THE SOUTH AFRICAN COUNCIL
for the
QUANTITY SURVEYING PROFESSION

Established in terms of the Quantity Surveying Profession Act 2000 (Act 49 of 2000)

PROFESSIONAL SKILLS MODULE NO. 2

MANAGE PRODUCTION PROCESS OF PRICE DETERMINATION DOCUMENTS FOR BUILT ENVIRONMENT PROJECTS

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ORGANISATIONAL COMPONENT

1.0 GENERAL PREMISE AND EDUCATIONAL APPROACH

The general objective with this module is to emphasise **understanding** rather than **memorising** and to develop the professional's skill to apply the principles in a practical way. A problem-driven approach to learning is followed.

2.0 LEARNING ACTIVITIES

2.1 The relevant study material is made available through the office of the South African Council for the Quantity Surveying Profession (SACQSP).

3.0 ASSESSMENT CRITERIA AND FEEDBACK

3.1 The understanding of the module will be assessed via a multiple choise examination that is conducted on-line
3.2 The minimum pass mark for a module is 60%.

4.0 CPD CREDITS

4.1 The CPD credit weighting of this module is 5 Category 1

4.2 Studying the content of this module alone is not sufficient to master the required skill. Professionals are required to study price determination documents based on different measuring systems for different types of developments and to practice the skills for different scenarios. The different approach towards producing price determination documentation for public and private developments should also be mastered.

5.0 RECOMMENDED ADDITIONAL READING

5.1 The Association for South African Quantity Surveyors. 1999 (6th Edition Revised). Standard System for Measuring Building Work.

5.2 The Association for South African Quantity Surveyors. 2008. Model Preambles for Trades.

5.3 The Association for South African Quantity Surveyors. 2005. Model Bills of Quantities.

5.4 C. J. Willis, A. Willis, W. Trench, S. Lee. *Willis's Elements of Quantity Surveying (Eleventh Edition).* Wiley-Blackwell, 2011.

5.5 A. Ashworth, K. Hogg. *Willis's Practice & Procedures for the Quantity Surveyor (Eleventh Edition).* Blackwell Science, 2002.

5.6 M. Hackett, I. Robinson, G. Statham. *The Aqua Group Guide to Procurement, Tendering & Contract Administration*. Blackwell Publishing, 2007.

5.7 Candidates are required to read the following papers dealing with current issues and developments in the management of the production process of price determination documents:

- Peter R Davis, Peter E D Love, David Baccarini. (2009). "Bills of Quantities: nemesis or nirvana?", Structural Survey, Vol 27 Iss 2, pp. 91-108. http://dx.doi.org/10.1108/02630800910956434.
- Henry Odeyinka, Srinath Perera. (2009). "An evaluation of the budgetary reliability of bills of quantities in building procurement." In Cobra 2009, Royal Institution of Chartered Surveyors (RICS), London, United Kingdom, pp.445-446. ISBN 978-1-84219-519-2 [book section].

- Hamimah Adnan, Abdul Hadi Mohd Nawawi, Siti Maimunah Mohd Akhir, Azizan Supardi and Heap-Yih Chong. (2011). “Bills of Quantities: Perspectives of Contractor in Malaysia.” Australian Journal of Applied Sciences, 5 (11), pp. 863-873.

- Tan Chin Keng. (2011). “A study on the use of measurement software in the preparation of bills of quantities among Malaysian quantity surveying firms.” ICT and Knowledge Engineering, 9th International Conference, pp. 53-58.

- Abdul Rashid Rosli, Mustapa Muzani and Nurhuda Abd Wahid Siti. (2006). “Bills Of Quantities – Are They Still Useful And Relevant Today?” International Conference on Construction Industry 2006, Padang, Indonesia, 21st June – 25th June 2006.

6.0 RANGE STATEMENT

This module relates to the performance of work typically undertaken by quantity surveyors and newly qualified persons are expected to demonstrate their acquired skills through their ability to perform the following in their place of employment.

6.1 develop management plans for the production of price determination documents for built environment projects.

6.2 manage the production process for price determination documentation.

6.3 undertake quality assurance of price determination documentation.

6.4 combine facts, ideas and proposals into a complex whole.

6.5 understand and apply basic computer skills.

6.6 demonstrate problem-solving skills.

6.7 demonstrate communication and presentation skills.

MODULE CONTENT

ABBREVIATIONS

ASAQS - Association of South African Quantity Surveyors
CIDB - Construction Industry Development Board
SABS - South African Bureau of Standards
SANS - South African National Standards
SSMBW - Standard System of Measuring Building Work

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1. INTRODUCTION

The purpose of this module is to map out the managerial process that unfolds when compiling a price determination document for built environment projects. Large built environment projects are unique, complex and designed for a specific purpose in a specific location, cost vast amounts of money and their construction often span several years. Inevitably the project will not roll out as planned and therefore planning must make provision for change. The approach should be "plan for the best but expect the worst". Large construction companies have few projects at any given point in time due to the nature of the projects described above. It is therefore crucial that they obtain work based on accurate estimating and good pricing [(6)]. This brings us to the two primary functions of price determination documents and that is firstly to create a uniform basis for competitive tendering and secondly to serve as a basis for determining pricing of variations. It is therefore of paramount importance that these documents are presented in a format that will facilitate these functions.

1.1 Management principles

Koontz and Weihrich define management as "the process of designing and maintaining an environment in which individuals, working together in groups, accomplish efficiently selected aims" [(6)]. The nature of management is therefore to motivate and co-ordinate the efforts of the individuals in the groups by applying the management functions of planning, organizing, staffing, leading, co-ordinating and controlling. These functions are partly planning functions and partly executive functions and can be summarized as follows:

Planning functions	Executive functions
Planning: Selecting objectives, deciding upon future course of action	Leading: Influencing people so that they will contribute to organization and group goals
Organizing: Establishing an intentional structure of roles for people to fill in an organisation	Co-ordinating: "The essence of management", the achievement of harmony of individual effort towards the accomplishment of group goals
Staffing: Filling and keeping filled, positions in the organizational structure	Controlling: Measuring and correcting the actions of subordinates

Table 1: The functions of management
Source: Managing International Construction Projects: An Overview (page 11)

Before the planning phase can even start cognizance must be taken of the procurement strategy according to which the project is to be executed. The most significant influence on any building project is the choice of procurement strategy. The strategy revolves around two components namely the conditions of contract that spell out the roles, responsibilities and liabilities of the contracting parties and the price determination method that is the process through which the services of the contractor is selected therefore the procurement strategy determines the efficiency with which the entire project is produced from design through to completion of construction [(8)]. The procurement strategies pertain to the relationship between the designers and the contractor.

The strategies currently in use are divided into two categories namely traditional and non-traditional strategies. With traditional strategies the contractors only get involved when the design is almost complete and with the non-traditional strategies the contractors are involved at an early stage so that they can contribute to the design process. Price determining documents play a more significant role in the traditional procurement strategy but are also important in non-traditional procurement strategies [(8)].

The traditional procurement strategies are still widely practiced and preferred and for the purposes of this module only the methodology pertaining to the traditional procurement strategies is discussed further.

The application of the planning and executive functions to the production process of price determination documents will become clear later on in the module.

1.2 Price Determination Documents

Price determination in the built environment is done according to two methods namely by measurement or by reimbursement of costs[9]. Reimbursement contracts do not involve the preparation of price determination documentation and are therefore not discussed any further.

With measurement contracts the construction work is measured on the basis of the actual quantities required for the finished project and the price is determined by multiplying the quantity of work by rates supplied by contractors. The rates include all the costs incurred by contractors such as material, labour, plant, direct and indirect overheads and an allowance for profit.

Measurement contracts in use are:

- *Drawings and specification measurement contracts (also called contracts without quantities)* are only suitable for simple and straightforward projects where each tenderer is issued with a set of drawings and a specification and it is up to the tenderer to measure the quantities and interpret the specifications in order to determine a tender price.
- *Performance specification measurement contracts* require tenderers to prepare a tender price based on the client's brief and user requirements only which leaves the tenderer to decide on the type of material and methodology to apply to meet the performance criteria.
- *Schedule of Rates measurement contracts* are similar to bills of quantities, contain the items but not the quantities. No tender price can be calculated for such a contract.
- *Bills of Quantities measurement contracts* are based on Bills of Quantities that contain qualitative and quantitative information derived from the drawings and specifications and are prepared in accordance with standardised methods of measurement. The tender price for all the tenderers is determined on the same detailed information [(9)].

Bills of Quantities are the most commonly used measurement contracts hence this module focuses on the principles, methods, techniques and procedures applied during the production process of these documents.

1.3 The Client

The scope of professional services offered to a client is divided into six (6) stages as follows:

Stage 1: Inception

Stage 2: Concept and Viability

Stage 3: Design Development

Stage 4: Documentation and Procurement

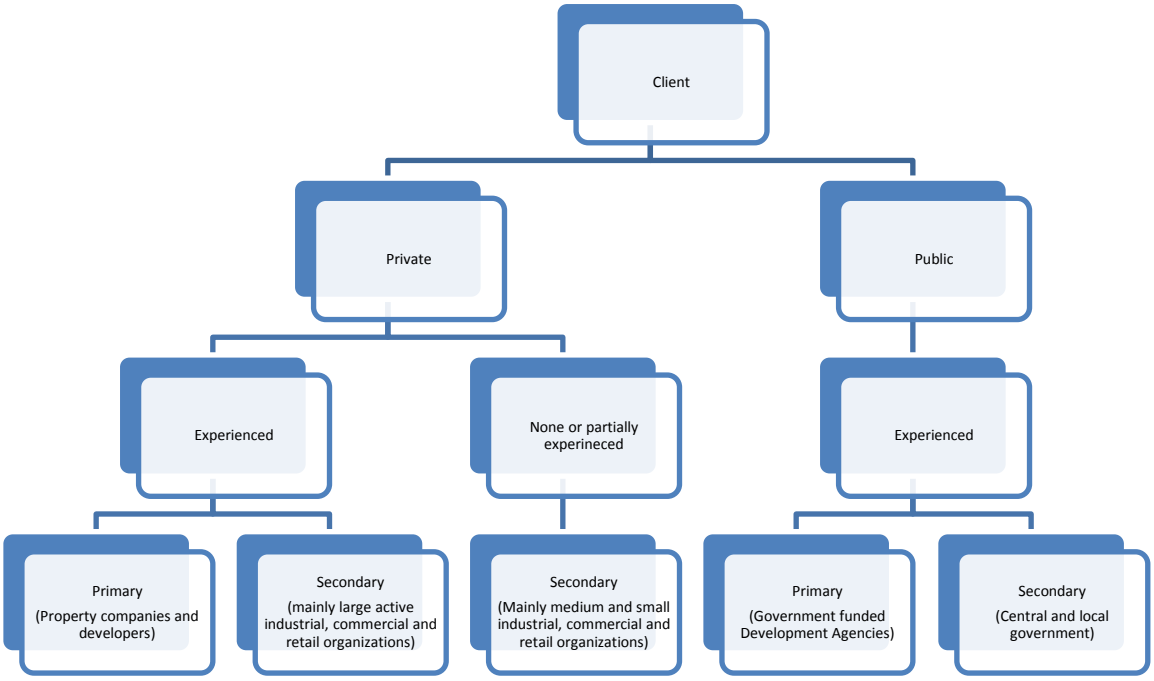
Stage 5: Construction

Stage 6: Close-out

Producing a price determination document is part of stage 4. In all likelihood the quantity surveyor would have been appointed at an earlier stage to provide early cost advice through estimates therefore the type of client would be known by the time the services incorporated in stage 4 are required.

Regardless hereof it is necessary to discuss the profile of the clients in the built environment because different client profiles influence the procurement processes followed and the appearance of price determination documentation.

Clients in the built environment are categorized as follows:



Where primary means that these clients derive their primary income from constructing buildings to sell, lease, etc. and secondary means that these clients are the users of the buildings to house their businesses, etc.

Figure 1: Categories of Clients in the Built Environment
Source: Introduction to Building Procurement (page 25)

Distinguishing between private and public clients is necessary because public spending is subject to rigorous administrative and financial controls to eradicate the possible occurrence of fraud and corruption and all procedures are subject to annual audits [13]. The procedures that the documentation is subject to influence the structure and format of the price determination documents. In South Africa all public entities are obliged to apply the principles as proposed in the Construction Industry Development Board's Standard for Uniformity in Construction Procurement [11] for compiling price determination documents (bills of quantities).

1.4 Structure for Price determination Documents (Bills of Quantities)

Regardless of whether the client is from the public or private sector each Bill of Quantities must contain the sections as set out below:

SECTION OF DOCUMENT	PURPOSE
1. Cover page	To communicate the title, project number and main stakeholders to tenderers
2. Notes to Tenderers	To provide administrative information and general instructions to the tenderers such as date and place of tender closure
3. Preambles (specification) 3.1 Preamble clauses contain description relating to the quality and performance of materials,	To provide tenderers with standards and codes of practice for execution of the work (quality of materials as well as quality of workmanship), and to assist in pricing adequately to meet

standard of workmanship, testing of materials and workmanship and samples of materials and workmanship	these requirements
3.2 General preambles (referred to as separate document e.g. Model Preambles of the ASAQS)	The supplementary preambles (particular or works specifications) are usually included in the trade bill to which they directly apply
3.3 Particular or works specification or Supplementary Preambles	
4. Preliminaries (usually the first bill before the trade bills) 4.1 This section covers the employer's requirements and the contractor's obligations with regard to carrying out the work 4.2 It would include names of the parties, description and location of the works, the form and type of contract and general facilities to be provided by the contractor 4.3 The bill is normally divided into three sections to provide for 4.3.1 Conditions of contract (clauses listed) 4.3.2 Standard/model preliminaries items 4.3.3 Project specific items	To allow tenderers to price for contract conditions with cost implications, for general indirect or site overhead costs e.g. supervision, temporary services and facilities, etc. and any other project specific contract requirement that has a cost implication
5. Trade bills consisting of measured items of work with quantities, provisional quantities, or prime cost amounts as the case may be for work to be undertaken by the main contractor or to be sublet to domestic subcontractors	To allow tenderers to price for the direct costs (labour, material, etc.) of executing the work
6. Provisional sums and Budgetary Allowances 6.1 Provisional sums 6.2 Item for main contractor's profit 6.3 Item for main contractor's attendance on specialist subcontractors 6.4 Budgetary Allowance	To allow the employer (through his agents) to insert allowances for the cost of work to be executed by specialist subcontractors for which designs have not yet been finalised at the documentation stage To insert allowances for the cost of work to be executed by the main contractor for which limited information is available at documentation stage
7. Final summary, including allowances for Contract Price Adjustment Provisions, contingencies, Value Added Tax, etc.	To arrive at a Tender or Contract Price inclusive of allowances that can only be finalised as the information becomes available during the construction phase

8. **Annexures**, details, specific documentation such as Engineer's geotechnical report, Environmental Management Plans, Health and Safety Specifications, etc.	To provide additional information through details that cannot be adequately described for pricing To provide tenderers with examples of terms and conditions contained in specific documents such as the construction guarantee, lien, etc.

Table 2: Structure for Bills of Quantities
Source: Willis's Practice & Procedures for the Quantity Surveyor and Unpublished Core Notes.

1.4.1 Structure of Price Determination Documents for Public Sector Clients

The Standard for Uniformity in Construction Procurement prescribes a series of standardized headings that are arranged into two clusters as illustrated in tables 3 and 4 below. The first cluster pertains to information to be supplied to the tenderer by the client and the second cluster pertains to the contract that will come into existence upon acceptance of the offer from the tenderer [(11)].

Contents		**Function and broad outline of contents**
Number	**Heading**	
Part T1: Tendering procedures		
T1.1	Tender Notice and Invitation to Tender	Alerts tenderers to the nature of the supplies, services and engineering and construction works required by the employer and should contain sufficient information to enable them to respond appropriately.
T1.2	Tender Data	States the applicable conditions of tender and associated tender specific data that establishes the rules from the time that tenders are invited to the time that a tender is awarded.
Part T2: Returnable documents		
T2.1	List of Returnable Documents	Ensures that everything the employer requires a tenderer to submit with his tender is included in, or returned with, his tender submission.
T2.2	Returnable Schedules	Contains documents that the tenderer is required to complete for the purpose of evaluating tenders and other schedules which upon acceptance become part of the subsequent contract.

Table 3: Documents that relate to the "Tender"
Source: Understanding the structure of tender and contract documents (page 2).

Contents		**Broad outline of contents**
Number	**Heading**	
Part C1: Agreements and contract data		
C1.1	Form of Offer and Acceptance	Formalises the legal process of offer and acceptance
C1.2	Contract Data	States the applicable conditions of contract and associated contract specific data that collectively describe the risks, liabilities and obligations of the contracting parties and the procedures for the administration of the contract.
Part C2: Pricing data		
C2.1	Pricing Instructions	Provides the criteria and assumptions which it will be assumed (in the contract) that the tenderer has taken into account when developing his prices, or target in the case of target and cost reimbursable contracts.
C2.2	Activity Schedule / Bills of Quantities	Records the contractor's prices for providing supplies / services / engineering and construction works which are described elsewhere in a specification within the Scope of Work section of the contract.

Part C3: Scope of Work		
C3	Scope of Work	Specifies and describes the supplies, services, or engineering and construction works which are to be provided and any other requirements and constraints relating to the manner in which the contract work is to be performed
Part C4: Site information (engineering and construction works contracts only)		
C4	Site Information	Describes the site as at the time of tender to enable the tenderer to price his tender and to decide upon his method of working and programming and risks.

Table 4: Documents that relate to the "Contract"
Source: Understanding the structure of tender and contract documents (page 2).

This structure is to be applied to civil and building contracts and the drafter of the documentation has a choice to compile a single document that contains the headings as set out above or to compile a set of documents consisting of three volumes as follows:

Volume	**Contents**	
	Number	**Heading**
Volume 1:	**TENDERING PROCEDURES**	
	T1.1	Tender Notice and Invitation to Tender
	T1.2	Tender Data
Volume 2:	**RETURNABLE DOCUMENTS**	
	T2.1	List of Returnable Documents
	C1.1	Form of Offer and Acceptance
	C1.2	Contract Data (Part 2: Data provided by the Contractor)
	C2.2	Activity Schedule / Bills of Quantities
Volume 3:	**DRAFT CONTRACT**	
	Part C1: Agreements and Contract Data	
	C1.2	Contract Data (Part 1: Data provided by the Employer)
	Part C2: Pricing Data	
	C2.1	Pricing assumptions
	Part C3: Scope of Work	
	C3	Scope of Work
	Part C4: Site information	
	C4	Site Information

Table 5: Standard headings and sequencing of documents when soliciting tenders where a three volume approach is adopted
Source: Standard for Uniformity in Construction Procurement (page 13)

Candidates are referred to the following documentation to fully grasp the requirements contained in the Standards of Uniformity in Construction Procurement.

- Recommendations on Refinements in Public Sector Procurement Policy, Practices and Procedures in the Construction Sector as endorsed by the Inter-ministerial Task Team for Construction Industry Development (2000);
- SANS 10403: 2003, Formatting and compiling of construction procurement documents
- SANS 294: 2004, Construction procurement processes, methods and systems;
- Construction Procurement Best Practices recognized by the Construction Industry Development Board (2004); and
- Board notice 86 of 2010, Construction Industry Development Board. *Standard for Uniformity in Construction Procurement*. 2010.

1.4.2 Structure of Price Determination Documents for Private Sector Clients

As mentioned before the price determination documents used in the private sector will also contain the information as illustrated above. The more experienced clients might have specific requirements to be incorporated into the documentation. It is not excluded that the structure of price determination documents for public sector clients also be applied to documents for private sector clients.

2. DEVELOPING PRODUCTION MANAGEMENT PLANS FOR THE PREPARATION OF PRICE DETERMINATION DOCUMENTATION

Learning outcomes

After studying this section, you should be able to:

Draft a production management plan for the preparation of price determination documentation by

- determining the trade or other breakdown
- quantifying and allocating the appropriate resource levels
- compiling a programme for the delivery of price determination documentation

2.1 INTRODUCTION

The processes involved in preparing and compiling Bills of Quantities are taking-off (measuring / quantifying), squaring, abstracting and billing [(17)].

The taking-off entails applying the rules prescribed by a particular standard method of measurement, describing the work to be executed according to the details shown on the drawings and information given in the specifications.

The resources needed are:

- drawings (architect's and engineer's).
- specifications (standard and project specific).
- standard method of measurement (to guide breakdown structure).
- a team of measurers (taker-offs).

Previously the structures of bills of quantities were discussed, but before embarking on the actual process of preparing and compiling a bill of quantities we also need to discuss the different formats, standard methods of measurement and breakdown structures applied in the production process of bills of quantities.

2.2 FORMATS FOR PRICE DETERMINATION DOCUMENTS (BILLS OF QUANTITIES)

2.2.1 The different formats of bills of quantities

The main purpose of the bill of quantities needs to be clear before the preparation of the bill can commence to ensure that the most appropriate format is chosen.

2.2.1.1 Traditional bills of quantities (with trade bills)

The trade breakdown is done according to a standardised method of measurement, which in South Africa is the Standard System of Measuring Building Work 1999 (6th edition revised) (SSMBW). The specifications are not repeated in the descriptions, but the document refers to a standard specification such as the Model Preambles for Trades, South African National Standards, etc. The quantities contained in these documents will be accurate and based on well-developed working drawings. The only provisional items or sections in such a document would be those that can never be determined accurately at the time of compiling the document such as foundations, stormwater and sewer drainage, etc. for example:

ITEM NO	DESCRIPTION	UNIT	QUANT	RATE	AMOUNT
	BILL NO. 3				
	MASONRY				
	SUPERSTRUCTURE				
1	Half brick walls	m2	15		
2	Half brick walls in beamfilling	m2	7		
3	One brick walls	m2	239		
	BRICKWORK SUNDRIES				
	2,5 mm Brickwork reinforcement				
4	75 mm Wide reinforcement built in horizontally	m	44		
5	150 mm Wide reinforcement built in horizontally	m	913		

Figure 2: Traditional Bills of Quantities
Source: Author

This format is the most popular for tendering purposes because it groups items similar in nature together which makes pricing convenient for estimators.

2.2.1.2 Provisional bills of quantities (with trade bills) are also compiled according to the SSMBW, but the quantities are based on less developed drawings and there is a real chance that the quantities will change hence the entire document is provisional and all the quantities are subject to re-measurement after the work is done.

2.2.1.3 Locational bills of quantities takes the same format as the traditional bills and the provisional bills but the quantities are broken down and allocated to a particular position within the project such as different buildings, parts of building, types of houses, etc. [15]. This format is very useful to firstly assist with more accurate pricing and secondly to make the determining of the value of work executed for payment much easier for example:

	BILL NO. 3					
	MASONRY					
	SUPERSTRUCTURE					
1	Half brick walls				m2	15
	A = 8	B = 3	C = 4			
2	Half brick walls in beamfilling				m2	7
	A = 4	B = 1	C = 2			
3	One brick walls				m2	239
	A = 127	B = 48	C = 64			
	BRICKWORK SUNDRIES					
	2,5 mm Brickwork reinforcement					
4	75 mm Wide reinforcement built in horizontally				m	44
	A = 23	B = 9	C = 12			
5	150 mm Wide reinforcement built in horizontally				m	913
	A = 487	B = 183	C = 243			

Figure 3: Locational Bills of Quantities
Source: Author

2.2.1.4 Annotated bills of quantities

The SSMBW trades and sections are still adopted but each item is annotated as to what it is and where it is located in the project. The annotations can either be provided in a separate document, in a separate section in the bill or on the opposite page so that the annotation and the actual item are aligned. This format is an extension of the locational bill of quantities. It would typically look as follows [15]:

		ITEM NO	DESCRIPTION	UNIT	QUANT	RATE	AMOUNT
	BILL NO. 3		**BILL NO. 3**				
	MASONRY		**MASONRY**				
	ANNOTATIONS		SUPERSTRUCTURE				
1	Internal dividing walls groundfloor (dwng 101/1)	1	Half brick walls	m2	15		
2	External walls, north and south	2	Half brick walls in beamfilling	m2	7		
3	External walls all elevations (dwng 101/1)	3	One brick walls	m2	239		
			BRICKWORK SUNDRIES				
			2,5 mm Brickwork reinforcement				
4	Internal dividing walls groundfloor (dwng 101/1)	4	75 mm Wide reinforcement built in horizontally	m	44		
5	External walls all elevations (dwng 101/1)	5	150 mm Wide reinforcement built in horizontally	m	913		

Figure 4: Annotated Bills of Quantities
Source: Author

2.2.1.5 Elemental bills of quantities

These bills are arranged in sections that are based on functional elements and the items in each element are arranged according to the sequence according to the SSMBW. The purpose of this format is to facilitate cost planning based on elemental cost analysis [15].

An element is defined as that part of any building that always performs the same function irrespective of its construction or specification [16]. Examples of elements are e.g. Foundations, External Envelope, Roofs, etc. In the South African context we follow the arrangement of elements as set out in the ASAQS's Guide to Elemental Cost Estimating & Analysis for Building Works.

ITEM NO	DESCRIPTION	UNIT	QUANT	RATE	AMOUNT
	ELEMENT NO. 5				
	EXTERNAL ENVELOPE				
1	Half brick walls in beamfilling	m2	7		
2	One brick walls	m2	239		
3	150 mm Wide reinforcement built in horizontally	m	913		
	ELEMENT NO. 7				
	INTERNAL DIVISIONS				
1	Half brick walls	m2	15		
2	75 mm Wide reinforcement built in horizontally	m	44		

Figure 5: Elemental Bills of Quantities
Source: Author

For comparison purposes the same measurable items have been shown in all the different formats for bills of quantities contained herein. Each element would however include all the measurable items in that specific element e.g. the external envelope illustrated in figure 5 above would also include windows, doors, external finishes, etc. which requires these items measured in different trades to all be allocated to the applicable element.

Elemental bills of quantities are rarely prepared for tender purposes because there is a lot of duplication for example one brick walls could appear in the elements of foundations, external envelope, internal division and external work. The automation of the bill production process has also made it possible to prepare the documents as traditional bills and allocate sort keys / codes to measured items so that the bills can be regenerated in different formats such as elemental. The automation process is discussed in more detail later on.

2.3 STANDARDISED METHODS OF MEASUREMENT

Several standardised methods of measurement have been developed in different countries for the application to different types of projects such as:

- Standard Method of Measurement (7th edition) published by the RICS in 1988 mainly used for building work in the United Kingdom.
- The newly published New Rules for Measurement (NRM2) published by the RICS as part of a set of measurement rules to deal with measuring throughout the procurement process of buildings. Being a new publication the NRM2 is not yet widely in use, but is the most significant development since the publication of the Standard Method of Measurement (7th edition) and should potentially be embraced in a big way.
- Civil Engineering Standard Method of Measurement (3rd editions) (CESMM3) is used in the UK for the measurement of civil engineering projects only and contains limited elements that pertain to civil engineering works such as heavy foundations, bulk earthworks, piling, railway sidings, roads, large structural steel structures and infrastructure services.
- The Agreed Rules of Measurement (4th edition) (ARM4) prepared and revised by Joint Committees established by the Construction Industry Federation and the Society of Chartered Surveyors Ireland in 2009 and is applied for measuring building works.
- Australian Standard Method of Measurement of Building Works (5th edition revised 2012).
- Standard System of Measuring Building Work 1999 (6th edition revised) as published by the Association of South African Quantity Surveyors.
- Civil Engineering Standard Method of Measurement Southern African Edition (CESMM3SA) that is a modified version of the CESMM3 used in the UK was prepared in conjunction with the South African Institute of Civil Engineering and published in November 2011. Currently bills of quantities for civil engineering projects in South Africa are still largely prepared in accordance with the measurement and payment clauses contained in SABS1200 Standardized Specification for Civil Engineering Construction. This document has however been replaced SANS1921, *Construction and management requirements for works requirements* and SANS2001, *Construction Works that* are aligned to the Construction Industry Development Board's *Standard of Uniformity in Construction Procurement* [(10)].

These are the most prominent Standard Methods of Measurement the list is not exhaustive.

Although several countries have developed their own standardised methods of measurement they all have the same goal and that is to lay down the general principles, procedures, general rules of measurement and information that guides the persons responsible for the co-ordination of the taking-off process [(7)].

The general principles contained in these standardised methods of measurement are:

- To provide a uniform basis for measuring building work (or civil engineering work).
- Embodies minimum essentials of good practice.

- Descriptions complete and clear leaving no reasonable doubt as to their intent and meaning and contain all the necessary information for pricing. Cognisance must be taken of items deemed to be included in the descriptions such as, manufacturing, transporting and delivering, unloading, storing, unpacking, hoisting, setting up, fitting, fixing in position, cutting, waste, etc. [2].
- The method of execution is left to discretion of contractor (unless prescribed). Bills of quantities describe desired result obtained through easiest, cheapest practical way.
- The setting out of the bills of quantities and the order according to which items should appear in the bills of quantities e.g. firstly divided into trades and sections of trades, then according to units in each trade (mass, volume, area, length and number) and lastly according to value placing the cheapest item first. Separation should not be excessive but is required for work differing in value due to character, position, purpose or method of execution.
- Sequencing of the dimensions to be firstly horizontal at right angle to the line of sight, then horizontal parallel to the line of sight and lastly the vertical or depth [2].
- The work shall be measured net as fixed in position with no allowances for waste, laps, etc. Although we measure so-called "accurate quantities" it doesn't mean that we measure every single little detail as a separate item. For instance when we measure a wooden rail screwed to brickwork, we measure the rail in m, and state in the description how it is fixed (screwed at 500 mm centres). We don't measure the screws separately.

  Clear distinction must be made between the terminologies "…descriptions must include…" and "…descriptions shall be deemed to include…". Labour items such as rounded edges, grooves or rebates are to be included in the description of the rails but mitres, splay cut ends, etc. are "deemed" to be included and will not even be mentioned in the description. In other words the contractor must "know" that these are included even though they are not mentioned in the description.

The advantages of applying standard methods of measurement are that:

- descriptions are standardised and consistent.
- the measurer becomes familiar with the continued use of standardized descriptions.
- billing can be done by less experienced and trained staff due to the minimum threshold.
- simplest possible wording, cryptic but clear and ambiguities are avoided.
- bill editing is greatly reduced.
- consistency between bills from different consultants aids the estimators of construction companies [7].

There is of course also a danger that inexperienced measurers will tend to use standardised descriptions even though they do not exactly fit the particular item.

2.4 BREAKDOWNS FOR PRICE DETERMINATION DOCUMENTS

The choice of the breakdown for any price determination document is guided by the purpose of the document and the level of available design detail [7]. The moment the purpose and the level of detail is established the measurer can decide on the most appropriate format and standardised method of measurement that would apply.

Earlier on the five different formats for bills of quantities were discussed. Four of the five formats would be based on a similar breakdown and it is only the elemental format that would differ. In South Africa the most commonly used standard method of measuring is the Standard System of Measuring Building Work 1999 (6th edition revised) as published by the ASAQS. The breakdown prescribed in this document is according to trades as illustrated in Table 6 below.

The ASAQS in conjunction with the University of Pretoria developed the Model Bills of Quantities that is an interpretation of the breakdown intended by Standard System for Measuring Building Work and demonstrates the further breakdown of trades by means of heading, sub-headings and sections. This document serves as the standard library most widely used in South Africa.

	TRADE NAME
1	Preliminaries
2	Alterations
3	Earthworks
4	Lateral Support
5	Piling
6	Concrete, Formwork and Reinforcement
7	Precast Concrete
8	Masonry
9	Waterproofing
10	Roof Coverings, etc.
11	Carpentry and Joinery
12	Ceilings, Partitions and Access Flooring
13	Floor Coverings, Wall Linings, etc.
14	Ironmongery
15	Structural Steelwork
16	Metalwork
17	Plastering
18	Tiling
19	Plumbing and Drainage
20	Electrical Work
21	Mechanical Work
22	Glazing
23	Paintwork
24	Paperhanging
25	External Work
26	Provisional Sums

Table 6: Trade breakdown
Source: Standard System for Measuring Building Work (6th edition)

Another work breakdown that is frequently used in South Africa is the elemental breakdown as contained in the Guide to Elemental Cost Estimating & Analysis for Building Works published by the ASAQS. The framework of the breakdown is given in Table 7 below.

This elemental breakdown structure is not commonly applied to bills of quantities but rather usually applied to elemental estimates. However modern technology has made it possible to re-generate bills of quantities created according to one format (say traditional) in different formats by allocating codes / sort keys to all measured items. The main use for an elemental breakdown is to perform cost analysis. The foreword of the guide describes the primary purpose thereof as "…. to enable and stimulate dedicated cost analysis and cost comparison between construction projects" [16].

It is important to realise that the estimates would be prepared according to the estimating guidelines and the bills will be prepared according to the standard methods of measurement, in other words in more detail. In the event of re-generating traditional bills of quantities as elemental bills of quantities care should be taken that the allocation of codes / sort keys to items does not deviate from the guide's proposed system to ensure that meaningful elemental cost analysis would be possible [16].

	ELEMENTS
	Primary Elements
1	Foundations
2	Ground Floor Construction
3	Structural Frame
4	Independent Structural Components
5	External Envelope
6	Roofs
7	Internal Divisions
8	Partitions
9	Floor Finishes
10	Internal Wall Finishes
11	Ceilings and Soffits
12	Fittings
13	Electrical Installation
14	Internal Plumbing
15	Fire Services
16	Balustrading, etc.
17	Miscellaneous Items
	Special Installations
18	Piling
19	Sun Control Screens, Grilles, etc.
20	Raised Access Floors
21	Special Fire Protection
22	Lifts
23	Escalators
24	Air Conditioning
25	Ventilation
26	Heating
27	Special Electrical Installation
28	Other Services
29	Compactors
30	Access Control
31	Gondolas
32	Stoves
33	Kitchen Equipment
34	Specialised Equipment
35	Security Systems
36	Communication Systems
37	Prefabricated Cold Rooms
38	Signage
39	Artwork
40	Miscellaneous Items
	Alterations
41	Alterations
	External works and services
42	Soil Drainage
43	Sub-surface Water Drainage
44	Stormwater Drainage
45	Water Supplies
46	Fire Service
47	External Electrical installation
48	Connection Fees, etc.
49	Demolitions
50	Site Clearance
51	Earthworks
52	Boundary, Screen and Retaining
53	Fencing and Gates
54	Roads, Paving, etc.
55	Covered Parking, Walkways, etc.
56	Pergolas, Canopies, etc.
57	Minor Construction Work
58	Pools, etc.
59	Sports Facilities
60	Garden Works
61	Miscellaneous items
	Preliminaries
62	Preliminaries
	Contingency Allowances
63	Price and Detail Development
64	Building Contract Contingencies
	Escalation
65	Pre-tender escalation
66	Contract escalation
	Value Added Tax
67	Value Added Tax

Table 7: Elemental breakdown
Source: Guide to Elemental Cost Estimating & Analysis for Building Works

Naturally all the trades and / or elements listed above in tables 6 and 7 are not applicable for every project but it is reasonably easy to determine the applicable trades / elements during the scrutiny of the drawings.

2.5 QUANTIFYING AND ALLOCATING THE APPROPRIATE RESOURCE LEVELS

We know that the prime objective is to produce a price determination document but this is easier said than done if no proper planning is done. Some early planning decisions to consider are therefore:

- who the plan is for?
- what the level of detail is / should be?
- what the time-scales should be?
- what planning hierarchy to follow?
- deciding on the programme duration.
- determining the activities and the activity durations[6].

At this stage the lead quantities surveyor knows what the level of available detail is in the form of drawings and information, has been told what the expected programme duration is. It is now up to him / her to develop the plans for the actual roll-out of the project.

Figure 6 below illustrates what needs to be put in place to achieve success and it confirms the early planning decisions listed above. The needs are:

- The project organisational structure (who the plan is for).
- The people needed to perform the work (who the plan is for).
- The leadership model (programming, determining activities and their durations).
- Standards of control.

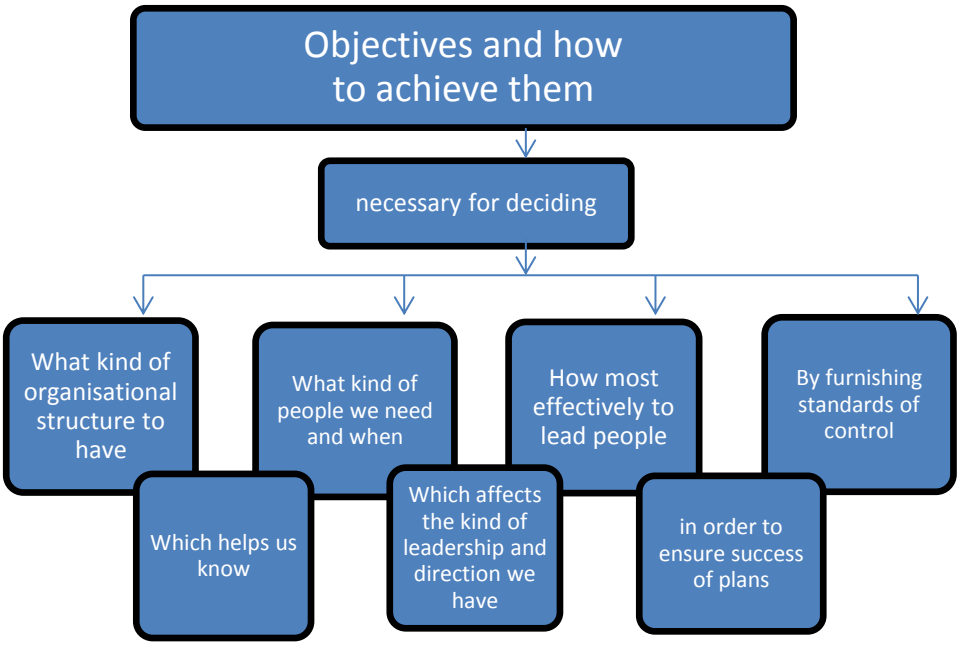


Figure 6: Plans as the foundation of management
Source: Management

2.5.1 Organisational structures

2.5.1.1 Organisational structures in quantity surveying practices

The second step of the planning function is to intentionally establish a structure of roles for people to fill in an organisation. The way in which quantity surveying practices organise and carry out quantity surveying work mainly depends on the size of the practice and the type of work that is undertaken. Mainly two organisation structures are found in quantity surveying practices. The first structure divides the normal quantity surveying work for projects into the different stages of cost planning, contract documentation, final accounts and specialist services. In such a structure the individuals have the opportunity to develop in depth expertise in a specific area. This does however require thorough co-ordination between the divisions because different individuals will deal with the different stages of a project [13].

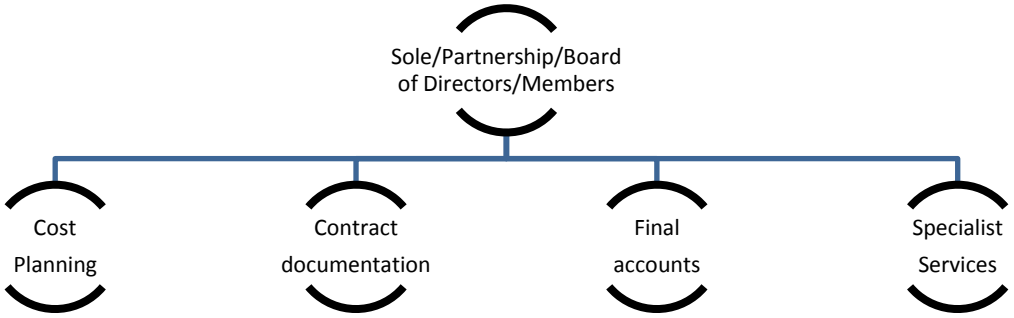


Figure 7: Organisation structure that promotes specialisation
Source: Willis's Practice & Procedure for the Quantity Surveyor (page 41)

The second structure follows a more general approach and allows individuals to be involved with a project from inception to close-out. Staff members are often allocated to teams that become specialists in certain types of projects [13].

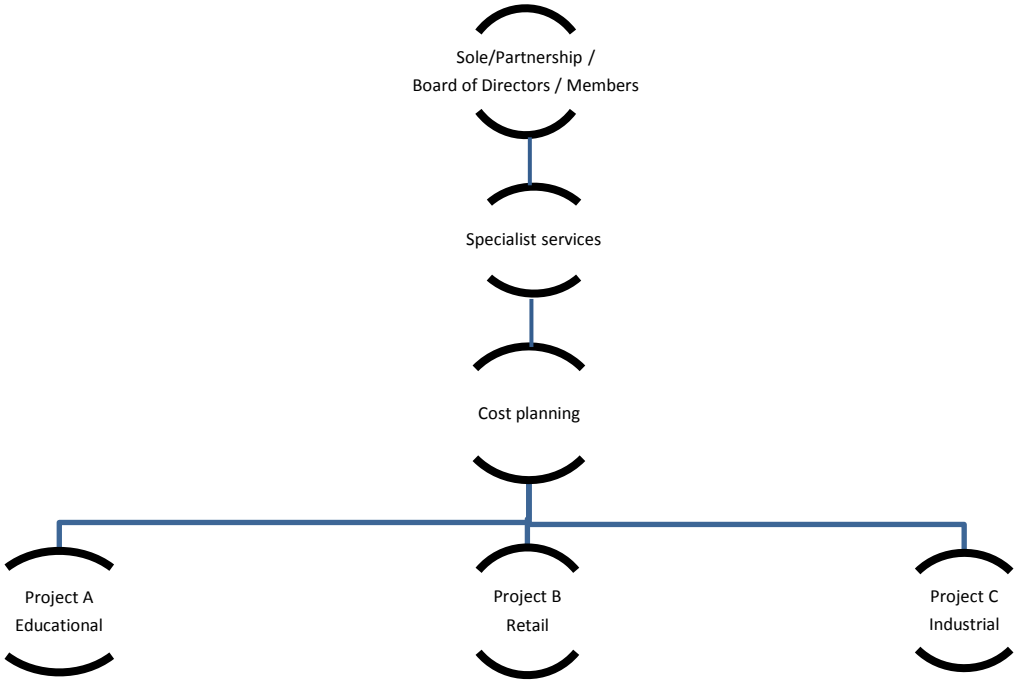


Figure 8: Organisation structure that promotes generalisation
Source: Willis's Practice & Procedure for the Quantity Surveyor (page 41)

Regardless of which organisational structure is applicable in the practice a planning and progress chart needs to be developed for the specific project. It is best to plan for the pre-contract stage only. The planning decisions must take the type, size and complexity of the project into account in deciding:

- which partner/director/member/ senior quantity surveyor will lead the project.
- establish the time needed to execute the work.
- determine how many staff members would be needed to do the work.
- whether it would be necessary to obtain the services of freelance staff.

2.5.1.2 Organisational structure for a project

Determining the number of measurers (taker-offs) required for executing the work will be influenced by the size of the project and in how many sections the work is divided. Even if only one person will measure, it is still good practice to divide the work into logical sections and to measure each section completely before moving onto the next one. If the work isn't divided and one attempts to measure everything at once, there is a good chance that parts will be left out. It will also be very difficult to trace the original measurement of an item if there is a query about it [(5)]. It is not practical to involve more than four measurers and very few projects would require more measurers.

The organisational structure must reflect the staff that will be involved with the projects, the division of the work and the allocation of the work to the responsible person. From experience the senior quantity surveyor would have a fair idea of how many measurers would be required. An in-house planning meeting should be convened to peruse the drawings and information available, discuss the division of the work and allocate preferences where possible. Practices that encourage generalisation prefer to offer staff the opportunity to choose what they prefer to measure and measurers tend to alternate the sections measured on different projects to ensure continued competence in all sections and staying abreast with latest design trends, material specifications, etc.

The division of sections will more or less follow the order of erection for the building [(7)] except for the services that are "stand-alone" sections and the specialist work that is to be covered by the provisional sums. An example of the division of work and the allocation of the sections to the measurers is as follows:

	SENIOR QS	QS Measurer 1	QS Measurer 2	QS Measurer 3
Foundations and ground floor construction		❍		
Concrete structure			❍	
Brickwork (external and internal walls)				❍
Roof construction and covering (if not concrete)	❍			
External finishes		❍		
Internal wall finishes				❍
Internal floor and ceiling finishes			❍	
Doors, windows and adjustments		❍		

Plumbing and Drainage	❍			
Preliminaries	❍			
Provisional Sums	❍			

Figure 9: Organisation structure of project and allocation of work sections
Source: Author (based on example in Managing International Construction Projects: An Overview on page 45)

2.6 PROGRAMMES FOR THE DELIVERY OF PRICE DETERMINATION DOCUMENTATION

2.6.1 Time management

Time and cost management related to staff has become increasingly important in markets where fee and tendering competition has become the order of the day. Staff is allocated to specific tasks on one or more projects at the same time.

It is therefore very important to programme the planning for the project as well as for each staff member involved in the project so that the progress of the project can be tracked and planning can be adjusted timeously if necessary to ensure that the deadline is met. The most favourite, easiest to draw and easiest to understand planning tool to be implemented is the bar chart [(6)].

As mentioned before the timetable for completing the bill of quantities is communicated at the initial planning meeting between the architect and the senior quantity surveyor. Assume the required completion date is the end of November and the process was initiated during the last week of August. This means that there are three months to complete the bills of quantities. None of the sections are subject to the completion of another therefore the scheduling for each measurer's work is started in the first week. Obviously the intention is that each section must be completed before the next section of work is undertaken.

Each measurer's workload is scheduled in a different colour so that the individual's commitment to this specific project can easily be seen. From the bar chart can be seen that all measuring activities are planned to be completed at the end of the third week in November. This leaves a week to conduct the final checks on the documentation before it is distributed to outside parties.

Month	SEPTEMBER					OCTOBER				NOVEMBER			
Week end	1	8	15	22	29	6	13	20	27	3	10	17	24
Week number													
Foundations and ground floor construction													
Concrete structure													
Brickwork													
Roof construction and coverings													
External finishes													
Internal wall finishes													
Internal floor and ceiling finishes													
Doors, windows and adjustments													
Plumbing and Drainage													
Preliminaries													
Provisional Sums													

Figure 10: Programming the work
Source: Author

2.6.2 Cost management

Cost management is just as important as the time management. Consideration needs to be given to whether the income is sufficient to cover costs incurred during these three months. The income would be calculated according to the recommended Tariff of Professional Fees as published by the SACQSP and apportioned to the documentation and procurement stage.

The expenses to take into consideration are typically:

- The salaries of the staff involved in the measuring process (pro-rata if it is not a full payment period).
- Pro-rata rent.
- Pro-rata furniture and fittings.
- Other expenses such as pro-rata telephone accounts, stationery, etc.

From this information can be determined whether a profit or loss is made for this particular stage. It would not be possible to increase the income if the fees are fixed therefore the expenses will need to be interrogated if it is a loss situation.

2.6.3 Design team meetings

Time can easily be wasted if the design team doesn't meet on a regular basis. On larger projects project managers are often appointed to manage the design process to ensure an efficient and coherent design. The decisions taken at the meetings must be recorded in such a way that the actions required from team members can be monitored and managed. The discussions should revolve around:

- new and revised information.
- the detailed design.
- the integration of the structural and service elements.
- specialised design input.
- health and safety principles.
- progress against programme [17].

Naturally the senior quantity surveyor would attend these meetings as the information emanating from there would be invaluable to the measuring process.

3. MANAGE THE PREPARATION AND PRODUCTION OF APPROPRIATE WORK-BREAKDOWN PRICE DETERMINATION DOCUMENTATION

Learning outcomes

After studying this section, you should be able to:

Manage the preparation and production of appropriate work-breakdown price determination documentation by

- establishing and setting up quantification (measuring) system
- assessing expected quality and timing of input documentation
- identifying, scheduling, timetabling and prioritising input documents
- undertaking the management of the production process for price determination

3.1 PREPARATION AND PRE-PLANNING FOR MEASUREMENT

3.1.1 Initiation of the management of the production process

The management process for the production of a price determination document is initiated by the senior quantity surveyor collecting the drawings and specification notes from the architect's office and at the same time discussing the project to determine the:

- timetable for the completion of the bills of quantities;
- level of information available;
- dates when additional detailed drawings and information could be expected and
- order in which the additional drawings and information is prepared (to suite both the architect's and engineer's offices procedures and the quantity surveyor's requirements) [13].

After this initial meeting the senior quantity surveyor will be in a position to establish

- what format the bill of quantities is required to be in;
- which standard method of measurement is the most appropriate and
- which breakdown of trades / elements is required for the project.

3.1.2 Receiving drawings, etc.

The first thing to be done when a set of drawings is delivered / brought into the quantity surveyor's office is to stamp the drawings with the practices' name and date stamp. It is also useful to identify what the drawing is used for e.g. "Estimating", "Bills of Quantities", "For construction", etc. This module deals with the production of bills of quantities and one would expect that all drawings received at this stage are to be used in the process of producing the bill of quantities, but as mentioned before, this is a further stage in the procurement process therefore the chance is good that there are already drawings in the office that were used for estimating purposes. The possibility also exists that revised drawings are received at such a late stage that the changes cannot be incorporated into the measurements without negatively impacting on the time constraint for producing the documentation and will necessarily have to stand over to the construction phase (in the form of a variation order) if the time cannot be extended [5].

A drawing register must be created to reflect the name and reference number of the project (in-house and client's), architect, and other consultants involved, titles and numbers of drawing, scales and drawing revision numbers. Separate registers should be created for architect's drawings,

civil/structural engineer's drawings, electrical and mechanical engineer's drawings respectively. The register could have the following format [5, 13]:

Project title: Posh Office Park **Consultant:** Innovative Architects (Pty) Ltd			**Project no. QSP 202** **Register no. 1**	
Drawing no.	**Revision no.**	**Title/description**	**Scale**	**Date received**
IA/2619/001	1	Site layout	1:200	10.10.2012
IA/2619/100	2	Ground floor layout	1:100	10.10.2012
IA/2619/200	2	Elevations	1:100	10.10.2012
IA/2619/300	2	Sections	1:100	10.10.2012
Etc. …				

Table 8: Drawing register
Source: Author and Unpublished Core Notes

The drawing register must be updated as soon as any additional drawings are received and distributed to all measurers so that each one can ensure that any impact on work already measured is adjusted / corrected / incorporated.

It is customary for the design offices to produce and issue drawing registers with the drawings therefore cross checks should be conducted to ensure that all the drawings listed have actually been received. These registers are however not sufficient to replace the in-house registers referred to above because they are not comprehensive to ensure drawing control.

3.1.3 Studying drawings, etc.

The drawings are studied after they are recorded. The purpose and the aim of checking specific aspects are to:

- acquaint yourself thoroughly with the project;
- check for obvious omissions and / or errors;
- see that all the necessary figured dimensions are given on the plans and sections;
- ensure that the figured dimensions actually total the overall dimensions (see example below);
- also check that overall dimensions on opposing sides of the building add up to the same figure;
- insert any dimensions that can be calculated and could be useful in the measurements;
- check for discrepancies between drawings and specifications;
- verify that the dimensions between the architect's drawings and the engineer's drawings coincide [5, 13].

Consider the figured dimensions below. The first check to do is to ensure that the detailed dimensions do add up to the overall total as displayed. If you add up 220 mm + 3 000 mm + 110 mm + 8 200 mm + 110 mm + 3 740 mm + 220 mm you will see the sum of 15 600 is indeed correct. If it was not the correct dimension must be filled in and communicated to the architect through the query sheet.

Any one of the intermediate dimensions could also have been missing in which case one would start with the overall dimension and deduct the given dimensions to determine the missing one e.g. 15 600 mm – (2 x 220 mm) – (2 x 110 mm) – 3 000 mm – 3 740 mm = 8 200 mm . In both instances the

calculated dimensions will be checked to ensure that they correspond accurately with the scale as indicated on the drawing.

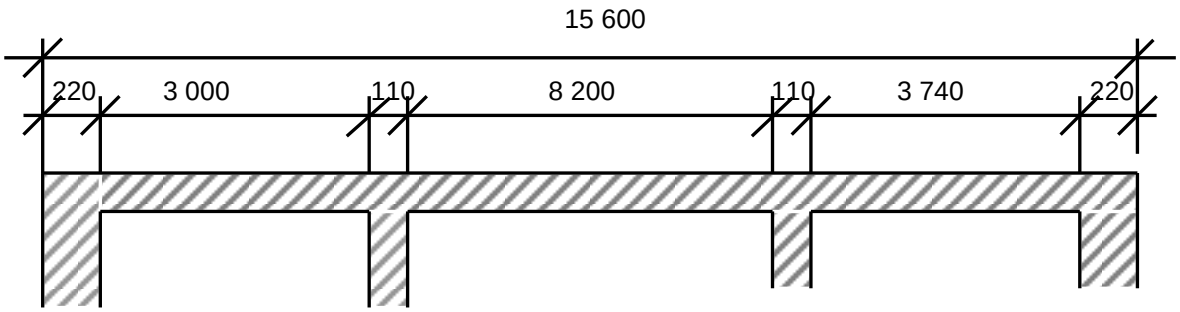


Figure 11: Example of figured dimensions
Source: Unpublished Core Notes

Any errors, ambiguities, omissions, clarifications, etc. need to be clarified with the relevant design consultant. It is important that information communicated at this stage be fully documented. This is done by preparing a query sheet to reflect the query and the responses. A sufficient batch of queries must be collected before communicating the queries to the architect or engineer. Communicating too frequently is a waste of everyone's time. It may be more practical to arrange a meeting to discuss the queries according to the listed items on the query sheet and notes made during the meeting must be communicated to the architect or engineer afterwards as confirmation and so that the drawings can be corrected [5, 13].

An example of a query sheet is as follows:

	Project title: Posh Office Park **Consultant: Innovative Architects (Pty) Ltd**		**Project no. QSP 202** **Query sheet no. 1**	
	Query	**Answer**	**Replied by**	**Date**
1.	Fixing detail for stanchions at fire staircases	1:20 Detail supplied on A4 drawing	S Mart (Architect)	15/11/2012
2.	Trade name for stair nosing strips	Genesis SQ10	S Mart (Architect)	21/11/2012
3.	Thickness of 50 mm diameter circular hollow section top rails	3 mm Thick	S Mart (Architect)	15/11/2012
4.	.....etc.			

Table 9: Query sheet
Source: Author and Unpublished Core Notes

3.1.4 Schedules, etc.

Information that cannot accurately be illustrated on drawings will be given in schedules such as internal finishes, doors and windows, sanitary fittings, etc. The quantities given on the schedules need to be cross-checked with the floor plans to ensure that they are correct and that every door and window on the floor layouts is annotated.

There are two approaches according to which for example door and window schedules are compiled. The first approach is to schedule a typical door or window design, award a specific reference such as W1 or D1 that is used to do the annotation on the floor layouts. The schedule would then reflect the

number of times the specific design occurs in the project. The second approach is to allocate a reference to each door or window. Doors and windows with the same design would therefore have several references.

Here is an example of floor layout annotations done according to the first approach which is also the most commonly used.

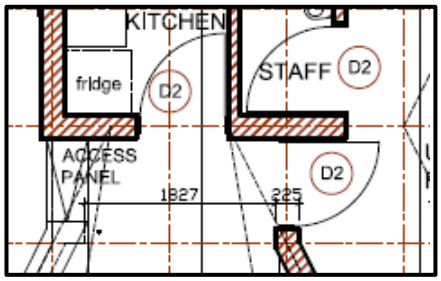


Figure 12: Annotation of doors
Source: Project drawing from author's collection

In the example of a door schedule below D1 is an example of the first approach and D2 is an example of the second approach.

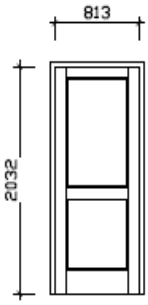
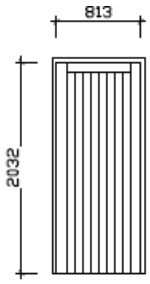
Project title: Posh Office Park **Consultant: Innovative Architects (Pty) Ltd**		**Project no. QSP 202** **Door schedule**
DOORS		
REFERENCE	D1	D2, D8, D12, D16, D20, D24
NO	25	6
FRAME	90 x 70 mm Once rebated Swartland Gold meranti frame with sill fitted with two 100 mm stainless steel butt hinges	90 x 70 mm Once rebated Swartland Gold meranti frame with sill fitted with two 100 mm stainless steel butt hinges
FINISH ON FRAME	Two coats Timberlife Satinwood Base 28 in strict accordance with manufacturers' instructions	Two coats Timberlife Satinwood Base 28 in strict accordance with manufacturers' instructions
DOOR	44 mm Swartland Code SD18 hardwood door	44 mm Swartland Code PD1 framed, ledged and braced hardwood door with closed back
FINISH ON DOOR	Two coats Timberlife Satinwood Base 28 in strict accordance with manufacturers' instructions	Two coats Timberlife Satinwood Base 28 in strict accordance with manufacturers' instructions
IRONMONGERY	As per ironmongery schedule	As per ironmongery schedule

Figure 13: Example of door schedule
Source: Author

Additional schedules to facilitate the measuring process need to be compiled according to which the adjustments and ancillary items are measured. If these schedules are drafted properly there should not be a need to continuously refer back to the floor layouts and finishing schedules when measuring the doors, windows and adjustments.

Project title: Posh Office Park Consultant: Innovative Architects (Pty) Ltd																Project no. QSP 202 Door adjustment schedule	
Door Ref	No	Size	Walls			Internal wall finishes			Internal floor finishes			External wall finishes			Lintels		
			220 mm	110 mm	280 mm Cavity	Plaster	Paint	Tiling	Carpets	Tiles	Vinyl	Plaster	Paint	Facing	Prestressed	Face brick-on-edge	
D1	25	813 x 2032	● x20		● x5	●	●		● x6	● x10	● x9	● x20	● x20	● x5	● x20	● x5	
D2	6	813 x 2032	●			● x6	● x3	● x3		● x6		●	●		●		
Etc.																	

Figure 14: Example of door adjustment schedule
Source: Author

3.1.5 Methodology

Other important aspects that need to be communicated and agreed by the members of the measuring team are:

- measuring notes to state up to which level the foundations are measured.
- "to take" note to list certain items that still need to be measured for which the information is outstanding.
- Stating whether net measures are applicable to door- and window openings or whether the measurer measuring the brickwork and wall finishes ignores the doors and windows and the team member that measures the doors and windows also measures the adjustments (refer to the adjustment schedule as discussed above).
- Collections of dimensions which are common to several items should be done to avoid unnecessary long calculation or repetition of calculations [5, 13].

3.1.6 Quality and timing of input information

After conducting all the checks as discussed above the senior quantity surveyor will have a thorough understanding of the quality of information at hand and will therefore be in a position to re-evaluate the initial project programme (as discussed in 2.6.1 above), to confirm with the architect and engineers when what information would be required and if necessary adjust the programme to suit the latest information.

The timing of information flow is very important because it impacts on all the parties involved for example it is common knowledge that structural engineers approach their designs from the top down therefore their attention to the detailed design of the foundations will happen at a later stage in the design process. The quantity surveyor need not insist on having this information before the actual measurements can commence. The element of foundations can easily be isolated by deciding on a logical level to which foundations will be measured and continue with the measurement of the superstructure. Similarly the schedules referred to above are developed at a later stage in the architect's process therefore the methodology of measuring over doors, windows and openings and doing adjustments at a later stage also enables the quantity surveyor to continue with a considerable amount of work before the schedules are actually required.

There is a direct relationship between the level of detail that an individual deals with and the duration of the activity. These relationships for each measurer as well as the senior quantity surveyor responsible for the delivery of the final product need to be factored into the production programme e.g.

the programme of a measurer may be only a few days in duration but requires every hour of those days to be accounted for whereas the overall documentation programme may cover e.g. two months but requires weekly assessment.

The relationship is illustrated as follows:

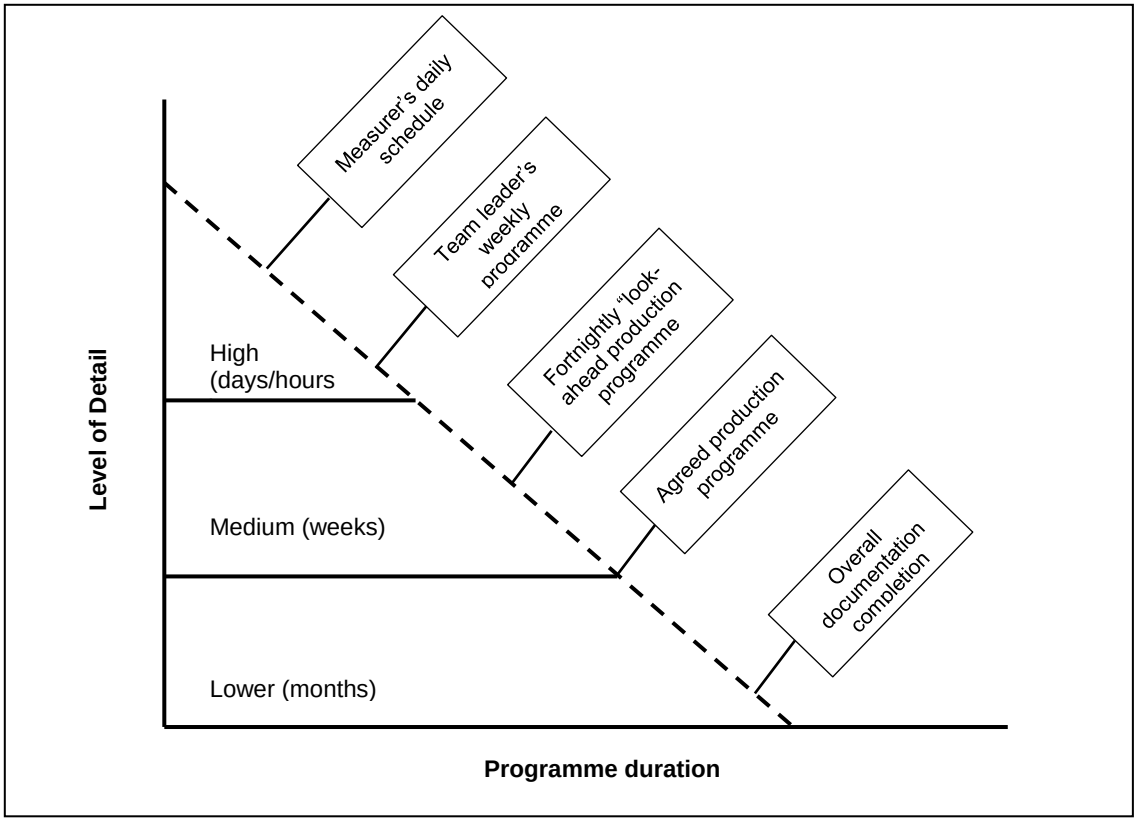


Figure 15: Relationship between duration and level of detail
Source: Adapted from Managing International Construction Projects: An Overview (page 30)

The scrutiny of the drawings, schedules and specifications will reveal the quality of the information and the senior quantity surveyor will be in a position to determine what portion of the work is to be provisional, which specifications are not sufficient and need to be substituted by prime cost amounts, identify items for which budgetary allowances are required and list work to be undertaken by specialist subcontractors for which provisional sums are to be provided.

3.1.7 Management of the production process for price determination documentation

In the introductory section of this module the management principles were stated as planning, organizing, staffing, leading, co-ordinating and controlling. Planning is required to establish the organizational structure for the project, identify the correct people to execute the required work and to institute standards and controls to ensure efficient executing of the plans.

The foregoing discussions highlighted aspects to consider when determining the project objectives, how to set up organizational structures and to allocate work to the identified staff for projects. The leadership role has also been discussed. Co-ordination is the essence of management and the pertinent role of the senior quantity surveyor in drafting the production programme, organizational structure, determining the breakdown structure, allocating the work, scrutinizing the drawings and collating the final document (discussed in the next section) is evident.

3.2 ESTABLISHING AND SETTING UP QUANTIFICATION (MEASURING) SYSTEM

3.2.1 Introduction

Most of the literature that deals with the production process of price determination documentation adopts the approach of describing the measuring process according to the traditional system. Although it might seem unrealistic to describe the traditional taking-off and bill production systems when it is common knowledge that computerised measurement and bill production systems are utilised in practice, it is necessary to have a detailed understanding of the traditional system to be able to adapt it and apply computerised and / or alternative systems [7]. The system is not discussed in detail herein because it is regarded as prior learning.

The compilation of bills of quantities according to the traditional methodology follows the following sequence:

- Taking-off;
- Squaring;
- Abstracting;
- Billing;
- Descriptions of items and
- Editing the draft bills of quantities [17, 7, 13].

Taking-off is the first and most time consuming process and involves converting information on architect's and engineer's drawings and in specifications into appropriate descriptions with accompanying quantities [17]. The continued development of computerised methods of measurement, standardised libraries system, etc. is all aimed at speeding up the process and simultaneously curbing costs and building in quality controls which all leads to added value. The importance of adding value cannot be over-emphasised [7].

The squaring, abstracting, billing and to a large extent the description of items are all processes that have been absorbed by the automation process.

3.2.2 Measuring and Bill production software

Measuring software allows for dimensions to be measured from drawings and calculates the quantities from the measurements (squaring) while bill production software collects the quantities of similar items (abstracting) and prints out the bills of quantities [6].

The operations that are followed are:

- The bill item descriptions are selected from a library of standard description which could either be a generic library or from a previously completed project. Where there are no appropriate descriptions a unique description needs to be drafted. This is a rare skill and it is likely that it is performed or supervised by the senior quantity surveyor because it requires experience and good linguistic skills.
- Dimensions are entered into the system by either using the keyboard of the computer or by using a digitizer (electronic mat). There are several on-screen take-off packages available such as Dimension X, OnCenter, PriMus-DCF and Exactal CostX. These take-off packages are either integrated with or compatible with the bill production packages or the dimensions are produced in a format that needs an interim process to insert them into the bill production packages. The most widely used take-off package in South Africa is Dimension X that is integrated with the most widely used bill production package, WinQS. Dimension X is also compatible with other bill production programmes.

- Reference dimensions according to area, location, etc. Referencing is of utmost importance in creating an audit trail.

The processes are illustrated as follows:

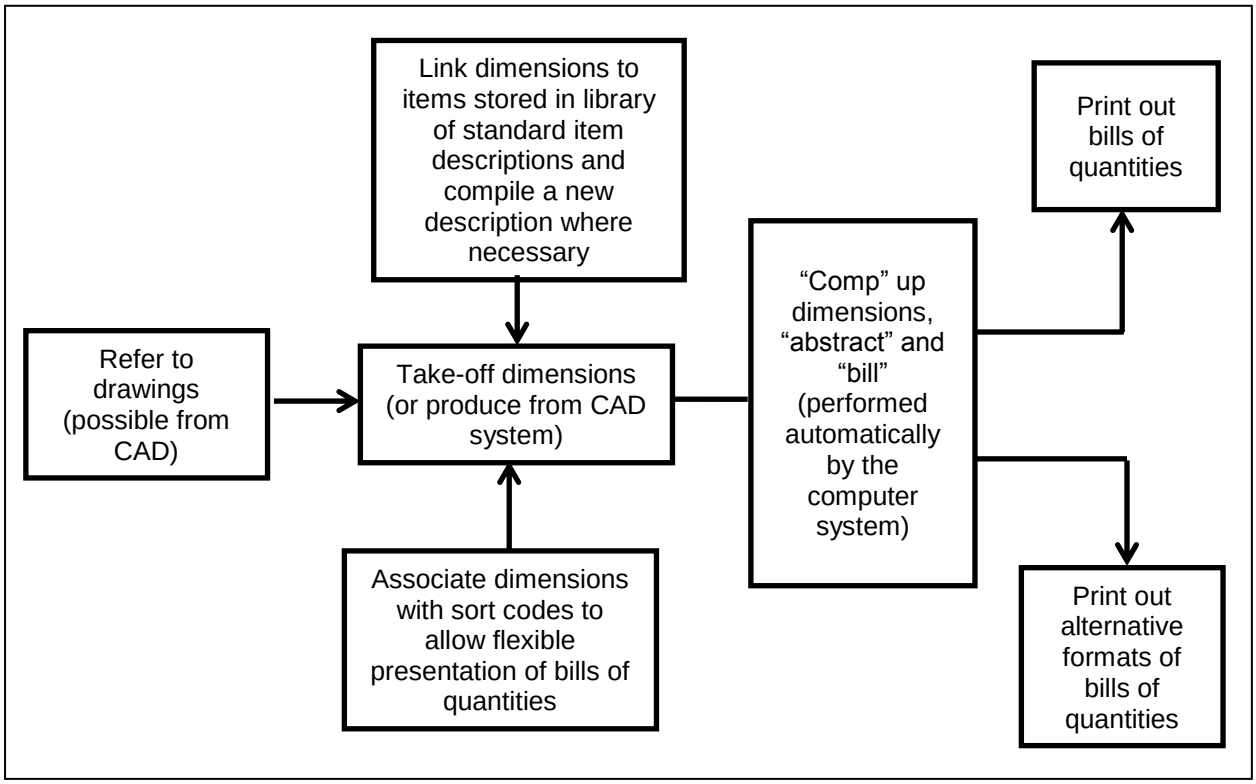


Figure 16: Flowchart of measurement and bill production
Source: Managing International Construction Projects: An Overview (page 58)

3.2.3 Creating a structure and selecting measurable items for electronic measurement

3.2.3.1 The structure

The first step is to create the structure of the document by entering the applicable trades / elements. (Refer to tables 6 and 7 for the list of trades / elements.) Thereafter items are copied from the standard library. The electronic measuring systems have the facility to create a project master (also referred to as the "parent" file) and subsequently create "child files" for the entire measuring team. The child files have limited functions in terms of:

- editing or deleting any "parent" description;
- inserting or editing any Section/Bill in the structure and
- inserting or editing a location,

but have the capacity to:

- insert dimensions for items which the descriptions were copied from the parent (user "parent"),
- insert new descriptions and insert the dimensions,
- copy a "parent" description [19].

After all taking-off is completed the "child" and "parent" files are merged into one document. The limited functionality of the "child" files is necessary to protect the structure and content of the document. The quality of the descriptions in the document can therefore be controlled by the senior

quantity surveyor [19]. The control and co-ordination of descriptions is of utmost importance when several measurers are working on the same project because it is counter-productive for measurers to constantly be asking each other for the exact wording of descriptions and wasted time is avoided in the final quality control checking for similar work described slightly differently by different measurers [7].

3.2.3.2 Selecting measurable items

To illustrate the process of choosing measurable items an example has been selected from the Metalwork trade in the Model Bills of Quantities [4].

Before looking at the example consideration must be given to the requirements of the standard method of measurement with regard to the specific items chosen to see how the rules have been interpreted in the model bill of quantities. The SSMBW requires that:

- metalwork "shall be classified according to type, quality and composition of the metal" [2];
- "welding, brazing, soldering, holes, bolting, rivets and riveting shall be **included in the descriptions** of the relevant work" [2];
- "rolled or drawn solid sections shall be given in kilograms [2];
- "steelwork shall be measured to the designed sizes of components and the calculation of masses shall be in accordance with "Structural Steel Tables" issued by the South African Institute of Steel Construction. No allowance shall be made in the mass for rolling margin" [2].
- "… balustrading, …, framework, etc. shall be given in inclusive items in kilograms or in meters or in number stating for each item the construction and the type and cross-sectional size of components and the number where relevant. Alternatively, when inclusive items are not practicable, work of similar design shall be suitably grouped under headings stating the general requirements. Separate items shall be given for the different components stating cross-sectional sizes. Fanged, rounded, scribed, closed and scrolled ends, intersections, bends, wreaths, etc. shall be given in number as extra over rails etc. but running joints shall be **deemed to be included** in the descriptions [2].

Below is the example of items copied from the Metalwork trade in the Model Bills of Quantities [4]. Note that each measurable item has an item number (generated automatically through the bill print function) and a unit of measurement. The units of measurement are as prescribed in the standard method of measurement. The descriptions contain question marks that need to be replaced with the actual values applicable for the specific project. Notice the use of headings and sub-headings to distinguish between different types of work.

Item No		Unit	Quantity	Rate	Amount	
	BILL?					
	METALWORK					
	STEEL HANDRAILS, BALUSTRADES, ETC					
	Welded handrails to ?					
1	? x ?mm Flat section continuous rails	**kg**				
2	? x ? x ?mm Hollow section continuous rails	**m**				
3	?mm External diameter ?mm thick continuous pipe rails	**m**				
4	Extra over ? for rounded closed end	**No**				
5	Extra over ? for mitred L-intersection	**No**				
6	Extra over ? for T-intersection	**No**				
7	Extra over ? for ramp or knee	**No**				

	SUNDRY STEELWORK					
	Bearers to brick linings, lintels, etc					
8	? x ? x ?mm Angle section bearers bolted to concrete	**kg**				
9	?mm ? expansion bolt	**No**				
	Floor duct covers					
10	?mm "Vastrap" plate duct covers in approximately ?mm widths and suitable lengths laid loose in framing	**kg**				
11	? x ? x ?mm Angle section framing with ? x ?mm flat section bent lugs each ?mm girth welded on at ?mm centres including embedding in concrete	**kg**				

Figure 17: Example of selected measurable items from the metalwork trade
Source: Model Bill of Quantities

The first two requirements in the SSMBW are covered in the main heading and the sub-heading. The third requirement is illustrated in the unit of measurement of items 1 and 8. Provision for the designed sizes is made in the descriptions of items 1, 2, 3, 8, 10 and 11. The sizes indicated on the drawings must be inserted into the description in lieu of the question marks. The application of the conversion factors contained in the steel tables will be done as part of the actual measuring. The last requirement allows for three alternative methods of measuring the items mentioned in the clause and the third alternative is applied in the example.

Do you still remember the emphasis placed on terminology used in standard methods of measurement earlier on? The meaning of the highlighted phrases in the extracts from the SSMBW above of "**included in the descriptions"** and **"deemed to be included"** are demonstrated clearly in this example. The "welding" that is meant to be included in the description is emphasised by stating it in the sub-heading while no mention is made of the running joints that are "deemed to be included" in any of the measurable items.

The items in the Model Preambles for Trades that correspond with the clauses extracted from the SSMBW state the following: "All welds shall be cleaned and filed or ground off smooth to approval. All welded joints shall be continuous. Metalwork shall have all sharp edges ground smooth. Tubular and pipe work shall include running joints. Rails, etc. described as "continuous" [items 1, 2 and 3] shall be in long lengths with welded joints." [(3)].This extract clearly demonstrates the additional information given in the specifications with regard to the quality of workmanship is not repeated in the bills of quantities.

3.2.4 Adding dimensions and referencing in electronic format

The unit of measurement as required in the SSMBW is linked to the standardised description. The unit of measurement for the item illustrated below is m3 (cubic metres). Note that the electronic measuring sheet automatically creates space for three dimensions and additional fields for timesing (same dimensions that occur more than once) and referencing. The dimension will not be accepted if all the fields are not filled in.

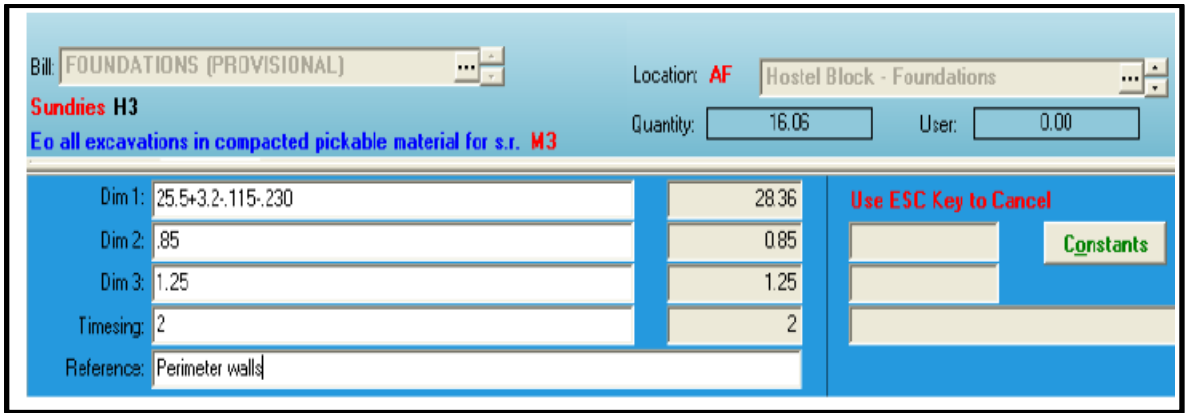


Figure 18: Electronic dimension sheet
Source: WinQS help files

The same dimensions would have been written as follows for hand measurement:

2/	28.63		*Excavate in earth*
	0.85		*not exceeding 2 m deep below NGL*
	1.25		*for surface trenches*
		- perimeter walls	

Figure 19: Hand measurement
Source: Author

3.2.5 Editing the draft bill of quantities

Editing the draft bill of quantities is a very important function because the document is the product according to which clients and other professional consultants will judge your firm's ability and professionalism. If the document is riddled with spelling and grammatical errors and is untidy due to the inconsistent application of headings, etc. it creates a negative impression even if the quantities and descriptions are correct [(17)].

Spelling and grammatical errors can easily be eliminated by applying the spelling checker built into the software but inconsistencies need to be physically checked. Common inconsistencies are:

- Inconsistent use of capitals, bolding and underlining in headings.
- Where dual spelling of technical words is correct only one should be used throughout for example "sill" and "cill" or "lintel" and "lintol".
- Spacing between numbers and units e.g. 200mm or 200 mm and also spacing between hundreds e.g. 2 000 or 2000.
- The order of dimensions in descriptions should be in the same order as taking off e.g. first the length, then the height and then depth e.g. 1 800 mm long x 900 mm high x 600 mm deep floor unit. It is also not necessary to include the wording in the dimensions e.g. 1 800 mm x 900 mm x 600 mm deep floor unit. Possibly the units in between can also be omitted e.g. 1 800 x 900 x 600 mm deep floor unit. Whatever the preference is it should be applied consistently throughout the document.

4. ACCURACY, COMPLETENESS AND OTHER CHECKS

Learning outcomes

After studying this section, you should be able to:

Undertake accuracy, completeness and other checks by

- Checking the final price determination documents for completeness
- Checking the final price determination documents for accuracy

4.1 Checking documents for completeness

In the previous section we discussed the importance of editing the draft bill of quantities and checking for obvious errors such as spelling and grammar mistakes, typing and heading inconsistencies. Apart from these obvious errors other more serious errors could occur such as entire trades being omitted (e.g. the heading Bill No is the trigger for the start of the next trade when printing from WinQS. If this heading is not inserted correctly in each trade the entire trade will be missed), items being overwritten in the merging process of several measurer's work into one file and then there is of course work overseen and possible duplications and /or omissions due to ineffective communication between measurers [13].

An easy and effective way to check for these errors is to collate all the drawings and to scrutinize each one for items / descriptions that have not been coloured in or bear no indication that they have been measured. Check all the measurer's query sheets for to take notes and any other outstanding information that could impact on the measurement. The specification should also be checked and it is good practice to run through it clause by clause and tick the clauses that are incorporated in the measuring, preliminaries or preambles [13].

Any alterations made to taking-off should be confirmed with the person that measured it originally as what might seem to be an error might have been done purposely with good reason. If the alterations are done at a late stage e.g. after the document has been merged it is important that the alterations be corrected in all the sets of information for record purposes [13].

4.2 Checking documents for accuracy

Measuring is a time-consuming process and it is not normal procedure to check measurements item for item except perhaps if a very inexperienced measurer is part of the team. There is a way however, to check that no major errors have been made by comparing certain quantities with each other. The following are examples of such comparisons:

- Areas of lightweight concrete screeds with waterproofing,
- Total area of walls with total of finishes to walls,
- Total number of door frames, doors and locks,
- Total area of screeds with floor finishes,
- Total area of plaster with paint and tiling, etc. on walls,
- Total areas of floors, ceilings, insulation and roofs with each other. (These will not line up exactly as roofs usually have slopes and overhangs, but some comparison can be made),
- Length of eaves gutters with fascia boards,
- Area of glass with half the area of paint on windows (for metal and timber windows),
- Number of sanitary fittings with service pipes, taps and traps [5, 7, 13, 17].

These checks will not produce exact comparisons but will at least alert the checker to items where the discrepancies are large and create the opportunity to correct the errors before distributing the documents to other stakeholders [5, 7].

4.3 Totalling of pages

There are two ways in which the monetary value of the pages in the bills of quantities can be collated. Firstly to have a running total by trade which entails that the total at the bottom of the first page is carried to the top of the next page, the process is repeated for as many times as there are pages and the total of the last page in the trade is carried to the final summary page.

An example hereof is as follows:

	Bill No. 2 EARTHWORKS	**Carried Forward**		R	

Bottom of first page

		Brought Forward		R	

Top of next page

	Bill No. 2 EARTHWORKS	**Carried to Summary**		R	

Last page of trade

Figure 20: Page totalling carried forward
Source: Author

Secondly each page can be totalled separately and each page of a trade is carried to a summary page for the trade and the total of the summary page is carried to the final summary. Before automation the first way was avoided as several pages would require recalculation if there was an error on one of the earlier pages however with automation the options are selected by merely changing a print setting in the bill production programme.

This example illustrates this choice:

	Bill No. 2 EARTHWORKS	**Carried to Collection**		R	

Bottom of each page in the trade

	Bill No. 2 EARTHWORKS **COLLECTION**				
		Page No		**Amount**	
	Total Brought Forward from Page No.	-2-			
	Total Brought Forward from Page No.	-3-			

Top of trade summary page

	Carried to Summary Bill No. 2 EARTHWORKS		R		

Bottom of trade summary page

Figure 21: Totalling each page and collecting the trade
Source: Author

All the page numbers and wording to suit the two alternatives are generated automatically during the bill printing process.

4.4 Notes to Tenderers and Final Summary

4.4.1 Notes to Tenderers

Typical notes proposed in the Model Bill of Quantities to be included in the notes to tenderers for private sector projects are:

- names of parties: all the consultants involved in the project to be listed,
- scope of contract: a brief description of the work is given,
- tender enquiries: Responsible person and contact details are given,
- acquaintance with tender documents: Documents and all local authority requirements and bylaws,
- signing of tender: the representative signing the document must be duly authorised and the company resolution to this effect be submitted,
- costs incurred by tenderer: the costs are not for the client's account,
- black Economic Empowerment: questionnaire to be completed and submitted,
- occupational Health and Safety Act – Contract and Specification: specifications and contract are to be studied and ensured that all obligations are included in tender,
- information to be provided by Tenderers: documents to be submitted are listed,
- escalation: call for two alternatives, CPAP and fixed price,
- escalation and Completion Dates: call for two tenders both with fixed price but with differing completion dates,

- site Inspection: information for compulsory site inspection meeting to be given if applicable,
- closing date of Tender: information pertaining to when and where the tender is to be submitted,

Only the notes applicable to the specific project are to be included [4].

Documents for public sector projects will be prepared in strict accordance with the Standards of Uniformity in Construction Procurement as prescribed by the CIDB. The standard formats of all the documentation listed in tables 3, 4 and 5 can be obtained from the CIDB.

4.4.2 Final Summary

The total of all the trade summaries are carried to the final summary. The final summary would look the same for both trade collection methods. Provision needs to be made for the escalation and the contingencies [17]. Care should however be taken that the notes to tenderers and the inclusion of allowances do not contradict each other.

Here is an example of a final summary including allowances for contingencies and escalation.

FINAL SUMMARY

Bill No		Page No		Amount
1	PRELIMINARIES	-13-		304 943.00
2	EARTHWORKS	-16-		644 904.44
3	CONCRETE, FORMWORK AND REINFORCEMENT	-19-		2 420 885.11
4	MASONRY	-22-		1 137 315.95
5	WATERPROOFING	-24-		422 908.08
6	ROOF COVERINGS	-25-		258 179.14
7	CARPENTRY AND JOINERY	-34-		838 673.61
8	CEILINGS, PARTITIONS, ETC	-37-		413 161.55
9	FLOOR COVERINGS, ETC	-38-		199 643.40
10	METALWORK	-40-		523 020.83
11	PLASTERING	-41-		165 545.33
12	TILING	-42-		144 860.09
13	PLUMBING AND DRAINAGE	-51-		443 367.87
14	GLAZING	-52-		75 377.00
15	PAINTWORK	-54-		503 264.60
16	PROVISIONAL SUMS	-57-		1 463 950.00
	SUBTOTAL		R	9 960 000.00

	Allow the amount of R 300 000 (three hundred thousand rand) for contingencies to be used at the discretion of the Principal Agent and deducted in full or partially if not required		SUM	300 000.00
	Allow the amount of R 200 000 (two hundred rand) for CPAP to be used at the discretion of the Principal Agent and deducted in full or partially if not required		SUM	200 000.00
	SUBTOTAL		R	10 460 000.00
	VALUE ADDED TAX (14%)		R	1 464 400.00
	Carried to Form of Tender		R	11 924 400.00

Figure 22: Final Summary
Source: Quantity Surveying Practice in South Africa (First Edition, Reprint 1) and Author

4.5 Form of Tender

The most commonly used building agreement in South Africa is the JBCC Principal Building Agreement which actually comprises a set of three documents namely the agreement itself, the Employer to Contractor Contract Data (that is issued to the contractor at tender stage) and the Contractor to Employer Contract Data (that is submitted with the contractor's tender). The form of tender is incorporated into the Contractor to Employer Contract Data and contains all the important information that should be included in any form of tender that is:

- reference to the address where the tender is to be delivered,
- statement that the form of tender is the offer to execute the project for the stated sum of money,
- states that a public opening will take place directly after the closing of tender,
- states that the lowest or any tender will not necessarily be accepted,
- the tender validity period,
- reference to the Employer to Contractor Contract Data with regard to any changes made to the standard conditions of contract,
- states the agreement to be entered into,
- tender sum (in numbers and in words).

5. FINALISATION AND DISTRIBUTION OF DOCUMENTATION

Learning outcomes

After studying this section, you should be able to:

Finalise and distribute the price determination documentation by

- Adjusting and correcting errors, omissions, etc. to final bills of quantities or other price determination documentation
- Preparing required addenda
- Distributing price determination documentation to relevant stakeholders

5.1 Adjusting and correcting errors, omissions, etc.

Once the bills of quantities have been distributed to the contractors for tendering mistakes can still be encountered regardless of the diligent checking. Changes to the document could also be required due to enquiries from the tenderers, changes to specifications, unavailable materials, etc.

Some of the enquiries might be simple clarifications and do not need to be communicated to all tenderers, but any items discussed with any one of the tenderers that might constitute a competitive advantage, must be put in writing and communicated to all tenderers. Tenderers must confirm receipt of this information in writing because it becomes part of the tender and is taken up in the final contract documentation.

An example of the notification (also referred to as an addendum) sent to the tenderers to communicate the changes, is as follows:

[Project No]
[Date]

To All Tenderers,

RE: Addendum to Tender for Posh Office Park

You are requested to make the following changes to the tender document of the above-mentioned project

Item 2 page 13: Change the quantity from 21 m2 to 211 m2

Item 6 page 48: Change the provisional sum for built-in furniture from R 300 000 to R 30 000

Please be advised that these changes form part of the tender and no claim will be entertained in this regard at a later stage

Acknowledge receipt of addendum no 1 by signing and returning it to our offices by no later than ??/??/????

_____ _____
Tenderer Signature

_____ _____
Designation Date

Figure 23: Notification to contractors for corrections to contract bills
Source: Author

When the tenders are submitted the tender adjudication is conducted, the tendered rates are inserted, erroneous rates, calculation errors, etc. are corrected and the changes communicated during the tender period are adjusted. Candidates are referred to Module 4: Manage price determination processes (tender procedures) for Built Environment projects for more information on tender adjudication.

5.2 Preparing required addenda

The purpose of addenda is to provide additional information through details that cannot be adequately described for pricing for example standardised manhole details, etc. Instead of trying to describe the manhole in detail the reference to the standardised drawing is stated in the description of the manhole and it is mentioned that the drawing is attached at the back of the document. This technique can also successfully be applied for custom made doors, windows, built-in fittings, etc.

The second purpose is to provide tenderers with examples of terms and conditions contained in specific documents such as the construction guarantee, waiver of contractor's lien, payment guarantees, etc. and also to provide tenderers with additional information that is applicable to the execution of the works but is not necessarily included in the measured work such as geotechnical reports, environmental management plans, health and safety specifications, etc.

5.3 Distribution of price determination documentation to relevant stakeholders

When the tender process is concluded, the successful contractor is selected and all corrections to the document are made. A complete set of contract documentation must be compiled in preparation for the signing. The set will normally comprise the contract data, the conditions of contract, drawings, the priced price determination document and any post-tender negotiation documentation. Contractually the compilation of the contract documentation and completion of the agreement and contract data is the responsibility of the principal agent, but the quantity surveyor is frequently requested to do this on behalf of the principal agent.

In the case of the JBCC Principal Building Agreement (PBA) it is necessary to complete the contract agreement consisting of the post-tender provisions and the contractual agreement contained at the back of the agreement [(20)], the contract data – employer to contractor that requires information regarding the contracting and other parties, contract and site information, insurances and securities, practical completion dates and penalties, documents and general, changes made to the standard conditions of contract and the declaration by the principal agent [(21)] to be completed and the contract data – contractor to employer that requires information regarding the contracting parties, securities, payment and adjustment of preliminaries, employer changes to the standard conditions of contract and the tender [(22)] to be completed.

The agreement (any agreement) states the party that is responsible for the custody of the contract documentation and how many copies need to be distributed to which parties. The JBCC PBA requires the "principal agent or such other party as stated in the contract data" to hold the signed contract documentation. Furthermore the JBCC PBA stipulates that the following number of sets of contract documents be distributed free of charge:

- One original set of signed contract documentation to the contractor.
- Two sets of signed contract documentation for each nominated / selected sub-contract agreement to the contractor.
- Number of copies of drawings, unpriced bills of quantities and documents stated in the contract data (construction guarantee, payment guarantee, waiver of contractor's lien, securities). The number of sets is a variable to be completed, but common practice is to supply two sets of documentation free of charge. One of the sets are to be kept on site for easy access thereto by the employer, principal and other agents.

Although it is not stated in the contract it is customary that the employer and the quantity surveyor each receive a complete set of contract documentation (usually copies).

6. TRENDS IN THE USE OF PRICE DETERMINATION DOCUMENTATION

In the introduction to this module the importance of the procurement strategy that governs the relationship between the designers and the contractor through the conditions of contract and the price determination method was emphasized. Price determining documents play a more significant role in the traditional procurement strategy but are also important in non-traditional procurement strategies *(8)*

With traditional procurement strategies the emphasis of the project is focused on cost due to limited funds or the necessity to report on the use of public funds. Non-traditional procurement strategies place more emphasis on the flexibility within the design and shorter construction periods which do not allow for the preparation of bills of quantities before commencement of the project.

The need for, use of and relevance of different price determination documents is frequently debated. Candidates are therefore required to take note of current national and international trends in this regard by obtaining and studying research papers on this specific topic. Some papers are listed in the recommended reading section of this specific purpose.

SELF-ASSESSMENT QUESTIONS

1. State and discuss the different methods of price determination.

2. Describe the different types of bills of quantities and projects to which they will be suited.

3. Discuss the purpose, advantages and disadvantages of standardised methods of measurement.

4. Explain how the planning and allocation of resources is approached for the preparation of bills of quantities.

5. Dealing with project drawings is a very important and integral part of a quantity surveyor's work. How are drawings dealt with from receipt to completion of the measuring process?

6. Explain how the quality and timing of information received from the design consultants would influence the type of bill of quantities and the in-house planning in the quantity surveyor's office.

7. Standardised methods of measurement do not make provision for measuring literally all items and often states requirements "to be included in the description" or "deemed to be included". Explain the difference in these concepts by way of an example and the implication of each from a contractor's perspective.

8. Explain the relationship between a bill of quantities and a standard specification such as the Model Preambles for Trades.

9. The bill of quantities is the product that a quantity surveyors presents to his client and fellow consultants. The quality of this document is therefore of utmost importance. Discuss the procedures followed in ensuring this quality.

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