantities *shall be determined* in accordance with Part 4: *Tabulated rules of measurement for elemental cost planning* (i.e. m, m<sup>2</sup>, m<sup>3</sup>, nr, etc.)
- Where this is not possible, GIFA *is to be* the unit of measurement

Paragraph 3.11.5 **Contractor-designed works**

- Such work *shall be identified and described separately in the cost plan as 'contractor designed works'*

**NB:**

1. There are no particular rules of measurement specified, and so it is assumed that Paragraph 3.11.4 will apply in this case
2. Where the contractor is to design the entire project, the main contractor's design fees are to be determined in accordance with Paragraph 3.16.7

**5.7.11 Unit rates used to estimate the cost of building works**

The unit rates, EUR and composite rates used in cost planning are usually derived from a number of sources:

- Internal 'in-house' database of historical costs (QS consultants, contractors or subcontractors).
- BCIS elemental cost analyses.
- BCIS price information (formerly Wessex price books).
- Builders' price books such as Spon's (prepared by Davis Langdon) and Griffiths' (prepared by Franklin + Andrews, 2014).
- First principles (i.e. rates built up from basic costs of materials, plant and labour).

## NRM1: Measurement rules

Paragraph 3.12.1

Unit rates are to **include**:

- Materials, labour and plant
- Subcontractors' or suppliers' design fees
- Subcontractors' preliminaries
- Subcontractors' risk allowances
- Subcontractors' overheads and profit

Paragraph 3.12.2

Unit rates are to **exclude**:

- Main contractor's preliminaries
- Main contractor's overheads and profit
- Project/design team fees
- Other development/project costs
- Risk allowances
- Inflation

The list of inclusions and exclusions in Paragraphs 3.12.1 and 3.12.2 is the same list as Paragraph 2.9.3 relating to order of cost estimates, except that subcontractors' risk allowances are to be included in the unit rates used for cost planning. Whether there is some reason for this difference or whether it is a mistake in the drafting is not clear.

Paragraph 3.12.3 warns that rates should be appropriately adjusted to remove built-in allowances for construction inflation.

### 5.7.12 Updating unit rates and other costs to current estimate base date

Paragraph 3.13 is simply concerned with making sure that the unit rates and EUR used for cost planning are always current at the time the estimate is made.

Therefore, the unit rates used in the order of cost estimate have to be updated for inflation to the base date of Formal Cost Plan 1, and the unit rates used in Formal Cost Plan 1 have to be updated to the base date of Formal Cost Plan 2 and so on.

This sounds a bit complicated, but the idea is that the rates used in each cost plan are current when that cost plan is compiled and that there is an allowance for inflation in the cost plan summary which allows for inflation from the date of the particular formal cost plan to the date of tender for the project. This allowance reduces over time until the final version of the cost plan is completed.

### 5.7.13 Main contractor's preliminaries

Main contractors' preliminaries represent a significant cost target in the cost plan which therefore has to be cost checked for each formal cost plan stage.

The extent of measurement of preliminaries items is limited as it is usual to allow a percentage on the building works estimate to establish their projected cost.

However, when more information becomes available, it is feasible that the contractor's preliminaries may be cost checked in detail using the extensive (but not *exhaustive*) list of items included in group element 9 of NRM1 Part 4: *Tabulated rules of measurement for elemental cost planning*.

Despite its title, *Measurement rules for main contractor's preliminaries*, Paragraph 3.14 contains very little by way of rules.

**NRM1: Measurement rules**

|                  |   |
|------------------|---|
| Paragraph 3.14.4 | If this can be called a 'rule', the sole requirement is that where the main contractor's preliminaries, or any part thereof, is to be based on a percentage addition, the percentage <i>is to be</i> applied to the building works estimate. The alternative, given by Paragraph 3.14.5, is to add a lump sum, but this is not a 'rule' |
| Paragraph 3.14.7 | This states that any cost plan allowance for subcontractors' preliminaries <i>is to be made</i> in the unit rates that are applied to the measured quantities   |

**5.7.14 Main contractor's overheads and profit**

The requirement to create a separate provision for main contractor's overheads and profit in the order of cost estimate, and in the cost plan, is one of the most inexplicable features of NRM1.

The database of elemental cost analyses held by BCIS contains some 18 500 analyses of tender prices for a wide range of projects of different types, sizes, values and locations over many years. Whilst there is no data available to indicate how many of these analyses reveal the contractor's overheads and profit addition, it is a 'racing certainty' that the vast majority, if not all, do not show this information.

This means that since the dawn of the cost planning era in the early 1950s, the rates used for order of cost estimating and cost planning have been inclusive of main contractor's overheads and profit. Consequently, the rates per m<sup>2</sup> of GIFA, EUR and the rates used for approximate quantities and cost checking include overheads and profit.

The reason for this is that these rates are derived from bills of quantities submitted by contractors at the tender stage, and the rates and prices contained in the bills of quantities also invariably include overheads and profit. Hence, the vast database of information used by the industry for order of cost estimating and cost planning, whether in-house data or data publicly available through BCIS or the usual builders' price books, is inclusive of main contractor's overheads and profit.

Being largely based on contractors' tenders, this database is incapable of being interrogated to reveal the true amount included for overheads and profit because contractors habitually do not volunteer this information in their tenders. Admittedly, some contractors do like to show their OH and P allowance as a lump sum addition to their tenders for a variety of reasons – but these instances are relatively few and far between and are certainly not 'the norm'. It is only, therefore, the tendering contractor who knows how much has been allowed in the tender to cover overheads and profit for each specific project.

How then can the quantity surveyor/cost manager hope to produce an order of cost estimate or cost plan showing a separate amount for main contractor's overheads and profit? The answer is simple – it isn't possible, at least with any degree of accuracy.

**Example**

Take a rate – any rate – let's say a rate of £69.12/m<sup>2</sup> inclusive of overheads and profit. Without knowing the contractor's percentage addition for overheads and profit, it is impossible to derive the net rate, that is, the rate exclusive of overheads and profit. The only way is to estimate the percentage and thereby calculate the net rate

Say, the estimated overheads and profit allowance is 8%

The net rate is therefore  $£69.12/1.08 = \mathbf{£64.00}$

So where does the 8% come from? It could be:

- An intelligent guess.
- From the quantity surveyor's assessment of the construction market at the time that the tender was submitted.
- Derived from an in-depth analysis of the contractor's profit and loss account from the annual financial report (turnover less cost of turnover).
- Derived from statistics of contractor's overheads and profit percentages which might have a mean of, say, 10% and a standard deviation of 2%, giving a maximum of 12% and a minimum of 8%.

None of these methods will give an accurate answer, and even the contractor's annual account figures will only be an average across the company and not the specific figure for a particular tender.

So, if the quantity surveyor/cost manager has to 'guess' the overheads and profit figure, what is the point of having two sums (net cost and overheads and profit) that are both inaccurate?

- It might be that the cost planner wants to add different OH and P figures to different parts of the cost plan due to the nature of the work involved.
- It might be that a cost target is required because the overheads and profit figure/percentage is the basis of the contractor's appointment (e.g. stage one of a two-stage tender).
- It might be that OH and P is to be 'ring-fenced' or protected due to the procurement strategy adopted for the project (e.g. partnering).
- It might be that the employer wishes to make overheads and profit a negotiable part of the tender competition (e.g. a framework agreement).

We could go on surmising forever, but the point is that the only clue given in NRM1 as to why main contractor's overheads and profit should be shown separately is that an *agreed level of overheads and profit* may have been established *as part of a two-stage tendering process* (refer to Paragraph 3.15.8).

Whilst NRM1 explains in great detail how overheads and profit is to be added into the cost plan (Paragraphs 3.15.2–3.15.5 and 3.15.7), it does not suggest any means by which the percentage may be arrived at other than *from a properly considered assessment of main contractor's overheads and profit found on previous building projects* (refer to Paragraph 3.15.6). NRM1 is silent on how this is to be done!

## Risk issue

Admittedly:

- An order of cost estimate is in effect only a budget.
- A cost plan is only an expression of how this budget is to be spent.
- The cost control of building design is not a precise science.

However, it would seem to be an (almost) pointless exercise (in the majority of cases) to separate overheads and profit in the order of cost estimate or cost plan, and there would seem to be no tangible justification for spending the time (and professional fees) for doing so. If this is to be done *from a properly considered assessment of main contractor's overheads and profit found on previous building projects*, then the best that could be achieved from available data is a guess at the level of overheads and profit and a guess at the net cost of the work involved in a project (i.e. the material, plant and labour costs).

The question therefore arises as to the quantity surveyor's legal position should it be decided to ignore this provision in NRM1.

The introduction to NRM1 (page 1) states that:

- *It is for each surveyor to decide on the appropriate procedure to follow in any professional task.*
- *However, where members do not comply with the practice recommended in (NRM1) they should do so only for a good reason.*
- *In the event of a legal dispute, a court or tribunal may require them to explain why they decided not to adopt the recommended practice.*
- *If members' actions are questioned in an RICS disciplinary case, they will be asked to explain the actions they did take and this may be taken into account by the Panel.*

Estimates of the main contractor's overheads and profit can be added in to the cost plan either as one item (or *cost centre* in NRM1) or as separate cost centres, one for overheads and the other for profit (refer to NRM1 Paragraph 3.15.1).

In view of the likelihood that little or no historic information will be available as a basis for the estimate, it is surprising that Paragraph 3.15.6 states that such information *is to be derived* from previous building projects.

### NRM1: Measurement rules

|  |   |
|--|---|
| Paragraph 3.15.1                                 | <i>Main contractor's overheads and profit <u>are to be based</u> on a percentage addition</i>   |
| Paragraph 3.15.1:<br>one separate cost<br>centre | <i>The estimated cost of any main contractor's overheads and profit <u>is to be calculated</u> by applying the selected percentage addition for overheads and profit to the combined total cost of the building works estimate and the main contractor's preliminaries estimate</i> |
| Paragraph 3.15.6:<br>two cost centres            | <i>The percentages addition to be applied for main contractor's overheads and main contractor's profit <u>are to be derived</u> from a properly considered assessment of main contractor's overheads and profit found on previous building projects</i>                             |
| Paragraph 3.15.8                                 | <i>Where the main contractor has been appointed early (e.g. as part of a two-stage tendering process), the actual agreed level of overheads and profit <u>is to be included</u> in the cost plan</i>  |

Paragraph 3.15.8 is the only workable measurement rule for main contractor's overheads and profit, and therefore, where an allowance has already been made in the cost plan, Paragraph 3.15.8 requires that the cost plan shall be adjusted according to the agreement reached.

#### 5.7.15 Project/design team fees

Paragraph 3.16.1 indicates that consultants' fees are a necessary part of a building project, and Paragraph 3.16.2 refers to the *list of typical project/design team fees* in Part 4: *Tabulated rules of measurement for elemental cost planning*, group element 11.

These fees include consultants' fees and fees payable to the main contractor for pre-construction services and design fees, where applicable – see Paragraph 3.16.3 which recommends that *separate allowances* should be made for each.

The remainder of Paragraph 3.16 is given over to an explanation of how such fees are to be calculated and what considerations should be made where the main contractor is to accept either full or partial design liability. The total project/design team fee estimate is given by the total of consultants' fees, main contractor's pre-construction fee and main contractor's design fees, each of which *is to be derived from a properly considered assessment of fees charged on other similar previous building projects*.



Paragraph 3.16.6(d) warns that care must be exercised to ensure *that sufficient allowance has been made for main contractor's overheads and profit on the pre-construction fee.*

### NRM1: Measurement rules

Paragraph 3.16.4 *Project/design team fees are to be included in cost plans*

#### 5.7.16 Other development/project costs

Other development costs form part of the building project but are not directly associated with the cost of building works (Paragraph 3.17.1). Examples include insurances, planning, party wall fees, etc.

### NRM1: Measurement rules

Paragraph 3.17.2 *Other development/project costs are to be included in cost plans, and they are to be added as a lump sum allowance*

Other development/project costs form part of the base cost estimate of the order of cost estimate and of the cost plan to which risk allowances and inflation estimates are added in order to arrive at the project cost limit.

They *are to be added* to the order of cost estimate/cost plan *as a lump sum allowance* priced on the basis of fixed cost or time-related items. Part 4: *Tabulated rules of measurement for elemental cost planning* (group element 12) provides examples of such items which include land acquisition, archaeological fieldwork and decanting and relocation costs (NRM1 Paragraph 3.17).

#### 5.7.17 Risk allowances

Paragraph 3.18.1 states that:

- *Risk allowances are to be included in each formal cost plan.*
- They are to be *based on the results of a formal risk analysis.*
- They are not to be standard percentages.

Strangely, Paragraph 3.18.7 suggests that risk allowances may in fact *be based on a percentage addition.*

Also strangely, Paragraph 3.18.5 recommends that *risk allowances be treated as three separate cost targets* but does, in fact, list four recommended (not mandatory) cost targets:

- a) Design development risks.
- b) Construction risks.
- c) Employer change risks.
- d) Employer other risks.

Perhaps (c) and (d) are intended to be combined?

The lack of clarity in Paragraph 3.18 is further exemplified by a failure to distinguish between **risk** and **uncertainty** and to emphasise that the purpose of risk assessment is to:

- Identify aspects of a project (threats) that could be detrimental to the cost limit.
- Provide a measure of the risk of a particular threat occurring determined by the likelihood of it happening and the consequence if it does.

- Eliminate risk where possible.
- Manage remaining (residual) risk.

In the context of cost planning, the presence or absence of design and other information is a determining factor in any assessment of risk, and this is why it is important to distinguish between risk and uncertainty. Ross and Williams (2013) cite Winch (2010) who suggests that there is a distinction to be made:

- **Uncertainty** relates to the absence of information required for decision-making.
- **Risk** is where a probability distribution can be assigned to an occurrence.

The need to reassess risk registers and risk estimates at regular intervals throughout the design process is emphasised in Paragraph 3.18.3, and Paragraph 3.18.4 explains that *successive assessments are to show decreasing risk* as a consequence of the more certainty attached to the project as time goes by. Paradoxically, the same paragraph notes *that risk does not always decrease* but offers no explanation for this statement.

Paragraph 3.18.10 refers to guidance offered in Part 4: *Tabulated rules of measurement for elemental cost planning* (group element 13) as to typical risks to be considered; this is a useful resource to help the quantity surveyor/cost manager to arrive at a balanced assessment of risk so that *considered risk allowances* (Paragraph 3.18.2) may be included in the cost plan.

### NRM1: Measurement rules

- |                  |  |
|------------------|--|
| Paragraph 3.18.1 | <ul style="list-style-type: none"> <li>▪ Risk allowances <u>are to be included</u> in each formal cost plan</li> <li>▪ Based on the results of a formal risk analysis</li> <li>▪ Are not to be standard percentages</li> </ul> |
| Paragraph 3.18.7 | Where any aspects of risk allowances... are to be based on a percentage addition, such allowances are to be calculated by multiplying the base cost estimate by the percentage additions                                       |

#### 5.7.18 Inflation

NRM1 Paragraph 3.19.1 makes the statement that *elemental cost plans are to be prepared using rates and prices current at the time the cost plan is prepared*. This statement has a number of implications that are not explained in NRM1 but are illustrated in Figure 5.2:

- The cost data upon which the cost plan is based will be historic information and may date back some time before the project inception.
- Whatever the source of cost data, it will have to be updated from its base date to the current date.
- The current date will be the base date of:
  - The order of cost estimate
  - The Formal Cost Plans 1, 2 and 3
- The base date of the cost data will vary:
  - Cost data used for the order of cost estimate (e.g. cost per m<sup>2</sup> GIFA, functional units) will probably date back some months, maybe years.
  - Cost data from elemental cost analyses of similar buildings may also date back some time.
  - Cost data for cost checking (e.g. unit rates from previous tenders) may be more up to date.
- This means that each formal cost plan will have to be updated from the previous one or, for Formal Cost Plan 1, from the base date of the order of cost estimate.
- Formal Cost Plan 3 will have to reflect the extent of inflation up to the tender base date.
- The total allowance for inflation up to the tender base date will not necessarily reflect the degree of inflation from the origin in Figure 5.2 because different data drawn from different base dates will have been used throughout the cost planning process.

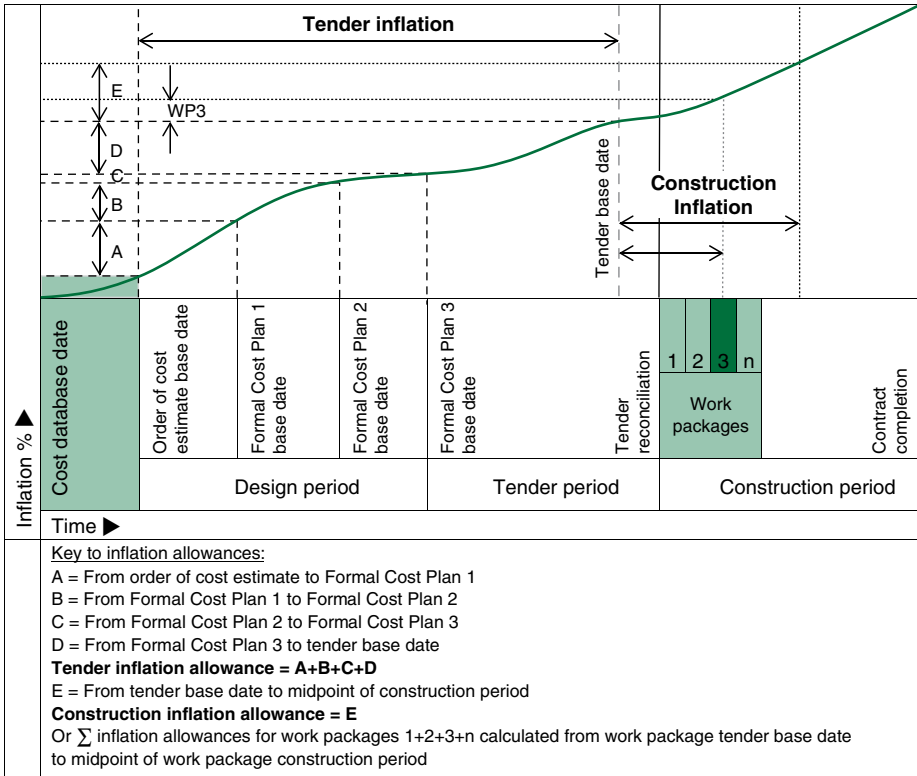


Figure 5.2 Inflation.

As far as the measurement rules are concerned, NRM1 Paragraphs 3.19.4 and 3.19.6 distinguish respectively between **tender inflation** and **construction inflation**:

- **Tender inflation**  
This is defined as *the period from the estimate base date to the date of tender return* (refer to Paragraph 3.19.2 (a)).
- **Construction inflation**  
This is defined as *the period from the date of tender return to the mid-point of the construction period* (refer to Paragraph 3.19.2 (b)).

**Risk issue**

It cannot necessarily be assumed that the date of tender return is the applicable date for calculating inflation risk.

Some standard forms of contract (e.g. JCT 2011) state a 'base date' for the calculation of fluctuations, and the date entered in the Contract Particulars may be some time (perhaps 3 weeks, it can vary) before the tender return date.

Paragraphs 3.19.4 and 3.19.6 also issue the warning that the measurement rules for tender and construction inflation may be oversimplistic where the project is to be procured with separate work packages.

This is because:

- The work package procurement programme will be different for each work package.
- Therefore, both the tender and construction inflation allowances should be calculated for each work package according to the procurement programme for the specific package concerned.

The guidance notes in NRM1 Paragraphs 3.19.4 and 3.19.6 are not quite clear, but it should be emphasised that:

- The tender inflation allowance for each work package should be related to the tender base date of the package concerned.
- The construction inflation allowance for each work package should be related to the mid-point of the construction period of the package concerned.

This is illustrated in Figure 5.2.

### NRM1: Measurement rules

|                     |   |
|---------------------|---|
| Paragraph 3.19.1    | <i>Elemental cost plans are to be prepared using rates and prices current at the time the cost plan is prepared</i>                                       |
| Paragraph 3.19.6(a) | Where procurement is to be on the basis of separate work packages, a separate allowance for construction inflation for each work package will be required |

#### 5.7.19 VAT assessment

Paragraph 3.20.1 recommends *that VAT is excluded from cost plans* due to problems of complexity, and Paragraph 3.20.2 recommends *that specialist advice is sought on VAT matters to ensure that the correct rates are applied*.

#### 5.7.20 Other considerations

Paragraphs 3.21.1–3.21.3 are concerned with capital allowances, land remediation allowances and grants, respectively, and in each case, it is recommended that *specialist advice is sought* on appropriate allowances and that such matters are *excluded from cost plans*.

#### 5.7.21 Reporting of elemental cost plans

Paragraph 3.22.4 provides a helpful list of typical items to be included in a cost plan report, and Paragraph 3.22.3 requires that the employer is clearly informed as to the items included in and excluded from the cost plan.

The essential part of a cost plan report is, of course, the cost plan. Depending upon how advanced the cost plan is in its development (Formal Cost Plan 1, 2 or 3), the cost plan will be presented as an elemental breakdown expressed in:

- Group elements (e.g. superstructure).
- Elements (e.g. frame, upper floors).
- Sub-elements (e.g. steel frames, concrete frames, timber frames).

The unit of measurement for each constituent part of a cost plan is ‘cost/m<sup>2</sup> of GIFA’ (Paragraph 3.22.1), but functional units or even ‘cost/ft<sup>2</sup> of GIFA’ may be used where appropriate (Paragraph 3.22.2).

**Example:****COST PLAN FOR NEW 20 000-SEATER FOOTBALL STADIUM**

| Group element | Element | Sub-element | Constituent              | Subtotals | Totals    | Subtotals per seat | Totals per seat |
|---------------|---------|-------------|--------------------------|-----------|-----------|--------------------|-----------------|
|               |         |             |                          | £         | £         | £                  | £               |
| 3             |         |             | <b>Internal Finishes</b> |           |           |                    |                 |
|               | 3.1     |             | Wall finishes            | 720 000   |           | 36.00              |                 |
|               | 3.2     |             | Floor finishes           | 932 000   |           | 46.60              |                 |
|               | 3.3     |             | Ceiling finishes         | 764 000   |           | 38.20              |                 |
|               |         |             |                          |           | 2 416 000 |                    | 120.80          |

Whilst not stated in Paragraph 3.22, it would seem sensible to also include absolute costs in the cost plan report, totalling to the agreed cost limit, as such values are likely to mean more to the majority of employers than cost/m<sup>2</sup>.

## 5.8 Part 4: Tabulated rules of measurement for elemental cost planning

The basic idea of cost planning is to break down the order of cost estimate so as to represent the evolving design in more detail and thereby aid the designer to make informed design choices.

As the design develops, and more detail becomes available, group elements may be subdivided into elements, and elements into sub-elements, and the rates used for estimating change from the 'approximate' cost per functional unit, or cost per m<sup>2</sup> of GIFA, to the more precise EUR. The order of cost estimate is thus developed into the outline cost plan and, subsequently, into the detailed cost plan.

Later on, at some point in the development of the cost plan, the 'component' level of detail is reached which requires a more detailed method of estimating. This is the point when 'quantities' can be produced that can be priced using 'unit rates'.

The purpose of Part 4 of NRM1 is to provide the 'tabulated' rules for measuring the component parts of elements and sub-elements for cost planning (and other) purposes. The rules are tabulated in the irritating landscape presentation redolent of SMM7 using, in the main, 'normal' units of measurement – m, m<sup>2</sup>, m<sup>3</sup>, nr, t – albeit that there is the occasional use of % and the choice between *item* and *nr* for certain items.

The measurement rules for cost planning are contained in NRM1 Parts 3 and 4. The Part 3 'rules' might be more accurately referred to as 'general rules', whereas the rules for the detailed measurement of building work are contained in Part 4: *Tabulated rules of measurement for elemental cost planning*.

The *Tabulated rules of measurement for elemental cost planning* are likely to be used at some point during or towards the end of Stage 3 – Developed Design of the RIBA Plan of Work 2013 – and this point marks the transition from the measurement of group elements and elements in cost/m<sup>2</sup> of GIFA to the measurement of building components in m, m<sup>2</sup>, m<sup>3</sup>, etc.

In this regard, it is unhelpful to think of order of cost estimates and cost plans as being separate entities measured in different units.

*Formal Cost Plan 1* is a development of the *Order of cost estimate* and, as such, will be measured in cost/m<sup>2</sup> of GIFA until such time as more detailed measurements can be taken – probably for the development of *Formal Cost Plan 2*. Nonetheless, all iterations of the cost plan must still be expressed in cost/m<sup>2</sup> of GIFA, in accordance with NRM1 Paragraph 3.22.1, accompanied by absolute values for clarity.

The other important function of the *Tabulated rules of measurement for elemental cost planning* is the cost checking of elements, sub-element and components. This process is akin to measuring approximate quantities in order to see whether the allowance for a particular item stands up to scrutiny when the detailed design of that item is available.

### Risk issue

In terms of measurement, Paragraph 2.19.4 is perhaps the most significant in that the employer is to be clearly informed as to what is included in, and excluded from, the order of cost estimate.

The quantity surveyor/cost manager would be well advised to ensure that the correct protocols are put in place to ensure that the order of cost estimate is crystal clear to the employer.

#### 5.8.1 Introduction

One of the potential further uses for the tabulated rules of measurement is signalled in NRM1 Paragraph 4.1.2 – whole life cycle costing – but bills of quantities for building work could also be prepared with NRM1 rules where the detail required by NRM2 rules is not practical or desired.

Paragraph 4.1.1 also explains that Part 4 of NRM1 contains advice on how the reallocation of costs from elements/sub-elements to work packages may be achieved and also on how elemental cost plans may be coded to achieve this, and other, objectives.

#### 5.8.2 Use of tabulated rules of measurement for elemental cost planning

The rules of measurement for cost planning are organised into 15 tables; the first 9 deal with building works and the remainder, the ‘softer’ issues such as preliminaries, project/design team fees and risks.

NRM1 Paragraphs 4.2.2 and 4.2.3 explain the hierarchy of the tabulated measurement rules for facilitating works (group element 0) and building works (group elements 1–8):

| Level | Hierarchy     | Example                                 |
|-------|---------------|---|
| 1     | Group element | 2 Superstructure                        |
| 2     | Element       | 2.1 Frame                               |
| 3     | Sub-element   | 2.1.1 Steel frames                      |
| 4     | Component     | 2.1.1.1 Structural steel frame          |
|       |               | 2.1.1.1.2 Fire protection               |
|       |               | 2.1.1.1.3 Factory applied paint systems |

There may be more than one element in a group element, one or more sub-elements in an element and one or more components in a sub-element.

It can be seen that the tabulated rules are based on a work breakdown structure and that the four levels in the hierarchy provide the basis for a coding system which acts as a frame of reference

for individual parts of the cost plan and as a means of redistributing discrete items into a work package structure if desired.

However, whilst all the levels are used to uniquely identify a component, not all parts of the hierarchy are measured:

- Level 1 is the group element to which a Level 2 element belongs but neither is measured.
- Level 3 is the sub-element to which a component belongs, but sub-elements are not measured.
- Level 4 is the component level; it is the components that are measured, and it is the components to which the measurement rules and the 'included' and 'excluded' items apply.

Table 5.9 illustrates how the NRM1 tables work.

It is important to observe the horizontal lines in the tabulated structure of the measurement rules as they denote the end of a sub-element (e.g. sub-element A) and the start of the next one (e.g. sub-element B), and they also help to divide sub-elements into one or more components (e.g. A1, A2 and A3).

Group elements 9–14 have a slightly different tabular structure, but the principles are the same. The tabular structure for each group element is described in NRM1 Paragraphs 4.2.5–4.2.10 respectively.

### 5.8.3 *Work not covered by the rules of measurement for elemental cost planning*

Paragraph 4.3.1 recognises that the NRM1 rules may not be exhaustive enough to cover every possible circumstance of components to be measured and that, in such situations, NRM1 rules are to be followed where possible.

Where not possible, the rules adopted shall be stated in the cost plan. This is sensible guidance especially where there is more than one cost planner or where personnel change for some reason or other.

### 5.8.4 *Method of coding elemental cost plans*

The NRM1 coding system for elemental cost plans is relatively straightforward (if you like brain teasers, try NRM2!), and guidance can be found in Paragraph 4.4 which provides a worked example.

The NRM1 example refers to two concrete beams which are part of a reinforced concrete frame:

- Concrete beams 1200 × 800 mm.
- Concrete beams 2000 × 800 mm.

The first place to begin the search for a code number for these items is Appendix E: *Logic and arrangement of Levels 1–3 for elemental cost planning* which is identified in Paragraph 4.4.1.

Appendix E identifies three levels:

- Level 1 – Group element.
- Level 2 – Element.
- Level 3 – Sub-element.

However, Paragraph 4.4.2 says that further code levels may be added as necessary.

Within each level is a classification system and each item listed in each level classification is given a number. This is illustrated in Table 5.10.

**Table 5.9** Tabulated rules.

| <b>Group element</b>   |                  |   |                      |   |   |  |  |
|--|------------------|---|----------------------|---|---|--|--|
| <b>Element</b>   |                  |   |                      |   |   |  |  |
| <b>Sub-element</b>   | <b>Component</b> |   | <b>Unit</b>          |   | <b>Measurement rules for components</b>   | <b>Included</b>  | <b>Excluded</b>  |
| <b>A</b><br>A sub-element is part of an element<br>A definition of the sub-element is to be found in this column | <b>A1</b>        | Components are part(s) of a sub-element<br>For example, component A2 is part of sub-element A | <b>m</b>             | Different units may apply to different components. For example, component A2 is measured in m <sup>2</sup> and A3 in m <sup>3</sup> | Rules that apply to each component within a sub-element, that is: <ul style="list-style-type: none"> <li>• What to measure it</li> <li>• How to measure it</li> <li>• What must be measured and described separately</li> </ul> | The work items deemed to be <b>included</b> in each component of the sub-element | The work items deemed to be <b>excluded</b> from each component of the sub-element |
|  | <b>A2</b>        |   | <b>m<sup>2</sup></b> |   |   |  |  |
|  | <b>A3</b>        |   | <b>m<sup>3</sup></b> |   |   |  |  |
| <b>B</b>   | <b>B1</b>        |   | <b>m<sup>2</sup></b> |   |   |  |  |
|  | <b>B2</b>        |   | <b>m<sup>3</sup></b> |   |   |  |  |



**Table 5.10** Classification system.

| Level 1<br>Group element |                       | Level 2<br>Element |              | Level 3<br>Sub-element     |  | Reference    |
|--------------------------|-----------------------|--------------------|--------------|----------------------------|--|--------------|
| 1                        | Substructure          | Substructure       |              | 1<br>2<br>3<br>4<br>5      | Standard foundations<br>Specialist foundations<br>Lowest floor construction<br>Basement excavation<br>Basement retaining walls         |              |
| 2                        | <b>Superstructure</b> | 1                  | <b>Frame</b> | 1<br>2<br>3<br>4<br>5<br>6 | Steel frames<br>Space frames/decks<br>Concrete casings to steel frames<br><b>Concrete frames</b><br>Timber frames<br>Specialist frames | <b>2.1.4</b> |
|                          |                       | 2                  | Upper floors | 1<br>2<br>3                | Floors<br>Balconies<br>Drainage to balconies   |              |
|                          |                       | 3<br>Etc.          | Roof<br>Etc. | 1<br>Etc.                  | Roof structure<br>Etc.   |              |

**Risk issue**

There is a mistake in Paragraph 4.4.2 following the first set of bullet points.

The codes given in this paragraph for the concrete beams example are stated as 3.1.4.3 and 3.1.4.4 which is not correct – the Level 1 reference should be 2 (superstructure) and not 3 (which is internal finishes).

It is worth reiterating at this stage that an elemental cost plan develops over time as the design progresses, and the starting point for the elemental cost plan is the order of cost estimate.

The order of cost estimate is not likely to be at a more detailed level than Level 1 – group element – and the first formal cost plan (Formal Cost Plan 1) *will use a condensed list of elements* which will then become more detailed as more information becomes available (refer to NRM1 Paragraph 3.11.4 (a)(iv)).

At some point in the cost planning process, the Level 3 (sub-element) level of detail will be too crude, and therefore, sub-elements will need to be broken down into **components** and **sub-components** for more accurate estimating.

Referring back to the concrete beam example earlier, beams are clearly a subset of **frames** and may be further subdivided into **concrete**, **formwork** and **rebar**. Consequently, further coding levels are needed to identify these specific components and sub-components in the cost plan.

NRM1 Paragraph 1.6.3: *Definitions* defines ‘component’ as *a measured item that forms part of an element or a sub-element*, and therefore, a concrete beam is a ‘component’ because it forms part of a concrete frame, which is a sub-element at Level 3.

Referring to Appendix E, the numbered reference for a concrete frame is 2.1.4 which is given by:

- Level 1 – Group element **2: Superstructure**.
- Level 2 – Element **1: Frame**.
- Level 3 – Sub-element group element **4: Concrete frames**.

Referring now to NRM1 Paragraph 4.4.2, this states that:

- Codes for levels 1–3 are provided by the measurement rules and that codes for level 4 (i.e. components) will be user defined due to the large variety of components that could be found in any particular sub-element.

However, looking at NRM1 Part 4: *Tabulated rules of measurement for elemental cost planning* (specifically group element 2: *Superstructure* on page 103 of NRM1), it can be seen that the items listed under the heading ‘Component’ also have a reference number notwithstanding that Paragraph 4.4.2 says that the component level reference (i.e. Level 4) will be user defined.

The logical conclusion to this statement is that the numbering under ‘Component’ in the rules of measurement is to be ignored in favour of a number to be made up by the person compiling the cost plan.

However, the question arises as to why components should be numbered in the measurement rules when the numbers are to be ignored? This doesn’t make any sense. Admittedly, the items listed in the *Measurement rules for components*, *Included* and *Excluded* columns are also referenced, but these are not measured items and would not feature in the referencing of a component or sub-component.

Looking back at Paragraph 4.4.2, it is clear that the idea of *user-defined* codes at Level 4 is so that components may be added that are not listed in NRM1. This is fair enough, as no method of measurement can anticipate every mortal thing, but it might have been a better idea to encourage users to continue the numbering at Level 4 rather abandoning the codes already provided.

A case in point in element 2.5: *External walls* is Rule C10 which states that *Contractor designed work is to be described and identified separately*. Therefore, an item at the component level for external walls to be designed by the contractor would require a *user-defined* code to distinguish it from 2.5.1.1 for external walls not to be designed by the contractor.

Finally, Paragraph 4.4.2 goes on to say that a user-defined Level 5 reference could be created, if desired, so that ‘sub-components’ such as formwork and reinforcement could also be given unique code numbers.

A simple example may help to illustrate the issues and, hopefully, provide a sensible solution.

Consider two below ground drainage items:

- Drain run A: depth to invert 0.9 m, pipe diameter 100 mm.
- Drain run B: depth to invert 1.2 m, pipe diameter 150 mm.

These items would be measured under NRM1 group element 8: *External works*, and their codes would be derived as shown in Table 5.11.

It can be seen that, using the NRM1 Component (Level 4) reference number results in two problems:

- Each drain run is coded with the same number.
- If there were, as is likely in practice, several drain runs with different pipe diameters and depths to invert, all the items would have the same code.

Clearly, this is not practicable as the two drain runs, A and B, are different items of work with different pipe diameters, different depths to invert and different costs, and each item merits its own code.

Ideally, each item would be coded uniquely, but also be traceable back to its root in NRM1, as this would be beneficial for auditability of the cost plan. It would be tempting to add a decimal point and further code number after the ‘2’, but this would create a Level 5 code and not a unique Level 4 code.

**Table 5.11** Measurement codes.

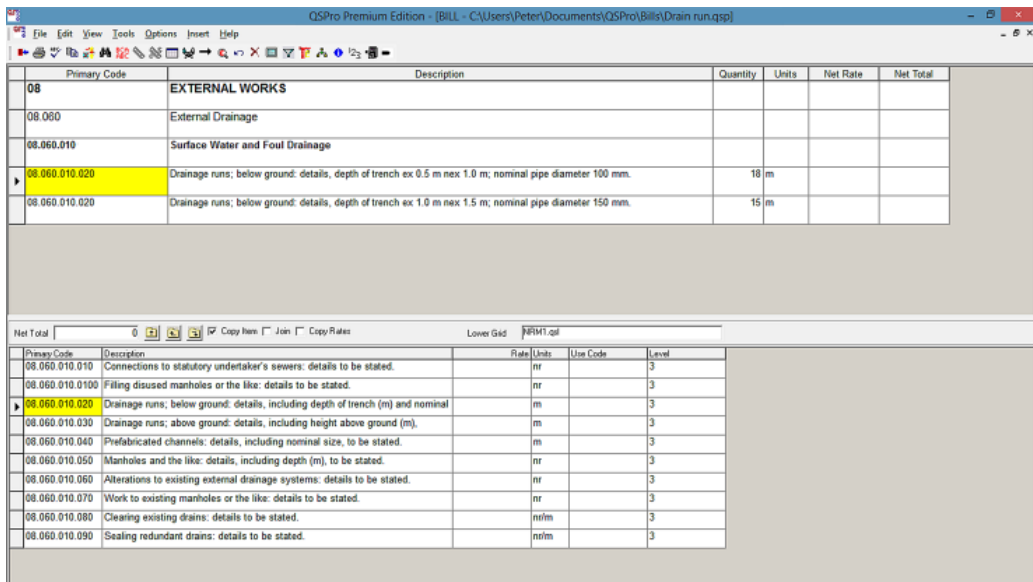
| Item   | Code                      |                    |                          |   |
|--|---------------------------|--------------------|--------------------------|---|
|  | Level 1                   | Level 2            | Level 3                  | Level 4   |
| <b>External works</b><br>External drainage<br>Surface water and foul water drainage<br>Drainage runs; below ground<br><br>• Drain run A<br><br>• Drain run B | Group element<br><b>8</b> | Element<br><br>8.6 | Sub-element<br><br>8.6.1 | Component<br><br>The NRM1 Level 4 reference number for drainage runs is 2. Using this reference, the item codes would be: |
|  |                           |                    |                          | State trench depth (m) and pipe diameter (mm)<br><br>8.6.1.2  |
|  |                           |                    |                          | Ditto<br><br>8.6.1.2  |

Part 2

Therefore, it would be logical if all below ground drain runs could be referenced under the umbrella of the 8.6.1.2 Level 4 code because this would trace the items back to the NRM1 Component level (Level 4) *Drainage runs; below ground* but with something added to make each item unique. This would mean changing the Level 4 code from 2 to some other number but preferably retaining the ‘2’ so as to maintain the link with *Drainage runs; below ground*.

QSPRO for Windows provides a clue as to how this might be achieved, and this is illustrated in Figure 5.3 which shows the respective descriptions and codes that might be employed.

It can be seen that QSPRO gives a primary code of 08.060.010.020 for both measured items, which is the equivalent to 8.6.1.2, but with ‘zeros’ added for greater flexibility. This provides the opportunity to change the Level 4 code (020), thereby giving drain runs A and B unique codes if desired whilst at the same time retaining the ‘2’ link to the NRM1 Level 4 descriptor for *Drainage runs; below ground*.



**Figure 5.3** Coding items – 1.

However, bearing in mind that there could be several 100 mm diameter drain runs with different depths to invert, a Level 4 code needs to be chosen that will accommodate a reasonable number of items.

For example, 100 mm diameter drain runs could be coded 210 to 219 depending on depth:

- 08.060.010.210 – Depth not exceeding 0.5 m.
- 08.060.010.211 – Depth exceeding 0.5 m but not exceeding 1.0 m.
- 08.060.010.212 – Depth exceeding 1.0 m but not exceeding 1.5 m.
- Etc.

Accordingly, 150 mm diameter drain runs could be coded from 220 to 229, and 225 mm diameter drain runs could be coded 230 to 239 and so on.

The revised codes for our example are shown in Figure 5.4 with the 100 mm diameter drain run coded 08.060.010.211 and the 150 mm diameter drain run coded 08.060.010.223.

| Primary Code   | Description   | Quantity | Units | Net Rate | Net Total |
|----------------|---|----------|-------|----------|-----------|
| 08             | EXTERNAL WORKS  |          |       |          |           |
| 08.080         | External Drainage   |          |       |          |           |
| 08.060.010     | Surface Water and Foul Drainage   |          |       |          |           |
| 08.060.010.211 | Drainage runs; below ground: average depth ex. 0.5 m max. 1.0 m; nominal diameter 100 mm.   | 18       | m     |          |           |
| 08.060.010.223 | Drainage runs; below ground: depth of trench ex. 1.0 m max. 1.5 m; nominal diameter 150 mm. | 15       | m     |          |           |

| Primary Code   | Description   | Rate | Units | Use Code | Level |
|----------------|---|------|-------|----------|-------|
| 08.060.010.010 | Connections to statutory undertaker's sewers: details to be stated.             | nr   |       |          | 3     |
| 08.060.010.010 | Filling disused manholes or the like: details to be stated.                     | nr   |       |          | 3     |
| 08.060.010.020 | Drainage runs; below ground: details, including depth of trench (m) and nominal | m    |       |          | 3     |
| 08.060.010.030 | Drainage runs; above ground: details, including height above ground (m).        | m    |       |          | 3     |
| 08.060.010.040 | Prefabricated channels: details, including nominal size, to be stated.          | m    |       |          | 3     |
| 08.060.010.050 | Manholes and the like: details, including depth (m), to be stated.              | nr   |       |          | 3     |
| 08.060.010.060 | Alterations to existing external drainage systems: details to be stated.        | nr   |       |          | 3     |
| 08.060.010.070 | Work to existing manholes or the like: details to be stated.                    | nr   |       |          | 3     |
| 08.060.010.080 | Cleaning existing drains: details to be stated.                                 | nr/m |       |          | 3     |
| 08.060.010.090 | Sealing redundant drains: details to be stated.                                 | nr/m |       |          | 3     |

Figure 5.4 Coding items – 2.

The user of NRM1 is now faced with a dilemma:

- Ignore the 'component' numbering in Part 4: *Tabulated rules of measurement for elemental cost planning* and employ a completely different numeric reference.
- Adopt the NRM1 'component' reference as part of a more logical system of referencing that provides flexibility and auditability.

### Example

- Use the NRM1 referencing system down to Level 3.
- If suitable, use the Level 4 component reference number.
- If the list of Level 4 component reference numbers in the measurement rules is not sufficiently exhaustive, introduce *user-defined* Level 4 reference numbers as required.
- Use the 'component' reference number listed in the measurement rules as part of the *user-defined* Level 4 reference.
- If the Level 4 reference is not sufficiently detailed (e.g. where there is more than one type of pipe material), create a *user-defined* reference (Level 5).
- Reference sub-components (e.g. different trench backfill details) with a unique *user-defined* Level 6 reference.

In the context of NRM1 Paragraph 4.4, there is nothing wrong with this approach as Level 4 codes (and beyond) are meant to be *user defined* in any event.

Whichever approach the quantity surveyor/cost manager takes to referencing the cost plan, it should always be remembered that:

- Each component should *be continuously and sequentially numbered under the sub-element* (refer to NRM1 Paragraph 4.4.3) which infers that only numeric codes can be used.
- The very purpose of a work/cost breakdown structure is to create a cascade of items each with a unique code, and therefore the use of alpha codes (letters) would not work.

### 5.8.5 Method of coding elemental cost plans for work packages

For some projects, the quantity surveyor/cost manager may need to present the cost plan in a work package rather than an elemental format. This could happen, for instance, where:

- There is early contractor involvement in the design process (e.g. stage one of a two-stage tender), and it makes both commercial sense and practical sense to divide up the project into work packages.
- The contractor is engaged early on in the project on the basis of an agreed fee (e.g. target cost contract) who then works with the employer's quantity surveyor to develop work package-based target costs.
- A project is to be procured on a traditional basis, but the work is to be tendered on the basis of bills of quantities for individual work packages to be managed by an in-house project management team (e.g. multistorey, high-value-high-quality speculative housing/commercial development).

The best time to determine the work packages would be when the contractor is on board.

In each case, a decision will have to be made as to the format of the cost plan and, in particular, the make-up of the individual work packages. To do this, and to avoid unnecessary duplication of effort, it would seem sensible to the allocate elements to appropriate work packages at the earliest possible stage, but this idea is not mentioned in NRM1.

Notwithstanding this, it should be understood that recoding the items in the cost plan does not imply any significant degree of extra work. It simply means that the cost plan will be subdivided into work packages instead of group elements, but the building work measured in each work package will still be measured and described in the NRM1 elemental format. This type of reordering can be easily done in a cost planning software package such as CATO or QSPro.

This situation is contemplated in NRM1 Paragraph 4.5 which suggests a numeric suffix codification framework such as that provided in NRM1 Figure 4.1. A selection of these can be seen in Table 5.12.

**Table 5.12** NRM1 work package suffixes.

| Work package   | Suffix |
|--|--------|
| Main contractor's preliminaries                        | /001   |
| Substructure and groundworks                           | /002   |
| Piling   | /003   |
| Concrete works (including precast concrete components) | /004   |
| Carpentry  | /006   |
| Masonry  | /007   |
| Curtain walling  | /011   |
| Etc.   |        |

There is no compulsion to use the NRM1 codes, but whatever the choice, Paragraph 4.5 suggests two methods of providing the additional coding needed to reallocate elements and sub-elements to individual work packages:

1. By *simply introducing one or more numeric suffix to each item in the cost plan* (Paragraph 4.5.1).
2. By using *one or more character(s) as a suffix in order to identify a work package* (Paragraph 4.5.2).

The first of these suggestions seems straightforward enough, but it is not clear why Paragraph 4.5.1 only refers to the reallocation of *elements and sub-elements* to work packages and fails to mention ‘components’ as it is quite possible that the cost plan may be developed to this level of detail at some point.

The first method of recoding may be explained by taking the simple example of a strip foundation shown in Figure 5.5.

The NRM1 code for this item (01.010.010.010) is given by:

|               |     |                      |         |
|---------------|-----|----------------------|---------|
| Group element | 1   | Substructure         | 1       |
| Element       | 1.1 | Substructure         | 1.1     |
| Sub-element   | 1   | Standard foundations | 1.1.1   |
| Component     | 1   | Strip foundations    | 1.1.1.1 |

In order to reallocate this item, from group element 1 to the ‘substructure and groundworks’ work package, a suffix (002) should be added to the elemental code. The eventual code number, however, will depend upon the level of detail reached in the development of the cost plan. This could be done at the elemental level (group element level is insufficiently detailed), in which case the code would be 1.1/002 or 1.1.002. At the finest level of detail, ‘component’ level, the code would be either 1.1.1.1/002 or 1.1.1.1.002.

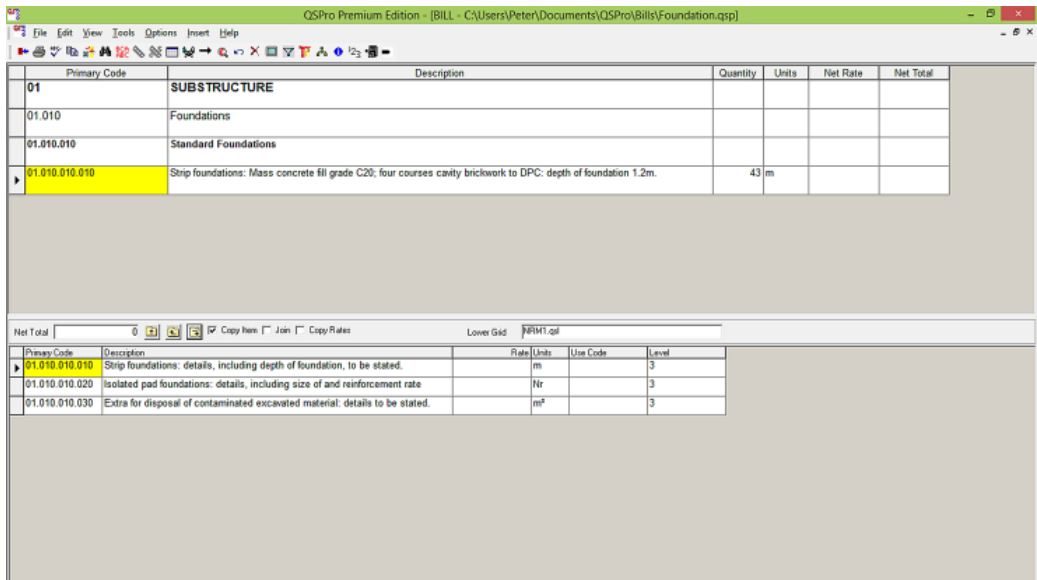


Figure 5.5 Recoding.

Further items in the cost plan would be similarly dealt with in order to populate the ‘substructure and groundworks’ work package and also to create other work packages as appropriate. Paragraph 4.5.3 emphasises that elements may be broken down into further detail by introducing *additional levels of code* as needed.

The second method of recoding elements to work packages is not at all clear, and it is less than obvious what the words *one or more character(s) can be used as a suffix to identify a work package* actually mean:

- A ‘character’ is defined in the Oxford Dictionary as:

*A letter, number, or other mark or sign used in writing or printing, or the space one of these takes.*

- *On the face of it, it would seem that Paragraph 4.5.2 simply means using some other code or reference – alpha or numeric – than those listed in NRM1 Figure 4.1*
- This character(s) would then be used as a suffix for items to be reallocated to the ‘substructure and groundworks’ work package (e.g. ‘B’)
- The suffix ‘B’, therefore, could be allocated to the foundation item giving a component level code of **1.1.1.1.B**, for instance.

### 5.8.6 Group elements 0–8

Group elements 0–8 of NRM1 Part 4: *Tabulated rules of measurement for elemental cost planning* provide the detailed rules for measuring building work items for inclusion in elemental cost plans.

The rules are structured in a tabular format as shown in Table 5.13.

**Table 5.13** Measurement rules.

| Sub-element   | Component   | Unit  | Measurement rules for components                                      | Included   | Excluded   |
|---|---|---|---|--|--|
| Sub-element title + definition of what the sub-element is | A named measurable part of a sub-element + details of what should be included in the description of the component | The unit of measurement applicable to the component | Rules that apply to the way in which each component is to be measured | Definitions of the work that is included in each component | Definitions of the work that is excluded from each component |
| Each sub-element has a unique numeric reference           | Each component has a unique numeric reference   | m, m <sup>2</sup> , m <sup>3</sup> , t, nr, item, % | Each rule has a unique reference prefixed with the letter C           | Each definition has a unique numeric reference             | Each definition has a unique numeric reference               |

Some ‘general rules’ that apply to the measurement and description of group elements 0–8 can be found in NRM1 Part 3: *Measurement rules for cost planning*. However, Part 4: *Tabulated rules of measurement for elemental cost planning* also contains several rules that might be considered as ‘general rules’, but instead of being included in Part 3, they are repeated throughout Part 4. Examples of such rules include:

- *Other cost-significant components are to be described and identified separately.*

- Contractor designed work is to be described and identified separately (**note:** where the contractor is only responsible for designing specific elements and/or components of the building project (i.e. not the entire building project)).
- Curved work is to be described and identified separately.
- Work to existing buildings is to be described and identified separately.
- Work within existing buildings is to be described and identified separately.

### 5.8.7 Group elements 9–14

Group elements 9–14 of NRM1 Part 4: *Tabulated rules of measurement for elemental cost planning* provide the detailed rules for measuring non-building work items for inclusion in elemental cost plans. Such items include main contractor’s preliminaries, risks and inflation allowances.

The rules are structured in a tabular format, but the layout of the tables is slightly different to that for group elements 0–8. For group elements 9, 11 and 12, the tables are laid out as shown in Table 5.14.

The layout for the group element 10 table is different as Table 5.15 illustrates.

The layout of the table for group element 14 is different again (see Table 5.16).

**Table 5.14** Measurement rules: group elements 9, 11 and 12.

| Component                                     | Included  | Unit  | Excluded  |
|---|---|---|---|
| A named measurable part of an element         | Definitions of what is included in each component | The unit of measurement applicable to the component | Definitions of what is excluded from each component |
| Each component has a unique numeric reference | Each definition has a unique numeric reference    | nr, item, per week, %                               | Each definition has a unique numeric reference      |

**Table 5.15** Measurement rules: group element 10.

| Element                                     | Included  | Excluded  |
|---|---|---|
| A named measurable part of a group element  | Definitions of what is included in each element | Definitions of what is excluded from each element |
| Each element has a unique numeric reference | Each definition has a unique numeric reference  | Each definition has a unique numeric reference    |

**Table 5.16** Measurement rules: group element 14.

| Element                                     | Included  | Unit  | Excluded  |
|---|---|---|---|
| A named measurable part of a group element  | Definitions of what is included in each element | The unit of measurement applicable to the element | Definitions of what is excluded from each element |
| Each element has a unique numeric reference | Each definition has a unique numeric reference  | %   | Each definition has a unique numeric reference    |



Finally, group element 13: *Risks* has no tabulated structure at all but consists of four elements, each of which is defined by a ‘boxed’ numeric list of items appropriate to the particular element concerned. The four elements are:

| Element | Risk                      |
|---------|---------------------------|
| 13.1    | Design development risks  |
| 13.2    | Construction risks        |
| 13.3    | Employer change risks and |
| 13.4    | Employer other risks      |

The ‘risks’ listed in group element 13 are *not meant to be exhaustive* but should be considered *merely a guide*.

Strictly speaking, these ‘risks’ are not risks at all but are items that might be considered by the cost planner when deciding what *risk allowances... are to be included in each formal cost plan* (Paragraph 3.18.1). Element 13 provides a good *aide memoire* of possible hazards or threats to the robustness of the cost plan, but like all such threats, the extent of the ‘risk’ should be a considered judgement based on the likelihood of the event happening and its impact or severity.

NRM1 Paragraph 3.18.1 calls for a *formal risk analysis* as the basis for risk allowances in the cost plan and guidance for this may be found in Paragraph 2.15.

The phrase ‘risk analysis’ is clearly used loosely as the guidance provides no indication as to how an analysis may be conducted nor is it likely in practice that this would be done with any degree of sophistication.

A risk register, and a *properly considered estimate of risk* (Paragraph 2.15.4), is about the best that might be expected in most cases.

## Note

1. *Bolam v Friern Hospital Management Committee* [1957] 1 WLR 582.

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