

# The adoption of CESMM3

## as a standard method of measurement of civil engineering quantities in South Africa

THE USE OF bills of quantities on construction contracts permits three important objectives to be achieved:

- Tenderers are provided with adequate information regarding the extent of the work required to enable them to accurately and confidently prepare tenders which may readily be compared with other tenders
- Employers can pre-determine with a high degree of accuracy the costs of contracts and the impact of possible variations to the works
- A sound basis is provided for the valuation of work carried out at any stage of a contract

Bills of quantities need to be underpinned by a system of measurement, preferably a standard one.

### DEVELOPMENT OF A STANDARD METHOD OF MEASUREMENT SYSTEM IN THE UK

The Institution of Civil Engineers (ICE) published a report of a committee dealing with engineering quantities in 1933 which provided a standard procedure for the drafting of bills of quantities for civil engineering work. ICE subsequently published the Standard Method of Measurement of Civil Engineering Quantities in 1953. This was reissued with slight amendments in 1963 and a metric edition in 1968.

In 1967 the Construction Industry Research and Information Association (CIRIA) initiated research into improving contract procedure. One of the projects proposed the means of making

the information in the bill more useful. CIRIA Report 34 concluded that civil engineering bills of quantities should apart from scheduling the components of the contemplated work, should also contain charges related to the method and timing of the contractor's operations. ICE worked on these proposals and published the Civil Engineering Standard Method of Measurement (CESMM) in 1976. The principal changes were:

- Greater standardisation in format
- The introduction of various levels of classifications or 'pigeon holes' from which descriptions could be developed
- The introduction of a coding arrangement
- The use of method-related charges to represent more clearly site construction costs such as the cost of setting up and operating plant, labour teams and the like
- A large number of small changes to remove anomalies and differences in interpretation

The second edition, CESMM2, was published in 1985 to keep pace with new technology, particularly in the site investigation and geotechnical processes, and to secure better compatibility with building measurement practice with the introduction of SMM7, Standard Method of Measurement of Building Works. The third edition, CESMM3, was published in 1991 to align the system with the sixth edition of the ICE Conditions of Contract.

CESMM3 defines a bill of quantities as 'a list of items giving brief identifying

descriptions and estimated quantities of work comprised in the contract'. Accordingly, the billed items merely identify the work and the person pricing a bill of quantities will have to look at the scope of work (drawings and specifications) and the contract data to obtain most of the information to arrive at a price.

### DEVELOPMENT OF A STANDARD SYSTEM OF MEASUREMENT IN SOUTH AFRICA

The first edition of the Standard Method of Measurement of Civil Engineering Quantities was published in 1960 by the South African Institute of Civil Engineers (SAICE), the South African Association of Consulting Engineers (SAACE) and the South African Federation of Civil Engineering Contractors (SAFCEC). This document was based on the 1933 and 1953 editions of the equivalent document published by the Institution of Civil Engineers (London). The first edition was revised in 1969, because of impending metrication and the 1969 edition was revised in 1973 to eliminate certain unsatisfactory features which it contained. A third edition was published in 1979.

Civil Engineering Quantities 1973: the Standard System of Measurement of Civil Engineering Quantities for South Africa and South West Africa (CEQ73) used the term 'Schedule of Quantities' as opposed to 'Bill of Quantities'. According to CEQ73, a 'Schedule of Quantities' is 'a list of items giving the estimated quantities and brief descriptions of the work to be performed and materials to be provided

under the Contract, the quantities being derived from the drawings and specifications, and space being provided for the insertion of price rates against each item and the extension and totalling of prices'. CEQ73 makes it clear that:

The Schedule of Quantities should be prepared on the understanding that, in the absence of specific directions to the contrary, the rates and prices that will be inserted will be considered as being the full inclusive rates and prices for the finished work described under the respective items as covering, not only all labour, materials, temporary work, plant, on-cost items and other overhead charges and profit, but also the general liabilities, obligations and risk arising out of the conditions of contract and specification. The contingent and potential causes of expenditure, generally classified as contractors' risks (eg timbering or side-sloping of excavations) are to be clearly and precisely defined in the conditions of contract specifications, so that they may be properly apportioned to the rates and prices in the Schedule of Quantities.

The measurement and payment clauses of SABS 1200 Standardised Specification for Civil Engineering Construction that was published in 1979 are based on CEQ73. Guidance on the application of this system was provided in SABS 0120, Code of Practice for use with Standardised Specifications for Civil Engineering Construction and Contract Documentation. The measurement and payment clauses of the Committee of Land Transport Officials' (COLTO) Standard Specification for Road and Bridge Works for State Road Authorities built upon and expanded the system of measurement contained in the SABS 1200 Standardised Specification for Civil Engineering Construction.

In 1990, SAICE published Civil Engineering Quantities 1990 as a successor to the Standard System of Measurement of Civil Engineering Construction Contracts. The need for revising CEQ73 became necessary as Chapter VII (Units and Methods of Measurement) had been adopted and incorporated into SABS 1200 Standardised Specifications, thus making much of CEQ73 redundant. Civil Engineering Quantities 1990:

- Incorporated the contents of all

the chapters of CEQ73 other than Chapter VII

- Provided a more disciplined approach to the derivation and recording of the quantities
- Illustrated the inter-relationship of both the taking-off and the schedule of quantities to the SABS 1200 series of standardised specifications read with SABS 0120 and SAICE's General Conditions of Contract (GCC82)

### **MEASUREMENT AND PAYMENT IN TERMS OF SABS 1200**

Each part of SABS 1200 is divided into eight main clauses dealing with scope, interpretations, materials, plant, construction, tolerances, testing and measurement and payment. All the parts of SABS 1200 covering construction activities include in the supporting specifications a reference to SANS 1200A, SANS 1200AA, SABS 1200AD or SABS 1200 AH. Each of these parts of SABS 1200 contains a clause 8.1.1.1 which reads:

#### **Method of measurement, all Sections of the Schedule**

Except where otherwise specified in Clause 8 of the standardised specifications or in the project specifications or in the preamble to the schedule, all items in the schedule shall be measured and shall cover the operations as recommended in the standard system of measurement of civil engineering quantities for South Africa and South West Africa [Namibia], published under the title civil engineering quantities as approved and recommended for general use by the South African Institute of Civil Engineers, the South African Association of Consulting Engineers and the South African Federation of Civil Engineering Contractors.

The standard wording to clause 1.1.3 of the Preamble to the Schedule of Quantities in SABS 0120: Part 4 (1982) reads as follows:

Descriptions in the schedule of quantities are abbreviated and the schedule has been drawn up generally in accordance with the latest issue of Civil Engineering Quantities. Should any requirement of the measurement and payment clause of the applicable standardised specifications, or the project specifications, or particular specifications conflict with the terms

of the schedule or, when relevant Civil Engineering Quantities, the requirements of the standardised, project, or particular specification, as applicable, shall prevail.

SABS 1020: Part 4 also provides guidance on the development of schedules of quantities.

### **RECENT DEVELOPMENTS IN PROCUREMENT DOCUMENTS IN SOUTH AFRICA**

The Green Paper on Public Sector Procurement Reform in South Africa that was published in 1997 proposed that there should be 'a complete separation in contract documentation between conditions of tender, conditions of contract, specifications and terms of payment (including methods of measurement)'. This proposal set the framework for procurement reform in the area of procurement documentation and led to the publication of SANS 10403, Formatting and Compilation of Construction Procurement Documents, in 2003 and the CIDB's Standard for Uniformity in Construction Procurement in 2004. The successor to the SABS series of standardised specifications, namely SANS 1921, Construction and Management Requirements for Works Contracts, and SANS 2001, Construction Works, are based on this principle and make no reference to measurement and payment.

### **MEASURING CIVIL ENGINEERING WORKS CONSTRUCTED IN ACCORDANCE WITH SANS 1921 AND SANS 2001**

Prior to the introduction of SABS 1200, civil engineering quantities were measured in accordance with CEQ73. The contents of CEQ73 were subsequently either incorporated into Clause 8 of each part of SABS 1200 or in Civil Engineering Quantities 1990 – that is, the system was no longer in one document. What has happened over time is that the principles and thinking behind the current system of measurement that flows out of Clause 8 of the SABS 1200 standardised specifications has become lost. Consultants and contractors alike are often unaware that the system of measurement and payment contained in the various parts of SABS 1200 needs to be read in conjunction with the relevant parts of SABS 0120, SANS 1200 parts A, AA, AD and/or Civil Engineering Quantities 1990.

**Continued on page 56**

## STATE-OF-THE-ART EXPANSION PROGRAMME

TO ACCOMMODATE its rapid growth, Intaka Tech has commenced a R300 million high-tech, four-phase expansion programme in Africa, which is scheduled for completion in November 2008.

Intaka Tech, a division of the international Intaka Group, manufactures and markets innovative, portable equipment, in particular water purification plants and on-site oxygen and medical air generation plants. This cost-effective equipment produces water and oxygen of a superior quality that is in accordance with international standards, ensuring it is fit for human consumption. It is used in many applications, ranging from construction and mining to healthcare.

The company already has well over 200 units in operation in a variety of local hospitals and rural communities, in both the private and public sector.

The objective of the ambitious expansion programme is to support and back the ever-increasing number of Intaka Tech state-of-the-art plants in South Africa and neighbouring countries, and to contribute to technical and infrastructural development throughout the continent, no matter how remote the locations requiring water purification or oxygen and medical air generation may be.

The programme is fundamental to the company's strategy to increase and entrench its business throughout the continent on an ongoing basis

The R300 million investment has been allocated to the development of at least three, most probably four, additional manufacturing sites, and will go to their construction, the cutting edge equipment required, as well as labour and training.

Central to this investment will be a focus on optimising customer service delivery and equipment back-up, and therefore developing Intaka Tech's service and maintenance facilities even further.

'This latest undertaking is another step forward in the implementation of our policy to improve and enhance the lifestyle and well-being of our target market and contribute meaningfully to industrial development in southern Africa,' says Dr Gastón Savoï, chairman of Intaka Tech.

Some of the other industries in which Intaka Tech equipment operates are environmental and recreational organisations, the food and packaging industry, fishing, waste management, and disaster zones.

## CONCRETE SURFACE BED TRAINING

Ever been to a function where the sandwiches had been out for too long and curled up at the edges? Shrinkage in concrete panels in floors causes exactly the same effect, says Bruce Raath, education and training manager at the Cement & Concrete Institute (C&CI).

'Shrinkage in the exposed top 50 mm of a concrete floor panel shrinks far more than the concrete in the bottom 50 mm. The difference

in the shrinkage is much greater when there is a sheet of plastic underneath the floor – then the only escape route for moisture is upwards.

'The surface shrinkage then curls the corners so that they lift away from the base underneath. When a heavy load, such as a fork lift truck, travels over one corner the panel will rock, and anyone standing on the opposite corner is liable to be thrown off his or her feet. After many passes of the fork lift, the corner will break off,' Raath states.

'Now consider what will happen if the floor is washed, and water can get through badly sealed joints to wet the underside of the panels which will expand. Again plastic underneath will make the resultant curling much worse.'

Raath says reducing the occurrence of curling, and many other defects in floors caused by not understanding the inherent properties of concrete, will be discussed during the training course on concrete surface beds to be presented by the School of Concrete Technology at the C&CI this year. Details of dates and more information are on the website [www.cnci.org](http://www.cnci.org).

► *First the corners curl, and then the panel cracks under weight – how to prevent this 'curling' in concrete flooring will be part of a C&CI training course in Midrand this year*



### Continued from page 19

The logical approach to dealing with the civil engineering quantities when using SANS 1921 and SANS 2001 is to base measurement and payment on a single stand alone document that deals with the standard system of measurement for civil engineering works in its entirety. Such a document should be sufficiently flexible to be used with any of the standard forms of contract that are included in the CIDB's Standard for Uniformity in Construction Procurement and the range of standard specifications that are currently in use in South Africa, including SANS 1921 and SANS 2001. Ideally such a document should be compatible with international practice.

It makes no sense to revert back to

CEQ73 or to update CEQ73. It is preferable to simply adopt the system currently used in the UK and elsewhere in the world.

CESMM3 is a logical choice as it is a document which is founded on the same thinking and philosophy as the system that has evolved in South Africa. It is widely used in Africa, is sold by SAICE and is well understood by the international community. It is a tried and tested document that is adequately supported by a range of comprehensive handbooks and texts.

### JCD'S PROPOSAL FOR A GUIDE TO THE APPLICATION OF CESMM3 IN SOUTH AFRICA

The Joint Civils Division is currently developing a guide to the application of the third edition of the Civil Engineering Standard

System of Measurement (CESMM3) in southern Africa. This guide will:

- Introduce the reader to the philosophy and thinking behind CESMM3
- Highlight the differences between the current system as embodied in Civil Engineering Quantities 1990 and the SABS 1200 standardised specifications
- Make recommendations regarding the adaptations that should be made to successfully apply it in the South African contracting environment

This publication will not replace CESMM3 in any way, nor will it purport to be a handbook on the subject. It will merely serve as a guide to the application of CESMM3 in the South African context to facilitate the adoption of CESMM3.

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