PART 1

INTRODUCTION, PROBLEM STATEMENT, RESEARCH OBJECTIVES AND RESEARCH APPROACH

The research report follows the flow of the research. The objective of Part 1 is to prepare the reader for the research report and contains two chapters:

Chapter 1: Introduction

Chapter 2: Research Objectives and Research Approach

CHAPTER 1
INTRODUCTION

1.1 MILIEU OF THE PROBLEM

Construction is one of the largest industries in the world and one of the most disjointed as well. One of the reasons why the industry is so fragmented is that the construction industry involves parties from myriad professions. Different types of information are exchanged between the various parties for the purpose of communicating design, construction and contractual matters. Individual firms have developed their own means of classifying and disseminating procurement and cost information to facilitate the process. However, as there is no standardised system of classifying and sharing of such information, data is lost along the way. Proper planning to eliminate conflict, duplication and omission in the distribution of procurement and cost information is lacking, and this can be ascribed to the fact that modern information technology has not fully penetrated the industry. Many professionals and contractors still use old-fashioned paper-based methods of exchanging information, making communication slow and inefficient. Advanced and cost-efficient communication technology, based on a nationally accepted and internationally compatible standard, should assist in making the construction industry a more powerful and streamlined machine. This will allow professionals and contractors to collaborate more effectively with partners, staff, building owners, manufacturers, designers, etc on both the local and international levels

The primary tools for communicating a designer's intent to the construction team are the construction documents that define the project. They consist of graphic drawings and written text. As legal documents in construction contracts, they are at the core of disputes and are frequently the basis for lawsuits on cost overruns, poor workmanship, and delay of work operations with concomitant late delivery of the project. Construction documentation must therefore be authoritative, accurate, reliable, user-friendly, and enforceable. Standard and particular specifications coupled with easy and reliable access to product literature form an integral part of the construction documents or serve as essential resources in the compilation process of other construction documentation such as bills of quantities

In the past specifications and other construction documents were generally prepared from previous project documents or a master text created and maintained within a particular firm. The specifier was thoroughly familiar with their format and with the products, manufacturers and reference standards described in the text. Technical review other than proofreading was minimal. However, in more recent times the procurement process has been undergoing a drastic change, mainly as a result of the advancement in information exchange through electronic transfer processes. In most technologically advanced countries such as the United Kingdom (UK), the United States of America (USA) and the Netherlands master text is now written, updated, and distributed nationally by specialist firms or organisations, then edited and distributed to specification drafters through specialist product specifying companies and expert system frameworks, each operating independently from one another but with interfacing facilities based on national classification standards

In the Republic of South Africa (RSA) a number of these specialist product specifying companies have appeared on the scene over the past few years to supplement the small number of companies that were already operating in this field. This research attempts to investigate, *inter alia*, how effective the services are that these companies render and whether these services are used on a regular basis (see Chapter 8). Regular review and coordination of these systems seem to be essential and the proper organisation of construction information is regarded as critical to the success of this element in the overall construction process. Proper planning needs to be done to ensure that construction documents are comprehensive, up-to-date and of good quality, and that such construction documents can be coordinated with the drawings, standards, regulations, by-laws, etc to eliminate conflict, duplication and omission of information

It is postulated that the development of a national standard (or code of practice) for classification of construction information can assist professionals and contractors to achieve these goals. Such a standard for classification is considered to be a natural development in the construction industry as it will enable the people involved to exchange general and specific project information through the system via the Internet, or other electronic means, rather than by communicating through the more traditional facsimile or other paper-based methods, providing all parties involved in the building process with the information and platform they need for specification writing, project supervision, work execution, etc

The establishment of a comprehensive communication system, based on a standardised classification system and featuring a good measure of flexibility, should limit, or even obviate, the tedious task of having to refer to contract documents of previous projects

Manufacturers are increasingly challenged to find better ways of presenting their building product information at the most opportune time and to the right project team member. Historically catalogues and online libraries of product data have assisted manufacturers in increasing their market exposure – but without any real guarantee that the products specified will be the products purchased at the time of construction. At the same time, fierce market competition, fast growth and global projects require architects, engineers, quantity surveyors, contractors, facility managers, etc to move expeditiously, find the best price and locate locally available building products. Advantages that a national standard for classification will provide, such as ease of access, uniformity and compatibility, should contribute to the effectiveness of information sourcing and thereby significantly reduce the time involved in satisfying requests for information, allowing, or at least assisting, the building and procurement processes to continue more effectively

1.2 PROBLEM STATEMENT

1.2.1 Introduction

Having sketched the milieu, it is now considered appropriate to describe the problem areas in more detail. Leedy (1997 : 101) describes the *qualitative research* approach that was followed in this study as follows: *… qualitative researchers often start with general research questions rather than specific hypotheses, collect an extensive amount of verbal data from a small number of participants, organise those data into some form that gives them coherence, and use verbal descriptions to portray the situation they have studied*

The general research questions referred to in the previous paragraph have, in this case, been summarised and are presented in the main problem statement that follows hereinafter and, in addition, sub-problem statements and delimitations to the scope of the research project are tabled. This is followed by the exploratory data collection process and analysis in Part 2 of this research, that in turn needed to be tested in the confirmatory data collection process as was done in Part 3 of this study

1.2.2 Main problem and sub-problems

The main problem of the study can be summarised as:

- The absence of generally accepted national classification standards for use in procurement documents in the construction industry such as specifications, bills of quantities, etc with levels of sophistication sufficiently adequate to accommodate contemporary and future trends such as the adoption of new construction techniques, the increase in specialisation in specific work areas, computerisation, etc, as well as the dynamic nature of the industry

In order to assist in the interpretation of, and to extract meaning from the exploratory data collection process and analysis, the main problem was divided into appropriate sub-problems. The division of the main problem into sub-problems should assist in finding the solution of the main research problem when these sub-problems are resolved. The following sub-problems (in question format) were identified:

- Are the standard/model documentation systems currently in use in the RSA effective or is there a need for change?

- Is there a need for a single national building specification system in the RSA and, if so, who should have the responsibility for drawing up, publishing, maintaining and financing such a system?

- What effect would a more detailed arrangement of work sections, created by the introduction of a national classification standard, have on the format of standard documentation in the building industry such as standard or particular specifications, standard methods of measuring building work, etc currently in use in the RSA?

- Would the introduction of a nationally accepted standard for classification facilitate and enhance search mechanisms and systems from the viewpoint of manufacturers and suppliers of building material products and users of building material product information?

- Does the RSA have the capacity to develop and maintain national standards of classification for structuring construction information and product literature similar to trends in other parts of the world?

1.3 DELIMITATIONS TO THE SCOPE OF THE RESEARCH PROJECT

In order to make the research project more manageable, the following delimitations were established:

- The study focuses on and is limited to the investigation of a proposed classification system for the construction industry in the RSA for use in the production of specifications, estimates and bills of quantities and specifically excludes the classification of other concepts such as building types, construction products, etc

- The classification systems in use in only a limited selection of overseas countries were scrutinised for comparative purposes and for providing guidelines for possible incorporation in procurement documents in the construction industry in the RSA. These countries were Sweden, the UK, Australia, Singapore, the Netherlands and the USA

- The research report is limited to recommendations on the format and style of a proposed classification system for the construction industry in the RSA and does not attempt to compile a comprehensive construction-indexing manual suited for immediate practical application. Extensive further inputs by others specialising in specific fields of application will be necessary

- The review regarding the origin of standardised classification systems, with application in the selected countries previously mentioned, is limited to the post Second World War period

1.4 STRUCTURE OF THE STUDY

The structure of the research report is given in Figure 1, which diagrammatically illustrates the setting out of the different parts and chapters of the study

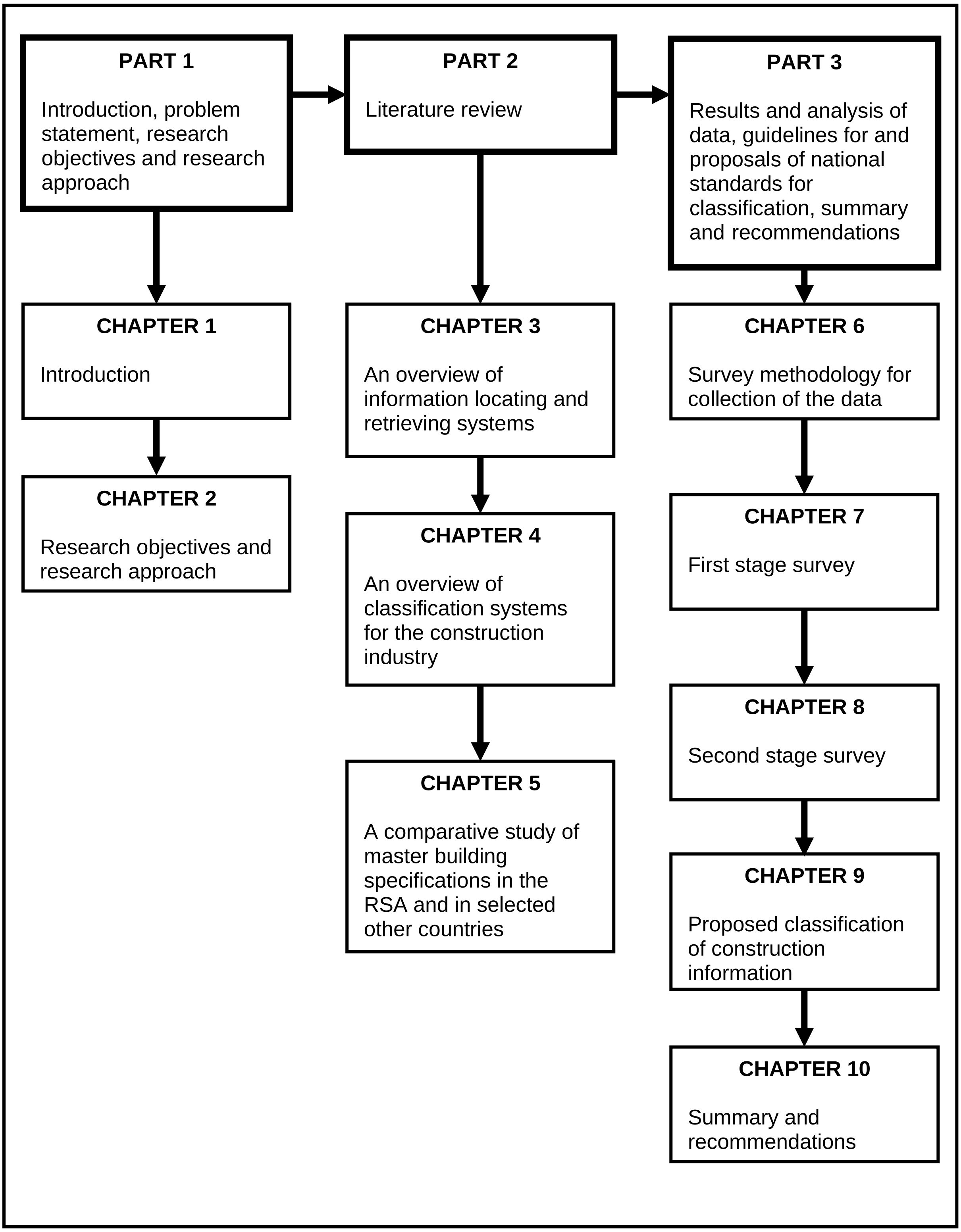


Figure 1: Structure of the study

CHAPTER 1 comprises a description of the study field, the problem statement, the delimitations of the study, and terms/definitions and abbreviations/acronyms used in the study

CHAPTER 2 deals with the research objectives and the research approach followed in the study

CHAPTER 3 gives an overview of the various information locating and retrieving (bibliographic) systems used by libraries etc and the influence information technology has on such systems

CHAPTER 4 gives an overview of the origin and development of classification systems for the construction industry

CHAPTER 5 compares the master specification systems of certain selected countries with those in use in the RSA

CHAPTER 6 describes the survey methodology applied for the collection of the data

CHAPTER 7 presents the data collected during the first stage survey

CHAPTER 8 presents the data collected during the second stage survey and the analysis thereof

CHAPTER 9 contains proposals for the development of national standards for classifying construction information

CHAPTER 10 deals with the final conclusions and recommendations and suggests possible areas for future research

1.5 TERMS AND DEFINITIONS

Bills of Quantities: A document drawn up by a quantity surveyor, usually in a standard format, for purposes of tendering, payment and final account. It comprises a descriptive list of all the items of work required to construct a particular building or buildings and descriptions of the materials, workmanship and other matters, such as the nature of the building site, conditions under which the construction work has to be performed, etc. These items are measured from the drawings issued by the architect or engineer(s) and from information supplied in specifications that have been prepared by the architect, engineer(s) and other specialists appointed on the project

Building Industry: The operational sector that provides buildings to the requirements of a client by making use of built environment professions, main contractors, subcontractors and a variety of allied resources

Civil Engineering Contracting Industry and Infrastructure: The operational sector that provides civil engineering structures (dams, roads, bridges, pipelines, etc) to the requirements of a client by making use of consulting engineers, civil engineering contractors, subcontractors and a variety of allied resources

Classification: A set of concepts arranged systematically according to chosen characteristics or criteria

Construction Industry: The collective name for the building and civil engineering contracting industries

Construction works: The provision of a combination of goods and services arranged for the development, extension, installation, repair, maintenance, renewal, removal, renovation, alteration, dismantling or demolition of a fixed asset including building and engineering infrastructure

Contract documents: Written and graphic documents that form the legal agreement between the contracting parties, consisting of the contract forms, conditions of the contract, specifications, drawings, contract modifications, and may or may not include bills of quantities/schedules of rates or other information schedules such as allowances for specialist work, prime cost amounts and contingencies

Dewey Decimal Classification (DDC): A bibliographic classification system devised by Melvil Dewey and first published anonymously in 1876

Element: The physical part or system of a facility with a characteristic function. Elements are defined without regard to the type of technical solution or the method or form of construction.

Information Source: An object or entity that communicates facts. There are various types of information sources; a few varied examples are books, magazines, newspapers, museum objects, films, computer databases and Internet sites

Library of Congress Classification (LCC): A bibliographic classification system drawn up by Herbert Putnam in 1897

Mapping dictionary: An interface between two different representations such as CAD layers and construction information classifications that allow for translation once the different information standards together with a computer coding system have been developed. Some potential uses of such a developed system would be automatic quantities take-off and life cycle costs computation

Online Publishing: An information source in electronic form that is made available online to the public through networks like the Internet

Reference Source means a source that applies authoritative information. It is intended to be referred to briefly for specific factual information only, and not to be read through at one stretch. To facilitate its ease of use, particular attention is paid to the systematic arrangement of items within it. For example, if it is in book form the contents could be arranged in an alphabetical sequence

Specification: A document containing instructions and/or requirements concerning the execution and quality of work included in the total works; such document may include illustrations to supplement or explain the textual information

There are various types of specifications depending on the nature of the work or the class of the specification, i.e. either open (contractor design), and closed or prescriptive (consultant design). The following definitions are not in alphabetical order, but are grouped together in order of general to more specific for the sake of clearness:

> ***General Specification:*** A standard/model specification which contents are intended to cover workmanship and materials encountered in a significant majority of projects
>
> ***Project Specification*:** A specification of works written for a specific project
>
> ***Particular Specification:*** A specification that is drawn up as a supplement to the General Specification to specify items for a particular contract not covered by the General Specification. The Particular Specification normally has preference over the General Specification
>
> ***Performance Specification:*** A specification that does not describe the object, but specifies the required functionality of the object

Prescriptive Specification: A specification that specifies the structure of the object and the physical properties of it

Descriptive Specification: A specification that is a hybrid of the foregoing developed to make the best use of the varying skills of those involved in the process of delivering modern buildings. The main function of a descriptive specification is to define scope, design intent, procedures for completing detailed design, quality control, and to provide the contractor with a fair indication of the solutions that are acceptable. The contractor is required to use his specialist experience to complete the detailed design (in consultation with the design team)

Standard: A document established by consensus and approved by a recognised body, that provides guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context

Standard documents: Written documents that have been established as models or examples by authority, custom, or general consent

Universal Decimal Classification (UDC): A bibliographic classification that essentially is an elaborate expansion of the Decimal Classification of Melvil Dewey. It was developed by the Institut Internationale de Bibliographie, now known as the International Federation for Documentation (FID), under the direction of Paul Otlet and Henri la Fontaine

Work Section: One or several physical parts of a building viewed as a result of particular skills and techniques applied to particular construction products and/or elements during the production phase. Work sections are usually executed by particular types of (sub)contractors or groups of operatives. The class is influenced by both inputs (e.g. the construction products used) and outputs (the parts of the facility constructed), and thus represents a duel concept

Works: The works are as described in general terms in the agreement, detailed in the contract documents, ordered in contract instructions and which include the contractor's and his subcontractor's temporary works. For risk, indemnity and insurance purposes the works shall further include materials and goods and those supplied free or otherwise by the employer to the contractor

1.6 LIST OF ACRONYMS AND ABBREVIATIONS

AIA	American Institute of Architects
AMA	General materials and workmanship specifications (Sweden)
ASAQS	Association of South African Quantity Surveyors
AEC	Architectural, Engineering and Construction
aecXML	Architectural, Engineering and Construction Extensible Mark-up Language (USA)
ASMM	Australian Method of Measurement
bcXML	Building Construction Extensible Mark-up Language (Europe)
BIFSA	Building Industries Federation South Africa
BS	British Standard
BSAB	Swedish classification system
BSI	British Standards Institution
CAD	Computer aided design
CAWS	Common Arrangement of Work Sections (UK)
CBE	Council for the Built Environment (RSA)
CEN	European Committee for Standardisation (Comité Européen de normalisation)
CROW	Centre for Research and Contract Standardisation in Civil and Traffic Engineering (Netherlands)
CIB	Conseil International du Bâtiment (France)
CIDB	International Council for Building Documentation (France)
CIDB	Construction Industry Development Board (RSA)
CPAP	Contract Price Adjustment Provisions (RSA)
CSI	Construction Specification Institute
CSIR	Council for Scientific and Industrial Research (RSA)
CSRA	Committee of State Road Authorities (RSA)
DDC	Dewey Decimal Classification
DIN	German Standards Institution (Deutsches Institut für Normung, e.V.)
EPIC	Working group for European Product Information Co-operation
EU	European Union
FID	International Federation for Documentation
FM	Facilities Management
GB	Great Britain
IAI	International Alliance for Interoperability
IBCC	International Building Classification Committee

ICIS	International Construction Information Society
IEC	International Electrotechnical Commission
IFC	Industry Foundation Classes
ISO	International Organisation for Standardisation
IT	Information Technology
JBCC	Joint Building Contracts Committee (RSA)
MBA	Master Builders Association (RSA)
NBS	National Building Specification (Great Britain)
NES	National Engineering Specification (Great Britain)
NHBRC	National Home Builders Registration Council (RSA)
OCCS	Overall Construction Classification System (USA)
OIN	Organisation Internationale de Normalisation (France)
PAS	Publicly Available Specification (ISO)
RIBA	Royal Institute of British Architects
RSA	Republic of South Africa
SAACE	South African Association of Consulting Engineers
SABS	South African Bureau of Standards
SAIA	South African Institute of Architects
SAICE	South African Institute for Civil Engineers
SBC	Swedish Building Centre
SMM	Standard Method of Measurement (Great Britain)
SSM	Standard System of Measuring Building Work (RSA)
STABU	National Standard Building Specification (Netherlands)
STANSA	Standards – South Africa
STEP	Standard for Exchange of Product Model Data
TS	Technical Specification
UDC	Universal Decimal Classification
UK	United Kingdom
UN	United Nations
UNISA	University of South Africa
UP	University of Pretoria
USA	United States of America
XML	Extensible Mark-up Language

CHAPTER 2

RESEARCH OBJECTIVES AND RESEARCH APPROACH

2.1 RESEARCH OBJECTIVES

The primary objective of this research study is to improve the effectiveness of producing quality and up-to-date procurement documentation for the construction industry, and to cause the achievement thereof in the shortest possible time. This research study will endeavour to illustrate the point that what is currently on offer in the RSA with regard to the procurement process falls far short of the local construction industry's requirements. Possible actions to be undertaken by the local construction industry to overcome these shortcomings will be investigated, with particular emphasis on establishing national standards for classification and specification systems that are modern, internationally compatible and suitable to accommodate present and future needs

The phases in the construction process covered by such national standards for classification and by specification systems are very much dependent on the related contracting procedures and methods of tendering. In most cases tenders for the execution of the works are invited at the end of the design phase in the RSA, as well as in other countries using similar procurement methods. With this method the emphasis is generally on specifications suitable for incorporation into bills of quantities for larger projects. However, other types of contracts are also commonly used. These include lump sum contracts, design and build, multiple procurement, etc. As a consequence of specifications mainly being used with bills of quantities contracts, measuring systems with the facility to provide specifications for items of work likely to be encountered, have been developed for exclusive use by quantity surveyors. With other types of contractual arrangement and for special applications, such as facilities management, this mode is often inappropriate as quantity surveyors will not always be involved

The possibilities for continued work exist, and it is most likely that one or more working groups will have to spend considerable time and effort in the development of appropriate systems. This can be achieved by an initial discussion of the most important priorities, followed by an investigation into the status of the current systems in use locally and available elsewhere, in conjunction with the status of the information provided by suppliers and manufacturers, and ultimately the publishing of comprehensive classification and specification systems suitable for use by the construction industry in the RSA

Some of the issues that need to be addressed to achieve the abovestated objective of improving the effectiveness of producing quality and up-to-date procurement documentation for the local construction industry are the following:

- Ineffective utilisation of modern information technology
- Insufficiency and unavailability of construction product information
- Lack of proper communication between the various local industry parties
- Incorporation of the latest international information modelling standards
- Inefficient application of marketing resources by building product manufacturers
- Rationalisation of disparate local classification systems
- Lack of quality and reliability of end products

Comprehensive building classification and specification systems can provide professionals and other construction industry players with the appropriate application methods they need to address most, if not all, of the above issues. All these issues affect quality and reliability in one way or another, and therefore also the ultimate goal of improving the effectiveness and image of the industry. This goal can be achieved by making the project procurement process more effective by providing reliable and up-to-date specifications and product information, in conjunction with established sound contractual and measurement procedures that are already in existence in the South African construction industry. These factors combined should positively affect the communication process, which ultimately should assist in improving the quality and reliability of end products and hence the effectiveness and image of the industry

2.2 RESEARCH APPROACH

As illustrated in the preceding chapter, this document is divided into three parts that follow the flow of the research and facilitate continuity in reading. The three parts are:

- Part 1: Introduction, Research Objectives and Research Approach

- Part 2: Literature Review

- Part 3: Results and Analysis of Data, Guidelines for and Proposal of National Standards for Classification, Summary and Recommendations

The three parts are subdivided into chapters addressing related matters (see Figure 1)

The information and data for this research report were obtained by the methods and procedures outlined below

2.3 REVIEW OF RELATED LITERATURE

For the collection of information from secondary sources an extensive review of related literature was carried out, and a selected number of classification and specification systems in use in other countries were reviewed. These countries were the UK, Australia, Sweden, Singapore, the Netherlands and the USA. These countries were specifically selected because of the influence that their systems have had on the development of classification in the construction industry worldwide and/or of the modern, comprehensive and up-to-date systems currently being employed by them. The development in the field of classification was then reviewed in detail and this was achieved by reviewing the latest literature published in conference papers and on the Internet, by attending seminars in the UK and Australia and by making contact, either on a personal level or through correspondence, with some of the leading players in this particular field of the industry

The review process was supplemented throughout by personal observations and experiences of the author, which have spanned a period in excess of three decades and which have occurred at the cutting edge of the industry

2.4 DESCRIPTIVE SURVEYS

Cooper & Emory (1995 : 240) define the collection of data from primary sources as data that *come from the original sources and are collected especially to answer our research question.* The main objectives of the data collection process were, firstly, to test the validity of the statements made and views expressed in the literature reviewed, and secondly, to obtain additional recommendations from respondents, which recommendations would hopefully assist towards the possible solution of the previously identified main and sub-problems. Efforts were therefore focussed on finding solutions to the problems and not to determine the extent thereof

In determining what is the most appropriate approach to adopt (the research design), the critical consideration is the logic that links the data collection and analysis to yield results, and thence conclusions, to the main research question being investigated. The main priority is to ensure that the research maximises the change of realising its objectives. Therefore the research design must take into account the research questions, determine what data are required, and how the data are to be analysed (Fellows & Liu, 2003 : 21)

A two-stage descriptive survey (Leedy, 1997 : 196 – 197; Cooper & Emory, 1995 : 121) was ultimately chosen for the data generation and analysis. The first stage survey process comprised obtaining qualitative data through structured interviews from a pre-selected sample of senior academic and practicing quantity surveyors in the UK. "Open-ended" questions regarding the current trends in compiling procurement documentation and systems for the classification of construction information were set on a non-standardised schedule (Zikmund, 2000 : 310 - 312). Certain tendencies were identified and some of these were used for the second-stage survey. The second stage survey process, which produced mostly quantitative data, comprised the design, pre-test and administration of a structured questionnaire that targeted architectural, quantity surveying and consulting engineering practices in the RSA to obtain their view on the effectiveness of local procurement processes (which included the process of managing information for construction)

2.4.1 Interviews

At the initial stage of the research process (after the preliminary literature review), it was decided that it would be beneficial to investigate the development of classification systems for construction information elsewhere in the world, as very little development on this issue had taken place in the RSA

According to Cooper & Emory (1995 : 269) there are two ways to gather data from primary sources, namely by observing conditions, people, etc, or through questioning or surveying people. They further argue that surveying is much more efficient and economical than observation. This argument was the main consideration when surveying was chosen in this study as the preferred method to collect the data. Survey research typically employs either a face-to-face interview, a telephone interview, or a written questionnaire (Leedy, 1997 : 196)

Time and cost restraints play important roles in the selection of an optimal survey method and for this reason the quickest and most economic method is usually used in surveys. This approach had the result that only one overseas country was selected for the purpose of conducting the first stage of the two-stage survey by means of structured interviews. The interviews were structured in such a way that the specific objectives, which are listed in 6.2.1 hereinafter, could be addressed

The choice fell on the UK as the most suitable country for this exercise because of the general perception that exists among building professionals in the first world that the UK is one of the foremost countries in the field of building construction research and imitable procurement methods

As a result of the abovementioned time and cost restraints the interviews were limited in number and restricted to the profession of quantity surveying only. Experienced quantity surveyors are generally well-informed about the various procurement processes, which, because of the foregoing restriction in the number of interviews that could be held, was the main reason why interviews were held with quantity surveyors only. From this group one interview was arranged with a leading academic who has published extensively on the particular and related problem areas, and five further interviews were conducted with partners/directors of some of the most prominent private quantity surveying consultancy firms in the UK, all of which have offices in other parts of the world (including the RSA)

The format and results of these interviews are presented in Part 3 of the research report

2.4.2 Survey questionnaire

The survey questionnaire, as indicated in Appendix 6, was designed on the basis of historical and current trends in organising construction information identified in the review of related literature and resulting in part from the interviews held in the first stage survey. The questionnaire was designed with courteousness, clarity and simplicity in mind. The questionnaire was furthermore structured for the purpose of addressing the specific research objectives, which are listed in 6.2.2 hereinafter

In the first place a pre-test for consistency and clarity of the draft questionnaire was carried out by a sample of ten respondents. The draft questionnaire was then submitted to the University of Pretoria for scrutiny of its ethical acceptance. Comments were raised on some aspects of the questions and the technical structure of the draft questionnaire. These comments yielded useful feedback which were incorporated in the final version, and subsequently submitted to the Department of Statistics at the University of Pretoria for statistical analysis following the encoding of the questionnaires

2.4.2.1 “Closed” type questions

“Closed” type questions were primarily used in the questionnaire, that is, the evaluation of the current status with regard to construction industry matters such as classification and specification in general, and more specifically, the establishment of whether a need exists for national standards for classification, were listed in such a fashion that the respondents were able to identify, evaluate and indicate their significance. The main advantages in using “closed” type questions are as follows:

- They are easy to respond to and consequently are expected to draw a high response rate
- Terminologies used to describe the issues raised by the various respondents are limited, which facilitates data processing
- The goals of the survey can conveniently be met

The respondents were required to indicate their agreement/disagreement on statements made that dealt with the following main subjects:

- Whether specification drafting for procurement documentation is effectively handled;
- Whether current standard specifications meet the demands of the industry, and, if not, whether the local industry needs a more comprehensive specification system;
- How effectively product information is sourced; and finally
- Whether a need exists for and how national standards for classification systems should be developed

The responses were measured against each statement posed in the first part of the questionnaire (Questions 1 and 2), according to the following scale:

1 = Strongly disagree

2 = Moderately disagree

3 = Undecided

4 = Moderately agree

5 = Strongly agree

The respondents, in the second part of the questionnaire (Questions 3 and 4), were required to indicate their agreement/disagreement on each question posed by answering, in the great majority of cases, either “yes” or “no” respectively

2.4.2.2 “Open-ended” comments

In addition, respondents were also given the opportunity, in an “open-ended” format, to express in their own words their views on the subject in a space allocated after the series of “closed” statements or questions on each subject area. These comments were all taken into account when the results of the survey were analysed

2.4.2.3 Bias

The possibility of bias in response to “closed” type statements or questions is usually high due to the fact that there is no evidence that the respondents have thoroughly considered the statements or questions. The possibility of bias in response to statements or questions was, however, mitigated by following the procedure described below:

- Field representatives of a well-known product library service provider, who offered to distribute the questionnaires to the respondents, were instructed to make personal contact with the person responsible for the particular firm’s classification/specification systems and to explain to him/her the objectives of the questionnaire. This procedure was followed in an attempt to secure the commitment of the respondents and to select the most appropriate, competent and motivated individuals where possible

- The work categories of the firms and the geographical areas in which they operated were carefully selected after consultation with the distributing company. It was ultimately decided to distribute the questionnaires to registered professional practices of architects, quantity surveyors and consulting civil engineers in the RSA only (see 6.2.2 hereinafter), and then only those who subscribed to the distributing company’s product information service (see Chapter 6 for a breakdown of the total number of registered practices and of the total number of practices eventually targeted)

2.4.2.4 Survey population

As stated above, the survey population targeted was restricted to selected architectural, quantity surveying and consulting civil engineering practices subscribing to the product library services of the company responsible for distributing the questionnaires. This excluded a number of registered practices that belong to the professions referred to, but who are not on the distributing company's subscription list

It is common knowledge that the distributing company in question is by far the biggest in the country when it comes to building product information services (see Chapter 8). The distributing company offers a subsidised, and therefore affordable, service to professionals (advertisers pay a fee to the company to have their product literature included in the files) and it can therefore be inferred that most practices would subscribe to the service even if they also use other service providers who charge a higher fee for their services. The decision to contact only the practices on the distributing company's list was therefore justified. The decision was further based on the assumption that because these practices had subscribed to such a product information service in construction, their personnel involved in information management should have appropriate knowledge and experience of the specification process in procurement documentation and should therefore be in a position to understand and meaningfully complete the questionnaire

PART 2

LITERATURE REVIEW

The objective of Part 2 is to execute a literature review process on the research topic from secondary sources such as previous research studies, books, journal articles, conference papers, etc. Information obtained from such sources can be most valuable on a topic such as construction, which, as a general rule, does not change rapidly. It steers the research in the right direction; it serves as a reference base against which certain findings can be tested; and it can be a rich source of hypotheses, which can be tested in the primary data collection phase of the study

In order to make the literature review more comprehensive and meaningful, the information reproduced from secondary sources was supplemented by the researcher's own reasoning and discussions on each of the topics addressed to establish a relation in each instance with the main problem in question

This Part contains three chapters:

Chapter 3: An overview of information locating and retrieving systems

Chapter 4: An overview of classification systems for the construction industry

Chapter 5: A comparative study of master building specifications in the RSA and in selected other countries

CHAPTER 3

AN OVERVIEW OF INFORMATION LOCATING AND RETRIEVING SYSTEMS

3.1 INTRODUCTION

In this chapter an overview is firstly given of some of the general indexing and classification systems that are in use in libraries locally and worldwide. This overview is continued and expanded in Chapter 4 by investigating classification systems that were specifically developed for the construction industry. A brief observation will also be made in this chapter of the modern electronic environment that started when personal computers first appeared in the late 1970's. Finally comments are made on the effect that information technology (IT) is having on classification systems and on the management of information in the construction industry

The research study has, as its ultimate goal, the recommendation of national standards for classification/specification systems for the construction industry in the RSA. However, these systems should not be viewed in isolation. It will be necessary to relate this concept to the aspects of information retrieval in general to obtain the full picture. This research study therefore firstly deals with these general aspects of locating and retrieving information before concentrating, in later chapters, on classification systems that have been developed for specific application in locating and retrieving information for the construction industry

3.2 INDEXING VERSUS CLASSIFICATION

3.2.1 General

Indexing and classification are two parallel concepts in the field of information retrieval. Indexing can briefly be described as a system that uses terms or codes as access points or an index for information retrieval, whilst classification, on the other hand, is the systematic arrangement of bibliographic entries using a numeric or subject system or a combination of both

In this research study the emphasis will be on classification rather than on indexing. The research study, as stated above, endeavours to establish guidelines for a comprehensive classification system for procurement documentation in the South African construction industry. The concept of classification differs fundamentally from an indexing system which is merely used as a tool for searching and locating information on materials, construction methods, pamphlets, articles, etc. For this reason classification is regarded as being more important than indexing and because of its lesser importance in this study, one example only of an indexing system is discussed

3.2.2 Example of an Indexing System

The Department of Architecture at the University of Pretoria developed and introduced an indexing system in the early 1970's to retrieve information, initially from periodicals only. The system has continually been expanded and is currently indexed as follows:

- TOBi: Trefwoordstelsel vir die Ontsluiting van Boukunde-inligting (Keyword System for the Retrieval of Architectural and Building Science related information)
- TOPi: Trefwoordstelsel vir die Ontsluiting van Plan-inligting (Keyword System for the Retrieval of Plan Information)
- TOSi: Trefwoordstelsel vir die Ontsluiting van Skyfie-inligting (Keyword System for the Retrieval of Slide Information)

Indexing, rather than classification, was chosen as the more effective long-term solution to architectural information retrieval. Indexing is suitable for large collections of documents and for documents with a variety of subjects (e.g. periodicals), the content of which is often abstract in nature

The above indexing system, acronymed TOBi, was established mainly through the efforts of Wegelin, a lecturer in the Department of Architecture. It consisted of index cards on which the particulars of an article were typed, which particulars included keywords describing the content of the article, and a homemade punch card system for the coordination of search terms. How the document is then stored is arbitrary and can be by class, author, title or number. Doing a search through the database by means of one or more keywords can retrieve a relevant document. Keywords are selected from a controlled thesaurus of terms in order to limit problems of semantics and syntax

The complete system was subsequently adapted for computer use, and has grown to include TOPi for archive pieces, and TOSi for slides. (All three programmes were recently upgraded to operate in an online environment)

Apart from keywords the programme can also search any other field of information, for example author, title, date (before or after), address and synopsis, which describes the name and type of building, its architectural style, as well as important aspects such as materials used, or qualities such as sustainability

The University's Academic Information Service established access to the TOBi programme during October 2001 and the programme's title was changed to ArchUP TOBI. Access can be obtained through the web link **http://explore.up.ac.za**. (Wegelin, 2001)

3.3 BIBLIOGRAPHIC CLASSIFICATION SYSTEMS

3.3.1 Introduction

Libraries have always used some kind of classification system, whether by keyword or concept, by size, or by subject. Even ancient libraries classified their scrolls and tablets. The underlying principle behind classification was to make materials easily accessible to library users

Today, computers make access relatively easy and a little less reliant on classification, but subject cataloguing still plays an important role in how information is arranged and located in a library. Even if all knowledge could be captured in machine-readable form, some means of classification would still be necessary. Modern computerised periodical databases still rely on subject classification as a means of organising a search for materials. If a searcher relied solely on keywords, narrowing a topic would become very time-consuming

The development of library classification systems is an ongoing process that started centuries ago and today there are various systems in use around the world of which some are "universal" or "general" schemes and others are of a more "specialised" nature

3.3.2 Classification in general

Imagine how difficult and time-consuming the arrangement shown below would make shopping in your local supermarket

		Lamb				Bread				
Wine				Potatoes				Beer		Tea
	Cakes				Beef		Butter		Cabbage	
	Margarine		Spirits				Pies		Coffee	
		Cocoa				Pork		Carrots		
Chicken			Beans				Cheese		Liqueurs	

Classification would make things much easier!

Lamb	Bread	Wine	Potatoes	Tea	Butter
Beef	Cakes	Beer	Carrots	Coffee	Margarine
Pork	Pies	Spirits	Beans	Cocoa	Cheese
Chicken		Liqueurs	Cabbage		

Classification is therefore the systematic arrangement of bibliographic entries in catalogues, bibliographies and indexes to facilitate the formal, orderly access to subject catalogue and/or shelves of libraries according to subject. (see also the definition of classification in Chapter 1). The process of classification can thus be divided into the following actions:

- Attempt to organise the whole field of human knowledge
- Grouping together of concepts or ideas by some common characteristic
- Separation of like concepts or ideas from unlike ones

3.3.3 Principles of classification

The Department of Information Technology, University of Pretoria, summarised the principles of classification in their concise notes issued to students as follows:

- *Field of knowledge is arranged into broad classes*
- *Each class is divided into subclasses by applying a single principle of division at a time*
- *Each subclass is subdivided into further subdivisions, applying a single principle of division at each step*
- *Each broad subject field eventually subdivided until the most specific identity for each subject has been found*
- *Each class and subclass is assigned a symbol (notation) representing that specific class*

To find a specific book, for instance, from the hundreds of thousands of books that are stored in libraries, one would need to use a library catalogue. This may be available in printed form (for example on a card index), on microfiche or on a computerised database. Books are grouped together on the shelves according to the subject they cover. Each subject is given a different shelf number that is its classification number. Most public and many academic libraries in the RSA use the *Dewey Classification System,* but the above principles of classification have led to the compilation of various classification schemes (systems) for use in libraries all over the world, the most important of which are briefly discussed below

3.3.4 Major classification schemes

Feather & Sturges (1977) identified four major classification schemes that are considered important by libraries over the world:

a) <u>Dewey Decimal Classification (DDC)</u>

- Example of an enumerative scheme
- Generally used worldwide and also used in South African libraries, especially with general collections

b) Universal Decimal Classification (UDC)

- Example of synthetic scheme
- Used in specialised libraries

c) Library of Congress Classification (LCC)

- Example of enumerative scheme
- Mainly used in the USA, hardly ever used in the RSA

d) Colon Classification (CC)

- Example of an analytico-synthetic scheme
- Particularly popular in India

These main bibliographic classification schemes - the DDC, the UDC, the LCC, (and to a lesser extent the CC) – are now established tools for ordering physical documents from general library collections. In addition, special schemes such as the Bliss Bibliographic Classification Scheme, the National Library of Medicine Classification, the Moys Classification scheme (Law), the CI/SfB scheme (Architecture and Building) and the London Classification of Business Studies scheme are also firmly established tools for practical classification of documents within specific subject disciplines

A brief overview of the structure of each of the main bibliographies is provided below (see Chapter 4 for discussion on the CI/SfB scheme)

3.3.5 Dewey Decimal Classification (DDC)

DDC is a general knowledge organisation tool that is revised on a continuous basis to keep pace with the variable knowledge level. Melvil Dewey, who published the first version thereof in 1876, conceived the DDC. It is currently the most widely used library classification in the world. It is used in more than 135 countries and has been translated into more than 30 languages. In the USA, 95% of all public and school libraries, 25% of all college and university libraries and 20% of

special libraries use the DDC. In addition, DDC is used for other purposes, e.g. as a browsing mechanism for resources on the World Wide Web
(Internet: **http://www.oclc.org/fp/about_the_ddc.htm**. Access: 9/27/00)

DDC is divided into ten main classes, which together cover the entire world of knowledge. They are:

000 Generalities (Computers, information & general knowledge)
100 Philosophy & psychology
200 Religion
300 Social sciences
400 Language
500 Natural sciences & mathematics
600 Technology (Applied sciences)
700 Arts & recreation
800 Literature
900 Geography & history

Each main class is further divided into ten divisions, and each division into ten sections (not all the numbers for the divisions and sections have been used)

The first summary contains the ten main classes and is represented by its first digit. For example, 500 represents natural sciences & mathematics. The second summary contains the hundred divisions and the second digit indicates the division. For example, 500 is used for general works on the sciences, 510 for mathematics, 520 for astronomy, etc. The third summary contains the thousand sections and the third digit indicates the section. Thus, 530 is used for general works on physics, 531 for classical mechanics, 532 for fluid mechanics, etc

Arabic numerals are used to represent each class in the DDC. A decimal point follows the third digit in a class number, after which division by ten continues to the specific degree of classification needed. The hierarchy of the system is expressed through structure and notation. Structural hierarchy means that all topics (aside from the ten main classes) are part of the broader topics above them. Any note regarding the nature of a class holds true for all its subordinate classes, including logically subordinate topics classed at coordinate numbers. Notational hierarchy is expressed by length of notation. Numbers at any given level are usually subordinate to a class whose notation is one digit shorter; coordinate with a class whose notation has the same number of significant digits; and superordinate to a class with numbers one or more digits longer. The underlined digits in the following example demonstrate this notational hierarchy:

600	Technology (Applied sciences)	
630	Agriculture and related technologies	
636	Animal husbandry	
636.7	Dogs	
636.8	Cats	

"Dogs" and "Cats" are more specific than (are subordinate to) "Animal husbandry"; they are equally specific as (are coordinate with) each other; and "Animal husbandry" is less specific than (is super- ordinate to) "Dogs" and "Cats"

3.3.6 Universal Decimal Classification (UDC)

UDC is an indexing and retrieval language in the form of a classification for the whole of recorded knowledge, in which subjects are symbolised by a code based on Arabic numerals. It was designed by the Belgian bibliographers Paul Otlet and Henry Lafontaine at the end of the 19th century, and has been improved and developed ever since

The media that embody knowledge may be in any form; they will often be literature (i.e. written documents), but may equally well be in any other medium: films, video and sound recordings, illustrations, maps, and objects such as museum pieces are all suitable for classification by UDC

To start with, there was only one version of UDC, which would now be called a "full edition", but there are now editions of various lengths. An idea of the growth of UDC is given by the number of entries that can be found in successive full editions published since its inception. The first edition (1905 – 1907) had about 33,000 entries, the second edition (1927 – 1933) over 70,000 entries, and the third (1934 – 1948) approximately double that to about 140,000 entries. Nowadays there are more than 220,000 direct subdivisions

UDC's most innovative and influential feature is its ability to express not just simple subjects but also relations between subjects. This facility is added to a hierarchic structure, in which knowledge is divided into ten classes, each class is subdivided into its logical parts, each subdivision is further subdivided, and so on. The more detailed the subdivision, the longer the number that represents it. This is made possible by the decimal notation (see below)

The symbols chosen for UDC notation are non-language-dependent, therefore universally recognisable. The Arabic numerals, supplemented by a few other signs familiar from mathematics and ordinary punctuation, are not only easily readable, but also easily transcribable using ordinary office machinery such as typewriters and computer keyboards

The arrangement is based on the decimal system, i.e. every number is a decimal fraction with the initial point omitted, and this determines the filing order; however, for ease of reading, it is usually punctuated every third digit. Thus, after 61 "Medical sciences" come the subdivisions 611 to 619; under 611 "Anatomy" come its subdivisions 611.1 to 611.9; under 611.1 come all of its subdivisions before 611.2 occurs, and so on; after 619 comes 62. An advantage of this system is that it is infinitely extensible, and when new subdivisions are introduced, they need not disturb the existing allocation of numbers

There are two categories of tables in UDC, namely:

a) The main tables outlining the various disciplines of knowledge, arranged in ten classes and hierarchically divided and numbered 0 to 9

b) Auxiliary tables, including certain auxiliary signs. The signs (e.g. the plus, the stroke, the colon, etc) are used to link two (or more) numbers, thereby expressing relations of various kinds between two (or more) subjects

The examples below are given to illustrate the auxiliary and main tables in their official filing order

• +(plus)	Addition, e.g. 59+636	Zoology and animal breeding
• /(stroke)	Extension, e.g. 592/599 (everything from 592 to 599 inclusive)	Systematic zoology
• :(colon)	Relation, e.g. 17:7	Relation of ethics to art

UDC works extremely well with computers, as it did with earlier automatic sorting devices. Scrolling through an on-screen display in classified order makes for productive browsing, and UDC's distinctive symbols make it possible to perform searches for any part of a compound number or for specified combinations of symbols, so providing highly accurate subject retrieval

UDC is managed and maintained by the International Federation for Information and Documentation (FID) that joined with several UDC publishers to form the UDC Consortium (UDCC). The UDCC maintains the quality of the scheme by reviewing its content and initiating revisions and extensions on a regular basis (Internet: **http://www.niss.ac.uk/resource-description/udcbrief.html**. Access: 9/27/00)

3.3.7 Library of Congress Classification System (LCC)

LCC is an American system and is used extensively in the USA, Canada and Australia. It has no multilingual capability, i.e. there is no well-known translation of the LCC schedules. The notation itself is not language dependent since it is an enumerative system, using letters (Latin) and numbers (Arabic) that are used in a considerable part of the world. Some classification numbers have captions in multiple languages, but these are primarily in the law schedules

LCC is one of the world's most widely used classification schemes. This is largely due to the fact that every exported record from the Library of Congress contains its own classification of the item. Apart from being dominant, it is quite old. In 1899 the Librarian of Congress Dr. Herbert Putnam and his Chief Cataloguer Charles Martel decided to start a new classification system for the collections of the Library of Congress (established 1800). Basic features were taken from Charles Ammi Cutter's Expansive Classification. LCC is an enumerative system built on 21 major classes, each class being given an arbitrary capital letter between A and Z, with 5 exceptions: I, O, W, X, Y (these appear at the second or third level in the notation for various subclasses). After this was decided, Putnam delegated the further development of different parts of the system to subject specialists, cataloguers and classifiers. Initially and intentionally the system was, and has remained, decentralised and the different classes and subclasses were published for the first time between 1899 and 1940. This has lead to the fact that schedules often differ appreciably in number and the kinds of revisions accomplished

LCC notations are composed of repeated letters and numbers. Capital letters are, as mentioned above, used for main and subclass notations. For subdivisions further down the hierarchies LCC uses Arabic numerals (e.g. Urban Transport = HE 305-311). There is no official comprehensive index to the LCC; the scheme is very extensive and contained in about 46 volumes published by the Library of Congress

LCC is the least international of the major general classification schemes. In its coverage it predominantly reflects a national collection; there is a distinct bias towards the social structure, history, law and cultural concerns of the United States. The notation is complex and not truly comprehensible internationally. In particular, the use of Cutter numbers, which has a linguistic dimension, is not likely to be consistently applied internationally (Internet: http://www.uk.oln.ac.uk/mediadata/desire/classification/class_4.htm. Access 9/28/00)

3.3.8 Bliss Bibliographic Classification (BC)

Because the BC is mainly used in the USA and not regarded as one of the major classification systems in other parts of the world, only a brief discussion on its development and characteristics is given

The BC was originally devised by Henry Evelyn Bliss and was first published in four volumes in the USA between 1940 and 1953. Bliss stated that one of the purposes of the Classification was to *demonstrate that a coherent and comprehensive system, based on the logical principles of classification and consistent with the systems of science and education, may be available to services in libraries, to aid revision ... of long established ... classifications* and to provide an *adaptable, efficient and economical classification, notation and index.* A fundamental principle is the idea of subordination - each specific subject is subordinated to the appropriate general one. This version of the classification is now known as BC1.

BC1 was first applied in broad outline at the College of the City of New York (where Bliss was librarian) in 1902. The full scheme followed the publication of two massive theoretical works on the organisation of knowledge. Its main feature was the carefully designed main class order, reflecting the Comptean principle of gradation in speciality. Work on a radical revision of BC1, incorporating the great advances in logical facet analysis initiated by Ranganathan (see Colon Classification described in 3.3.9 hereinafter) and developed by the Classification Research Group in Britain, began in the early 1970's.

On the formation of the Bliss Classification Association (BCA) in 1967, it was suggested that a new and completely revised edition of the full BC should be made available. However, the revision has been so radical that it is more accurately described as a completely new system, using only the broad outline developed by Bliss. Further revisions have been made to some of the BC2 volumes in order to retain subject currency and updates continue to be published in the BCA Bulletin (Internet. http://www.sid.cam.ac.uk/bca/bchist.htm. Access 07/04/2002)

3.3.9 Colon Classification (CC)

The CC is regarded by some librarians (e.g. Feather and Sturges, 1977) as one of the four major bibliographical classification schemes used by libraries worldwide. However, only a very brief summary of the scheme will be provided because of the scheme's limited application in South African libraries

Feather and Sturges describe the CC as a classification scheme designed by Ranganathan, who based the scheme on the classification of any subject by its uses and relations, which are identified by numbers divided by a colon. It was the first example of an analytico-synthetic classification, in which the subject field is first analysed into facets, and class numbers are then constructed by synthesis. Ready-made class numbers are not provided for most topics but are constructed by combining the classes of the various unit schedules out of which the scheme consists. It has proved particularly popular in India where it originated, and has inspired classification researchers in many other parts of the world (Internet: http://www.alexia.lis.uiuc.edu/fall1998/lis380/week07/cls_scheme.html. Access 4/4/2002)

3.4 GREY LITERATURE

3.4.1 The concept of grey literature

Books are only one of the many sources of information and usually this is somewhat general in nature. More specialised, specific and up-to-date information may be found in journals, articles, etc that is not conventionally stored in libraries. Such information is commonly referred to as *grey literature.* Behrens (2001 : 374) observes that the concept of grey literature is used to describe a wide range of information sources that are not available through the normal bookselling channels. In other words, the information sources are non-trade material. Grey literature does not refer to the colour of the information sources, but is used rather in the sense of something that is indeterminate and difficult to categorise. Grey literature encompasses certain categories of information sources that, for practical reasons, are considered to be non-conventional when compared with other information sources

3.4.2 Non-trade material

Many information sources that are disseminated today do not become available via the commercial publishing trade. They may become available through any number of channels apart from publishing houses; for example private organisations in commerce, in industry and associations for professions or trades. Sources such as reports, conference proceedings, standards, trade literature, house journals, etc may usually be regarded as grey literature

Since these sources do not normally pass through the usual process of publication and distribution via the commercial publishing trade, their bibliographic control is usually adversely affected. The sources are seldom submitted for legal deposit, and they generally do not appear in major bibliographies such as national bibliographies. The result is that they are often difficult to identify and locate. In addition, many such sources are printed in limited quantities and distributed randomly or haphazardly by the issuing bodies

Furthermore, the forms in which these information sources appear may be anything from a photocopied and stapled document to a high quality bound volume. Grey literature often provides information in a form that is not available elsewhere, for the information may be so new that it has not yet been incorporated in more conventional sources, or may be so specialised that it is not commercially available to publish it in the conventional manner

These are some of the reasons why the Internet is increasingly being used for the publishing of grey material. Later in this chapter the use of the Internet as a search tool for information, and in particular grey literature, shall be considered in more detail

3.4.3 Problematic bibliographical control

According to Behrens (2001 : 375) the major problem associated with most categories of grey literature is its bibliographic control. The vast number of organisations which issue grey literature, the lack of promotion and publicity of these resources, their abundance, their arbitrary or specialised distribution, small print runs, differing forms and types, and the fact that it is not usually the subject of legal deposit regulations are all factors that make bibliographic control difficult. The awareness of this bibliographic control problem has resulted in concerted efforts by libraries and national and international organisations to establish and improve bibliographic control methods and tools for grey literature

One of the categories of grey literature that will be concentrated on is that of trade literature. Trade literature encompasses many types, most of which are advertising pamphlets, catalogues, booklets and brochures that companies issue to make their products and services known to their potential buyers. Trade literature is usually distributed by the company by mailing or physically delivering the sources to potential customers, inserting the literature in periodicals or newspapers, making the literature available at retail stores, trade exhibitions and conferences, providing the information through information service providers by paying them a fee for such a service, or placing the information on the Internet

Trade literature is an important source of information in technical fields, such as the construction industry, where there is strong competition for the marketing of technical products. It is also important for people operating in these fields, such as architects, engineers, quantity surveyors, etc, to be aware of which products are available for selection and specification needs. Companies in the South African construction industry, especially those in the wholesale trade business, annually spend a considerable amount of money on distributing trade literature as part of their marketing strategy. Details of this statement are provided in 3.4.4 below

3.4.4 Wholesale trade sales of construction materials in the RSA

The South African construction industry consists mainly of three sectors; the residential or housing market, non-residential investment, and the civil engineering industry. It is general knowledge in the construction industry that each of these sectors contributes roughly a third to the total investment in construction in the RSA per annum. Although these three sectors all form part of the construction industry, they are inherently driven by different factors required to stimulate investment. Nonetheless, materials for construction are used throughout the industry, including the informal market that mostly purchases materials via the local retailer or merchant

Industry Insight, a construction management information service provider for the construction industry, reported in their 2nd Quarterly Report (May 2002) that official figures released by the South African Reserve Bank indicated that investment generated in the construction industry during 2001 was roughly R50 billion (see Table 1) and that the informal or unrecorded market, not shown in the officially published figures, amounted to a further estimated R10 billion. Thus total investment was estimated at roughly R60 billion per annum for 2001. It is generally accepted that construction materials contribute between 40% and 50% of the total investment in building work; the balance being the cost of labour. This supposition is confirmed by figures released by Industry Insight in their newsletter released in June 2002 following the abovementioned Report in which it was reported that the figure for wholesale trade sales amounted to R 29,1 billion in 2001

	1999	**2000**	**2001**
R' millions			
Total buildings	23 563	23 579	24 845
Residential	10 278	11 054	12 440
Non-Residential	13 285	12 525	12 405
TOTALS	**47 126**	**47 158**	**49 690**

Table 1: Investment in buildings, R millions 1999 prices (Source: Industry Insight, 2001)

Van Aardt (2002) of the Bureau of Market Research, UNISA, maintains that there are no detailed statistics available in the RSA to accurately determine what companies in the construction industry would spend per annum on marketing. However, based on his experience on marketing strategies he estimates that companies manufacturing building products or systems for the South African construction industry would spend somewhere between 2% and 3% of the annual wholesale trade in construction materials on the publishing, marketing and distribution of their technical products or systems. Thus for 2001 it can be deduced that this expenditure would have amounted to between R 600 and R 900 million

3.5 INFORMATION TECHNOLOGY IN THE CONSTRUCTION INDUSTRY

3.5.1 Introduction

Since the late 1940's (see Chapter 4) there has been a fascination with the intellectual problem of how to organise construction information for subsequent retrieval and re-use in projects. The solution was found in the development of classification systems, standard specification systems, product information systems and cost information systems. In Chapter 4 it is more fully described that the first formal construction classification system, which was called *Samarbetskommittén for Byggnadsfrägor* (from which came the iabbreviation SfB), was introduced just more than fifty years ago in Sweden. This system found widespread use in Sweden for the organisation of information in architects' and other professionals' offices. Over the next twenty years SfB and similar developments became the model for building industry classification, specification, product information and cost information systems throughout Europe, the USA and some other parts of the world

Much more recently, mainly only in the last five years, desktop computing, office networking and global communications via the Internet have started to provide the kind of all-pervasive IT that is needed to make a really big leap forward in construction documentation practices. However, this research report will indicate hereinafter that in many respects these developments still exist in theory only and that much further progress will have to be made before the construction industry will enjoy the benefits they might eventually bring

3.5.2 Problems associated with the Internet

The introduction to electronic sources on the Internet referred to above makes one aware of the potential of the Internet as a source of information. In a research project of this nature it is impossible to cover all the features of the Internet and far more can be found about its possibilities by reading further the by now considerable number of publications available on this contemporary topic. The literature review on the Internet as a source of information has shown that the authors, in most of the publications consulted, are still of the opinion that the Internet, at this point in time, will not displace libraries or diminish the value of the reference collections in libraries. However, the Internet will provide the user with many more options in an information search, for the information is probably available there; all that is needed is to find it and evaluate whether it is suitable. This simple statement hides myriad implications and problems, and Behrens (2001 : 45) has identified the following ten such problems:

- *The Internet is not a logically organised collection (like a library), which is why it is often called an online anarchy. It was never designed to be the enormous information storage and retrieval system that it has become. There is no single standard way of making information available on the network and there is no single standard way of searching for it. You may have to search in one place using a particular set of keywords and then use a completely different approach when searching in another place. This can be very frustrating and time-consuming*

- *Even if you are a capable searcher who knows how to narrow down a search, you are likely to retrieve far too many sources for your needs, many of them containing similar information*

- *The third problem flows from this, namely that there is far too much garbage made available and this will be retrieved together with the worthwhile information*

- *The next problem is an overflow of the third: you need to be sceptical about your search results, as you cannot rely on the information you find. You need to check that it is authoritative, correct and up to date before you can regard it as useful*

- *Resources on the Internet are not stable. They are ephemeral in that their contents can be changed with ease and they can be removed completely or moved to another site by whoever made them available*

- *The Internet does not provide comprehensive coverage, especially for older information or documents*

- *Access to the Internet can be painfully slow when the traffic is heavy and you could also be cut off through technical breakdowns on the side of the computer or network system, electricity power failures or problems with ICT links*

- *The Internet is an increasingly commercial environment (most of the traffic is of a commercial nature) and it has become the new playground for advertisers*

- *Finally, you may need to pay for authoritative information. Whereas some (or even most) of your needs can be satisfied through the resources which can be accessed free, serious research usually involves using commercial databases like indexing and abstract services, most of which require subscriptions*

These problems with information sourcing on the Internet are confirmed by Mouton's (2001 : 35) discussion on using the Internet as a research tool. He remarks that the Internet has made a huge impact on the information that it makes available, but that it is not without its problems, as is evident from the following assertion by the author: *One of the negative effects is that, ironically, it is to some extent more difficult to search for information and retrieve all the sources on a particular topic because information on the Internet is <u>much less structured and codified than in a traditional library.</u>* (My emphasis) *Even the most comprehensive search engines work more on a trial-and-error basis than on systematic and well-designed thesauri and catalogues*

In a recent survey conducted by Murray, et al (2001) on the use of software by South African construction industry professionals it was found that proprietary software is widely used, but that there is a lack of knowledge of technological advancement in the use of web-sites and multi-disciplinary web-sites. It was also found that there is not much interest in the subject and rather a lack of understanding of how it works in practice

Internationally the above position is not much different, as Amor (2001) pointed out in a paper delivered to the CIB-W78 conference regarding IT in construction held recently in the RSA. He said that although the Internet has been identified as a major form of dissemination for the majority of research and publishing organisations in the construction industry, there is no unifying system to tie these sites together and offer their resources to the industry. He further revealed that the use of global Internet search engines provide little help, with extraneous and low quality information being returned along with important information, and that a recent analysis showed that the best search engine only covers 16% of the Internet's estimated 800 million publicly indexable web pages

This view is shared by Woestenenk (2002c) when he argues that *in construction information technology (IT) research and development little attention seems to have been given to how an industry in which the adoption of IT has been very slow is going to migrate to a product modelling approach to construction documentation. There has been little cooperation to date between the main streams developing new technologies*

Improving the application of IT in construction is therefore a major international research endeavour in scientific establishments and industry. In this regard the CIB's Working Commission 78 (see 4.2.2 hereinafter) has been very active for almost 20 years in holding annual meetings of leading scholars in the field. The objectives of the commission are according to Amor, et al (2001) the following:

- *To foster, encourage and promote research and development in the application of integrated IT throughout the life cycle of the design, construction and occupancy of buildings and related facilities;*

- *To proactively encourage the usage of IT in construction through the demonstration of capabilities developed in collaborative research projects; and*

- *To organise international co-operation in such activities and to promote the communication of these activities and results*

A brief look at the next generation IT and how it may have an impact on the management of construction information follows below

3.5.3 Preparing for the Next Generation Internet (NGI)

3.5.3.1 Introduction

Although certain problems associated with the use of the Internet were highlighted above, it is common knowledge that information technologies and communication are bringing about an industrial revolution based on information, on the scale of that which rocked the 19th century and which was unthinkable less than two decades ago. The development of these new means of communication represents an element of increased competitiveness for enterprises and opens up new perspectives in terms of both work organisation and job creation. The diffusion of these new technologies at all levels of economic and social life is thus gradually transforming our society into an "information society"

Governments in first world countries, especially those of the G7, have recognised the influence that this new technology will have on society. For instance, the European Commission set up the Information Society Project Office (ISPO) in 1994 as part of the Commission's action plan on Europe's way to the information society. It constitutes a general framework within which actions in the different fields relating to the information society will be structured and mutually consolidated. The plan is based on four main lines of action:

- Adaptation of the statutory and legal framework, the central element of which is liberalisation of infrastructure. Important measures will also be proposed relating to: definition of the universal service and its financing, interconnection and interoperability, intellectual property rights, electronic and legal protection, media control and the international dimension

- Encouragement of initiatives in the field of Trans-European networks, services, applications and content. The Commission intends to act as a catalyst for initiatives from the private sector, the member states, regions and cities, particularly through the ISPO whose role will be to encourage and facilitate the setting up of partnerships for launching applications

- Social and cultural aspects. A group of experts will be charged with assessing the impact of the information society in private, professional and public life for the purpose of advising the Commission on what measures to implement

- Promotion of the information society. Promotional actions will be planned, aimed at both the general public and target groups with the aim of explaining the stakes of the information society, its opportunities and risks

Following the remit of G7 leaders at their Naples Summit in 1994, Ministers from G7 countries and Members of the European Commission met in Brussels in February 1995. In their conclusions eight core principles were endorsed for promoting the new computer, telecommunications and media networks. The G7 identified 11 international projects whose aim it is to demonstrate the potential of the Information Society and stimulate development

One of the projects that originated from the above is eConstruct, Project No. IST-1999-10303. It falls under the European DG13 5th Framework IST Programme, and has as its goal the development of: *eCommerce & Business in the European Building and Construction Industry: Preparing for the Next Generation Internet (NGI)*. The project has various partners such as construction companies (end-users), academic institutions (research and development) and software vendors. Another notable partner is the International Alliance for Interoperability (IAI), an international organisation with several Chapters around the world, and which actively promotes interoperability in the architectural, engineering and construction, and facilities management (AEC/FM) industries (Woestenenk, 2002c)

eConstuct and its partners have already done a large amount of research and development and have made great strides in developing some of the aspects that the industry needs. Some of the needs identified are:

- Open communication for catalogue information
- Agreement needed on these catalogue "Objects" and their "Properties"
- The requirement of a "flexible" structure – that also supports catalogue specific information
- To be able to find things and compare them
- Inexpensive and easy to use

At the closing ceremony of a seminar and workshop held in Sidney, Australia, in October 2001 which was organised by the Australian Chapter of the IAI and attended by delegates from across the globe, it was agreed that although much work has been done to resolve some of the abovementioned needs, workable outcomes and full implementation will only be achieved in the next generation

Due to space and the previously stated study limitations, it is not feasible in this research report to fully describe and illustrate the work that has already been done in the field of electronic product data transfer and particularly the development thereof by eConstruct and its partners. Further reviewing is limited to a brief overview of the meaning and development status of some of the important terms relating to the electronic development in the transfer of product data that is followed by a diagrammatic illustration in Figure 2 (see 3.5.3.5 hereinafter) portraying how the technology is eventually to be implemented

3.5.3.2 Current developments

Woestenenk, director of STABU in the Netherlands and one of the foremost leaders in the development of object-oriented approaches for the management of construction information, discussed some of the developments currently being undertaken during a pre-arranged meeting with the author at STABU's headquarters in Ede (October 2002a). He revealed that a recent initiative by ISO/TC59/SC13 may bring about the cooperation between the main streams developing new technologies referred to in 3.5.3.1 above. It has initiated an object-oriented approach as an alternative to traditional, view-related classification. From this approach the LexiCon has been developed by the Dutch *Bouw Afsprakenstelsel* (BAS) organisation, which felt the need for an integrated, interoperable information platform

The LexiCon identifies physical objects and spaces as classes of interest for the construction industry, with a scope reaching from the largest construction works (e.g. an airport) to the smallest articles delivered by manufacturers (e.g. nails or sand). Each class is defined by a set of attributes and each attribute is a class as well. The LexiCon approach solves the problem of synonyms, homonyms and translations between languages. The LexiCon is implemented in a database and the application provides an object-oriented interface to the underlying database. This interface supports both specialisation hierarchies as well as composition hierarchies

The LexiCon will initially be populated with objects selected from existing sources, like classifications and product catalogues in at least two languages, English and Dutch, with the possibility of adding other languages

The LexiCon is based on ISO STEP and IFC's (see 3.5.3.3 below), and intends to be populated and maintained by the users on a worldwide scale, combined with local and individual extensions

3.5.3.3 Standard for Exchange of Product Model Data (STEP) and Industry Foundation Classes (IFC)

At the international level there are a few relevant organisations (see Chapter 4) doing research and development in construction IT. There is ISO in which TC10/SC8 (construction documentation), TC59/SC13 (construction information) and TC184/SC4 (STEP) should be mentioned. There is CIB in which W78 is concerned with Information Technology for Construction and there is EDI that focuses on protocols for electronic commercial messages

The core STEP technology is multi-sector and is represented by the many parts of ISO 13030. As part of the ISO STEP suite of standards, the process industry developed a very generic information model, which was published as AP221. A model based on AP221 has been developed by the oil and gas industry, resulting in ISO 15926. For purposes of direct implementation these models are far too generic, so for implementation the instrument of a so-called Object Library was chosen. The library describes physical objects, which are of interest for the industry, using the principles outlined in the generic model

The construction industry, however, moved in a different direction, leading to the development of ISO 13030 parts such as AP225 (Building elements using explicit shape) and AP230 (Building structural frame: steelwork). In addition, a need was felt for a Kernel Model[1]. Part 106 was proposed for this, but this project has been moved to the IFC's developed by the IAI

Ingirige, et al (2001) submit that the development of product models such as IFC in construction has been influenced to a great extent by the successful adoption of STEP in many other industries. Work on STEP started in 1984 and is concerned with the transfer of product data mainly in manufacturing and retail industries. Although STEP considered the construction industry under its team 12 organisation, developments in object modelling in the construction industry were spearheaded by the IAI. IAI specifies how physical objects such as doors, windows, walls, etc, and abstract concepts such as spaces, organisation, etc, in a construction facility should be represented electronically through its development of IFC. IFC represent a data structure, which facilitates sharing data across applications giving each professional in the construction industry the opportunity to define their own view about the objects. Software is being developed (by eConstruct and its partners) based on the universal IFC specifications to create specific applications in the construction industry

Ingirige, et al (2001) further describe three possible ways to share data, namely:

- *Exchanging of files by e-mail or physical medium. (files attached to e-mails or on diskettes)*
- *Using of shared databases*

[1] Karl J Lieberherr & Cun Xiao. 1991. *The Demeter Kernel Model for Object-Orientated and Language Design.* Technical Report NU-CCS-90-11 (revised), Northeastern University, Boston, USA

- *Using of software interfaces*

Presently most software applications share information using physical files. Data could also be transferred and shared using a database. The main thrust of IFC development is however in the area of software interface development for information sharing and exchange as illustrated in Figure 2 hereinafter

3.5.3.4 Extensible Mark-up Language (XML) and Web Standards

XML integrates data from different sources that are dispersed and exist in a variety of formats. XML maintains the intelligence of the data all the way through a processing chain. Therefore data can be retrieved from several sources, combined and customised and sent to another level for processing. According to Ingirige, et al (2001) the difference between IFC and XML is mainly between the volume of information handled. The former is about sharing project information in large volumes whereas the latter concerns transactions in smaller volumes. Several research groups have been involved in the development of XML, but in terms of regions there are two main groups who are currently actively involved in the development process, one in the USA and one in Europe. The group in the USA is known as aecXML and the group in Europe is known as bcXML (under the eConstruct project). Both aecXML and bcXML have thus become web standards. In both cases, it is recognised that there is diversity in national and local regulations which gives rise to conflicts in information flows in different regions

The current Internet language HTML only supports free form data exchange. Under the eConstruct project it is proposed to develop the Internet so that XML based structured information could be exchanged between architects, engineers, quantity surveyors, suppliers, contractors and subcontractors. Therefore the web standard developed (bcXML) could facilitate information exchanges within the European construction industry using the Internet as a common platform for user access, but as stated hereinbefore, this process would probably only become fully operative in the next generation

3.5.3.5 Summary

The electronic transfer of data through IFC's and bcXML browser exchange can best be summarised by a graphical presentation. Figure 2 illustrates how professionals and other users in the construction industry might make use of the Internet for managing all relevant product information in the next generation

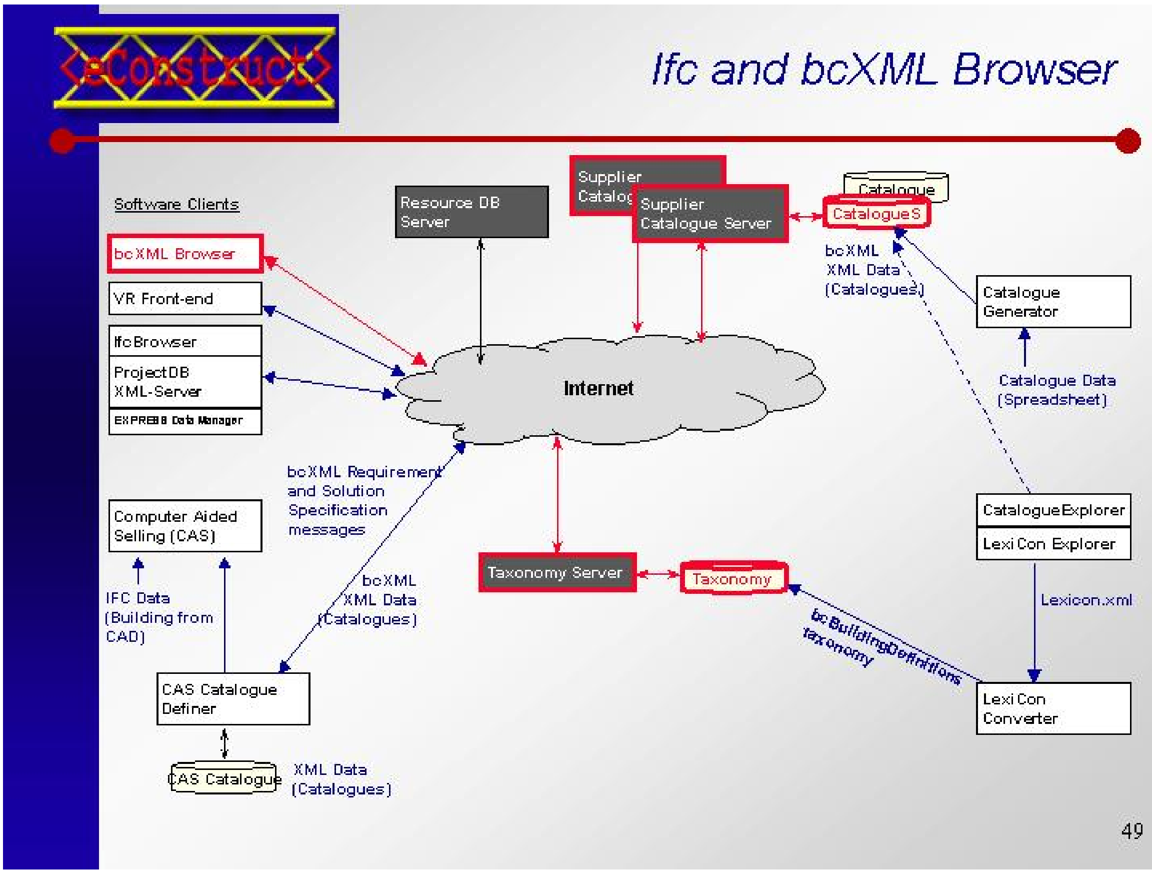


Figure 2: Diagrammatic portrayal of electronic transfer of data through IFC and bcXML browser exchange (Source: Woestenenk, 2002c)

3.6 CONCLUSION

With digital electronic data, number codes such as MasterFormat's five digit numbers and SfB's rigid classification system (see Chapter 4), may not be essential. Certain aspects, however, which are the classifications, hierarchies within subclasses, and consistent definitions, will continue to be of importance. Such standardisation will remain a useful and critical tool for those developing the software and also for those applying the software. When objects are defined for object-orientated technology, it is important that the objects always reside within the same class and subclasses and that they mean the same thing to all participants. An overall classification table and thesaurus that is a consensus standard will be an important reference in the development of advanced information technology for the construction industry

The most elementary understanding of the development of computer software programmes using objects which are mini software programmes within the larger computer programme (also referred to as object-orientated technology), indicates that classification is an essential aspect of this form of computer programming. The categorisation by classes, each with many layers of subclasses, is essential for developing and applying object-orientated technology. Object-orientated technology works efficiently because the method of a larger class can be passed down, or inherited by, all of its subclasses. If the data entered into an object-orientated database cannot be organised into classes and subclasses, this new technology cannot effectively be used. If a comprehensive classification table is not available, some form of classification must be developed, either formally or informally, by those applying object-orientated technology. No such development has taken place in the RSA to date and the local industry is facing the serious dilemma of increasing isolation in these important aspects of information management

Questions that can rightfully be asked are, firstly, where does the RSA fit into this global picture and, secondly, what measures should be taken by the local construction industry not to be left behind in what is taking place in most first world countries with regard to information management? It may be argued that some core processes, mainly drafting and specifying, production of bills of quantities and design in architectural and engineering disciplines, have been automated to a significant degree. Computerisation of these processes has progressed steadily over some twenty or more years, but in fact there has been practically no integration of the information being processed. Drawings, specifications and bills of quantities, for example, remain largely in their own domains with only occasional efforts being made to integrate them systematically

The impediments to IT adoption in the construction industry are well known. They include low or negative profitability, low education standards, typically small size of firm and the transitory nature of projects and project teams. While each of these shortcomings might be addressed to some degree it seems unlikely that the fundamentals will change in the near future. This has the outcome that progress can only be in stepwise fashion, with each step being consistent with widely available technology and its uptake by the industry in general

Woestenenk (2002b) presented his view on the immediate future in an article entitled *The Lexicon - A bridge between theory and practice* in which he wrote the following*: However, construction IT research and development often involves academic schemes with little relation to* *everyday reality or ambitious ideas involving global change on a massive scale. Rarely, if ever, is there any vision of how a fragmented, under-funded, uncoordinated industry with multiple participants is to get from "here" to "there". The objective of re-engineering the processes of design and documentation across the industry is frustrated because nobody is working out how to do it - all the attention is going to some distant future and hypothetical state and not to how we can do it incrementally as the technology advances and becomes increasingly affordable and cost-effective*

To try to answer the question of where the RSA fits in the circumstances described above some distinctions should be made between the local bodies responsible for drafting of model documentation and setting of national standards for the local construction industry. Locally there are consultants', contractors' and manufacturers' organisations, but these organisations focus on the market position of their members, and they generally do not give a high priority to research and development. There are also building research institutes and standardisation bodies, but these have problems in bringing the results to the marketplace. There are no national product and cost information systems, as some other countries have. However, standard specification systems are in use, but this study report will indicate in later chapters that they are inadequate and do not meet the local industry's needs

A gap therefore exists between the "now" and "then". At the present moment the local construction industry has to put up with procurement documentation that is often of inferior quality because of the lack of adequate model documentation it can be based on, and the future idealistic situation described above that might still be some decades away. Immediate steps will, therefore, have to be taken to bridge this gap, and it is the author's opinion that comprehensive classification and specification systems should be introduced into the local market as soon as would practically be possible, as these systems will stand the local industry in good stead for some time to come. The local industry cannot allow such disasters as the collapsing of shopping mall roofs, bridges, etc, and in general the poor quality of the end products that are being delivered to continue, much of which could be prevented or augmented with proper project specifications and quality support documentation. This study will attempt to make certain recommendations in the final chapter for industry role players to consider that might assist the local construction industry in "bridging the gap"

CHAPTER 4

AN OVERVIEW OF CLASSIFICATION SYSTEMS FOR THE CONSTRUCTION INDUSTRY

4.1 INTRODUCTION

This chapter provides an overview of some of the international and national organisations that are involved in national standards for construction classification, national master specifications and cost information systems. This is followed by a résumé of an investigation into the developments that have already taken place and research currently being undertaken in the field of classification systems for the construction industry, with specific reference to the classification of building-related information, products, materials, etc

Attempts to find international solutions to organise the ever-increasing volume of grey literature electronically (see 3.5.2 hereinbefore) is an ongoing process and governments and other organisations have already spent huge amounts of money worldwide on this issue, either through sponsorships or private funding for commercial end-user interests. Examples of such organisations are the Division of Building and Construction Technology (Boutek) of the Council for Scientific and Industrial Research (CSIR) in the RSA, the Norwegian Building Standards in Norway, the Svensk Byggtjanst in Sweden, the Technical Research Institute (VTT) in Finland, the Royal Institute of British Architects (RIBA) in the UK, the Stichting STABU in the Netherlands, Nemetschek AG in Germany, to name but a few. Certain academic institutions such as the School of Construction and Property Management at the University of Salford in the UK, the Department of Architecture, Building and Planning at the Technical University of Eindhoven and Delft University of Technology in the Netherlands are also actively involved in specific research programmes

4.2 MAJOR INTERNATIONAL ORGANISATIONS INVOLVED IN STANDARDISATION OF BUILDING CLASSIFICATIONS AND SPECIFICATION SYSTEMS

4.2.1 The International Organisation for Standardisation (ISO)

The following abstract describes the role of ISO as an international standardisation body and provides some background information on the work that has been done by its committees on the subject of building classifications. The main source of information on ISO was the Internet

(Internet: http://www.iso.ch/). This was supplemented by related information arising from other sources reviewed such as articles, seminar papers, personal communications, etc

ISO is a non-governmental organisation established in 1947 and is a worldwide federation of national standards bodies from some 140 countries. The mission of ISO is to promote the development of standardisation and related activities in the world with a view to facilitate the international exchange of goods and services, and to develop cooperation in the spheres of intellectual, scientific, technological and economic activity. ISO's work results in international agreements that are published as International Standards

ISO is not the abbreviation for International Organisation for Standardisation - that should read "IOS". ISO is a word derived from the Greek *isos,* meaning, "equal"' which is the root of the prefix "iso" - that occurs in a host of terms, such as "isometric" (of equal measure or dimensions) and "isonomy" (equality of laws, or of people before the law). ISO is used around the world to denote the organisation, thus avoiding the plethora of abbreviations/acronyms resulting from the translation into the different national languages of members, e.g. OIN in French (from *Organisation Internationale de Normalisation*). Therefore, whatever the country, the abbreviated form of the Organisation's name is always ISO

The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organisations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO further collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardisation. The International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3

An ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50% of the members of the parent committee casting a vote

An ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by two thirds of the members of the committee casting a vote

The two most important documents that were recently published by ISO that impact on structuring technical product information for construction works are ISO 12006-2 and ISO/PAS

12006-3. The former has seen the development of a new standard *Organisation of information about construction works – Part 2: Framework for classification of information* which embraces many of the classification systems which have seen the light since the first formal construction classification, referred to as SfB, was introduced in Sweden (see 4.3.3.2 hereinafter). The latter, named *Organisation of information about construction works – Part 3: Framework for object-oriented information exchange* is a companion to ISO 12006-2 and should be regarded as complementary rather than contradictory. While ISO 12006-2 is a standard that reflects many years of refinement of classification systems, ISO/PAS 12006-3 represents the implementation of established information modelling practice using a new ISO process which aims to bring new work of this kind into use as quickly as possible

Woestenenk (2002a) sums up the most recent work in which the committees of ISO have played an important part as follows:

On June 4th 1999 a meeting was held in Vancouver, Canada, sponsored by ISO, and organised by ISO TC59/SC13 (Building Construction - Organisation of information about construction works). Invited to this meeting were representatives of ISO TC184/SC4/WG3/T22 (STEP/AEC), IAI, CIB W78, ISO TC10/SC8, ICIS and EDIBUILD. The intention of this meeting was to start merging the streams mentioned above. The result of the meeting was the establishment of a Standing Conference of interested parties, to meet on a regular basis. ISO TC59/SC13 was urged to actually make a start with their work item WI 12006-3 Building construction – Organisation of information about construction works – Part 3: Framework for object-oriented information exchange. At the meeting of ISO TC59/SC13 on June 6th 1999, also in Vancouver, it was decided that a new working group will proceed with work item WI 12006-3, as urged by the coordination meeting

Woestenenk (2002a) further disclosed that WG6 of ISO TC59/SC13 is about to meet to discuss the proposed model that will be at the base of *Part 3: Framework for object-oriented information exchange* that is referred to above. The so-called Standing Conference has been initiated by ISO TC59/SC13 to handle administrative matters for the coordination of other groups (ISO TC184, CIB, ICIS and IAI) that are active in the same area of information exchange

ISO's active involvement in classification matters is evident from the foregoing and an indication of the prominent role that the organisation fulfils in an attempt to find a solution for storing and exchanging data between applications and between all the participants in the construction process

4.2.2 Conseil International du Bâtiment (CIB)

The following abstract describes the role of the CIB as a facilitator in international cooperation and information exchange between governmental research institutes in the building and construction sector. The main source of information on CIB was the Internet (Internet: http://www.cibworld.nl/). This was supplemented by related information arising from other sources reviewed such as articles, seminar papers, personal communications, etc

CIB was established in 1953, with the support of the United Nations (UN), as an Association whose objectives were to stimulate and facilitate international cooperation and information exchange between governmental research institutes in the building and construction sector, with an emphasis on those institutes engaged in technical fields of research. At that time an implicit objective also was to help rebuild the European infrastructure for building and construction research following the ravages of the Second World War

CIB has since developed into a worldwide network of over 5000 experts from about 500 member organisations active in the research community, industry or education, who cooperate and exchange information in almost 60 CIB Working Commissions and Task Groups covering all fields in building and construction related research and innovation. These Commissions and Task Groups initiate projects for research and development and information exchange, organise meetings and produce a large number of publications acknowledged as being of global standing. Meetings are for members only, or are international symposia and congresses open to all. Publications are proceedings, scientific or technical analyses and international state-of-the-art reports, many of which formed the factual basis for developing international standards or were used as such

Amongst CIB member organisations are found almost all the major national building research institutes in the world, e.g. Boutek in the RSA. Although considerable attention is still given to technical topics within CIB programmes, there are currently also activities focused on topics such as organisation and management, building economics, legal and procurement practices, architecture, urban planning and sustainable development

4.2.3 International Construction Information Society (ICIS)

The following abstract describes the role of ICIS as an organisation that provides national master specification and cost information systems in the building and construction sector. The main source of information on ICIS was the Internet (Internet: http://www.icis.org). This was supplemented by related information arising from other sources reviewed such as articles, seminar papers, personal communications, etc

At the beginning of the 1990's ICIS was founded by the producers and publishers of national specification systems. ICIS currently consists of 17 member organisations in 14 countries, which include Australia, Canada, the Czech Republic, Finland, Germany, Japan, the Netherlands, Norway, Sweden, Switzerland, the UK and the USA

ICIS is an association of organisations that provide national master specification and cost information systems, and aims to improve communication at international level between all members. These member organisations provide technical services to hundreds of thousands of construction professionals worldwide who use their products and services to prepare construction documents. For the changing needs of their member clients ICIS aims to anticipate and address the following changes occurring in the construction industry:

- The strong trend towards international harmonisation of standards and procedures
- The increasing functionality and user-friendliness of information used in construction processes
- The need to integrate a wide variety of related resource data, particularly drawings, specifications, costs, and product information

In April 1996, ICIS delegates approved the following mission statements after a yearlong planning process:

- To improve, on an international level, communication among participants in the construction process
- To represent the common interests of ICIS members in dealings with international and national organisations, authorities, and associations
- To investigate international developments in the field of construction information
- To support, investigate, and promote efforts and developments in the field of construction information that lead to worthwhile international harmonisation and standardisation

- To set principles for organising and preparing construction information

ICIS has published a number of reports in connection with construction information. One of such reports published and still being maintained is titled *A Description and Comparison of National Specification Systems* (see Chapter 5). This report provides comprehensive comparative information about the products and services of each of the ICIS member organisations

ICIS also published a report titled *State, Trends, and Perspectives of National Specification Systems in European Construction* (see Chapter 5). This report explores the social, economical and cultural reasons for differences of national specification systems in Europe

ICIS has cooperated with ISO on classifications for the construction industry by investigating and developing classification tables. The objective is to develop tables to the level of detail appropriate for international harmony to facilitate national implementation. To achieve this objective ICIS has decided to follow the following procedures or actions:

- To cooperate with other national and international authorities such as the Committee for European Normalisation (CEN), the European Product Information Cooperative (EPIC), and ISO STEP in the development of harmonised international information models

- As a result of the foregoing activities the ICIS has established a network of construction information organisations for exchange of information and collective pursuit of common goals

- To continue their work on performance specifications to effectively use that method of specifying. Once all the issues are identified and the list is comprehensive, ICIS proposes to develop a technical document that will present a collective position on proper development and application of performance specifications

- ICIS is also studying environmental issues that can be managed through proper specification practices. The initial effort will be to identify critical issues that must be resolved. From these issues, ICIS will develop a technical document that will represent the collective position of ICIS members on how to write specifications that are sensitive to the environment

- ICIS is furthermore studying the impact of international standards on national specifications. ICIS has concluded that the emergence of international standards must be taken into account, as the construction industry becomes more of a global business. A technical document will be prepared that will represent the common opinion of its members on how to properly incorporate international standards in national specifications

- ICIS is developing draft tables for construction elements and master lists of construction entity parts as an initial step towards development of classification tables for information in the construction industry. These are the first efforts that are planned to expand to several classification tables in support of an emerging international standard on classification of information in the construction industry. Other tables that ICIS is studying to identify critical issues to be resolved are specification work section tables, construction complexes tables, and construction entities tables

4.2.4 The Construction Specifications Institute (CSI)

The following abstract describes the role of CSI as an organisation that organises and presents construction information. The main source of information on CSI was the Internet (Internet: http://www.csinet.org/). This was supplemented by related information arising from other sources reviewed such as articles, seminar papers, personal communications, etc

CSI is an individual membership technical society whose core purpose is to improve the process of creating and sustaining the built environment. CSI provides technical information and products, continuing education, professional conferences, and product shows to enhance communication among all disciplines of non-residential building design and construction in an attempt to meet the industry's need for a common system of organising and presenting construction information. CSI has more than 18 000 members that include architects, engineers, contractors, specification writers of construction products, suppliers of construction products, building owners and facility managers

CSI was founded in 1948 and has its headquarters near Washington in the USA, and has 143 local chapters nationwide. It is the foremost institute of its kind in North America and has, since its inception, been actively involved in research and creation of construction related information CSI has the following as mission statement: *The Construction Specifications Institute advances the process of creating and sustaining the built environment for the benefit of the construction community by using the diversity of its members to exchange knowledge*, and the CSI, in its code of ethics, pledges itself to:

- *Establish and maintain high standards of professional conduct*

- *Freely interchange information and experience with members of the construction community*
- *Maintain confidentiality of privileged information*
- *Avoid conflicts of interest*
- *Avoid misrepresentation of products and services*
- *Promote improvement of construction communications, techniques and procedures*

4.2.5 The International Alliance for Interoperability (IAI)

The following abstract describes the role of IAI as an alliance of organisations within the construction and facilities management industry with the primary aim of improving processes within the industry through defining the use and sharing of information. The main source of information on IAI was the Internet (Internet: http://www.iai-international.org.iai/). This was supplemented by related information arising from other sources reviewed such as articles, seminar papers, personal communications, etc

In August 1994, twelve USA based companies joined together to examine the potential for making different software applications work together. Basing their efforts around the then newly-developed ARX development system for AutoCAD Release 13, they felt that there was a significant economic benefit to be gained from this interoperability of software if it could be shown to work

The original participants in the interoperability project decided that what they were doing needed to be revealed to the construction and facilities management industry as a whole, and to all software vendors. By doing so, they felt that it would be possible to develop a vendor neutral standard for software interoperability. In October 1995, they established the Industry Alliance for Interoperability (IAI) in North America

The early members of the IAI realised the increasingly global nature of the industry. They took their message to other countries, initially in Europe, and then to Asia and Australasia. From this contact, other Chapters were established. The German Speaking Chapter was formed in December 1995 followed in January 1996 by the UK Chapter. At the first international IAI meeting in London in 1996, there were representatives from many countries and these have now grouped themselves into the nine Chapters that exist today. It was also at this meeting that the decision was taken to change the name of the organisation to the International Alliance for Interoperability to reflect its global reach

IAI issued the first full Release of its Industry Foundation Classes (IFC) Information Model in January 1997. Several further Releases have been issued since, the latest of which is IFC 2x that was issued in October 2000. IFC 2x marked a major change in the way that IFCs are developed and released. It created a framework for the development of models that can progressively extend the range and capability of IFCs in a modular way. Projects will develop models using this platform and will issue models independently as work is completed. An addition to IFC 2x has been the introduction of the ifcXML specification. This defines the complete IFC Model in the XML Schema Definition Language (XSD) and provides an alternative approach to information sharing

IAI has become one of the foremost organisations in the field of developing systems for improved information management, and many software vendors are working together with, and sponsoring the activities of, the IAI

4.3 BUILDING CLASSIFICATION SYSTEMS

4.3.1 General

The discussion on building classification systems that follows will show that building classification is a fairly new concept when one compares their existence with that of the general classification systems referred to earlier in this study. The discussion on building classification systems will start by tracing the historical development thereof, followed by scrutiny of some of the more important international systems published up to date, and finally by investigating recent trends, especially those in the USA

4.3.2 An overview of the development of building classification systems in Europe after the Second World War

National standardised classification and/or specification systems for the building industry were first introduced in the 1950's and 60's in the Scandinavian countries. During the following decades, national systems were progressively introduced in more European countries, most recently in the Netherlands in 1990. As early as in 1947, however, the authorities responsible for rebuilding destroyed areas in Belgium and France after the Second World War called for a conference on building documentation, which was to coincide with the Paris International Exhibition on Housing and Building in the summer of that year. The most important topic at the conference was the international need for document information, and the management of such information

Decisions taken at the conference in Paris initiated developments that ultimately led to standardised classification and/or specification systems that reflect national characteristics and specialties, making them all unique. These differences between the various systems originated mainly from the predominance of local structures in the construction industry, as the large majority of construction projects were, and still are, essentially local in character. It will, however, become evident later in this chapter that the European construction industry is characterised by increasing internationalisation and a reduction of entrance barriers to local markets and information necessary for international cooperation

The abovementioned conference in Paris agreed that the format and classification of documents for filing must be standardised. It was recommended that the format should be the international A4 size and, for classification purposes, a specific notation should be followed by which the document could be filed. The problem of international classification, however, was left unsolved and only after another five years, in 1952, did the International Federation for Documentation (FID) and the International Council for Building Documentation (CIBD, later CIB) set up a joint committee to investigate this problem. This joint committee then appointed the International Building Classification Committee (IBCC) whose work was set out in the following four phases:

- To study and publish selected UDC numbers to be used for building classification
- To study and publish the Swedish SfB filing system
- To study other systems of classification and filing in the building field
- To develop a standard method for classification and filing

After starting in 1953 with phase 1 IBCC published a document in 1955 that was called *ABC: Abridged Building Classification for Architects, Builders, Civil Engineers, a selection from the Universal Decimal Classification*. Work on phase 2 followed, which included a study of the Swedish SfB system, after which the committee published the IBCC Report No. 1: *Recent developments in building classification,* also in 1955

Thereafter work on phase 3, which included a comparative study of filing systems already in operation throughout the world, commenced. Fifty-five systems were reviewed and compared and the conclusion reached was that the two most useful systems in operation were UDC, for its wide

subject coverage, and SfB, for its brevity, flexibility and relevance to building practice. This survey was published in 1959 as IBCC Report No. 2. Further reports followed and it was decided at the sixth plenary meeting of the IBCC in 1959 to recommend SfB and UDC as the most suitable systems for the building industry in and between the offices of practitioners and in the building industry at large. IBCC made the following recommendations concerning the implementation of their decision:

- That CIB should publish or promote the publication of the SfB system in several languages for use in the classification of trade catalogues, codes of practice, etc
- That copyright be vested in CIB
- That the SfB tables should be amended only on advice of IBCC
- That SfB/UDC building filing manuals might be published nationally on the responsibility of CIB member institutes

Since 1961 there have been several important international developments, as well as the further development of the SfB/UDC system. The 1968 *Construction Indexing Manual* was published by RIBA after many months of field trials and intensive development work by RIBA as SfB Agents for the UK. The revisions were the fruits of seven years' practical experience with the international SfB system that was introduced in the UK in 1961 with the publication of the *SfB/UDC Building Filing Manual*

As mentioned above, national specification systems were introduced in various other European countries after 1960. A peculiar situation has, however, developed with the unintentional formation of a (West) European dividing line. All the countries to the north of the Alps and of France have a national standardised specification system, whilst the countries of southern Europe have no such system, their situation being the same as that in the other countries before the national standardised system came into being, i.e. each specification writer produces and works with his own in-house system

The European construction industry is characterised by increasing internationalisation as a result of globalisation, a reduction of entrance barriers to local markets as a result of the European Union (EU) and also because most of the countries in Europe have decided to adopt the same currency. Hence there is a strongly growing demand by individuals, companies and organisations active in the construction sector for information on foreign national construction markets and information necessary for international operation. There is a particularly strong need for an exchange of information on procurement issues, such as specification systems, used by other national construction industries in countries such as North America, Canada and Australia. This is indicative of the global society of today brought about by the advance in communication technology

4.3.3 The Swedish building classification system – BSAB

4.3.3.1 Introduction

The foregoing overview on the development of building classification systems in Europe has shown that the Scandinavian countries, and in particular Sweden, played a prominent role in developing such systems. Sweden took the lead in Europe with the introduction of the SfB system. The Swedish Building Centre (SBC) (Swedish: *Svensk Byggtjänst*) was founded in 1934 and is currently owned by approximately forty industry and trade organisations that represent clients, consultants (including architects and engineers), contractors, construction workers, building product manufacturers, etc. After the British and Finnish Building Centres it is the third oldest institute of its kind in the world.

SBC develops and sells printed and IT-based information products and services to the relevant construction and building maintenance industries. It currently has approximately 125 full-time employees and has offices in Stockholm, Gothenburg, Malmo, Växjo, Örebro, Gävle and Sundsvall in Sweden and in Riga in Latvia. At the beginning of 1998 SBC merged with its subsidiary *Bygginfo* that provides up-to-date information on literature, technology and products for professionals in building construction and building services engineering. *Bygginfo* also offers building professionals further training in the form of courses, study visits and trips in the fields of contract law, building construction, building services engineering, management and economics. The publishing section of SBC issues about thirty new publications every year, concentrating on areas where there is a need for up-to-date information

It is evident from the above information why Sweden is regarded as one of the world leaders in the development of building information classification systems and related literature. It is for this reason that fairly extensive coverage will be given in this and the next chapter on the origin of the Swedish SfB system and the latest AMA 98 Swedish national specification system that is based on the Swedish BSAB classification system

4.3.3.2 General description and structure of the SfB system

The SfB system originated in Sweden, where various bodies concerned with building formed a committee in 1947 for purposes of coordination. The committee was called *Samarbetskommittén för Byggnadsfrágor,* from which the abbreviation SfB derives. This committee was responsible for a number of publications, which led to the acceptance in Sweden that the SfB system shall be used as the national method for organising official and centrally-produced construction industry specifications, price books and building product data sheets. From Sweden it spread to the other Scandinavian countries, and elsewhere

Other countries, which included the RSA, Australia and New Zealand, soon followed. Ingor Karlén, then the director of the SfB Bureau and also the secretary of the SfB committee of IBCC, made the following statement in the foreword to RIBA's *Construction Indexing Manual* (1968 : 6*) SfB is now in use in many parts of the world, and the flow of international trade both in goods and services, and developments in the use of computers, makes it seem likely that the need for an effective international classification and coding system for all purposes in the building field will continue to increase*

The SfB system organises information in such a way that it can be stored and retrieved efficiently. In order to do this, information is divided into recognisable groups so that if a particular item is required, only one or two groups need to be examined. In information retrieval terms this is equivalent to examining one group of documents on a shelf instead of searching the whole shelf

During 1966 the SfB Agency UK made proposals to IBCC for changes to the system that emanated from a specially commissioned report. The main change, although not part of SfB, entailed the incorporation of two additional tables to meet with UK needs and which were not included in the 1961 RIBA *SfB/UDC Building Filing Manual.* The English version also added the letters CI as prefix to SfB after which it was referred to as the CI/SfB system to distinguish it from the International SfB tables. In the CI/SfB system there are four main divisions, each of which is identified by a separate table, as shown hereunder:

- Table 0

  Representing the built environment (buildings and spaces that go together, such as houses, schools, hospitals, etc)

- Table 1

  Representing the different parts or elements of the building (such as doors, windows, balustrades, etc)

- Table 2/3

  Representing construction forms and materials (building products such as bricks, pipes, sheets, tiles, etc)

- Table 4

  Representing abstract concepts (such as heat, light, building regulations, structural stability, etc)

The above information was then given a particular kind of reference or notation that would show the person responsible for filing where the document should be placed. A specially designed classification box, located in the top right-hand corner of documents, was designed as depicted in Figure 3 below using a different type of notation for each table

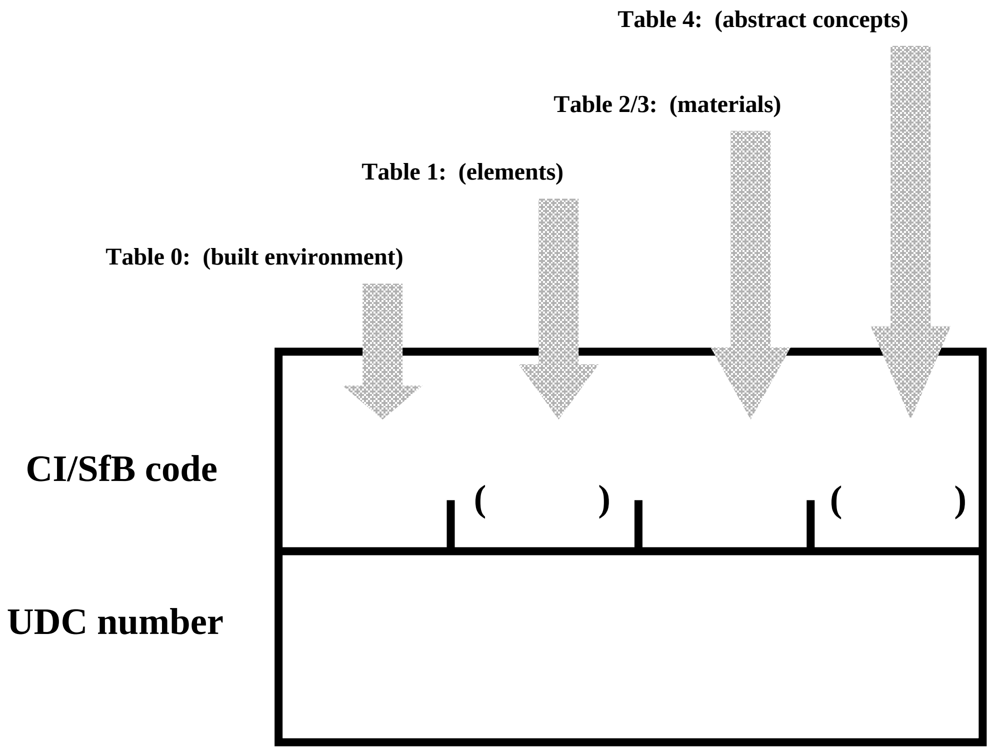


Figure 3: The notational structure of the CI/SfB classification system for use on documents (Adapted from: RIBA in *Construction indexing manual*, 1969 : 11)

Each of the four parts of the box in Figure 3 corresponds to one of the above-mentioned tables, each represented by a different form of notation:

- Table 0

  A number, usually two or three digits long, e.g.: 410

- Table 1

  A bracketed number, usually two or three digits long, e.g.: (21.1)

- Table 2/3

  A capital letter with a lower case letter sometimes followed by a number, e.g.: Fg2

- Table 4

  A bracketed capital letter sometimes followed by a number and a lower case letter, e.g.: (E2g)

The basic classification of the CI/SfB system is provided in Appendix 1. This summarised table contains insufficient detail to be used for classification. A more comprehensive exposition of the CI/SfB system is contained in the RIBA handbook, *Construction Indexing Manual* between pages 29 and 107

As the prefabricated and service engineering parts of a construction project became more and more important, the SfB system was no longer adequate for the changing demands of the users. For this reason the *Byggandets Samordning AB* (BSAB) classification system was developed and introduced in 1972. It contains two product classification tables that formed the basis for AMA 83, the edition that preceded AMA 98. (For details and contents of the Swedish AMA98 and RA98 specifications refer to Chapter 5 and Appendix 4)

4.3.4 The Uniclass classification system for the construction industry in the UK

4.3.4.1 Introduction

In the foreword to the first post-war edition of *Specification* (1946 : 37), (an authoritative British document on specification in the construction industry that was by then already in its 48th year of use), the following guidelines were laid down with regard to trade headings in the document: *It is not the intention of this specification to attempt the almost impossible task of giving a list of the various items which are likely to appear in any architect's specification, but it is thought that if there were a standardised order for the various trades together with a standardised order for certain key headings belonging normally and naturally to these trades, every item likely to appear in an architect's specification would fall into place under one of the standard headings, and that such standardised practice would make it easier to trace items in any specification and tend to reduce the change of omission*

Also in the same foreword the basis was provided on which the classification was to be standardised and this was stated as follows: *In searching for the best authority upon which to base this standardisation it has appeared to the Committee that only one course could be* *adopted – namely, to make the order of the trades and key headings to run or agree with the order given in the "Standard Method of Measurement of Building Work, 1935".* This format has continued to form, and still to this day, forms the basis of the classification of trades in specifications and bills of quantities in the UK, as is evident from the classification in the *Common Arrangement of Work Sections (CAWS)*

CAWS, first published in 1987, is a working convention designed to promote standardisation of, and detailed coordination between, bills of quantities and specifications. It is part of the industry-wide Co-ordinated Project Information (CPI) initiative and has been used for the arrangement of the National Building Specification (NBS), the National Engineering Specification (NES) and the Standard Method of Measuring Building Works – Seventh edition (SMM7)

Since its publication, CAWS has enjoyed widespread use for the arrangement of building project documents (see Chapter 7) and feedback from this usage and developments in construction technology have indicated that useful additions and amendments could be made. The second edition, published in 1998, aligns CAWS with the United Classification for the Construction Industry (Uniclass)

4.3.4.2 General description and structure of the Uniclass system

Uniclass is a contemporary classification system for the construction industry in the UK and was published in 1997. Uniclass is a classification scheme for organising library materials and for structuring product literature and project information. It incorporates both the CAWS and the Electronic Product Information Co-operation (EPIC) (a new European standard for structuring product data and product literature). This national standard therefore is in line with the framework proposed by ISO and sets out a new definitive classification system with fifteen tables, each with sub-titles and codes that, according to its authors, cover the interests of the whole construction industry. Each table represents a different facet of construction information, and they are unified by a simple coding system, which is suitable for computer applications and can be used, separately or in combination, for:

- Arranging libraries
- Structuring product literature
- Coordinating project information

- Structuring technical and cost information

- Developing frameworks for databases

In the preface of this manual (1997 : 9) the structure of the manual is explained as follows:

> *Uniclass follows the international framework set out in ISO Technical Report 14177: Classification of information in the construction industry July 1994; and builds upon the success of CAWS. It is also intended to supersede CI/SfB, the most commonly used classification system for construction information.* (My emphasis)
>
> CI/SfB was last revised in 1976, and when the question of its revision was reviewed by the SfB Agency in the UK it was decided that replacing it with a Unified Classification was the best solution. The main reasons were:
>
> - International developments: the advance of computerisation and the limitations of SfB in this respect caused several countries to review their information structures and explore new concepts in information analysis. Through work in ISO, ICIS and EPIC, the UK was able to benefit from cooperative efforts in developing classification theory and practical tables
>
> - CAWS: the publication of CAWS in 1987 introduced an alternative information-structuring scheme, which became widely used through NBS, NES and SMM7. CAWS and CI/SfB were operating in parallel, and one of the objectives of the Unified Classification project was to integrate CAWS into a new system
>
> - Currency: CI/SfB did not reflect changes in the industry, including the many new building types, concepts involving energy and environmental issues. The whole system needed updating for new topics
>
> - Notation: the brackets and the combinations of upper case and lower case letters made the codes difficult for users to understand. This complex notation also caused problems with computerisation

4.3.4.3 Links between the British Uniclass classification system and other documents

The aim of the authors of the Uniclass classification system was to unify all classification systems in use in the UK at the time. The system is based on at least four other important systems, namely: CI/SfB, CAWS, CESMM3 and EPIC. These systems also incorporate the NBS and NES specification systems

One of the Uniclass tables, *Work sections for buildings,* is based on the classification used in CAWS. This provides a link from Uniclass to specifications based on NBS and other specifications that use the CAWS structure. The latest version of SMM7 is also based on CAWS

It is now possible, because of the design of Uniclass, to allow coordination by cross-reference. Many clauses in NBS for instance are for “types of work” rather than just material or workmanship, e.g. “brick walling”, “built up felt roof covering system”, etc. These can be cross-referred from the drawings and bills of quantities by stating the work section and clause code, e.g. “Polished concrete block walling F10/250”. NBS further cross-refers to British Standards, industry standards, codes of practice and other specifications where suitable, to minimise the amount of information given in project specification, particularly for materials and components. However, workmanship requirements are covered in detail, except in a few sections where suitable standards exist

No attempt will be made to provide a detailed explanation of all of Uniclass’s 15 tables that were developed to cover the wide range of all the topics and activities to be found in construction information, but information provided will be limited to the table *Work sections for buildings* which is provided in full in Appendix 2*.* This is done in an effort to explain the link between the aforementioned Uniclass, CAWS, NBS and SMM7 documents and to comply with one of the delimitations of this research given in Chapter 1 that excludes the classification of other concepts such as building types, construction products, etc

The abovementioned table sets out the classification in Uniclass for *Table J: Work sections for buildings*. (For details of the classifications/indexing for CAWS, SMM7 and NBS refer to Chapter 5 and Appendix 5 respectively). The purpose for providing these and other classifications, indexes, summary of work sections, etc from classifications/specification/measuring systems from the countries selected is to ultimately be able to compare and propose similar, but unique, national standards for classification in the South African building industry (see proposals in Chapter 9)

4.3.5 The American UniFormat, MasterFormat, SectionFormat and PageFormat classification system

This four-part classification system is the CSI sponsored system widely used in North America and is jointly produced by Construction Specifications Canada and the CSI. It works as follows: (Internet: http://www.csc-dcc.ca/public/cat2-6.htm. Access: 9/27/00

- UniFormat - a classification system for construction information based on elements and systems. UniFormat is intended to provide a usable format for use at the early stages of a project before particular materials and methods have been determined, and to classify data associated with performance and costs of completed projects for comparative analysis. UniFormat organises and defines basic elements and systems which, when integrated, encompass the requirements to construct a project

- MasterFormat - an industry-accepted system of numbers and titles for organising project cost data and for filing product information and other technical data

- SectionFormat - provides a consistent appearance and organisation of specification sections in Division 2 through Division 16; the principles also apply to sections of Division 1, General Requirements

- PageFormat - provides an orderly, uniform presentation of text for each page of a specification section

The USA has recently developed, as in the UK, an unified classification system called the *Overall Construction Classification System* (OCCS) with the intention that it would be used by all industries
involved with creating and sustaining the built environment – from conception through demolition – as the basis for organising information and deriving relational databases, as more fully described below

4.4 RECENT INTERNATIONAL DEVELOPMENTS

In August 1996, ISO published a draft standard called *A Framework for and Fundamentals of Classification Construction Objects (ISO TR14/77).* It deals with the fundamentals of classification for the construction industry by identifying objects of importance in the construction industry and outlining how they should be classified in tables. It does not provide a complete operational classification system. The tables themselves would vary in detail from country to country

ICIS is also currently coordinating its work with the ISO WG6 activity as well as working on the development of classification tables for Construction Complexes, Construction Entities, and Elements. Work on development of other tables has been temporarily suspended. However, coordination meetings held in July 1999 in Vancouver, in October 1999 in Munich, and in June 2000 in Hong Kong, indicate renewed interest

In another recent development the OCCS Development Committee has published a first introductory version of the OCCS (October 2001) and the committee responsible for its publication has invited various organisations, individuals, etc to comment on it. The Committee had recognised the need for a classification system to organise the enormous amount of data created during the life cycle of any built environment, and that the increasingly widespread use of computers only serves to highlight the fragmented way that building projects are commenced, designs created and realised, construction carried through to completion, and buildings maintained, renovated, and ultimately demolished

The work on OCCS, however, did not start at a blank page, as it has been accepted that several existing formats are available that can serve as legacy systems and starting points. One of the more important systems that is considered to be such a legacy is the Uniclass system

Until recently the method of locating information had generally been to establish a library containing design and construction information that provides an extensive collection of trade association reference and national standards, manufacturer's catalogues, etc. In many cases such libraries are being replaced by databases where the user is able to conveniently search through and sort information electronically for various applications

The Internet is, however, impacting on all that (see Chapter 3). The problems that the Committee faced were, firstly, how to deal with all the available information and, secondly, how well users are able to search the Internet to find what they are looking for. It is usually not a problem of finding information; but rather finding too much information on the subject and related subjects. How does one separate the wheat from the chaff? After something is downloaded, how is it filed so that the user and everyone else in the firm can find it later? How does one find the products among multiple manufacturers with the particular characteristics needed for the project in question?

The Committee then investigated whether the USA has the classification tools to find answers to these questions and to make the information "user-friendly". It was concluded that if the subject is technical and dealing with materials and methods, the MasterFormat classification system can be applied. But this system has its limitations, since there is not necessarily one and only one location in which to file information. For example, MasterFormat guides the user to specify gypsum sheathing materials applied to wood studs in Division 6 and those applied to metal studs in Division 9, even though it is the same material. The problem is, therefore, where to locate the file for gypsum sheeting project information? MasterFormat was not originally designed to be a data filing system, and this deficiency was evident

If the subject is an element, assembly, or system of a building, the UniFormat classification system can be applied. However, if the subject relates to other than building construction, further problems will be encountered, since UniFormat is limited to buildings and related site work. In addition, tools for the classification of project types, the process, the phases, construction aids, the participants, etc do not readily exist

To overcome these and other problems, OCCS set the goal to create a classification system that will cover the entire built environment from inception to demise. OCCS intends to operate under the following principles:

- Create an open standard with broad industry participation;
- Follow a new ISO international standard for such classification systems; and
- Be North American in scope and use existing legacy systems where appropriate

The format of the new OCCS classification system can briefly be described as a system comprising 12 related tables or, in reality, a relational database. Appendix 3 presents an abbreviated summary of the OCCS tables

The OCCS tables are organised in a faceted, rather than an enumerative, manner. Objects may be comprehended from multiple perspectives, or facets. The intersection of these locations among the tables provides for the detailed classification of an object. The following is an example of how to classify a structural steel railroad bridge. In an enumerative classification system one would have to make a choice of classifying it as a structural steel item, a bridge, or part of a railroad. In a faceted set of tables such as OCCS, all three characteristics may be accounted for: Railroad in Table 01 – Facilities, Bridge in Table 02 – Constructed Entities, and Structural Steel in Table 12 - Attributes. Other examples are:

- Structural Analysis by Vibration Consultant during Design Development:
    - Design Development in Table 07 – Process Phases;
    - Structural Analysis in Table 08 – Process Services; and
    - Vibration Consultant in Table 09 – Process Participants

- Interior Partitions of Metal Studs/Gypsum Board with STC over 45:
    - Interior Partitions in Table 04 – Elements;
    - Metal Studs/Gypsum Board in Table 04A – Designed Elements; and
    - STC over 45 in Table 12 – Attributes

- Paving for Plazas for Office Buildings:
    - Office Building in Table 01 – Facilities;
    - Plazas in Table 03 – Spaces; and
    - Paving in Table 04 – Elements

- Hydraulic Passenger Elevators with Minimum Capacity of 10,000 Pounds (4540 kg):
    - Hydraulic Passenger Elevators in Table 06 – Products; and
    - Minimum Capacity of 10,000 Pounds (4540 kg) in Table 12 – Attributes

- Articles on Pumping of CIP Concrete for Dams:
    - CIP Concrete in Table 5 – Work Results;
    - Pumping in Table 10 – Process Aids;
    - Dams in Table 02 – Constructed Entities; and
    - Article in Table 11 – Process Information

A complex subject can be classified to whatever degree of detail desired

The OCCS tables will basically follow the DDC Classification system cataloguing the physical world and the built environment throughout the full life cycle, and capable of supporting computerised information storage and retrieval. Each table is a single major classification, and within each table there are additional major classifications and a hierarchy of subclassifications. Organisation of information by classifications and subclassifications will be essential for software development by utilising object-oriented technology and by establishing electronic databases. A framework of classes and subclasses will eliminate redundancy. The envisaged hierarchy is as follows:

Levels of classification:

1 - Table
2 - Category
3 - Class
4 - Subclass
5 - Sub subclass

As previously mentioned, the preliminary set of OCCS documents was published in October 2001 with the primary purpose of obtaining industry-wide review and comment

4.5 SUMMARY

Chapters 3 and 4 provide an overview of the development of classification systems for the construction industry internationally and the effect IT is having on how building data is exchanged and accessed

Specifile (Pty) Ltd, a local franchise of an international company specialising in information retrieval, which has more than 2200 subscribers in the RSA and neighbouring countries, conducted a survey on future planning during the year 2000 to, *inter alia*, establish the possible impact the Internet is having on product sourcing. The results were contained in their newsletter No 4, 2001 that stated the following*: The 2000 survey indicated that* ***only 0,08%*** *of respondents rated the Internet useful for product sourcing.* This apparent lack of commercial use of the Internet is confirmed by a recent survey undertaken by Ernst & Young, in an article published in the South African Property Review (2002), wherein it is alleged that two thirds of corporate users do not use any form of online procurement system and only 15% of respondents are using online procurement systems for real estate transactions. The results further show that e-retailing commerce has captured little more than 1% of retail sales

However, the growing use of modern communications is bound to result in substantial changes in the way the world does business, and more specifically in the context of this study, in the increasing use of electronic exchange of construction information between different members of the project team, and with product manufacturers and suppliers. These changes are brought about by the availability of fast, powerful and relatively cheap computers; fast and relatively cheap telecommunication methods, and the rise of global electronic networks, particularly the Internet. These technologies are driving the envisaged rapid growth of electronic commerce. In the next few years, e-commerce will certainly impact in some way on businesses, if it has not already done so

The organisation of information, specifically that of construction information, is what is critical to its understanding and efficient usage. With computer systems at each end of the communication, it matters less how items are labelled, but the concepts by which they are organised need to be agreed. One school of thought is of the opinion that full text search and keywords make classification obsolete, but the general perception amongst construction IT specialists, as observed during the review process, is that data need to be organised somehow, and it will be much more convenient if the supplier and user of the data make use of the same structure

If keywords are used, as is typical for searching the Internet, they need to have some structure, and this structure should relate to that which is most widely known in the construction industry, or to that of a widely used set of data, such as a standard specification. It is unfortunate that in the RSA a complete and widely used national specification does not exist (see Chapter 5), since the other countries that were studied in this research report are building, or intend to build, their structure for new classification systems on top of their existing specification systems

In conclusion it can be stated with a reasonably amount of certainty that the literature review on classification systems has indicated that, for the foreseeable future, a classification system that has overall support in the industry will facilitate in the product information distribution process between all the relevant parties in the building process, either through traditional means or through reliance on the Internet and other electronic means

CHAPTER 5

A COMPARATIVE STUDY OF MASTER BUILDING SPECIFICATIONS IN THE RSA AND IN SELECTED OTHER COUNTRIES

5.1 INTRODUCTION

In this Chapter, particular focus will be placed on the development of master building specifications (specification systems) in the RSA and in selected other countries. The other countries selected are Sweden, the UK, Australia, the Netherlands and the USA. The first two countries were selected because of the important influence that developments in building classification systems there have had on specifications in Europe in general, and on specifications in the RSA specifically, and all five countries for their modern approach and research already conducted in this field that resulted in up-to-date and comprehensive specification systems being in use in these countries. These systems will be compared with systems currently in use in the RSA to establish whether the modern national specification systems in these selected countries can impact on, and expose a need for, the drafting of a revised national master specification system for the local construction industry

The construction industry, as previously defined, is the collective name for the building and civil engineering contracting industries. In certain countries no distinction is made between these industries, while in other countries they are often referred to as “light” and “heavy” construction respectively (Hauptfleisch & Siglè, 2002 : 1). Every construction project, whether classified as building or civil, is unique due to the diversity of the works and the changes to the parties involved. Consequently, efficient information exchange between construction parties is crucial for the successful completion of any construction project

The general specification (plus project/particular specifications when available) is one of the main instruments used in the construction industry for information exchange between construction parties. It fulfils a central role from the inception and design phases to the completion of the construction phase, and is one of the key documents from which information, for either drawings or bills of quantities, flows. The following points illustrate this statement:

- The architect or engineering consultants, who, as the designers, should be jointly responsible for producing the specification, by formulating the results of their design activities in the relevant specification for use in the works

- As a result of the advances in computer technology standard specifications have become the order of the day in most countries. Architects, engineers, and, ultimately also quantity surveyors, enjoy the benefits of having the facility to call up marked-up copies of a standard specification that can be adapted for each specific project with relative ease

- The construction parties tendering for contracts use the specification as a guide for determining the potential methods of execution, the associated costs, the tender value, and, ultimately, the final contract price

- After the tender has been awarded, the specification will form an essential part of the contract documentation. It states what is expected from the contractor by the client within the framework of the contract by prescribing minimum standards of materials and workmanship

In most developed countries project specifications are based on national standardised specification systems. These national systems provide uniformly structured standard specification items for the project specification drafters. The specification items normally provide a neutral description of the most common construction works to cover workmanship and materials encountered in a significant majority of projects. If a material is not encountered in a significant majority of projects, its preamble will in all likelihood not be included in the specification. Most standard specifications are designed to assist in abbreviating descriptions in texts of a proposed new project, whether it is for descriptions on architectural or engineering drawings and technical specifications or for descriptions in bills of quantities, schedules of rates, etc. The specification items may also provide links or interfaces to other information systems of the construction sector, such as design, products and cost information systems

5.2 GENERAL DESCRIPTION AND STRUCTURE OF THE SPECIFICATION SYSTEMS IN SELECTED OTHER COUNTRIES

5.2.1 Introduction

The general descriptions and structure of the specification systems in selected other countries that follow hereinafter were abstracted mainly from the ICIS Report No 1, published in May 1997, which was followed shortly thereafter by the ICIS Report No 2, compiled by Mindt after completing her doctoral thesis on the subject. These Reports dealt in a very comprehensive manner with the development and status of the national specification systems that were investigated. The descriptive results of the first report pointed to the diversity of the individual systems investigated in 13 selected countries in Europe and elsewhere, whilst the second report set out to analyse and compare more intensively the specification systems of seven of these countries, and of their application in the national construction markets of the European ICIS members

The specification systems of all five countries that were selected for investigation in this research study were contained in these two reports. Four of these countries, namely the UK, Australia, the Netherlands and the USA, were visited during the literature review process to supplement and verify the correctness of the information in the reports. This was achieved by conducting personal interviews with individuals in the respective organisations that were responsible for the development, maintaining and management of the specification systems

5.2.2 The Swedish National Specification System – AMA98, AF AMA98 and RA98

The technical part of the Swedish specification system, AMA98 (and RA98) is arranged in accordance with the BSAB classification system. The system consists of two Tables; Table 1 is based on work sections and Table 2 on elements (see Appendix 4). AMA98 and RA98 use these tables to code the specification text

AMA is the abbreviation (in Swedish) for ‘General Material and Workmanship Specifications’ published by the Swedish Building Centre. It consists of standard specifications and is invoked by cross-reference in project specifications. Recommendations and guidance are given in a separate publication RA98, and AF AMA98 covers the contract administration requirements. Both these documents are arranged in work sections. Each work section is divided into variants through a hierarchical classification. Specification texts are located at the relevant level in the classification system. Reference to text at one level automatically invokes specification at the higher levels, e.g. reference to clause F4.71 invokes all clauses at F4.7, F4 and F. This is called the ‘pyramid rule’

The AMA system consists of six books, namely:

- AF AMA (administrative and contract rules)
- Mark AMA (excavations)
- Hus AMA (houses and buildings)
- VVS AMA (sanitary, water and heating services)

- Kyl AMA (cooling systems), and
- EL AMA (electrical services)

In order to limit the size of a specification, all texts in the AMA books are structured in accordance with the aforementioned 'pyramid rule'. The specification writer takes the item that is required from the relevant AMA book, e.g. S2.31 washbasin. For this, a text is drafted with additions and changes to the original AMA text to specify what is needed. The rest of the text of the AMA item S2.31 would still be valid (e.g. all the invoked standards) even though it has not been incorporated into the project specification. In the case of discrepancies, the specification drafter's text takes precedence. If the specification drafter requires the standard AMA text, he needs only to quote the code and item heading

The text of S2.31 does not, however, contain the whole description of the washbasin. All super-ordinate texts, S2.3, S2 and S are also automatically included in the specification even if their numbers and headings are not written in the specification. The specification reader must always study the specification from the bottom to the top. It is meant to avoid the recurrence of text in several items of the AMA books, which were developed for manual use, the main priority being to minimise the number of pages. Therefore, texts common to several items are written on a higher level than texts that are only valid to one item. The whole AMA system is thus based on a referencing method. The project specification refers to AMA, but AMA is not attached to the project specification. The specification reader has to study the project specification and the AMA together

In short, project specifications contain only differences from the AMA system and some additional information. With these changes the specification drafter decides how detailed his project specification will be

5.2.2.1 Links between the Swedish AMA specification system and other documents

AMA98 is related to drawings, bills of quantities, cost estimates and product information through the BSAB classification system. Standard methods of measurement are coordinated directly with AMA98. Cost estimate reports are built up elementally using BSAB Table 2, subdivided by Table 1 when a more detailed breakdown is required

Drawings use the principal group numbers in BSAB Table 2 (e.g. 33) as part of the drawing number to provide elemental groupings of graphic information. Notes on drawings can be directly linked to the specification by cross-reference

In the event of a discrepancy between the project documents, the specification takes preference

Because the AMA is a reference specification system contractors of all types in the industry must have their own copy. There are approximately 2300 building and civil engineering firms, 1500 – 2000 HVAC firms and 800 – 1000 electrotechnical firms in Sweden of which almost 90% use the AMA system. Likewise do most consultants use the AMA system

5.2.3 The UK Specification Systems – NBS and NES

The UK has two national systems, namely:

- The National Building Specification (NBS) covering building construction
- The National Engineering Specification (NES) covering mechanical, electrical and associated services

The NBS is published by NBS Services, a division of RIBA Companies Ltd, which is wholly owned by RIBA, while the NES is published by the National Engineering Specification Ltd, a wholly owned subsidiary of the Chartered Institution of Building Services Engineers. Both systems consist of standard paragraphs that are reproduced in project specifications to define performance of components, elements and services, and the quality of materials and workmanship required

The NBS and NES systems are based on the same classification system called CAWS (see Chapter 4) that in turn is based upon natural groupings of work within the building industry and roughly corresponds to the usual programme of work sequence. It has a hierarchy of three levels grouping work sections together. A three digit, alphanumeric coding system is used (see Appendix 5) denoting the three levels, e.g.

H	Cladding/Covering
H6	Slate/Tile cladding/covering
H62	Natural slating

Only the NBS system will be discussed further in this report as this system is much more widely used than the NES system and of more relevance to this study (for the complete layout of the NBS system see Appendix 5)

Three versions of NBS are available through subscription services, namely Full (Standard), Abridged (Intermediate) and Minor Works. The Standard version is used for large projects, the Intermediate version for medium-sized projects and the Minor Works version for very small projects

In most cases, the architect is the specification drafter and he will select from the NBS system those items needed for the project. NBS provides two different types of items, one consisting of pre-formulated text (usually dealing with workmanship) and the other providing prompts for the user's own insertions (e.g. location, preparation, manufacturer and reference, accessories, etc). NBS does not have a standard arrangement or standard headings within work sections. The clauses are arranged to suit the type of specification, which can be a preliminaries, a performance specification, a materials and workmanship specification, etc. The specification drafter can work with the NBS system either manually or on computer by using specific software programmes (e.g. 'Specification Manager', 'NBS for Windows', etc)

Although not everyone in the UK uses the NBS system (some architectural firms use their own in-house specification system or adopt the specification from another similar project), the greater majority of firms find it useful since they lack the experience to write their own specifications. In almost all instances the specification will be drawn up by the architect and then distributed to the quantity surveyor (or directly to the contractor if no quantity surveyor is appointed) for incorporation into the procurement documentation. This is done mostly in an electronic format for easy downloading; normally through the Internet by means of File Transfer Protocol (FTP), which can be accessed by anyone, or only by using a password should there be a security need

NBS provides extensive guidance in the form of general notes at the beginning of each work section, and more detailed notes alongside the clauses. The latter assist the specification drafter to select and complete clauses, choose from alternatives and cross-refer to other sources of guidance. More general supporting information is also supplied as part of the service. This includes:

- Notes on the preparation of specifications
- Status lists giving a detailed history of revisions to each work section
- A listing of all standards, regulations and other technical references cited in NBS, showing the latest amendments and the location of these documents in the work sections

The service is further supported by public and in-house training and information courses to show specifiers, through practical exercises, how to use the NBS system

5.2.3.1 Links between the NBS specification system and other documents

Project specifications are compiled by altering a copy of the NBS text on paper or computer by deleting clauses, inserting project specific information where the text is incomplete, changing the text if necessary and adding new clauses. The objective is to produce a project specification which is a complete document, there being no need for the contractor to refer to NBS

NBS based project specifications cannot readily be priced. Bills of quantities, a separate document currently based on the SMM7, are produced for this purpose by a quantity surveyor,. The bills of quantities are issued together with the project specification, tender drawings and specific contract conditions to make up the full set of procurement documentation. On smaller projects the work is priced on the drawings and project specification only

The names of proprietary products are not included in NBS or NES. This is left to the specification drafter to insert them as part of the project specification. Users will receive product information directly from the manufacturer, either through sales representatives or by mail. Product directories are available which provide lists of manufacturers of certain products. The Building Centre, situated in London, offers an extensive product information service. RIBA Companies Ltd also provides product information in various forms – directories, data sheets, computer drawings on diskette, and manufacturers' product literature - as part of a library service. RIBA librarians update the users' libraries every month and the Company has created a database of products on CD-ROM that is based on the EPIC classification system, which is updated regularly

The CAWS classification for use by NBS, NES and SMM7 is not generally suitable for arrangement of information on drawings. Consequently NBS has been designed to allow coordination by cross-reference as described under the previous heading. Many clauses are for "types of work" rather than just material or workmanship, e.g. "brick walling", "built up felt roof covering system", etc. These can be cross-referred from the drawings and bills of quantities by stating the work section and clause code, e.g. "Polished concrete block walling F10/250".

NBS cross-refers to British Standards, Codes of Practice, industry standards, and other specifications where suitable, in order to minimise the amount of information given in the project specification, particularly for materials and components

5.2.4 The Australian National Specification System – NATSPEC

Construction Information Systems Australia (CISA) was founded in 1975 and has as its primary function the development, production and maintenance of the national building specification – NATSPEC

NATSPEC is a simple generic subtractive system. That is, generally only one version of a clause is offered (this makes it simple), there are no clauses specifying proprietary products (therefore it is generic), and specifiers start with full prototype work sections, and are expected to delete text not required (hence it is subtractive)

NATSPEC material is organised fundamentally around work sections (which may correspond in scope to trades - see Appendix 6) that are broken down into subsections, then into clauses and subclauses, and finally into paragraphs and subparagraphs. Work sections are not numbered (it is left to the project specification drafters to number their work sections as they see fit). For subsections and down in the hierarchy, a certain amount of standardisation has been imposed. For example, the first two subsections are usually General, and Quality. Subsections and clauses are numbered consecutively, e.g. 2.1, 2.2, 2.3, etc. Subclauses, paragraphs and subparagraphs are not numbered. Hereunder is an example of tracing through the hierarchy:

Work division		Structure
Work group		Concrete construction
Work section		**In situ concrete**
Subsection	5	PLACING AND CURING
Clause	5.6	CURING
Subclause		**General**
Paragraph		Curing period:
Subparagraph		. Fully enclosed internal surfaces

NATSPEC contains five packages for different applications, namely:

- BASIC
- BUILDING
- SITE+STRUCTURE
- SERVICES
- DOMESTIC

Each package is regularly updated (at least twice a year) to reflect new or updated Australian and other standards, changes to the Building Code of Australia and technical developments in the building industry, and has a comprehensive Commentary to help the user to customise and supplement the material for the specific project

NATSPEC BUILDING is for use on more complex buildings and it is NATSPEC's definitive specification. The remainder of this section will focus only on this package

NATSPEC BUILDING also covers tendering procedures, preliminaries, quality assurance and contracting issues. It consists of three components, namely:

- Introduction;
- Templates; and
- Commentary

Each NATSPEC work section consists of two MS Word files – a NATSPEC Template file (which can be copied and edited to suit a project) and a NATSPEC Commentary file (which gives guidance on editing procedures). When writing the specification, a split screen enables the specification drafter to have the Template files on the left and the relevant Commentary pages on the right. There are hyperlinks from blue clause headings in the Templates to the equivalent clause headings in the Commentary

Appendix 6 provides a complete list of all the work sections in the NATSPEC specification system

5.2.4.1 Links between the NATSPEC specification system and other documents

Because the content of the system is generic, use of proprietary reference is an *alternative* to what is provided, that is, where brands and model numbers are identified, project specification drafters may have to delete or alter the text of NATSPEC. It is however recognised that, for many items, specification by proprietary item is the norm. The Company's ATLAS is intended to assist, by advising specification drafters which products demonstrably conform to standards specified in NATSPEC, using third party product certification or attestation schemes

However, for many items it is not usual to specify by trade name, e.g. fasteners, aggregate, masonry units, etc. For some clients, particularly those in the public sector, it is generally not permitted to use trade names (exceptions are commonly made for ironmongery items, and for some items subject to long-term supply contracts, such as carpets)

NATSPEC makes extensive reference to Australian and some British and American standards. The Commentary advises on the legislative status of standards and suggests sources of further information

There is no organised set of links between NATSPEC and other documents at this stage, though hypertext links, mostly to background technical information, cited standards and the Building Code of Australia, are provided on the BuilDIR CD-ROM,. However, the current (fifth) edition of the Australian Method of Measurement (ASMM) has been aligned to the structure of NATSPEC. This is evident from the following extract from its preface: *It was acknowledged that with NATSPEC to be adopted nationally there was a need to align the ASMM with NATSPEC, at least in terms of set-out, terminology and sections. The new edition provides for Bills of Quantities to be readily aligned with NATSPEC sub-contract sections*

5.2.5 The Netherlands Specification System – STABU

The specification system in the Netherlands is the STABU system, published by 'Stichting Standaardbestek Burger- en Utiliteitsbouw (STABU)' and has existed in its current version since 1991. The system covers all types of building construction work, but excludes highway construction and other civil engineering works. Civil engineering is covered by the RAW specification, published by the 'Centre for Research and Contract Standardisation in Civil and Traffic Engineering (CROW)'. STABU works in close collaboration with CROW and the two publishing organisations endeavour to harmonise their systems as far as possible. (In this study report the focus will be on the STABU system only)

The STABU system can be used in all phases of the construction process (e.g. inception, design and production). It can also be applied for the maintenance of buildings. The system is structured by work sections, elements, trades, products and spaces, and was specially developed for use with computers. It consists of a relational database, together with the necessary classifications and a comprehensive library of specification texts. It is based on the assumption that each part of a project has its own identity. In the system such parts are called "building parts" and "spaces". Building parts are the physical parts that can be recognised in a building, like walls, floors, stairs, lifts and heating installations. Each building part represents a "group" that contains a number of variants, representing special types and subtypes. For example, some of the variants for WALLS are: cavity walls, curtain walls, wall openings, lintels, etc. Spaces are the inside and outside spaces of the building that could each have their own specification. At the time of drafting this research report the details for this specification group were not yet available

The STABU system lends itself to integration into a future computer information system that would cover all aspects of information used in the construction industry, allowing interfaces with drawing systems, design systems, cost information systems, planning systems, management systems, product information systems, building regulations and standards. The STABU system has already grown into an extensive information system for the building industry, from inception to demolition and recycling

The different types of specifications are organised into the following specification groups (see Appendix 7 for a more detailed arrangement) that can be related to each other:

- A *General information,* covers standards, contract conditions, drawings, calculations, documentation, location and tender information

- B *Products and materials,* describes construction products and materials either by means of performance or prescriptive orientated specifications

- D *Building parts,* represents those parts of a building (such as walls, roofs, floors, etc) that can be identified in the first and subsequent design drafts. The building parts are described either by means of performance or by means of prescriptive orientated specifications

- F *Functions,* describes performances and functional requirements of building parts

- M *Site equipment,* as far as it is important for a specification

- R *Workmanship/Assembly,* describes the quality of the work result, workmanship, tolerances, etc

- V *Spaces,* describes inside and outside spaces of the building that could have their own specification

A complete description of a building part uses variant descriptions out of one or more specification groups, and description units have been defined which can be used to specify building parts. In these description units pointers are given to the relevant specification groups. For example, there is a description unit: “22.32.12 MASONRY WITH MORTAR, SANDLIMESTONE BLOCKS”, pointing to several specification groups, among which is B211312 SANDLIMESTONE BLOCKS. This description unit can be used to specify, for instance, one of the possible variants of the building part WALLS

Figure 4 gives a diagrammatical layout of the structure. On the left a building part is described as a Performance Specification, and on the right as a Prescriptive Specification. The Building Parts are defined in the main group “D”

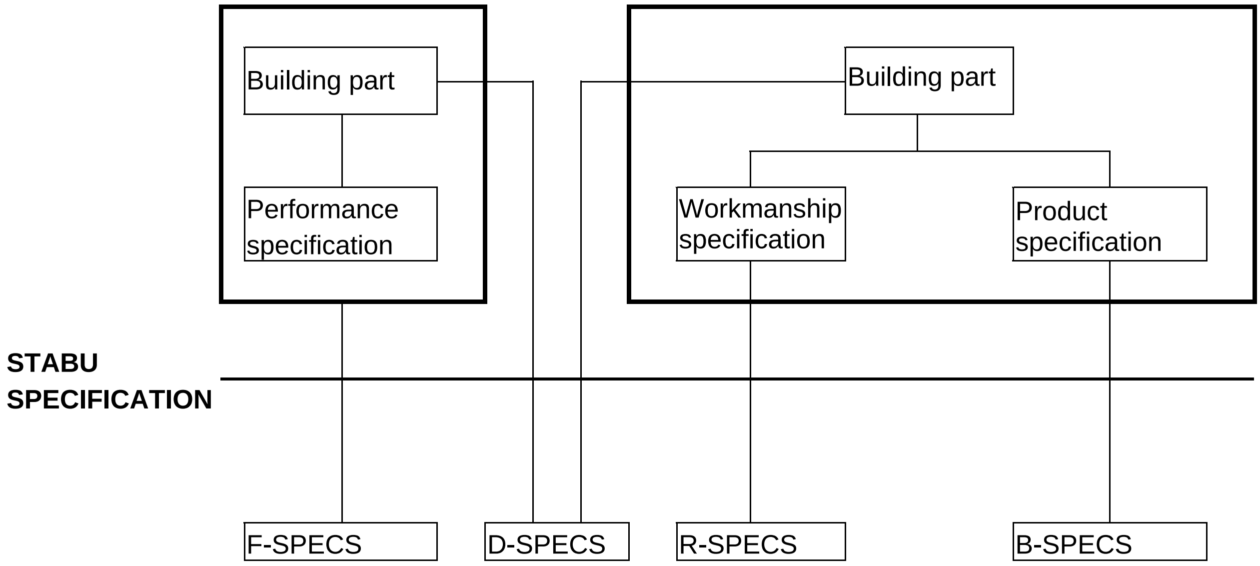


Figure 4: Structure of the Netherlands STABU specification system
Source: ICIS Report No 1

Each classification of a main group has two levels: the group level and the variant level. The group level identifies a “family”, and the variant identifies members of the family as well as subgroups within the family

Building parts (main group “D”) on the group level represent those parts of a building that can be identified in the first design sketches, such as outer walls, inner walls, roofs, floors and heating installations. The variants in these groups identify special types and subtypes. Thus, on the high level these building parts could be used as Elements. When the design process progresses these Elements will be decomposed into parts, which will, however, remain part of the Element family

The other main groups ("B", "F", "M", and "R") are categories of specifications, which follow the same principle as used with building parts

A project specification is written by using the relational database that permits the specification drafter to enter and use the system in three different ways: with keywords, with building parts or with work sections. It does not matter which entrance mode was selected because, due to the relational database, the final project specification will always be the same

5.2.5.1 Links between the STABU specification system and other documents

The STABU system is used in conjunction with the *'STABU Standaard 1990'* that defines the standards and terms of work based on the 'Uniforme Administratieve Voorwaarden voor de uitvoering van werke (UAV)'. The STABU standards book is updated regularly, and forms part of every construction contract in the Netherlands that is based on STABU

Manufacturers may, if they so desire, advertise proprietary specifications of their products in the STABU database. (General neutral specifications are however always provided; therefore the specifier is never obliged to select a specific manufacturer's specification). When referring in the database to information on manufacturers and proprietary products such information is marked with a small 'f'. In the project specifications the various products can then be described in more detail, e.g. by colour and size. STABU is currently developing, in collaboration with manufacturers, knowledge-based computer systems (expert systems) that will assist architects in selecting the most appropriate products for their project

The most common commercial product information system is published by 'Nederlandse Bouw Dokumentatie (NBD)'. NBD and STABU publish a joint product information system, including references to building standards. This information has been available on CD-ROM since 1994, and manufacturers pay a fee to NBD for advertising their products on the system. A substantial percentage of Dutch manufacturers are already participating in the NBD system (Woestenenk, 2002)

All the parties involved in a particular project would make use of the STABU specification. Architects and engineers normally prepare the specification, and the contractor uses it to enter the quantities and rates to make up his tender. The contractor provides those relevant parts of the specification to his subcontractors, but sometimes not all subcontract works are specified, in which case the subcontractor must prepare his own particular specification. Quantities are generally calculated by the contractor himself (the use of independent professional quantity surveyors for this purpose is not common in the Netherlands). For this purpose the STABU organisation has developed standard bills of quantities combined with the specification system, and subscribers to the system need only to enter quantities and rates against the various items. Several other cost data programmes exist on the Dutch market, not all of which are interfaced with the STABU system

STABU invokes the Dutch national standards issued by the ‘Dutch Institute for Standardisation’ and CEN, DIN and ISO standards. A similar interchange (as for product information) exists. Normally only the Dutch and CEN standards are used (in approximately 95% of instances). DIN and ISO standards are only used if a Dutch or CEN standard is not available, or if they are clearly superior

5.2.6 The American Specification System – MASTERSPEC

Several specification systems exist in the USA. Some are private enterprise systems, and others are US Government agency guide specification systems for use by architects and engineers for project specifications written for that agency’s purposes

The two major private organisations that produce and publish specification systems are the American Institute of Architects (AIA) and the Construction Sciences Research Foundation (CSRF). The Professionals Systems Division of the AIA produces the MASTERSPEC Specification System and CSRF produces SpecText. SpecText is reviewed and approved by the CSI

MASTERSPEC and SpecText are similar in scope and content. The main difference is in their methods of presenting optional text from which to choose in order to draft a project specification. MASTERSPEC presents a library of full text specification paragraphs from which the architect/engineer selects. Unwanted paragraphs are then deleted by the specification drafter (it is thus similar to the British NBS specification system). SpecText presents some optional text from which to choose and further provides blank spaces in which to insert variable text. MASTERSPEC is the most widely used system in the USA

MASTERSPEC is organised according to the MasterFormat classification system and SectionFormat (see Appendix 8 for a more detailed arrangement). The former classifies work sections and the latter organises a specification section that divides each section into three parts (see also 4.3.5 hereinbefore):

- Part 1 describes how the products in the section relate to the remainder of the specifications
- Part 2 describes the qualitative requirements for the products included in the section
- Part 3 specifies the quality of workmanship for installation of the products

Each part is subdivided into articles and paragraphs that are presented in a uniform sequence from section to section (see Appendix 8). This standard format contributes to specification information being presented in a consistent and uniform sequence

MASTERSPEC is used by architects, structural engineers, services engineers and interior designers in private and public offices (including federal organisations) on an annual “license-to-use” basis that is updated four times a year by issuing revised and new work sections. Updating is accomplished through a process of review by a committee of system users and researched by full-time AIA staff specification writers

Project specifications are compiled by altering a copy of the MASTERSPEC text on paper or computer screen, deleting editorial instructions and unwanted paragraphs, inserting project specific paragraphs, and finally numbering the paragraphs or lines of text to aid referencing (see Appendix 8). The completed specification is a self-contained project-specific document resulting in contractors not having to refer to the original MASTERSPEC text

MASTERSPEC based project specifications are not priceable documents. Contractors have to prepare their own estimates of quantities for tendering purposes. Bills of quantities are not common in the USA

5.2.6.1 Links between the American MASTERSPEC specification system and other documents

MASTERSPEC can be coordinated with drawings at work section level by cross-reference to the MasterFormat codes. A drawing annotation system, called CADNOTES/M, has been developed for this purpose. This is a database of coded keynotes that extends the MasterFormat classification with a structured suffix to uniquely identify specific components or elements, e.g. '10160.A32 Toilet partition, metal; ceiling hung; porcelain enamel finish'

MASTERSPEC links with standards and codes of practice by cross-reference where relevant

5.3 GENERAL DESCRIPTION AND STRUCTURE OF SPECIFICATION SYSTEMS IN THE RSA

5.3.1 Introduction

Because of the distinct differences in procurement methods that have existed in the RSA over the years between the private and public sectors, the information on procurement documentation, with specific reference to the application and development of specification systems in these two sectors, will be provided under separate headings in this section

Traditionally specifications for private works - whether general, particular or both - were produced solely by the architect. This is still happening to a certain extent, especially in cases where a quantity surveyor has not been appointed. In the latter circumstance architects will normally make use of their in-house general and project specifications. These in-house specifications differ in style and format between individual architectural firms as no national standardised specification system exists upon which they can be based. These in-house specifications are frequently also outdated or incomplete. Some architects, after being questioned on this issue, expressed the view that this state of affairs was caused by the erosion of their fee income, in addition to other criteria. Since the minimum fee scales were abolished some two decades ago, architects have had to compete with their counterparts, as well as with other disciplines such as engineers and quantity surveyors, on a fee basis in order to secure appointments. This *status quo* has resulted in architects not being able to spend the quality and quantity time that is required to draft proper specifications on individual projects. However, it must be mentioned in this regard that some use is being made nowadays of a publication by Wegelin called *Model Building Specifications and Standards Guide for Architects, 4th edition (Amendment 2, Nov 2000)* that contributes to more uniform and up-to-date specifications. This publication is also available in diskette format for convenient downloading

Seen against this background, architectural firms in the RSA were often accused of neglecting their duty to consistently produce quality and comprehensive specifications on projects where they had that particular responsibility. Incomplete or inaccurate specifications lead to claims from the contracting fraternity and ultimately put the quantity surveyor in the unenviable position of having to explain to the client why additional costs had been incurred

The situation has therefore arisen that the quantity surveyor, if appointed and thereby being part of the professional team, is forced to take on the additional responsibility for producing the specifications on almost all private sector works. The architect will usually issue his annotated drawings, occasionally accompanied by specific model specifications (such as those for national anchor tenant installations that may include supermarket chains, clothing chains, etc.) to the quantity surveyor for measuring purposes. It is prescribed in the Standard System of Measurement Building Work 1999 (SSM) that quantity surveyors shall prepare bills of quantities containing clear and complete descriptions, leaving no reasonable doubt as to their intent and meaning, and that contain all the essential information necessary for pricing. Without a proper and comprehensive separate specification, the quantity surveyor is obliged to insert additional preambles, either as a complete section in the beginning of the document, or as part of the various trades, to accommodate the preceding requirement for comprehensiveness

Quantity surveyors took cognisance of these changed circumstances and the Association of South African Quantity Surveyors (ASAQS) set up a committee to produce model preambles for the building industry to meet the foregoing requirements. The development and format of this model document are described in more detail below

5.3.2 Private Sector: The Model Preambles for Trades 1999 – ASAQS

The Model Preambles for Trades, 1999 edition (Model Preambles), is the current primary document in use on most major private building works in the RSA, especially in instances where a quantity surveyor has been appointed as one of the agents of the professional team, and where bills of quantities are to be prepared. For minor works, such as private residences etc, the architect will be the sole agent in most cases, and the specification that will apply (if at all) will usually be the descriptions on contract drawings and/or an abbreviated in-house particular specification

5.3.2.1 Development and status of the Model Preambles

During the late 1970's the ASAQS requested the Northern Transvaal Chapter (currently known as the Gauteng Chapter) to produce a standard preambles document that would have as its basic philosophy the assistance of quantity surveyors in abbreviating descriptions in the text of bills of quantities. A committee for this task was established under the chairmanship of Trevor

Louw, and the committee finally published the document in 1980, entitled *Standard Preambles for Trades, First Edition*, under the then chairmanship of Carl Klopper

In or about 1986, another committee was formed to consider the development of a revised Model Preambles document for the local industry that would also accommodate for coastal conditions where these differed from inland conditions, and which were until then not fully covered in the aforementioned document. As this was largely done at the instigation of Brian (Buddy) Scott, who served on the ASAQS Board at the time, it was decided to establish this committee in Durban, a coastal location, where he resided. The initial members of this committee were all members of the local Natal Chapter committee, and after three years of intensive work the first edition of the *Model Preambles for Trades* was published in 1989

The ASAQS also requested that the document be updated when necessary and reprinted when stocks of the previous edition run low. Further editions were updated with relatively minor amendments and were published in 1992, 1995 and 1997

When the ASAQS requested another revised edition after 1997, it was decided to broaden the representation of members on this committee to include other sectors of the building industry. A new committee, which included representatives from the South African Institute of Architects (SAIA) and the local Master Builders Association (MBA) representing the Building Industries Federation South Africa (BIFSA), was formed

As a result of this interaction between various sectors, an intensive examination of the entire document was carried out. This resulted in the publishing of the most recent edition in 1999

According to Cahill (2002), the present chairman of the Preambles Committee, the committee is currently in a dormant status, but will presumably be revived whenever stocks of the current edition are running low. In the meantime the chairman's only task is to respond to queries and to keep note of various points raised for possible inclusion in the next revision

5.3.2.2 General description and structure of the Model Preambles

The Model Preambles is arranged in the traditional trade format that corresponds exactly to the trade format of the SSM, but with the exclusion of certain of the trades (i.e. Preliminaries, Lateral support, Piling, Electrical work and Mechanical work). This format has been in existence, with only minor amendments, since the early 1900's. The trades in the Model Preambles are broken down into clauses and subclauses, and then into paragraphs. Only the clauses and subclauses are numbered, but the numbering is unique for each trade, as there is no standardisation between the various trades. Apart from the same trade order as in the SSM, there is no further correspondence within the respective trades with regard to the order or headings between the two documents

Wherever possible, reference has been made throughout the Model Preambles to the South African Bureau of Standards (SABS) – now Standards South Africa (STANSA) - Specifications and Codes of Practice to describe workmanship and materials respectively. Where such Specifications or Codes do not exist, suitable preambles have been compiled for workmanship and materials. The Model Preambles, however, only covers workmanship and materials to be encountered in a significant majority of projects. Therefore, if a material is not likely to be encountered in a significant majority of projects, its preamble will not be included in the Model Preambles, and specific preambles would have to be drafted to ensure that the preambles for a specific project are complete

5.3.2.3 Links between the Model Preambles and other documents

The following recital of items 1.3 and 1.4 in the 'Explanatory notes and instructions' on the use of these Model Preambles demonstrates the link between the Model Preambles and bills of quantities in particular:

1.3 By its very nature, this document is a "Model" document and one that is designed to act as a basis upon which to build. It is anticipated that it will be supplemented by a "Supplementary Preambles" document included in the text of the bills of quantities that will include, inter alia, the following:

1.3.1 supplementary clauses of a general nature that practitioners may deem necessary to cover their own individual requirements

1.3.2 additional clauses pertaining to specific materials incorporated in a project and not covered by the Model Preambles

1.3.3 amendments to anything contained in the Model Preambles. A clause has been incorporated in the "General" section of the document stipulating that anything contained in the "Supplementary Preambles" which is at variance to what is contained in the Model Preambles, will take precedence over the Model Preambles and apply to the works in hand

1.4 It is intended that this document will be used by reference only in the text of the bills of quantities and will NOT be bound or reproduced therein

Apart from the link described above between the Model Preambles and bills of quantities, there is no other organised set of links between the Model Preambles and other documents. The Model Preambles is available in hard copy format only with the result that the text cannot be changed or expanded to create a project specification. This study will attempt to establish in Part 3 whether these and other limitations such as its incompleteness, are real problems that users of the document in the local building industry experience, and whether it will continue to limit the document's use until these shortcomings have been addressed and brought into line with national standards prevailing in the other countries investigated in this study report

5.3.3 Public Sector: Standard Specifications etc

5.3.3.1 General

The democratisation of the RSA in April 1994 and its subsequent re-entry into the international community has had a profound impact on the environment in which its people are now living. The new government has embarked upon a number of initiatives aimed at developing policies, procedures and practices to respond to the challenges brought about by the changed environment

Some of the documentation emerging from these activities which impact on the workings of the construction industry are:

- The Reconstruction and Development Programme (a political initiative to assist in the upliftment of previously disadvantaged people)
- The National Home Builders Registration Council (NHBRC) Bill
- The Green Paper on Public Sector Procurement Reform in South Africa
- The Labour Relations Act
- The 10 Point (Interim Strategies) Plan
- The Green Paper on Public Works towards the 21st century

- The White Paper on Creating an Enabling Environment for Reconstruction Growth and Development in the Construction Industry

As part of the attempt to reform public sector procurement in the RSA, a Procurement Forum was established to oversee this initiative. A task team was appointed, comprising of officials from the office of the State Tender Board and consultants from the private sector, to research and draft policy proposals for consideration by a policy unit comprising of the Minister of Public Works, the Deputy Minister of Finance and senior officials from the departments of State Expenditure, Public Works, Trade and Industry and Arts, Culture and Technology. The task team was funded by means of a grant obtained from the World Bank by the Minister of Public Works prior to the 1994 elections

At the outset of the process, it was recognised that legislation, following a white paper on procurement, would be required in order to coordinate all reform policy proposals to make the process operational. As a result, the task team was required to develop interim policy proposals, which could be implemented within the ambit of existing legislation, and as such serve as the interim policy until such time as the reform process had run its course. A 10 Point (Interim Strategies) Plan was adopted by the then Cabinet of National Unity during November 1995. The ten points of this plan encompass the following strategies:

1. Improvement of access to tender information

2. Development of tender advice centres

3. Broadening of the participation base for contracts less than R7 500

4. Waiving of security/sureties on construction contracts having a value less than R100 000

5. Unbundling of large projects into smaller contracts

6. Promotion of early payment cycles by Government

7. Development of a preferencing system for small and medium enterprises owned by historically disadvantaged individuals

8. Simplification of tender submission requirements

9. Appointment of a procurement ombudsman

10. Reclassification of building and engineering contracts

The 10 Point Plan remains the Government's procurement policy to date

The Green Paper on Public Sector Procurement Reform contains a number of specific proposals regarding uniformity in contract documentation. These relate to:

1. The generic categorisation of contracts

2. The formatting of contract documentation

3. Standard conditions of contract

4. Standardisation of contract documentation

5. Construction standards

6. Families of general conditions of contract

7. The publishing and distribution of specifications

Some aspects of the above proposals in the Green Paper and their implications, insofar as the construction industry is concerned, were reviewed in a report by Watermeyer entitled *Contract documentation in a changed environment* (Watermeyer, 1997) at the 1997 Annual General Meeting & Convention of South African Association of Consulting Engineers (SAACE). The aspects that dealt specifically with specification matters were:

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)

The implications of this proposal are as follows:

- Changes in conditions of contract should not affect other aspects of the contract such as specifications, measurement and payment

- The specifications of the Committee of State Road Authorities (CSRA) are unacceptable, as they contain conditions of contract and terms of payment

- The SABS 1200 Standardised Specifications are unacceptable, as they contain both methods and terms of payment, but can be made acceptable by the removal of Section 8 in respect of each specification

- The Department of Public Works (DPW) PW 371 Specification of Materials and Methods to be Used needs to be revised to make it acceptable, as it makes reference to prices in several of its sections

- Stand-alone standard systems of measurement, independent of specifications, are required

Government should play a leading role in the standardisation of contract documentation and contract options and set an example in this regard for the private sector

The private sector will in all probability only be persuaded to make use of public sector documents if these documents embrace best practices which are superior to the documentation which they currently utilise. Conversely, the public sector will only make use of private sector documentation if such documents adequately serve their requirements in the reformed procurement environment

Construction standards common to all disciplines should be developed for engineering and construction works contracts

This proposal raises a number of issues as it implies that there should only be one standard. Currently, in the civil engineering sector there are two roadworks specifications *viz* CSRA and SABS 1200. CSRA has always been justified on the basis that it covers major roads, whereas SABS 1200 only covers township roads. Recently, however, standardised SABS 1200 series specifications have been produced for major roadworks. A call for a single standard will require either an amalgamation of these standards or the abandonment of CSRA, as it is limited in its application

In the housing sector, NHBRC has produced standards and guidelines, as it found that existing building industry specifications do not provide adequate risk exposure. These standards differ materially from other standards, as they keep references to SABS specifications to an absolute minimum, and rather list the salient and relevant requirements that need to be satisfied

The whole tendering process should be made more accessible to emerging enterprises by ensuring that tender documentation is:

- ***easy to comprehend and "user-friendly"***
- ***free of unduly onerous requirements and conditions***
- ***standardised***

The current call is to simplify documentation. Simplification needs to deal with issues such as language, style, presentation, layout and numbering. At its centre is coherency in documentation and structure. For example, civil engineering contract documents, which are structured in accordance with SABS 0120, are easy to follow, as the contents are presented in a logical sequence, and the reader knows where to find specific aspects of the contract. Furthermore, sections of such documentation, for example, project specifications and special conditions of contract, are drafted in such a manner that amendments to standard documentation can be readily detected. This is often not the case in building contracts

The White Paper on Creating an Enabling Environment for Reconstruction Growth and Development in the Construction Industry addresses several aspects of procurement insofar as the construction industry is concerned, one of which is the establishment of a Construction Industry Development Board (CIDB). This led to the promulgation of the CIDB Act (Act 38 of 2000). This Act tasks the CIDB with, *inter alia,* the promotion and implementation of policies, programmes and projects aimed at procurement reform and standardisation and uniformity in procurement documentation, practices and procedures. The Act also empowers the CIDB to publish best practices, promote standardisation of procurement processes within Government's procurement policy framework, and allows the CIDB to initiate, promote and implement national programmes and projects aimed at the standardisation of procurement documentation, practices and procedures

Both the public and private sectors have responded positively to the aforementioned Green and White Papers in a pragmatic manner, and a number of working groups and committees have been established in developing documentation previously referred to under this heading

A brief overview will be provided below on the current standing of development of the Government's policy framework on standardisation of procurement documentation, as regards specification matters for building work only

5.3.3.2 The Department of Public Works' PW 371 Specification of Materials and Methods to be Used (PW 371)

The fourth edition of the PW 371 is the current primary document in use on most public building works in the RSA. The DPW is the official body responsible for the publication and revision of the document. It was last revised in 1993 after the first edition was published in 1982. The format and application of the document are similar to that of the Model Preambles described hereinbefore and the document therefore has the same limitations on its usage. This document is one of those identified in the aforementioned Green Paper that needs to be revised to make it acceptable. However, van Schalkwyk (2002), head of the standard documentation section in the DPW at the time of drafting this chapter, revealed that the DPW had no immediate plans to update the document due to a lack of funding

5.3.3.3 SABS 1200 and SABS 0120 documents

The Watermeyer report published in May 2002 entitled *An update on standardisation, simplification and uniformity in procurement documents* set out, *inter alia,* the current position and status of these documents

SABS established a Technical Committee for Construction Standards (TC 5120.61) during the latter part of 2000 to deal with a large number of standards covering all aspects of construction works. Work priorities with respect to procurement-related documents were identified as being to:

- revise SABS 1200 and SABS 0120;
- develop construction standards for building work; and
- develop targeted procurement standards

Both SABS 1200 and SABS 0120 were developed for, and are used exclusively for, civil works in the RSA, except for certain Standard Specifications in SABS 1200, e.g. CONCRETE (SABS 1200G) and STRUCTURAL STEEL (SABS 1200H or 1200HA), which are often adapted and included in the preambles or specifications for building works. The abovementioned committee has taken a decision to withdraw SABS 1200 and SABS 0120 once a new specification for construction works that encompasses both civil and building works has been drafted. A working group has been constituted and a project leader has been appointed to develop this new specification, which will be referred to as *SABS 2001: Standardised specifications for Construction Works*

Question 1.9 of the questionnaire (see Appendix 9) posed the question whether there is support for the development and ultimate adoption of a single comprehensive standard specification in the RSA. Judging from the foregoing, it seems that the Government, through the initiatives of the abovementioned Technical Committee, is about to embark on such an exercise. Actions in this regard are, however, currently limited to the civil engineering industry. The following segment from Table 1 contained in the abovementioned report confirms the abovementioned objective (Watermeyer, 2002)

	Key proposal	**Implications of proposal**
4	Construction standards common to all disciplines should be developed for engineering and construction works contracts	1) There should be only one series of standardised specifications 2) Construction standards should not cover issues raised in standard forms of contract

Only after SABS 2001 has been completed (it is anticipated that it will be developed in a phased manner and may take several years to complete), and the South African Institute for Civil Engineers (SAICE) has published the new measurement and payment system, can SABS 1200 and SABS 0120 be withdrawn or phased out

5.3.4 Commercial specification systems

A number of commercial product library information systems have come onto the South African market in recent years for specific application in the construction industry, mainly as a result of the advancement in IT. The initial objective of these systems was to replace the libraries of catalogues with complete on-line product information that would be accessible to designers, estimators, quantity surveyors, contractors, etc. Some of the systems that have been developed to date are integrated with specific bills of quantities production programmes, with the information on products and services being classified according to the usual trade format approach prescribed in the SSM

The information that is provided in these systems about products aims to be complete, i.e. without a need for further reference to hard copy catalogues. Thus information such as place of manufacture, materials from which the product is made, complying standards, warranty details, application methods, etc are all provided. In addition, model bill descriptions of all likely items to be encountered for the specific product range are often provided, which can be conveniently downloaded by the taker-off. These systems, however, still have very little utilisation in the construction industry (see Chapter 8). A possible reason for the slow uptake is that the number of manufacturers subscribing to these systems is still relatively small, with the result that not enough information is available, thereby rendering the use of the service ineffective

5.4 SUMMARY

The specification systems described in this Chapter, and in the aforementioned two reports published by ICIS, all differ in their scope and content and the level of detail they contain. Nevertheless, there are no substantial differences between the systems; they all cover more or less the same basic construction works, their structure follows the chronology of a construction project, and their main users are consultants and contractors. Further development of all the systems investigated seems to be in the same direction and follows the technologically most advanced specification systems (more specifically those of Switzerland and the Netherlands). A common goal is the continuous integration of computer technology, mainly by providing interface facilities with other construction information systems

Most of the existing systems use a word processor environment, which means that a “delete unwanted text” or “cut and paste” technique is used to produce project specifications. This has the result that the information is only interpretable by humans. In relational systems, bits of information can have a meaning understood by computer, through definition of attributes and possible ranges of values, so that the information can be interpreted by the system and processed without human intervention. It is commonly accepted (see Chapter 3) that much more work and research are still needed in this regard

To summarise, there are more similarities than differences between the various specification systems investigated. There is a common nucleus in all these systems, as they all do the same thing in a slightly different way, i.e. offering specification items for specification writers of construction projects. Differences between the specification systems result mainly from national legislation and usages. The conclusion reached in the abovementioned Report No 2 is that harmonisation of national specification systems will not be achieved in the short or even medium term, as the cost of and hindrances to a conceivable harmonisation outweigh the benefits. However, it is expected that in the long term (10 to 20 years) some form of harmonisation will be possible. This trend towards harmonisation is expected to be driven mainly by growing internationalisation and the resulting needs and demands of consultants and construction companies operating at both national and international levels. Computer technology and software developments will obviously also continue to have a major impact, as only these technologies can provide the real means for international information exchange

The advancement and rapid growth in IT, and the limitations of current information structures in this respect, is cause for the local construction industry to seriously review its applications. It is therefore suggested that if the local construction industry wants to derive mutual benefit for all concerned, by bringing the local information structures up to an acceptable level with what is on offer elsewhere in the developed world, it will have to embark on cooperative efforts with international organisations and countries abroad that have adopted, or are currently developing, new concepts in information analysis

PART 3

RESULTS AND ANALYSIS OF DATA, GUIDELINES FOR AND PROPOSAL OF NATIONAL STANDARDS FOR CLASSIFICATION OF CONSTRUCTION INFORMATION, SUMMARY AND RECOMMENDATIONS

This last Part of the research document is divided into four phases. The first phase is covered in Chapter 6, which describes the methodology used to collect the data from primary sources. The second phase covers the results of the data gathered and the analysis thereof, and is presented in Chapters 7 and 8. The third phase deals with guidelines for restructuring work sections and a proposal for the establishment of national standards for classification of construction information, and is covered in Chapter 9. The final phase is Chapter 10, which gives a summary of the practical benefits to be derived should the proposals and recommendations be implemented and suggests possible areas for future research

The headings of the five chapters of this Part are as follows:

Chapter 6: Survey methodology for collection of the data

Chapter 7: First stage survey

Chapter 8: Second stage survey

Chapter 9: Proposed classification of construction information

Chapter 10: Summary and Recommendations

CHAPTER 6

SURVEY METHODOLOGY FOR COLLECTION OF THE DATA

6.1 INTRODUCTION

The choice of a sampling method depends greatly on the objectives and requirements of the research. The objectives of the data collection process from the primary sources for this research study were, firstly, to establish whether the data collected would provide adequate support for the hypotheses that are ultimately to be posited (see Chapter 10), and, secondly, to obtain additional recommendations from respondents which could assist towards the solving of the stated problems. As previously discussed (see 2.4 hereinbefore), a two-stage descriptive survey was regarded the most appropriate for the data collection process and analysis

The literature review stressed the importance and complexity of classification in the construction industry regarding its effect on the procurement processes. Some classification systems were discussed, and the advantages of national standards for the local construction industry were highlighted. The industry's need for a classification system, combined with various other factors such as the unavailability of an up-to-date and comprehensive national specification upon which the classification system can be based, and the lack of proper communication between the various industry players, were pointed out as important aspects for consideration. The emphasis in this study was on finding solutions to the stated problems, and not on determining the extent thereof. Extensive questioning and probing were therefore necessary, and it was decided at the time that the most appropriate method of investigation of the validity of some of the statements and views put forward would be a descriptive survey process

A survey, when reduced to its basic elements, is quite simple in design. The basic function of a survey is that the *researcher poses a series of questions to willing participants; summarises their responses with percentages, frequency counts, or more sophisticated statistical indexes; and then draws inferences about a particular population from the responses of the sample* (Leedy, 1997 : 196)

Because of the specialised nature of the statements and questions that are contained in the structured interviews and survey questionnaire, it follows logically that only that specific part of the population that disposes of the necessary knowledge and appropriate experience could be targeted

Modern communication technology makes data collection through questionnaires relatively simple and affordable, but the personal interviews that preceded the questionnaires, being costly and time consuming as a survey process, had to be narrowed-down to a limited number of pre-selected experts

The rest of this Chapter describes, for each stage of the two-staged descriptive survey processes, the methodology used to collect the primary data. Background information only is supplied regarding the survey procedures (the full results of the surveys are given in Chapters 7 and 8 respectively). The information is divided into the following sections:

- Sampling method
- Size of the selected sample
- Survey processes used for collection of the data
- Response

6.2 SAMPLING METHOD

The respective stages of the two-staged descriptive survey are, within each of the abovementioned sections, described separately under their respective stage headings

6.2.1 First stage

In Chapter 2 the reasons were given why the first stage survey was conducted in the UK (see 2.4.1). To obtain quality data from the selected sample, it was decided to set up structured interviews on an individual basis. The respondents were each personally contacted beforehand in order to inform them about the purpose and style of the proposed interview. The main objectives of the interviews were stated as the following:

- To determine to what extent quantity surveyors are making use of model documentation made available by the RICS, or any other body in the UK, in the procurement processes;
- To establish which party in the professional team usually takes the responsibility for drafting project specifications;

- To evaluate the continued use of bills of quantities in the procurement process, and to ascertain what influence computerisation in the measuring process has had on quantity surveying practices; and

- To evaluate how successful the implementation has been of the tabulated format of the SMM7 since its inception in 1988

6.2.2 Second stage

The potential survey population could have included architects, engineers, quantity surveyors, other building professionals such as landscape architects, town and regional planners, and contractors, subcontractors, manufacturers, suppliers, property developers, etc. This population would have amounted to literally tens of thousands of people, making the survey far too costly, and logistically almost impossible

As a result of these limitations on the size of the population, it had to be determined which sampling method would be the most appropriate, and from whom to draw the survey sample. In making inferences about a population, it is attempted to extract as much information as possible from a sample. The basic sample plan, *simple random sampling*, often accomplishes this goal at low cost. Other methods, however, had to be considered in this research report to increase the amount of information about the population. One such procedure considered is *stratified random sampling*. According to Keller & Warrack (2000 : 157) a *stratified random sample is obtained by separating the population into mutually exclusive sets, or strata, and then drawing samples from each stratum.* Another procedure considered is *judgemental sampling.* Hussey & Hussey (1997 : 147) state that according to this procedure *the participants are selected by the researcher on the strength of their experience of the phenomenon under study*

After careful consideration it was decided to draw the survey sample from the practices of only three of the abovementioned professional disciplines, namely architects, engineers and quantity surveyors. This decision was based mainly on two factors, i.e. the specific expertise that the person belonging to one of these selected professional groupings would possess regarding the subject matter, and the manageable size of the target population. The procedure followed to determine the size of the sample (see 6.3.2 hereinafter) was thus a combination of the abovementioned sampling procedures

The respondents were requested to rate hypothetical statements, conclusions and recommendations that flowed from the literature review in accordance with a five-point rating scale (first part of the questionnaire) or to indicate either a positive or negative answer to the questions in the "yes" and "no" blocks provided (second part of the questionnaire). At the end of each series of questions the respondents could state their own point of view by using the "open-ended" response format provided. The questionnaire was compiled in an effort to determine the following main objectives:

- To establish how effective and up-to-date the currently available specification systems are and whether there is a need for change;
- To determine the preference regarding the task of preparing specifications;
- To ascertain whether a preference exists for a single national building specification system in the RSA and, if so, who should publish, maintain and finance such a system;
- To establish what the classification format of such a national specification system should be;
- To investigate whether the Internet and/or individually customised on-line product information systems will suffice and in fact replace the need for a separate standard specification;
- To establish how often, and which of, the currently available product information systems are consulted, and whether they in fact satisfy the present needs; and
- To determine whether a need and the capacity exist for the development of a unified classification system for structuring product literature and project information similar to trends in other parts of the world

6.3 SIZE OF THE SELECTED SAMPLE

The larger a sample, the more the mean values of ratings on statements/tests etc. will incline towards the population mean values. For practical reasons mentioned before, the size of the samples for the two stages had to be limited, but at the same time still had to be representative of the population

The statistical viewpoint regarding the size of a sample is put forward in the following statement by Cooper & Emory (1995 : 211): *According to the central limit theorem, for sufficiently large samples (n ≥ 30), the sample means will be distributed around the population mean approximately in a normal distribution. Even if the population is not normally distributed, the distribution of sample means will be normal if there is a large enough set of samples.* Cooper & Emory (1995 : 205) note further that: *One false belief is that a sample must be large or it is not representative. This is much less true than most people believe*

Hence how large a sample should be is a function of the variation in the population parameters under study and the estimating precision needed by the researcher

Taking the above viewpoint and the actual size of each survey of the two-staged survey into account, the inputs from the structured interviews in the first stage and from the survey questionnaire in the second stage were regarded adequate to meet the objectives of the study

6.3.1 First stage

The choice of interviews as a means of collecting data and the sampling procedure for the first stage are discussed in Chapter 2 (see 2.4.1)

6.3.2 Second stage

The reasons why only the professional firms of architecture, engineering and quantity surveying in the RSA were targeted are given in 6.2.2 hereinbefore. The respective totals of the number of practices belonging to the abovementioned disciplines and registered with their respective organisations at the time of distributing the questionnaires are listed in Table 2 below:

PROVINCE	ARCHITECTS (SAIA)	CIVIL ENGINEERS (SAACE)	QUANTITY SURVEYORS (ASAQS)	TOTAL
Eastern Cape	94	68	62	224
Free State	68	33	45	146
Gauteng	735	199	238	1172
Kwazulu-Natal	229	135	124	488
Limpopo	29	48	25	102
Mpumalanga	37	39	25	101
Northern Cape	10	14	9	33
North West	29	29	23	81
Western Cape	446	106	107	659
TOTALS	**1677**	**671**	**658**	**3006**

Table 2: Total number of architectural, civil engineering and quantity surveying practices in the RSA (Sources: SAIA, SAACE and ASAQS)

Even ignoring the logistics involved in carrying out the survey of all the practices included in the Table above, the estimated cost proved to be prohibitive. The problem was, however, resolved by making use of the services of Specifile (Pty) Ltd (hereinafter referred to as Specifile), a subsidiary company of Information Handling Services South Africa (Pty) Ltd (IHS SOUTH AFRICA), which undertook to distribute the questionnaires amongst their subscribers. The entire Specifile circulation figure amounted to 2217, made up as follows:

- Architects 997*
- Quantity Surveyors 286*
- Building Designers 82
- Consulting Civil Engineers 169*
- Municipalities 72
- Builders 84
- Educational Institutes 92
- Mining Houses 18
- Government Departments 185

- Commercial Organisations (Property developers, export agents, etc) 232

TOTAL NO OF PRACTICES, INSTITUTIONS, ETC	**2217**

For the three professions selected (marked with an asterisk in the above circulation figures), namely architects, consulting civil engineers and quantity surveyors, the number of practices totalled 1452 (997 + 286 + 169 = 1452). This was considerably less (about 50%) than the total of 3006 for registered offices for these three professions listed in Table 2. Possible reasons that can be put forward for this discrepancy are that practices often operate as "ghost" practices for appointment purposes by state departments, or operate as single partner practices that cannot afford such information services. It was considered that most of the established practices would subscribe to an information service of the kind that Specifile offers. This latter fact substantially contributed to the decision taken to target only those practices on Specifile's distribution list and which formed part of the disciplines selected. It was furthermore decided that the total of 1452 practices for the target population was manageable, not only in relation to cost, but also in relation to handling matters such as delivering, collecting, coding, etc. of the questionnaires

6.4 SURVEY PROCESSES USED FOR COLLECTION OF THE DATA

6.4.1 First stage

For the survey process used in the first stage descriptive survey refer to 2.4.1: Interviews

6.4.2 Second stage

For the survey process used in the second stage descriptive survey refer to 2.4.2: Survey questionnaire

6.4.2.1 Analytical discussion of the questionnaire

The questionnaire is divided into five parts, each part covering a specific aspect or field of the study. This was done to give the questionnaire a logical structure and to provide an opportunity for the respondents to rate statements or answer questions and comment on each part separately. As the design of the statements or questions (statement/question construction) and the way in which the ratings/answers are to be recorded (response methods) are considered to be important contributory factors towards the overall success of questionnaires in any primary data collection process, particular attention was given to these aspects

It should be noted that the Division of Research Report, Department of Information Technology at the University of Pretoria, rendered valuable assistance in the structuring of the questionnaire

Statement/Question construction

The questionnaire starts with the collection of the "administrative" information such as the respondent's occupation, specialisation sector, location of organisation, etc. This is followed by the "target data" or research questions

In designing the statements or questions the following four criteria, in concurrence with Cooper & Emory (1995 : 302 - 317), were considered as being the most important:

- Statement/Question content
- Statement/Question wording
- Response structure
- Statement/Question sequence

Response methods

Both "closed" and "open-ended" responses were included in the questionnaire

- "Closed" responses – In "closed" statements or questions respondents were asked either to rank or rate alternatives; they were not given the opportunity to express their opinion. A five-point rating scale was mainly used to gather "closed" responses by requesting the respondents to encircle one of the five numbers provided. Number 5 meant "strongly agree", number 4 meant "moderately agree", number 3 meant "undecided", number 2 meant "moderately disagree", whilst number 1 meant "strongly disagree". Some responses provided for only two categories, i.e. either "yes" or "no", whilst one response called for a rating by marking with an **X** in one of four columns, headed "daily", "often", "seldom" or "never"

- "Open-ended" responses – In "open-ended" statements or questions respondents were given the opportunity to express their opinion in their own words. Cooper & Emory (1995 : 312) point out that "open-ended" responses supplement "closed" questions in a number of ways. Firstly, due to space constraints the researcher cannot really ask all the "closed" questions necessary. This alternative gives respondents the chance not only to express their views on the topic at hand, but also to highlight areas not covered in the questions. In certain cases the researcher might fail to address the problem adequately, or the real problem is not brought to the fore. Secondly, it serves as a controlling mechanism, as it allows the researcher to investigate the possible conflicting answers where they are in contrast with answers in the "closed" questions

Length of the survey questionnaire

In the second stage survey the "target data" or research questions were divided into four main problem areas that related to the:

- Drafting of specifications
- Format of specifications
- Management of product information sourcing
- Development of a classification system

Normally a short questionnaire is preferred, as common sense indicates that people do not want to waste time on lengthy responses. However, brevity for its own sake would fail to meet the objectives of the survey

Taking the abovementioned problem areas into account, a very short questionnaire would not have achieved the objectives of the research. However, a very compact format in the design of the "closed" and "open-ended" questions was followed, thereby restricting the length of the questionnaire to five pages (excluding the covering letter). A total of 53 statements/questions were included for which information or ratings were required and, in addition, provision was made for "open-ended" responses on each of the four main problem areas. It was further stated in the covering letter (in bold to draw the respondent's attention to the fact) that the questionnaire should take no longer than 15 minutes to complete

6.4.2.2 Procedures and analyses

After the completed questionnaires were collected from Specifile, they were encoded and submitted to the Department of Information Technology at the University of Pretoria for statistical analysis. Various consultations with the designated advisers from that Department and from the Department of Statistics were held to determine the most appropriate manner in which to present the data

These consultations culminated in the decision to make use of descriptive statistical methods so that the reader would be able to easily extract useful information from the data collected. Descriptive statistics, according to Keller & Warrack (2000 : 3) … *deals with methods of organising, summarising, and presenting data in a convenient and informative way.* One form of descriptive statistics uses graphical techniques that allow the drawing of pictures, and in Chapter 8 a variety of graphical presentations (bar charts and histograms), which were followed in each instance by inferences and conclusions based on the data presented, were used to achieve the abovementioned objective

The first phase comprised the presentation of the data collected from the statements made in Questions 1 and 2 (see Tables 6 to 24). A template was designed to cater for the sample as a whole and for the disciplines of architecture, quantity surveying and civil engineering separately, and incorporated the following:

- A horizontal bar chart that graphically displays the frequency data
- Mean values (arithmetic mean)
- Standard deviations that give a measure of the spread of the ratings

The second phase comprised the presentation of the data collected from the statements made in Questions 3 and 4 (see Figures 5 to 13). A variety of graphical presentations (histograms) were employed to depict the frequency distribution between the responses received from the three disciplines of architecture, quantity surveying and civil engineering

The final phase comprised the grouping of relevant statements or questions in Questions 1 to 4. Frequency and percentage distribution analyses were performed on the first four groupings (see Tables 25 to 28) to assist in establishing whether trends were indicated by the data collected that in turn could be used for drawing conclusions and inferences from the main objectives previously determined for the second stage survey (see 6.2.2 hereinbefore)

6.4.2.3 The criteria for admissibility of the data

Only responses from persons employed in the professional practices previously mentioned, who had duly filled in the questionnaires, were used in this study. No assistance was given to the respondents in answering the questionnaire, and in this way any external influences were avoided. Of the total of 274 questionnaires collected, only three had to be disregarded due to irrelevant comments and responses. It was found that the ranking of the importance of items from 1 to 5 was apparently misunderstood by some of the respondents, but because of the relative insignificance this had on the total result, these misunderstandings were ignored and all the responses of the accepted questionnaires were incorporated into the overall analysis without any qualifications or corrections

6.5 RESPONSE

6.5.1 First stage

Interviews were conducted with five firms of quantity surveyors in the private sector, represented by individuals listed hereinafter, and with one university. The procedure used on all six occasions was basically identical and consisted of:

- A general introductory discussion about the nature of the project and the people and institutions involved.
- A structured interview conducted in a semi-formal manner based on a list of prepared questions

Each interviewee was given the opportunity to comment or add to the list of questions that they were confronted with. For the full list of the interviewees and their particulars see Appendix 11

Data, which proved to be very valuable, were collected during the first stage data collection process and thereafter as a result of the aforementioned interviews and correspondence conducted. The process proved to be instrumental in the direction the research effort took after the completion of this stage. Full results of the first stage data collection process are contained in Chapter 7

6.5.2 Second stage

From the 1452 questionnaires (see 6.3.2 hereinbefore) delivered in person to the company that undertook the distribution, it was impossible to establish how many questionnaires actually reached the individual respondents. The field representatives were tasked to request the respondents to complete the questionnaire while the representatives were busy with their normal product information distribution process, and then to collect the completed questionnaire before they departed. This did not happen in all instances. For example, the responsible person might not have been at the office at that specific time, and the firm was then requested to complete and post or fax the questionnaire to the field representative. The field representatives close to the distributing company's head office in Johannesburg delivered the completed questionnaires by hand. However, the field representatives from areas outside the Gauteng Province had to make up a parcel of the completed questionnaires received, whereafter they posted it to the distributing company by making use of the Free Post Service arrangement that the company had with the Postal Services at that time. Unfortunately, during this period this Free Post Service was cancelled by the Postal Services, resulting in some of the parcels not arriving at their destination before the cut-off date

It is therefore impossible to accurately calculate the response rate. If it is assumed that 10% (say 142) questionnaires never got delivered and another 5% (say a further 70) got lost through the mail, **the response rate is roughly 22%**, derived by dividing **the total of 274 valid responses received** by the total of 1240 {the total after adjustment; i.e. 1452 - (142 + 70) = 1240} and expressing the answer as a percentage by multiplying by 100. The period from start of delivery to the last receipt was approximately six weeks

The acceptably high response rate of 22% can be attributed to the fact that the field representatives delivered the questionnaires by hand to the person in the firm who deals with specification matters (even if only to some extent). It has been assumed for the purpose of this research study that these targeted persons were knowledgeable about, or had at least some interest in, the survey, and that this would contribute to the questions being understood and correctly answered

A breakdown of the response from the different sectors is listed in Table 3 below:

	ARCHITECTS	ENGINEERS	QUANTITY SURVEYORS	OTHERS	TOTAL
No of questionnaires issued	997	169	286		1452
No of questionnaires after adjustment	850	145	245		1240
No of questionnaires received	166	39	66	3	274
Response rate	**19,5%**	**26,9%**	**26,9%**		**22,1%**

Table 3: Total number of valid responses received categorised according to discipline

In the above Table the total of 3 for “Others” is for questionnaires received whose responses were ignored in the subsequent analysis, as it was apparent that the respondents who completed the questionnaires were not qualified to do so, and had submitted information that was obviously incorrect

The target number of completed questionnaires that was set during the planning stages of the second stage survey was a minimum of 250 valid responses. This figure was based on a target of between 15% and 20% of the total number of questionnaires delivered, which is higher than what is generally accepted to be the norm for this type of survey (Hussey & Hussey, 1997 : 163). This target has been exceeded as 274 responses were received. The response rate of just more than 22% for the selected sectors combined is therefore deemed to be satisfactory

6.6 SUMMARY

The results of the qualitative data collected from the structured interviews in the first stage survey are presented in Chapter 7 in an informal non-quantifying method by reducing the data in such a way that conclusions can be drawn and verified (Hussey & Hussey, 1997 : 248)

The empirical results from the second stage survey, and the discussions and inferences arising from them, are presented in Chapter 8. The numbering of the statements or questions corresponds in all instances to the numbers used in the questionnaire, for easy reference

The sample for the second stage survey was sufficiently large (n>30 in all instances) and lends itself to statistical analysis. The inferences that were drawn from the quantitative and qualitative data collected from the sample as a whole (all sectors combined), and of the three disciplines individually, should therefore have statistical value

CHAPTER 7

FIRST STAGE SURVEY

7.1 INTRODUCTION

This Chapter and the one following present the data collected from the selected respondents and give inferences drawn and conclusions made that had arisen from the data analysing process. The methodology of the data collection process is described fully in the previous Chapter

7.2 CONFIDENTIALITY

Respondents were given the assurance that any information regarding the activities of their employers or company would at all times be treated as strictly confidential. The names of the respondents would not be linked to any information received, thereby ensuring the greatest measure of confidentiality. The respondents were furthermore assured that no information offered during the interview would at any time be used to compare individual companies with one another or with other organisations

7.3 DATA COLLECTED

Each question posed during the structured interviews is repeated hereinafter and the answers obtained are given verbatim immediately thereafter

Question 1: Do firms in the UK follow the rigours of the SMM7, or is it not unusual for individual practices to vary considerably in this regard (as is the case in Australia)?

Respondent Answer

1. SMM7 is the standard used for almost all building works within the UK requiring full bills of quantities. Dependent on the nature of the works being measured, and the completeness of the design information, it is not unusual for the method of measurement to be abridged, amended or enhanced as long as suitable preambles/notwithstanding clauses are provided

2. Yes, generally, but some companies would qualify or specify different measurement rules in exceptional cases

3. Yes, they follow the SMM as far as possible

4. For bills of quantities, most practices endeavour to follow SMM7 to the letter. However there are often situations where a “notwithstanding” clause is applied, either stated or unstated, in order to get round a tricky measurement problem, generally caused due to lack of design information and the desire to “include something” rather than a defined provisional sum

5. Most people follow SMM7 rules to the letter as the “deemed to be included” provision cover a large amount of the “labours” that people tried to get out of measuring under SMM6 – SMM6 was a very extensive method of measurement

6. Firms do follow the instructions of the SMM7

Question 2: Has the Common Arrangement of Work Sections (CAWS) been adopted by the majority of firms in the UK, and, if so, how successfully has it been implemented?

Respondent Answer

1. Yes, although not all firms have got to grips with the full requirements when producing the tender information

2. Yes, but because specification is generally in the form of NBS Specification the specification is often written after the completion of the drawings and not issued to well into the bills of quantities production programme; this is a major problem with bill production these days

3. Yes, CAWS has been adopted and is used widely by all firms. It seems reasonably well implemented

4. Yes, very successfully it would appear

5. The “Common Arrangement” etc documents were all the “Rage Documents” at the time of the introduction of SMM7 – these have now faded away to some extent

6. Yes, very successfully

<u>Question 3: Which one of the consultants takes on the responsibility for drafting the specifications for the works?</u>

<u>Respondent</u> <u>Answer</u>

1. Engineering and architectural consultants are responsible for the drafting and preparation of specifications clauses for their works. The SMM7 relies heavily on the specification to convey the exact building requirements

2. Architects, engineers and other design consultants are generally responsible for drafting the specification

3. The architect and engineer complete the specifications (usually based on the NBS format specification)

4. The designer. This is usually the least satisfactory aspect of the documentation. In my experience, most designers don't understand the purpose behind such documents and therefore the information contained in them is inadequate, or worse, incorrect. And I totally agree with the recent letters in *Building Magazine* where quantity surveyors have suggested that the tendency of helpful surveyors to "fill the gaps" left by the specification by making sensible assumptions effectively lets the designer off the hook. They seem to believe that as long as the contractor is able to submit a price, he will also be able to undertake the work to a standard and details, which often exist only in the designer's mind. The adopted standards of the NBS are enormously helpful of course, however, many designers simply issue an incomplete template that to a large extent defeats the purpose. However, only designers who maintain a revisions subscription can benefit from this and stay up to date

5. A large number of projects are based on the NBS Specification – where the architect generally fills in the blank spaces in the clauses he requires to be used. This specification covers the full version of the JCT contract as well as the "Intermediate" and "Minor Works" versions. This specification comes on a computer disc and can be quickly edited and printed out. Some firms of architects do not have the disc (i.e. do not subscribe to NBS) and cheekily request the quantity surveyor to type in the requirements and print out the specification

6. The questions are about quantity surveyors and our approach to SMM7 and CAWS; then Question 3 talks about who is responsible for drafting specifications for the various "trades". All a bit worrying! It is the architect's job to specify! I think it must be clearly understood that the CAWS and SMM7 are only part of the documentation for Coordinated Project Information (CPI). This is not just a QS scheme; it involves architects, engineers and builders and really only works when they all agree to adopt CPI and work towards it together. I think the Preface to SMM7 helps to understand this

<u>Question 4: Has the formal use of bills of quantities in the procurement of building work declined in recent years?</u>

<u>Respondent</u> <u>Answer</u>

1. There has been a shift towards the more accelerated procurement routes; Management, Construction Management, Design and Build, Design and Manage, Specification and Drawings, etc. These procurement routes seem to be more suited to large projects when completion dates are a major factor to the project. There are still a large proportion of projects procured using the traditional/lump sum measured bills of quantities approach

2. Yes, but measurement is still an important part of obtaining competitive tenders in the procurement procedure, Clients want their buildings yesterday, but they still want the competitive edge

3. Yes, their use has been declining but in my opinion is now picking up again as most clients appreciate their value in getting the best price and control of the final account

4. Yes, undeniably, mainly due to clients' reluctance to pay the additional cost of preparing the bills, and include the additional time necessary for their preparation in the pre-contract programme. Their observation that if a mistake is made they will be liable for any additional costs may also be a factor. The two fundamental reasons for preparing bills of quantities (ensuring that all tenders can be compared on an equal basis and the provision of a relevant schedule of rates for post contract use) are probably not regarded as priorities to most clients. However, I agree again with the letter writers in *Building Magazine* that the process of preparing bills of quantities should assist the team in providing better design information through the necessity of thinking carefully through the

entire design before obtaining prices. Of course, the other frequently voiced comment is that the lack of a tender bill of quantities does not mean that the contractor can necessarily price (or manage the project) without one, so the effort of its preparation is merely passed on to one or more other parties, and many quantity surveyors' practices undertake this work on behalf of the contractor rather than the client

5. The use of full bills of quantities on all projects has declined over the years in an attempt to speed up tender production. "Drawing and Specification" projects and the letting of "Working Packages" with specialist contractor design have fired this

The short design / tendering period is probably due to clients being persuaded to get the contract let and hope that the architect etc can sort out the design later. Architects are now tending to rely heavily on specialist suppliers / subcontractors providing the design for free, however the design cost is hidden in the specialists tender for the works

The more one moves away from bills of quantities the larger the problems that occur post contract, the client inevitably being left to pick up the bill. It is not possible to state if the excess construction cost to the client exceeds what would have had to be paid if the bills of quantities route was followed. All one can say is that the architect / engineer etc would have had to produce a fully thought out and detailed set of drawings prior to a contract being entered into

6. Yes

Question 5: Has the increasing automation of the measuring function and the recognition that it is a largely technical function (requiring the exercise of a relatively low level of professional discretion) led to chartered surveyors not being involved in the measuring process any longer?

Respondent Answer

1. There is no doubt that measurement software has allowed a more user friendly approach to the measurement function, and this has provided more junior surveyors with the software to produce bills of quantities. Unfortunately none of the current software on the market is an "intelligent system"; the old adage "rubbish in rubbish out" is still applicable. Today's measurement surveyors are required, more and more, to use their experience and construction knowledge to interpret the consultants' requirements. Nearly all our

firm's measurers are RICS qualified; many have specialised in the measurement process and are of course very experienced. I would also add that the average age is in the 40's – 50's

However, rightly or wrongly, it would be fair to say that the process is now considered by many to be more of a technical function, and one that not many new surveyors would appear to, or are being trained to, know too much about

2. Not completely. Generally people specialising in measurement do the measurement. As a rule these people are of the older generation who were trained and are experienced in the measurement process and have a good knowledge of building construction and building procedures. Training methods for quantity surveying students these days have moved away from measurement. But without measurement it is impossible to analyse and compare tenders, which is a major role for the quantity surveyor as far as the client is concerned

3. Due to the increasing complexity of buildings and the fact that many architects cannot get their design details onto drawings it is my belief that quantity surveyors are often involved in a high level of professional discretion. Automation cannot think for the architect. A good level of experience is needed and quantity surveyors are not now getting the basic training that they use to get. Without the basic skills, we are a dying breed

4. No, I do not believe that this is the case, mainly because there is no real alternative yet. Certainly some unqualified but experienced surveyors have set themselves up to specifically provide a measuring service, but I don't believe that this is widely prevalent. Even with the increased use of software tools to assist in the process, the necessary skill needed to interpret drawings (which are often not much more than indicative sketches or collections of CAD lines which all mean something but don't communicate exactly what) can usually only be found in experienced chartered surveyors. The development of intelligent automated measurement software will also fail except where designers are able to accurately and finitely express their intentions using real object-oriented CAD software. I believe that the RICS have recognised that this is not the best use of talented surveyor's time, but until there is sufficient experienced technical staff available, the solution will continue to be the sidelining of the bills of quantities in favour of Specification and Drawings, Design and Build and Management Contracting procurement routes

5. The question of professional discretion still comes into the production of the bills of quantities, especially in the preliminaries items and other matters that the contractor is required to take into consideration in preparing his tender

   The quality of measurement either by computer or written on paper is dependent on the knowledge of "building construction and methods" of the taker-off. In some respects a more ordered mind is needed in computerised measurement to follow a set route of taking-off i.e. initial length, then x width x depth for excavation and cart away, x width for level bottom of trench, x depth x 2 for earthwork support etc. It is generally difficult (if not impossible) with all computer systems to add an extra item in at the right place, as one could do in writing from the back of the sheet

6. I find it difficult to accept the idea that "measuring for bills of quantities is a largely technical function requiring the exercise of a relatively low level of professional discretion". We have all suffered from qualified, but inexperienced in measurement terms, surveyors who are unable to provide the relatively high level of professional discretion required for bills of quantities production. Of course, as the role of quantity surveying has diversified, other chartered quantity surveyors have left measurement and bill production behind and have branched out into other fields, all related to construction, such as cost control, project management, etc and probably feel that measuring and interpreting architect's drawings and specification notes, preparing contracts, obtaining tenders, whether for packets or for complete jobs, is all fairly low key. For me, they are all chartered quantity surveyors, each doing their own particular speciality, one just as important as the other

   Getting down off my soapbox, and reverting to the question, I am sure there are still a good proportion of chartered quantity surveyors still involved in the measuring process

Question 6: How many recognised computer measuring programmes are commercially available in the UK?

Respondent Answer

1. The main players currently in the market place are: "Catopro", "RIPAC", "Qscript" and "Masterbill"

2. Not sure, possibly as many as ten

3. I do not know – possibly a dozen or so

4. I believe that there are in the region of 4 to 6 major systems available with full support, with perhaps another 4 or 5 more budget priced programmes offered by independent suppliers

5. There are various systems that are available – see the adverts in the Chartered Surveyor and other trade journals

   Be aware that once wed to a system you have to accept it for "warts and all". However, the more one uses the system the more tricks you find to get it to do what you require. The main consideration in choice of a system is to obtain one that is able or provide "full bill descriptions" for any item, rather than having to build up a description for each measurement item

6. Do not know the exact number, but there are quite a few

<u>Question 7: The SMM7 has been prepared in a tabulated format similar to that used in the Civil Engineering Standard Method of Measurement (CESMM3). How well has this been received and applied by the industry and what is your feeling on the possibility that this format might restrict the thinking process of the taker-off during the measuring process?</u>

<u>Respondent</u> <u>Answer</u>

1. As far as I know it has been widely accepted by the industry with no major upheaval required. The method of measurement is trade driven, and follows a logical, unrestricted, flexible approach to measurement

2. Very well. Generally not restrictive on the thinking process I feel, because experienced measurers enhance the requirements of SMM7 to give estimators more information in relation to the contract being tendered

3. I think that there should be greater clarification – several sections are rather vague in their interpretation. Might also be somewhat restrictive, but no more so than with the use of a Model Bill or a library of items

4. My own experience was that once I got used to the tabulated format I found it much more useful and easier to refer to, and I think it actually assists a logical thinking process rather than restricts it

5. Going back in time a billing format was developed by Fletcher and Moore (1970's), which was in a staccato fashion, which lent itself to a layered (levelled) bill description, this probably forced the SMM7 committee to go to a tabular format

   The main reason the levelled format has succeeded is that it groups all work related to a material (i.e. Concrete Grade C30) under the same heading, and it is easier for the estimator to price like items whether they be cube, run or number

   As stated previously the thinking process is the same for all measuring processes regardless of the SMM used. SMM7 provides its own shorthand in the written format – Conc C30: slab: 150-450 th. If you have a "standard library", this acts as an *aide memoir*/tick list to follow

6. In my view, the tabulated format of SMM7 does not restrict the thinking process during measuring. It is all part of the thinking process of the new generation which is 100% computer-minded

<u>Question 8: Is the SMM6 still being used by anybody or has it largely disappeared from the scene?</u>

<u>Respondent</u> <u>Answer</u>

1. No longer used by our firm, but it may still be used by smaller quantity surveying practices and possibly some contractors

2. I have not used it since the early 80s, but find it still useful for reference where SMM7 rules do not cover items that were previously covered in SMM6

3. It took some time to die out, but not used anymore. I find it a useful document to refer to if further clarification is required (see question 7)

4. I believe some contractors still use SMM6 for "approximate quantities bills", but I haven't come across it in quantity surveying firms for at least five years now

5. SMM6 has disappeared as the current forms of contract all state that they are based upon measurement in accordance with SMM7

6. It has largely disappeared

<u>Question 9: What revisions have occurred to the SMM7 and the other documents published by the Building Project Information Committee (BPIC) since its inception in 1988?</u>

<u>Respondent</u> <u>Answer</u>

1. Revised SMM7 issued July 1998 incorporating Uniclass classifications and minor cosmetic changes to previous method of measurement, most noticeably dealing with Contaminated/Hazardous materials

2. SMM7 and all supporting documentation revised 1998

3. Seventh edition issued 1988, reprinted 1989 incorporating amendment sheets 1 and 2, reprinted 1992 incorporating amendment sheets 1, 2 and 3, and revised again in 1998. No other amendments that I know of

4. Not qualified to comment

5. There have been one or two changes to SMM7 over the years, the most obvious being related to stud partitioning (edges and ends) and structural steelwork. In the case of steelwork this was to provide more information to the contractors, which in most cases had already needed to be computed to arrive at the total steel weight. Other changes have been to clarify and define problem items

   SMM7 provides that, if items are not covered by a stated Work Group, one can always select a suitable Work Group and state that the particular material has been measured under that Work Group's set of rules

6. Not involved since the publication of SMM7 and therefore do not know

Question 10: Are there any further publications except the "Co-ordinated Project Information for Building Works - a Guide with Examples" on the use of the documents published by BPIC, RICS and BEC (the Building Employers Confederation)?

Respondent Answer

1. None that I am aware of, I will investigate further and let you know

2. I am not sure but assume there are numerous books, which have been published on the use of these documents

3. I should imagine that there are several – it would probably be best to forward a copy of the relevant pages of the RICS bookshop catalogue

4. Project Specification: A Code of Procedure for Building Works
Production Drawings: A Code of Procedure for Building Works
Common Arrangement: Classification of Work Sections
NBS Specification: Available also on disk – download what you need (References similar to SMM7 i.e. follows the same numbering)

5. With the NBS specification and SMM7 most of the measurable/priceable items are covered – professional judgment is however needed to ensure that the full content/extent of the required contractual requirements is in the documentation

6. Do not know

Question 11: Is there a "Model bills of quantities" available in the UK. One that covers almost all possible items to be encountered on the majority of projects?

Respondent Answer

1. No model to my knowledge, our firm has a standard library based on the SMM7 phraseology, which is used as the basis of all measured works descriptions. The majority of projects require the preparation of rogue descriptions; this is normally due to the architect's design or the status of the information. Engineering elements however have a

greater use of standard items, as there are fewer variations to cover particularly in the measurement of earthworks, structural steel, concrete, formwork, reinforcement, etc

2. Each software measuring system produces its own which might vary in detail but are all based on the SMM7. There are also other standard libraries in existence

3. There are several standard phraseology Bills of Quantities available – I generally use the RICS's "Library of Standard Descriptions" and the firm's CATO descriptions

4. Not that I'm aware of, although libraries such as those produced for use by software developers are probably the closest things available

5. There are various Standard Libraries that have been published over the years to cover works for the Ministry of Building and Works, Local Authority Schools Building Systems, etc

   There is also Gardiner & Theobald's Standard Library (relating to the CATO system), which covers more items than most people would ever need

6. Bills of quantities using standard phraseology were consistently condemned from the point of view that they did not adequately describe the work. It is not uncommon for quantity surveyors to produce their own version of say the Fletcher & Moore Phraseology, either without qualifications of the SMM or with only some of these qualifications, or just measured to conform to the SMM. The flow pattern of descriptions is considered hard to follow and professional quantity surveyors take too literally to standard phrases; not amplifying them or properly writing rogue inserts. The Standard Library of Descriptions could be construed as a Model Bills of Quantities

<u>Question 12: Is it the case, as in South Africa, that quantity surveyors are not always sufficiently skilled in the technology of service installations or in the related SMM7 measurement requirements and that surveyors are therefore content to agree to a lump sum approach or acquiesce to the engineer preparing the procurement document?</u>

<u>Respondent</u> <u>Answer</u>

1. Our firm has its own M&E department; it is their experience that it is not a matter of lack of skilled surveyors, more that consultants are not required/prepared/paid to produce the drawings necessary to allow full SMM7 measurement to take place

2. Generally tenders are procured by the Services Consultant on a specification and drawings only issue, but there are quantity surveyors who specialise in M&E measurement

3. Yes – due to the complexity of M&E installations specialist M&E quantity surveyors are generally used, but generally tenders are obtained on specification and drawings. M&E bills of quantities are not that often used

4. I don't believe that quantity surveyors are insufficiently skilled to cope with services installations measurement. Very often the engineer is not required to produce a full design, or cannot provide it in time to allow the preparation of full measured bills. Lack of experience and unjustified fear therefore may mean that many surveyors feel unable to attempt services measurement

5. The measurement of M&E services is directly related to the quality of the design – in a high number of cases a services engineer is not employed or not required to provide a full design, thus the detailed design is left to the specialist subcontractor and so no bills of quantities are produced

   Whilst it is accepted that knowledge of service installations is required to enable a measurement to be undertaken, it is not outside the ability of a good surveyor to readily master this type of work

6. Services developed in complexity over the years, and it became apparent that it required a specialist group of measurement surveyors – OK in a large firm but difficult in a small one. Once again a case of chartered quantity surveyors diversifying!

7.4 TRENDS INDICATED BY DATA COLLECTED

The format of the questions of the first stage survey was all "open-ended" with the result that there were no pre-formulated categories for possible answers. The Division of Research Support of the Department of Information Technology, University of Pretoria, describes the use of "open-ended" questions in it's *Guidelines for creating Questionnaires* as follows*: This type of questions are usually used when insufficient knowledge regarding the particular subject exists and the* *researcher is uncertain whether predefined categories will cover all possibilities. Open questions are, therefore, particularly useful for exploratory studies*

The passage quoted above was found to be particularly relevant, as the main aim of the decision to conduct the interviews for the first stage survey in the UK was to explore whether methods employed and systems developed there could impact on the procurement process applied in the RSA. How to formulate categories for the comments gathered became apparent also only after the comments were analysed. The questions put to the interviewees were then grouped under each objective in an attempt to ascertain if the comments that were made by the respondents provide sufficient grounds to explore the objectives further. The findings proved to be of great value and had a major influence on the development of the questionnaire used in the second stage survey

The main objectives of the first stage's structured interviews are recited as headings hereunder for the sake of convenience, and each heading is followed in each instance by inferences drawn and conclusions made from relevant responses from interviewees

<u>Objective 1:</u>

To determine to what extent quantity surveyors are making use of model documentation made available by the RICS, or any other body in the UK, in the procurement process

Grouping of Questions 1, 2, 9, 10 & 11

With reference to Questions 1, 2, 9 and 10 it is clear from the responses received that the interviewees were of the opinion that:

- Quantity surveyors were conforming to the modified principles of measuring contained in the SMM7;
- They were aware of the latest amendments to the SMM7;
- They had adopted the classification structure as prescribed by CAWS; and
- They were not always aware of what kind of model procurement information was available in the industry

With reference to Question 11 it is evident from the responses received that the industry had not adopted a specific standard for model descriptions in bills of quantities and that various models existed that could be used for that purpose

Objective 2:

To determine which party in the professional team is usually responsible for drafting project specifications

Question 3

The comments collected with reference to Question 3 indicate a total agreement by all the interviewees that the design consultant (architect and engineers) should have the responsibility for the drafting of specifications. (This notation is also supported by the literature reviewed). It should, however, be noted that two of the interviewees indicated that the present state of affairs in the UK needs to be addressed. Respondent No. 2 stated that: *This is usually the least satisfactory aspect of the documentation*. *In my experience, most designers don't understand the purpose behind such documents and therefore information contained in them is inadequate, or worse, incorrect;* whilst Respondent No. 5 added that: *Some firms of architects do not have the disc (i.e. do not subscribe to NBS) and cheekily request the quantity surveyor to type in the requirements and print out the specification*

As far as could be established the designer disciplines also, as a rule, perform the function of specifying in various other countries such as Sweden, the Netherlands, Australia, New Zeeland, Singapore, Canada and the USA. The only evidence that could be found of the quantity surveyor's involvement in this matter is when the designer does not properly execute his duty in this regard, thereby compelling the quantity surveyor to add to or revise the specification. The duty of checking the specification and the drawings etc for correctness or completeness is generally regarded as one of the basic duties of any quantity surveyor and any such involvement in the specification process would not imply his co-responsibility for drafting project specifications. The situation in the RSA differs appreciably from the foregoing and will be expanded on later in this Chapter

Objective 3:

To evaluate the continued use of bills of quantities in the procurement process and to ascertain what influence automation in the measuring process has had on the quantity surveying profession

Grouping of Questions 4, 5, 6 & 12

With reference to Question 4 the comments that flowed from interviewees indicate that procurement by means of bills of quantities was still considered the most satisfactory solution in obtaining competitive tenders, certification and finalisation of the account, cost control, etc. It was, however, admitted that the use of bills of quantities had declined in recent years. The declining use was apparently brought about mainly by market forces that had led to competition on the basis of fees and the introduction of new procurement methods such as Design & Build

Responses to Question 5 indicate that the use of computerised measurement systems is not regarded as merely a technical function that can be handled by inexperienced operators. Most of the interviewees agreed that a quality document could only be obtained through people properly trained and experienced in the measurement process. Question 6 revealed that a variety of commercial measurement systems were on offer in the UK at that time

Comments made in response to Question 12 indicate the declining use of the measurement of mechanical and electrical services. The shift of measurement is away from the quantity surveyor and towards the specialist subcontractor, who uses methods of measurement more akin to the manufacturing process or other trade customs. The lack of detailed designs and accompanying detailed drawings were also given as reasons prohibiting quantity surveyors from preparation of detailed measurement items for mechanical and electrical services

Objective 4:

To evaluate how successful the implementation has been of the tabulated format of the SMM7 since its inception in 1988

Grouping of Questions 7 & 8

With reference to Question 7 the inference can be drawn from the responses received that quantity surveyors in the UK have widely accepted the tabular format of the SMM7 and that they were in favour of using the tabular format as opposed to the prose format of its predecessor (the SMM6). It is further interesting to note that some of the interviewees find the tabular format particularly useful because of its layered nature that groups all work related to material under the same heading, which, in addition, also assists the thinking pattern of the new computer-minded generation

Question 8 revealed that interviewees were unanimous in their opinion that the SMM6 had become obsolete. It was, however, mentioned that the SMM6 is still useful if only for reference or clarification purposes because of the brevity of descriptions in the SMM7

7.5 SUMMARY

Data collected from leading role players in the quantity surveying profession in the UK, regarding developments in the procurement process, were presented and organised, and inferences and conclusions were posed in this Chapter. It focussed mainly on the latest methods employed by quantity surveying practices and classification systems currently employed in the construction industry

The main objective of the first stage survey can be summarised as the investigation into what influence recent developments in procurement procedures, especially the introduction of the tabulated format of the standard method of measuring (SMM7) and the classification system (CAWS), have had on the quantity surveying profession in the UK, and how these developments benefit the local construction industry. It appears from the data gathered that the quantity surveying profession in the UK regards these developments as a natural evolutionary progression in the procurement process and that they generally are in favour of, and have also widely adopted, these latest developments

Some of the more directional responses on which the sample of six interviewees had consensus, can be summarised as follows:

- The architect/engineer (the designer) should have the responsibility for drafting the project specifications

- The format of standard methods and systems, such as the standard method of measurement, should be brought into line with the computer-minded modern thinking process of the new generation

- Although it was generally agreed that the use of bills of quantities in the procurement of building work has declined in recent years, the consensus of opinion was that it remained and will continue to play an important role in the procurement process

- The recently introduced classification system CAWS has been adopted and is already used widely in the industry

Final conclusions and recommendations appear in the next chapter (Chapter 8) after the second stage survey and are again summarised in the final chapter of this study (Chapter 10)

CHAPTER 8

SECOND STAGE SURVEY

8.1 INTRODUCTION

The second stage survey formed the basis of the primary data collection process. Respondents were asked to rate the statements in the first part of the questionnaire (Questions 1 and 2) on a five-point scale, and the latter part of the questionnaire (Questions 3 and 4) required a positive or negative response to the questions posed. The statements or questions flowed mainly from the literature review and the first stage interviews conducted in the UK and included hypothetical statements and recommendations towards the possible solving of the problem areas. Respondents also had the opportunity to express in their own words, in an “open-ended” format, their opinion on the problem areas and to volunteer additional recommendations or comments

Appendix 6 is comprised of the questionnaire distributed to respondents and the responses obtained. The “open-ended” recommendations and comments and responses to Questions 1 and 2 are not shown in the Appendix because of obvious logistical problems. However, a selection of some of the important recommendations and comments emanating from the “open-ended” format and the full response on all the questions of the questionnaire, including those of Questions 1 and 2, are provided in item 8.3 of this Chapter

8.2 ANALYSIS OF THE ADMINISTRATIVE PART OF THE QUESTIONNAIRE

The first question of the administrative part of the questionnaire requested the targeted respondents to indicate their profession, namely those of architects, quantity surveyors, civil engineers, project managers, academics and others. However, because of the low number of responses received for the latter three sectors, it was decided to reduce the eventual number of groupings to only three, namely those for architects, quantity surveyors and engineers; project managers, academics and others were merged into one of these sectors, as it was possible to ascertain a relatedness by analysing the personal information provided (see also 6.2.2 hereinbefore)

The groupings into the professions of architects, quantity surveyors and civil engineers were used in the analysis of the data of the second stage survey. Probable explanations have been provided in cases where significant differences in the frequency and percentage distributions occurred between the responses gathered that could be linked to the respondent's profession. The sample for each profession being larger than thirty (see 6.3 hereinbefore), lends itself to statistical analysis and conclusions that have been made from the results of the individual samples, and of the sample as a whole (all professions together), should therefore be of statistical value

Table 4 gives a percentage distribution of the respondents' line of business indicating the number of questionnaires received for each category and its percentage of the total number of questionnaires received. The category of 'others' is for the disregarded questionnaires received

	ARCHITECTS	QUANTITY SURVEYORS	ENGINEERS	OTHERS	TOTAL
LINE OF BUSINESS	166 = 61 %	66 = 24 %	39= 14 %	3 = 1 %	274 = 100%

Table 4: Percentage distribution of respondents' line of business

Listed in Table 5 are the percentage distributions of the respondents' size of organisation, economic sector and location. Percentage distributions for all groupings combined are also given. The numbers that appear in brackets in each grouping indicate the number of valid responses that were received for the respective questions

	ARCHITECTS	QUANTITY SURVEYORS	ENGINEERS	TOTAL
SIZE OF ORGANISATION	(166)	(66)	(39)	**(271)**
• 0 – 5 people	59.0%	68.2%	30.8%	**57.2%**
• 5 – 10 people	21.1%	9.1%	15.4%	**17.3%**
• 10 – 20 people	13.9%	18.2%	7.7%	**14.0%**
• 20 – 50 people	2.4%	0%	23.1%	**4.8%**
• 50 – 100 people	1.2%	0%	5.1%	**1.5%**
• > 100 people	2.4%	4.5%	17.9%	**5.2%**
ECONOMIC SECTOR	(166)	(66)	(39)	**(271)**
• Private	78.9%	80.3%	66.7%	**77.5%**
• Public	15.1%	7.6%	25.6%	**14.8%**
• Academic	6.0%	12.1%	5.1%	**7.4%**
• Other	0%	0%	2.6%	**0.3%**
LOCATION	(165)	(66)	(39)	**(270)**
• Inland	60.6%	63.6%	51.3%	**60.0%**
• Coastal	39.4%	36.4%	48.7%	**40.0%**

Table 5: Percentage distributions of respondent’s size of organisation, economic sector and location

The first exercise, after consulting with the adviser from the Department of Information Technology designated to assist with the statistical calculations and analysis of the data previously encoded in the questionnaires, was to consider whether the respondents’ size of organisation and the economic sector in which their organisation operated (see Table 5) should be investigated for variances in the results of the statements made in Questions 1 and 2. After careful consideration it was decided that such data would not meaningfully influence the outcome of the investigation, and the particular data were, therefore, ignored in the subsequent analyses. It is, however, interesting to note that the survey results indicated that the size of organisation for civil engineers was generally larger than that of architects and quantity surveyors, and that a substantially higher percentage of respondents from the civil engineering profession, in comparison to the other two professions, indicated that they were employed in the public sector

The next exercise involved grouping the nine provinces under the heading of location into ‘Inland’ and ‘Coastal’ (see Table 5). The reason for this was the low number ($n \leq 30$) of responses received for certain of the provinces. Another motivation for using these specific groupings was to investigate whether the respective groupings had different views on specification matters, a perception held by some in the industry. For this purpose the responses received from the Free State, Gauteng, Limpopo, Mpumalanga, Northern Cape and North West provinces were grouped under 'Inland' (60% of total responses received), and the responses received from the remaining provinces under 'Coastal' (40% of total responses received)

A C*hi-Squared* test that, according to Hussey & Hussey (1997 : 232), is *a non-parametric technique used to assess the statistical significance of a finding, by testing for contingency (uncertainty of occurrence) or goodness of fit* was executed on the data collected from all the statements. The evaluation of the results thus obtained is given hereinafter in one specific case only where it was found that a statistically significant difference (the 5 per cent critical value) exists between the actual frequencies and hypothesised frequencies (see Table 26 under Objective 1 hereinafter). For the purposes of this study it was regarded sufficient to indicate only such occurrences where the values were ≤ 0,05

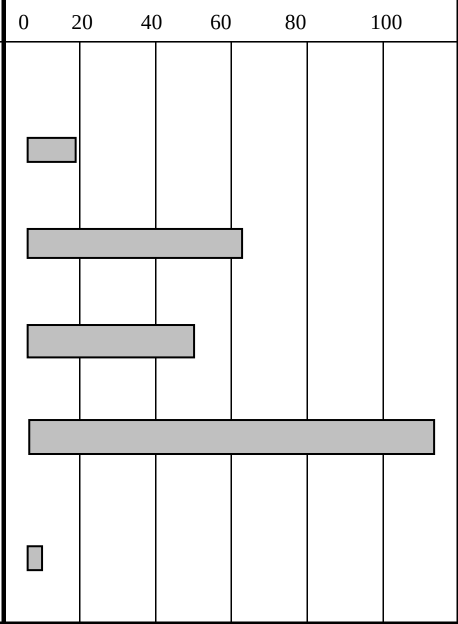
8.3 DATA COLLECTED

8.3.1 Arithmetic mean values and standard deviations of responses to statements in Questions 1 and 2

Tables 6 to 24 (inclusive) give the arithmetic mean values (Mean) and standard deviations (S.D.) of the ratings of the total of all respondents (all professions combined) and of each profession separately on the statements made in Questions 1 and 2. As previously mentioned, a "closed" response method was used whereby respondents agreed or disagreed on a five-point rating scale. A rating of 5 indicates that respondents strongly agree with the statement, a rating of 1 indicates strong disagreement, whilst a rating of 3 indicates a neutral/undecided position. A graphical presentation of the data collected is further included in each Table for the visual effect it provides

An evaluation of the realisation of the sample's response to each statement in Questions 1 and 2 of the questionnaire follows under the respective Tables in the form of a brief discussion, which is amplified/supported/not supported by "open-ended" comments where applicable

8.3.2 Evaluation of data collected for Question 1: Is the current status of specification writing for building works in the RSA satisfactory?



	TOTAL	GRAPHICAL PRESENTATION	TYPE OF RESPONDENT		
			ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**270**		165	66	39
Strongly Disagree	**21**		11	7	3
%	***7.8***		*6.7*	*10.6*	*7.7*
Moderately Disagree	**65**		39	19	7
%	***24.1***		*23.6*	*28.8*	*17.9*
Undecided	**50**		31	13	6
%	***18.5***		*18.8*	*19.7*	*15.4*
Moderately Agree	**119**		74	25	20
%	***44.1***		*44.8*	*37.9*	*51.3*
Strongly Agree	**15**		10	2	3
%	***5.5***		*6.1*	*3.0*	*7.7*
Mean	**3.15**		3.20	2.93	3.33
S.D.	**1.09**		1.08	1.11	1.11

Table 6: The present state of affairs is satisfactory. Specification drafting is handled effectively by our organisation and nothing has to change (Statement 1.1)

The sample mean (3,15) of the total for all respondents is slightly above the neutral position (3) indicating that the sample of 270 respondents was neutral/undecided on whether they agree with the statement that the present state of affairs involving specification drafting is satisfactory and that nothing has to change. The quantity surveying profession was clearly the most concerned about the current state of affairs

In the "open-ended" responses following Question 1, two of the respondents noted the following on this particular issue:

The existing product databases are not comprehensive enough

Paradigm shift to Internet and computerised specifications is not happening in the industry

	TOTAL	GRAPHICAL PRESENTATION	TYPE OF RESPONDENT		
			ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**270**		165	66	39
Strongly Disagree	**7**		4	2	1
%	***2.6***		*2.4*	*3.0*	*2.6*
Moderately Disagree	**25**		13	9	3
%	***9.3***		*7.9*	*13.6*	*7.7*
Undecided	**26**		18	5	3
%	***9.6***		*10.9*	*7.6*	*7.7*
Moderately Agree	**89**		55	20	14
%	***33.0***		*33.3*	*30.3*	*35.9*
Strongly Agree	**123**		75	30	18
%	***45.5***		*45.5*	*45.5*	*46.1*
Mean	**4.10**		4.12	4.02	4.15
S.D.	**1.07**		1.04	1.17	1.04

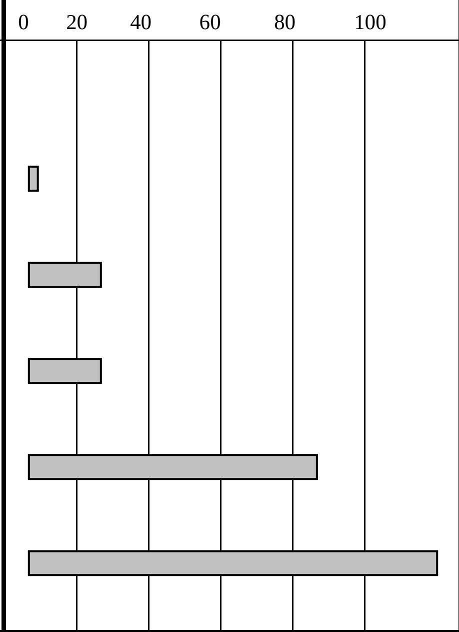


Table 7: Specification drafting should be the responsibility of the designer (architect/engineer) (Statement 1.2)

The sample mean (4.10) of the total for all respondents, and for the disciplines respectively, is an indication that the respondents supported the statement that the designer should have the responsibility for producing project specifications. Support for this statement was almost equally strong between the respective disciplines. The result is, however, in direct contrast to what has been experienced in the building industry (not so much so in the civil engineering industry). It is a commonly known and accepted fact that the quantity surveying profession in the RSA has, over the years, become more and more involved in the drafting of specifications, and that this duty is today almost exclusively that of the quantity surveyor on projects where he has been appointed as part of the professional team

A possible explanation for the abovementioned development could be found in the following "open-ended" comment made by an architect on this issue:

> *There is no doubt that the designer should be the specifier, but designers (architects) are prejudiced on fees; so why bother - leave it to the quantity surveyor!*

The discussion on who should be responsible for drafting specifications is continued following Table 8 hereinafter

	TOTAL	GRAPHICAL PRESENTATION 0 30 60 90 120 150	TYPE OF RESPONDENT: ARCHITECT	QUANTITY SURVEYORS	ENGINEER
Total Responses	**268**		163	66	39
Strongly Disagree	**0**		0	0	0
%	**0**		*0*	*0*	*0*
Moderately Disagree	**3**		2	0	1
%	**1.1**		*1.2*	*0*	*2.6*
Undecided	**14**		10	3	1
%	**5.2**		*6.1*	*4.6*	*2.6*
Moderately Agree	**92**		59	19	14
%	**34.3**		*36.2*	*28.8*	*35.9*
Strongly Agree	**159**		92	44	23
%	**59.4**		*56.5*	*66.6*	*58.9*
Mean	**4.52**		4.48	4.62	4.51
S.D.	**0.65**		0.67	0.57	0.68

Table 8: Specific expertise and appropriate experience are essential requirements that the drafter of specifications should possess (Statement 1.3)

The vast majority of respondents supported the statement (sample mean = 4.52) that the specification drafter should possess of specific expertise and experience. The three disciplines indicated almost equally strong support for the statement

There are generally two broad classes of specification, namely open (contractor design), and closed or prescriptive (consultant design). Under these classes there are generally four basic methods for communicating the ends or outcomes required:

- Performance (open)
- Descriptive (closed)
- Proprietary (closed)
- Construction methods (closed)

Each method can rely on custom-made text, or on reference to external documents such as standards and codes. Each of these methods needs effective management during the construction process, and the rules for management (substitutions, approvals, submissions, checking conformance, etc) must be clearly given in the specification

Gelder (2001 : 10) identified the following five desirable features of specification methods:

- Compatibility with the form of contract;
- Clear-cut responsibility for design;
- Internal consistency, both technically and contractually;
- Capacity to obtain a good price for the work; and
- Ability to integrate and coordinate services, especially with structural and other services elements

Designers (architects and engineers) are deemed to have expert knowledge with regard to the abovementioned specification matters, and should, generally, be more capable than quantity surveyors of preparing and managing project specifications. Quantity surveyors would, generally, not have received the basic training required for drafting proper specifications, as little emphasis is placed on this aspect in courses presented by Universities and Technicons in the RSA, and quantity surveyors would, therefore, generally lack the required experience to properly manage the specification process. Quantity surveyors are mostly forced by the circumstances to provide 'something' in bills of quantities, or other types of procurement documents, in an effort to avoid later claims by the contractor that might result in cost overruns on budgets submitted to the client

Smallwood (2002 : 8), in an article on construction health and safety published in the *Construction World,* comments that *design effectively defines the work to be done.* With specific regard to health and safety aspects he remarks as follows in the same article: *Designers are also in the position to exclude hazardous materials and either mitigate or eliminate the need for dangerous processes, i.e. designers can eliminate foreseeable risk. In addition, designers have a moral responsibility for construction health and safety in that they are prescribing work to be done by others.* It should be clear from the foregoing that the designer should take the leading role during the design and construction phases concerning construction health and safety as well as other specification matters. This is to ensure effective supervision of standards of workmanship and quality of materials, which has to be measured against the project specification and design

In his doctoral thesis that investigated, inter *alia*, the effectiveness of the procurement process in the RSA, Grobler, (2000 : 368) confirms the importance of proper supervision by stating: *Quality control personnel must ensure that products are constructed according to drawings and specifications. (It seems so obvious, but quality control failed to prevent the many documented catastrophic failures in recent history).* The designer, as mentioned previously, should have the responsibility for preparing the specification, and should, in addition to the quality control process, visit the site regularly to ensure that critical elements are constructed according to the design, and that construction techniques are sound and safe. These functions clearly belong to the designer and not to the quantity surveyor

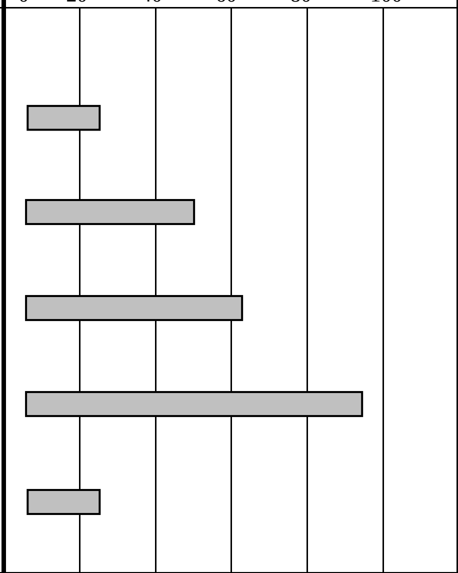
	TOTAL	GRAPHICAL PRESENTATION	TYPE OF RESPONDENT		
		0 20 40 60 80 100	ARCHITECT	QUANTITY SURVEYORS	ENGINGEER
Total Responses	**267**		163	66	38
Strongly Disagree	**27**		20	3	4
%	**10.1**		*12.3*	*4.6*	*10.5*
Moderately Disagree	**52**		38	6	8
%	**19.5**		*23.3*	*9.1*	*21.1*
Undecided	**61**		42	8	11
%	**22.9**		*25.7*	*12.1*	*29.0*
Moderately Agree	**96**		49	33	14
%	**35.9**		*30.1*	*50.0*	*36.8*
Strongly Agree	**31**		14	16	1
%	**11.6**		*8.6*	*24.2*	*2.6*
Mean	**3.19**		2.99	3.80	3.00
S.D.	**1.18**		1.17	1.05	1.06

Table 9: The existence and application of the "Model Preambles for Trades" (1999) published and issued by the ASAQS are well-known facts (Statement 1.4)

The sample mean (3.19) of the total for all respondents is surprisingly low. More than 50% of the respondents indicated that they were between neutral to strongly disagreeing with the statement.

It is obvious to reason why architects and engineers would know less about the existence and application of the Model Preambles in the RSA, as it is a document that, until recently, had been solely maintained by the quantity surveying profession, a fact which is clearly evident when the mean values of the respective professions are compared. However, about 25% of quantity surveyors also did not agree with the statement, which might be an indication that some quantity surveying firms use their, or the architect's, in-house specifications, or no specification at all, when compiling tender documentation for private projects

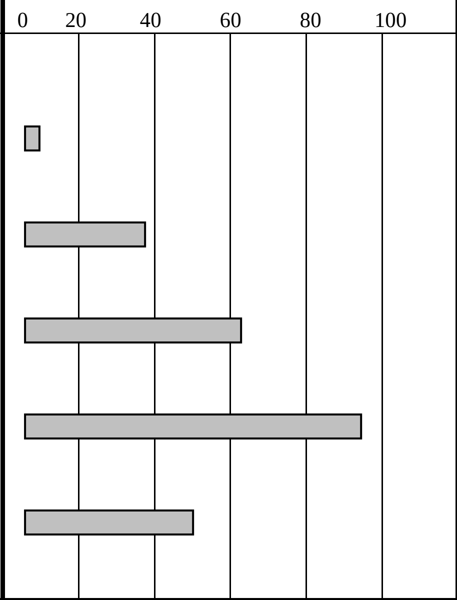
The Model Preambles for private projects in the RSA may, therefore, not be as widely used as is commonly accepted. Possible reasons for this state of affairs may be ascribed to the following facts:

- On many projects, especially on lump sum projects, incomplete contract documentation is often the norm. In such instances a project specification is seldom included, and contract documentation generally consists of only the agreement, the contract drawings and possibly a schedule of quantities

- One of the basic philosophies of the Model Preambles has always been that the document is intended for use by reference only, and that it is not to be bound or reproduced in the procurement documentation. It is possible that this form of application has led to the fact that some consultants are not aware of its existence

- Architects and builders were until recently not represented on the Model Preambles subcommittee, and it is only since 1997 (see 5.3.2.1 hereinbefore) that the representation of quantity surveyors only on the committee was broadened to include other sectors of the building industry (engineers - of all kinds - are still not represented)

GRAPHICAL PRESENTATION



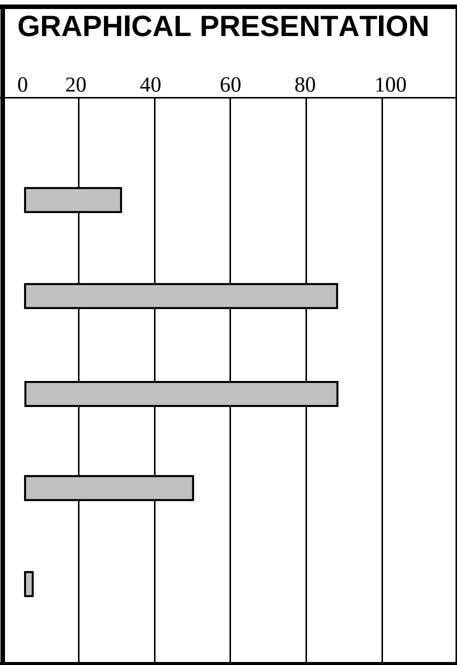
	TOTAL	TYPE OF RESPONDENT		
		ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**268**	164	66	38
Strongly Disagree	**15**	13	0	2
%	**5.6**	*7.9*	*0*	*5.3*
Moderately Disagree	**39**	26	6	7
%	**14.5**	*15.9*	*9.1*	*18.4*
Undecided	**64**	43	10	11
%	**23.9**	*26.2*	*15.2*	*28.9*
Moderately Agree	**97**	60	24	13
%	**36.2**	*36.6*	*36.4*	*34.2*
Strongly Agree	**53**	22	26	5
%	**19.8**	*13.4*	*39.4*	*13.2*
Mean	**3.50**	3.32	4.06	3.32
S.D.	**1.13**	1.13	0.96	1.09

Table 10: The quantity surveying profession is the most preferable profession for drawing up and publishing the abovementioned "Model Preambles for Trades" (Statement 1.5)

The sample mean (3.50) of the total for all respondents is an indication that the respondents agreed with the statement. The highest mean value (4.06) belongs to the respondents from the quantity surveying profession, which can be ascribed to the fact that, although all the respondents previously agreed that the designer consultants should be responsible for the specification (see discussions under Tables 7 and 8 hereinbefore), it is generally left to the quantity surveyor to perform the task of drafting specifications. It seems, therefore, that quantity surveyors in the RSA have become sceptical that the designer consultants can still effectively fulfil this role. This situation is, however, not unique to the RSA. This inference is supported by the following abstract from one of the interviews conducted in the UK (for the full record of the interviewee's comment see Chapter 7, and more particularly interviewee 4's comment on Question 3)

> *This is usually the least satisfactory aspect of the documentation. In my experience, most designers don't understand the purpose behind such documents and therefore the information contained in them is inadequate, or worse, incorrect*

There were, however, quite diverse opinions in all three sectors on Statement 1.5, of which the fairly large standard deviation of 1.13 for all sectors combined is testimony. The surveys and literature reviewed have indicated that all professions should jointly share the responsibility for drawing up and maintaining model specifications. This aspect will be discussed more fully following Tables 15 and 16 hereinafter



	TOTAL	TYPE OF RESPONDENT		
		ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**260**	158	65	37
Strongly Disagree	**35**	24	8	3
%	**13.2**	*15.2*	*12.3*	*8.1*
Moderately Disagree	**84**	44	30	10
%	**32.7**	*27.9*	*46.2*	*27.0*
Undecided	**84**	55	11	18
%	**32.3**	*34.8*	*16.9*	*48.7*
Moderately Agree	**50**	29	15	6
%	**19.1**	*18.3*	*23.1*	*16.2*
Strongly Agree	**7**	6	1	0
%	**2.7**	*3.8*	*1.5*	*0*
Mean	**2.65**	2.67	2.55	2.73
S.D.	**1.02**	1.06	1.03	0.84

Table 11: The abovementioned "Model Preambles for Trades" is a comprehensive and up-to-date document and is therefore in no need of expansion or revision (Statement 1.6)

The sample mean (2.65) of the total for all respondents, and for the three professions respectively, have ratings of below the neutral position of 3, which is an indication that the respondents did not agree with the statement that the Model Preambles is a comprehensive and up-to-date document

The literature review has revealed (see Chapter 5) that it is a mammoth task to properly develop and maintain a comprehensive specification system (In the USA, for example, contributors spend approximately 18 000 man-hours annually to maintain and update the MasterSpec specification system)

The task of drawing up and maintaining the Model Preambles document has up to now been the responsibility of a few committee members who have offered their services purely on a voluntarily basis (see Chapter 5). This is obviously not an ideal situation and the construction industry in the RSA, should it desire to reap the benefits of having such a comprehensive and up-to-date specification system, will have to make the necessary investment, in both time and money, in such a venture. This issue is discussed more fully following Table 24 hereinafter

	TOTAL	GRAPHICAL PRESENTATION	TYPE OF RESPONDENT		
			ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**266**		162	66	38
Strongly Disagree	**29**		17	7	5
%	**10.9**		*10.5*	*10.6*	*13.1*
Moderately Disagree	**61**		35	17	9
%	**22.9**		*21.6*	*25.8*	*23.7*
Undecided	**76**		55	10	11
%	**28.6**		*34.0*	*15.2*	*29.0*
Moderately Agree	**76**		42	23	11
%	**28.6**		*25.9*	*34.9*	*29.0*
Strongly Agree	**24**		13	9	2
%	**9.0**		*8.0*	*13.6*	*5.2*
Mean	**3.02**		2.99	3.15	2.89
S.D.	**1.15**		1.10	1.25	1.13

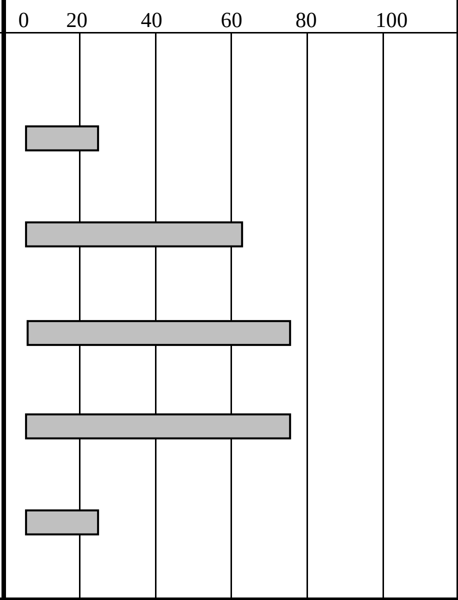


Table 12: The existence and application of standard specifications published and issued by public authorities (e.g. PW 371 – 1993) are well-known facts (Statement 1.7)

The sample mean (3.02) of the total for all respondents is (as in the instance of Table 9: Statement 1.4) surprisingly low. More than 60% of the respondents indicated that they were between neutral to strongly disagreeing with the statement. What is even more surprising, when the results are compared to those of Statement 1.4, is that there were fewer quantity surveyors who professed to know of the existence and application of specifications issued by public authorities than of the Model Preambles drawn up for use on private projects. No logical explanation could be provided for this discrepancy, other than that the respondents might not have fully understood the question posed, or that they might never have been involved in any work for public authorities

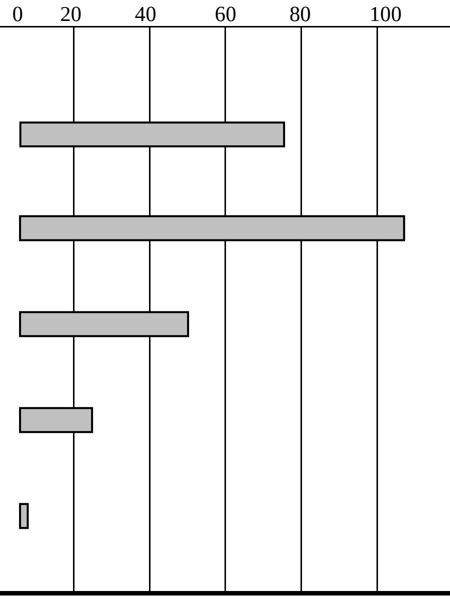
	TOTAL	GRAPHICAL PRESENTATION	TYPE OF RESPONDENT		
			ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	267		163	66	38
Strongly Disagree	75		38	23	14
%	28.1		*23.3*	*34.9*	*36.8*
Moderately Disagree	103		65	26	12
%	38.3		*39.9*	*39.4*	*31.6*
Undecided	55		37	10	8
%	20.8		*22.7*	*15.2*	*21.1*
Moderately Agree	29		19	6	4
%	10.9		*11.7*	*9.1*	*10.5*
Strongly Agree	5		4	1	0
%	1.9		*2.4*	*1.5*	*0*
Mean	2.20		2.30	2.03	2.05
S.D.	1.03		1.03	1.01	1.01

Table 13: Standard specifications issued by public authorities are comprehensive and up-to-date documents and are therefore in no need of expansion or revision (Statement 1.8)

The sample mean (2.20) of the total for all respondents, and for the three professions respectively, have ratings of well below the neutral position of 3, which indicates that the respondents did not agree with the statement that the specifications issued by public authorities are comprehensive and up-to-date documents. In addition to the discussion following Table 11, where probable reasons have been given why the respondents also, but to a lesser extent, felt that the Model Preambles is neither comprehensive nor up-to-date, the following may be added that flowed from the literature review conducted on specifications issued by public authorities in the RSA (see also 5.3.3.2 hereinbefore):

- PW 371, used by the DPW as well as most other public bodies, was last revised in 1993
- As a result of the time that has lapsed since the document was last revised the references to SABS Specifications, Codes of Practice, etc are incomplete and out-of-date (The document does, however, have on its covering page a statement to the effect that references to such specifications, codes, etc *shall be deemed to refer to the latest issue of such specifications and codes as may be amended from time to time…)*

- The foregoing statement does, however, not provide for specifications and codes that have been issued since 1993 – of which there have been a substantial number. To give support for the foregoing statement, the numbering of the most recent specification related to the building industry, *SABS 1879:2001 – Precast concrete suspended slabs,* can be compared with that of the latest specification referred to in the 1993 edition, i.e.*SABS 1491:1989 - Portland cement extenders*

- Furthermore, sparse specification information is provided in PW 371 document for certain contemporary materials such as aluminium, and nothing at all is said about the anodising thereof. Product information on aluminium (mention of this product material is once again made for illustration purposes) has recently received extensive coverage in new SABS Standards, and also in other technical brochures, such as those recently published by the Association of Architectural Aluminium Manufacturers of South Africa (AAAMSA). Such information is obviously not contained in PW 371, as most of it has been published after 1993

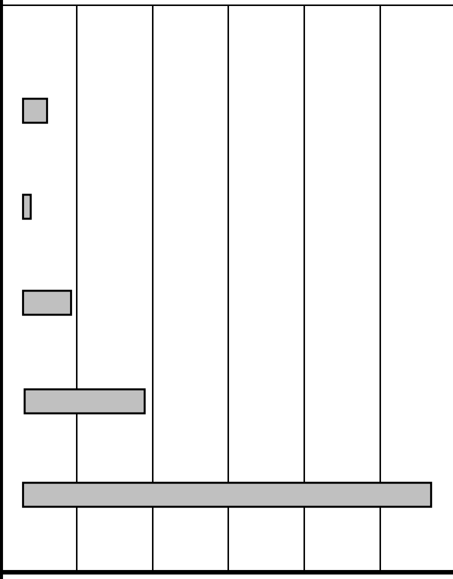
	TOTAL	GRAPHICAL PRESENTATION	TYPE OF RESPONDENT		
		0 30 60 90 120 150	ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**267**		164	65	38
Strongly Disagree	**11**		7	3	1
%	**4.1**		*4.3*	*4.6*	*2.6*
Moderately Disagree	**8**		6	1	1
%	**3.0**		*3.6*	*1.5*	*2.6*
Undecided	**17**		13	3	1
%	**6.4**		*7.9*	*4.6*	*2.6*
Moderately Agree	**60**		38	12	10
%	**22.5**		*23.2*	*18.5*	*26.3*
Strongly Agree	**171**		100	46	25
%	**64.0**		*61.0*	*70.8*	*65.8*
Mean	**4.39**		4.33	4.49	4.50
S.D.	**1.02**		1.06	1.00	0.89

Table 14: There should only be one comprehensive and up-to-date national building specification in the RSA (Statement 1.9)

The vast majority of respondents supported the statement (sample mean = 4.39) that there should be only one comprehensive and up-to-date specification system in the RSA. All three disciplines indicated strong support for the statement

In the "open-ended" responses following Question 1 two of the respondents noted the following on this particular issue:

> *The industry should standardise nationally (with as much as possible "internationalisation" to optimise the functioning of industry on a competitive basis and to cater for globalisation). All professions to contribute*
>
> *The aim should be to standardise and unify the present diversification that exists*

It has previously been reported (see 5.3.3 hereinbefore) that the private sector will in all probability only be enticed to make use of public sector documents if these documents embrace best practices which are superior to the documentation which they currently utilise. Conversely, the public sector will only make use of private sector documentation if such documents adequately serve their requirements in the reformed procurement environment. This study has previously also reported on the government's proposal that the various systems currently utilised by the different public authorities be amalgamated into one, and also on the fact that the government has no immediate plans to revise the PW 371 within the foreseeable future (see 5.3.3 hereinbefore). It seems, therefore, rather certain that the initiative to produce a single system would have to come from the private sector

The abovementioned proposal implies that there should be only one standard. The question that can rightfully be asked is whether it would be possible to have a single standard for both the building and civil engineering industries. The answer to this question is probably negative, as these two industries have hitherto been operating largely independently from each other, and seem likely to continue in this way. This argument is further supported by the fact that the Task Group (see 5.3.3 hereinbefore) has recently started with the complete revision of the SABS 1200 series of standard specifications (which is used by and large in the civil engineering industry only) without considering any amalgamation with specifications currently being utilised in the building industry

	TOTAL	GRAPHICAL PRESENTATION (0 20 40 60 80 100)	TYPE OF RESPONDENT		
			ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**269**		165	66	38
Strongly Disagree	**28**		17	7	4
%	**10.4**		*10.3*	*10.6*	*10.5*
Moderately Disagree	**24**		20	3	1
%	**8.9**		*12.1*	*4.6*	*2.6*
Undecided	**49**		29	16	4
%	**18.2**		*17.6*	*24.2*	*10.5*
Moderately Agree	**70**		41	18	11
%	**26.0**		*24.9*	*27.3*	*29.0*
Strongly Agree	**98**		58	22	18
%	**36.4**		*35.1*	*33.3*	*47.4*
Mean	**3.69**		3.62	3.68	4.00
S.D.	**1.32**		1.34	1.28	1.29

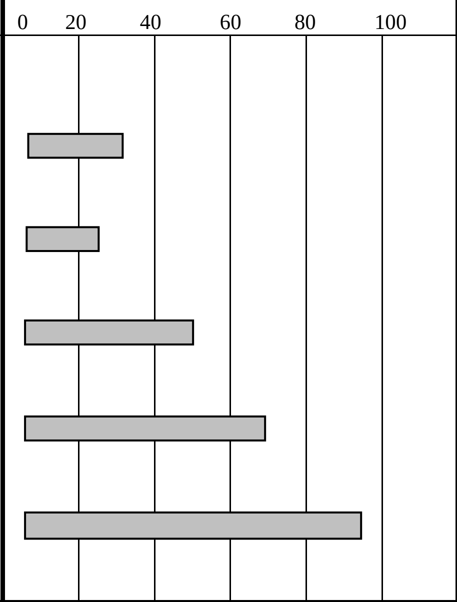


Table 15: Such a national building specification should be written, revised and published by a private commercial company, and private and public users should become subscribers to it to make it independently sustainable (Statement 1.10)

The sample mean (3.69) of the total for all respondents is an indication that the respondents agreed with the statement. There were, however, quite diverse opinions in all of the professions on the abovementioned statement, of which the fairly large standard deviations are testimony

The national building specification systems of the other countries that were reviewed in this study (see Chapter 5) were, in all instances, managed and maintained by private commercial companies. Subscribers pay an annual fee that, in RSA terms, may be fairly substantial, to subscribe to these systems. To illustrate this point, the annual fees for 2002 to subscribe to the NATSPEC in Australia, according to SPECnews Australia (2001 : 9), are given as an example:

- BASIC $ 528
- BUILDING $2072
- SITE+STRUCTURE $ 800
- SERVICES $ 800
- DOMESTIC $ 232
- BCA $ 180

=====
$4612
=====

At the exchange rate current at the time of drafting this chapter (October 2002) of approximately 5,50 South African rands to the Australian dollar, the annual subscription for all the packages marketed by NATSPEC would have totalled approximately 25 000 South African rands

It is evident from the foregoing that a comprehensive commercial specification service would be relatively expensive when introduced in the RSA. The South African market is also relatively small, and many consulting firms in the RSA operate as single partner entities that may find it too expensive to subscribe to such a service. This is confirmed by one of the "open-ended" responses received following Question 1:

> *There have been attempts in the past toward a national specification, but the RSA could not afford such a service*

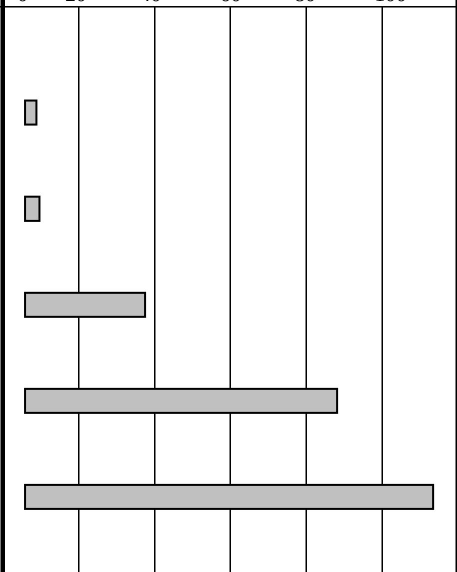
	TOTAL	GRAPHICAL PRESENTATION (0 20 40 60 80 100)	TYPE OF RESPONDENT: ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**269**		165	66	38
Strongly Disagree	**12**		8	2	2
%	**4.4**		*4.9*	*3.0*	*5.2*
Moderately Disagree	**15**		7	4	4
%	**5.6**		*4.2*	*6.1*	*10.5*
Undecided	**38**		23	9	6
%	**14.1**		*13.9*	*13.6*	*15.8*
Moderately Agree	**86**		55	20	11
%	**32.0**		*33.3*	*30.3*	*29.0*
Strongly Agree	**118**		72	31	15
%	**43.9**		*43.7*	*47.0*	*39.5*
Mean	**4.05**		4.07	4.12	3.87
S.D.	**1.10**		1.09	1.06	1.21

Table 16: Such a national building specification should be written, revised and published by an appointed committee under the auspices of an umbrella body for all the building professions such as the CIDB (Statement 1.11)

The sample mean (4.05) of the total for all respondents indicates that the respondents agreed with the statement. The mean values of the responses received from all three professions are almost identical and indicate stronger support for this statement than for the previous statement (Statement 1.10)

In the “open-ended” responses following Question 1 a respondent noted the following on this particular issue:

> *One body controlling specifications must be in place that shall set standards throughout the country – information must be obtainable and updated through the Internet*

The positive support from the sample on the above statement would therefore suggest that the respondents would be in favour of some intervention and cooperation by public authorities, such as the recently established CIDB. In developed first world countries, such as the UK, Sweden, the Netherlands, and the USA, the respective industries can probably afford to pay the high subscription charges for the benefits of using a comprehensive and up-to-date specification system. The situation in the RSA, however, would be different, as previously pointed out, and can be compared with that of other developing nations, such as Singapore. In Singapore, according to Goh & Chu (2002), such developments are joint exercises between the government and private organisations, constituent bodies, etc where it is one of the government’s stated policies to create Singapore as a business and IT hub. For this reason the Construction Industry IT Standards Technical Committee (CITC) was established in 1998 to continue the work (but with specific emphasis on the construction industry) that was initiated with the formation of the National IT Standards Committee (NITSC) in 1990 to spearhead development of national standards in all sectors of the economy

To date, CITC has initiated and established standards in the areas of CAD, cost and resources information and national specifications. It is the view of the respondents, as indicated in Table 16 above, that the RSA should create similar programmes as a joint venture between government and the private sector. It is recommended in the final chapter of this study that the construction industry should follow the Singaporean, or similar, experiences

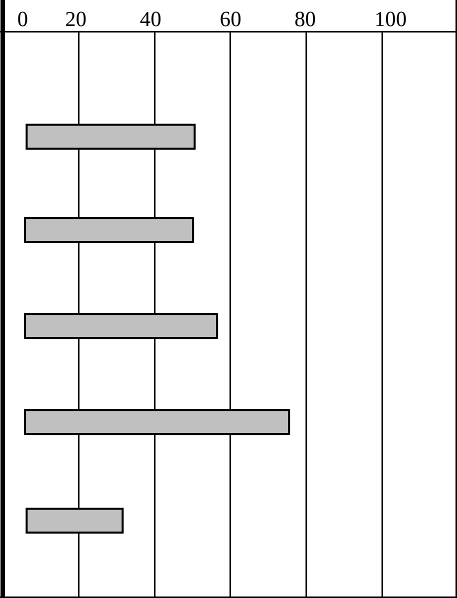
	TOTAL	GRAPHICAL PRESENTATION	TYPE OF RESPONDENT		
		0 20 40 60 80 100	ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	267		164	65	38
Strongly Disagree	50		32	12	6
%	18.7		*19.5*	*18.5*	*15.8*
Moderately Disagree	54		28	20	6
%	20.2		*17.1*	*30.8*	*15.8*
Undecided	57		33	15	9
%	21.4		*20.1*	*23.1*	*23.7*
Moderately Agree	74		50	12	12
%	27.7		*30.5*	*18.5*	*31.6*
Strongly Agree	32		21	6	5
%	12.0		*12.8*	*9.2*	*13.2*
Mean	2.94		3.00	2.69	3.10
S.D.	1.31		1.33	1.24	1.29

Table 17: Separate standard specifications are something of the past, as all relevant information can be obtained from the Internet or from product libraries such as QPL, SPECXpert, etc (Statement 1.12)

The sample mean (2.94) of the total for all respondents, and that for quantity surveyors (2.69) in particular, have ratings of below the neutral position of 3, which is an indication that they did not agree with the above statement

In the "open-ended" responses following Question 1 a respondent noted the following on this particular issue:

> *Obtaining technical information from the Internet is time-consuming and often information is incomplete; printed format still has a role to play*

In Part 2, literature review (and in particular Chapters 3 and 4), problems that still exist in adapting to the use of IT technology for information exchange in construction were highlighted. The most important drawback for the successful application of IT has been identified as the organisation of information

Montiere reported as follows on the problems being experienced in the business world with the application of IT in a recent article entitled: *Grote investeringen in IT vaak verspilling van geld* (De Telegraf of 30/09/2002):

> *Slechts een op de vijftig computertoepassingen in bedrijven werkt goed. De rest kan de toets der kritiek niet doorstaan. Hier is sprake van onvoldoende prestaties*
>
> *Dit is de onthutsende resultaat van een onderzoek dat het bureau Forrester heft gedaan onder 87 directeuren in Noord-Amerika en 25 directeuren in Europa die specifiek verantwoordelijk zijn voor die informatietechnologie (IT) binnen hun bedrijf*

8.3.3 Evaluation of data collected for Question 2: Does the South African building industry need a comprehensive specification system similar to systems that are in use in other countries such as the UK, Australia, the USA, etc?

	TOTAL	TYPE OF RESPONDENT: ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**269**	164	66	39
Strongly Disagree	**5**	3	1	1
%	**1.9**	*1.8*	*1.5*	*2.5*
Moderately Disagree	**14**	8	4	2
%	**5.2**	*4.9*	*6.1*	*5.1*
Undecided	**27**	16	7	4
%	**10.0**	*9.8*	*10.6*	*10.3*
Moderately Agree	**101**	62	22	17
%	**37.6**	*37.8*	*33.3*	*43.6*
Strongly Agree	**122**	75	32	15
%	**45.3**	*45.7*	*48.5*	*38.5*
Mean	**4.19**	4.21	4.21	4.10
S.D.	**0.95**	0.94	0.97	0.97

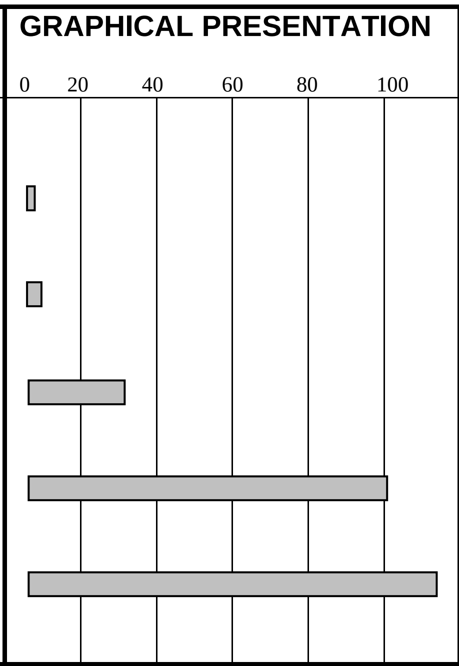


Table 18: The South African building industry needs a comprehensive specification system similar to NBS (UK) or MasterSpec (USA) (Statement 2.1)

The majority of respondents indicated strong support for the statement (sample mean = 4.19) that the South African building industry needs a comprehensive specification system that should correspond to international standards. The three disciplines were equally supportive on this issue

In the “open-ended” responses following Question 2 a respondent noted the following on this particular issue:

> *Though I believe a standard specification is imperative, to make it an international standard is ridiculous, as all countries have different weather and building conditions to take into account. There should be a national basis for the specification and then to adapt it per country for use as a particular specification*

The problem mentioned in the above response has been recognised in this research report, as is evident from the following extract from the summary of Chapter 5:

> *The conclusion reached in the abovementioned Report No 2 is that harmonisation of national specification systems will not be achieved in the short or even medium term, as the cost of and hindrances to a conceivable harmonisation outweigh the benefits. However, it is expected that in the long term (10 to 20 years) some form of harmonisation will be possible. This trend towards harmonisation is expected to be driven mainly by growing internationalisation and the resulting needs and demands of consultants and construction companies operating at both national and international levels. Computer technology and software developments will obviously also continue to have a major impact, as only these technologies can provide the real means for international information exchange*

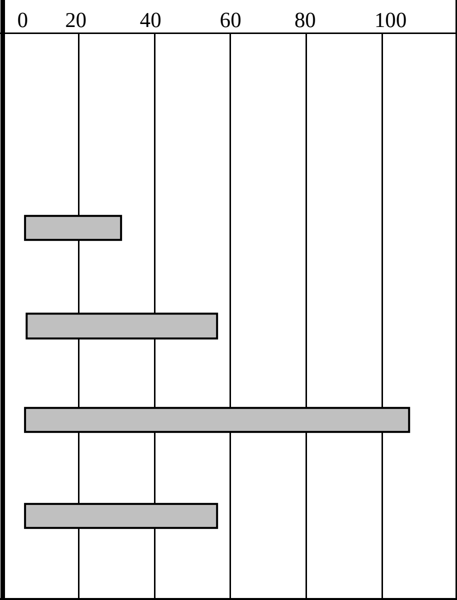
	TOTAL	GRAPHICAL PRESENTATION	TYPE OF RESPONDENT		
			ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**257**		156	64	37
Strongly Disagree	**0**		0	0	0
%	**0**		*0*	*0*	*0*
Moderately Disagree	**29**		17	8	4
%	**11.3**		*10.9*	*12.5*	*10.8*
Undecided	**60**		43	7	10
%	**23.3**		*27.5*	*10.9*	*27.0*
Moderately Agree	**110**		67	24	19
%	**42.8**		*43.0*	*37.5*	*51.4*
Strongly Agree	**58**		29	25	4
%	**22.6**		*18.6*	*39.1*	*10.8*
Mean	**3.77**		3.69	4.03	3.62
S.D.	**0.93**		0.90	1.01	0.83

Table 19: Preference is to be given to a specification system classified in accordance with the recognised and customary trades adopted up to now in local standard specifications etc. (E.g. "Model Preambles for Trades", "PW 371", "Standard System of Measurement", etc.) (Statement 2.2)

A joint discussion on Statements 2.2 and 2.3 follows Table 20 hereinafter

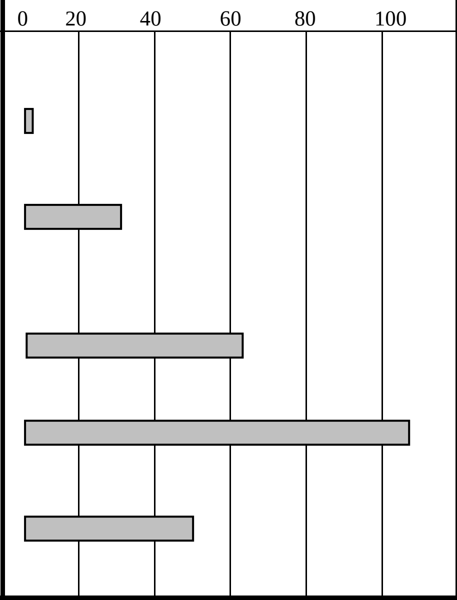
	TOTAL	GRAPHICAL PRESENTATION 	TYPE OF RESPONDENT: ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**257**		156	64	37
Strongly Disagree	**6**		4	2	0
%	**2.3**		*2.6*	*3.1*	*0*
Moderately Disagree	**28**		12	15	1
%	**10.9**		*7.7*	*23.4*	*2.7*
Undecided	**65**		42	17	6
%	**25.3**		*26.9*	*26.6*	*16.2*
Moderately Agree	**107**		66	17	24
%	**41.6**		*42.3*	*26.6*	*64.9*
Strongly Agree	**51**		32	13	6
%	**19.8**		*20.5*	*20.3*	*16.2*
Mean	**3.66**		3.71	3.38	3.95
S.D.	**0.99**		0.96	1.15	0.66

Table 20: Such a specification system should rather follow recently developed international classification standards as opposed to the traditional trade classification mentioned in Statement 2.2 above (Statement 2.3)

The sample means (3.77 and 3.66) of the total for all respondents in Tables 19 and 20 respectively are an indication that the respondents supported (almost to the same extent), statements 2.2 and 2.3. This should not have been the case, as these two statements are in fact a choice between two opposing principles. In other words, if a respondent supported the one statement, he should not have supported the other. The inference that can be drawn from this almost equal support for both statements is that the respondents were not really concerned with the format of the proposed classification method. It may, therefore, be classified in accordance with the traditional trade format, or follow international classification standards

It should be pointed out that the mean value of the responses for statement 2.2 received from quantity surveyors (4.03) is considerably higher than those received for statement 2.3 (3.38) thereby indicating the profession’s preference for the traditional trade format. This preference should not come as a surprise as quantity surveyors are used to applying the trade format classification method in, for instance, bills of quantities, final accounts, etc

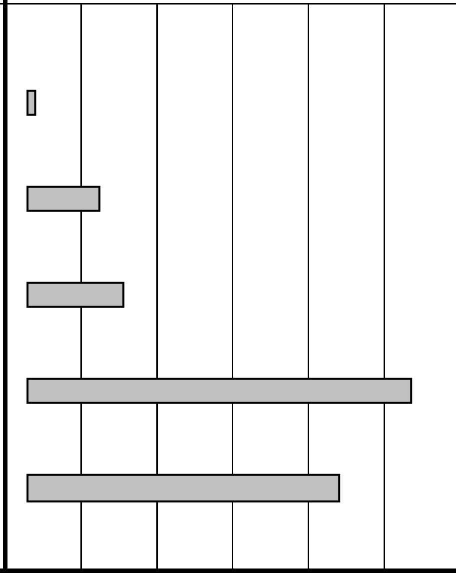
	TOTAL	GRAPHICAL PRESENTATION (0 20 40 60 80 100)	TYPE OF RESPONDENT: ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	258		157	64	37
Strongly Disagree	5		5	0	0
%	1.9		*3.2*	*0*	*0*
Moderately Disagree	21		12	9	0
%	8.1		*7.6*	*14.0*	*0*
Undecided	30		19	8	3
%	11.6		*12.1*	*12.5*	*8.1*
Moderately Agree	110		62	25	23
%	42.7		*39.5*	*39.1*	*62.2*
Strongly Agree	92		59	22	11
%	35.7		*37.6*	*34.4*	*29.7*
Mean	4.02		4.01	3.94	4.21
S.D.	0.99		1.04	1.02	0.58

Table 21: It will become increasingly important for information transfer to be standardised worldwide (Statement 2.4)

The majority of respondents were in support of the statement (sample mean = 4.02) that it would become increasingly important that information transfer be standardised. The engineering discipline was the most supportive on this issue (sample mean = 4.21)

Further discussion on this statement will be combined with the discussion following Table 22 hereinafter

In the “open-ended” responses following Question 2 two of the respondents noted the following on this particular issue:

> *International specification trends are very important to follow in order to be globally competitive, but South African building conditions are unique and that has to be taken into consideration*

> *Systems compatibility seems a worthwhile venture, where would it stop though – systems master planning for all relevant trades and professions (including CAD)?*

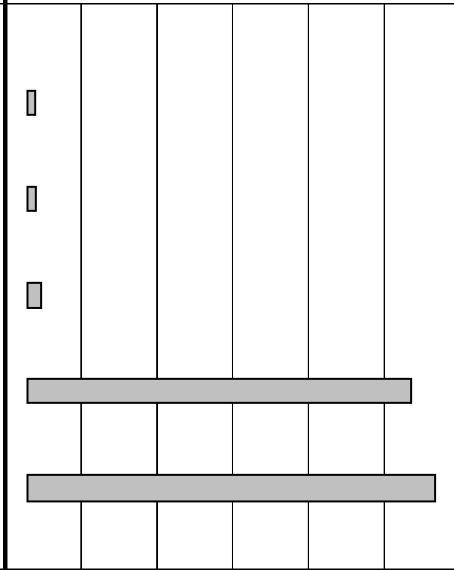
	TOTAL	GRAPHICAL PRESENTATION (0 20 40 60 80 100)	TYPE OF RESPONDENT: ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**259**		158	64	37
Strongly Disagree	**2**		2	0	0
%	**0.8**		*1.3*	*0*	*0*
Moderately Disagree	**4**		2	2	0
%	**1.5**		*1.3*	*3.1*	*0*
Undecided	**11**		2	7	2
%	**4.2**		*1.3*	*10.9*	*5.4*
Moderately Agree	**111**		66	27	18
%	**42.9**		*41.8*	*42.2*	*48.7*
Strongly Agree	**131**		86	28	17
%	**50.6**		*54.4*	*43.8*	*45.9*
Mean	**4.41**		4.47	4.27	4.41
S.D.	**0.72**		0.71	0.78	0.60

Table 22: It will become increasingly necessary for consulting firms in the RSA, currently working or intending to work with overseas partners, to exchange information using systems that are compatible with one another (Statement 2.5)

The vast majority of respondents indicated strong support for the statement (sample mean = 4.41) that it is important for consulting firms to be able to exchange information with other firms, both locally and abroad, using compatible systems. The respective disciplines were almost equally supportive on this issue

The inference that can be drawn from the positive response to the statement is that the key benefit for the respondents lies in the interoperability of compatible systems, especially in the area of e-procurement that is largely dependent on efficient information exchange between trading firms. The literature review has confirmed that increased familiarity with a uniform standard would lead to an overall increase in a firm’s productivity, which translates to cost and time savings over time. In addition, it being a national standard as proposed in this study, users would benefit from regular maintenance and refinements to the standard

The importance of limiting the number of standards has on a number of occasions been stressed in this study. It has also been established that there is a need for a common language if IT is to be used as a means to better and more efficiently manage and exchange information. In a broader context, it allows for interoperability between or among firms. To achieve this goal in the RSA, it has been suggested (see discussion under Table 16) that a committee be formed, similar to CITC in Singapore, to spearhead such development. It is further recommended that the proposed committee should adopt a similar mission to that of CITC, namely *to establish an industry-wide framework for the development and adoption of IT standards in the construction area* (Goh & Chu, 2002 : 2)

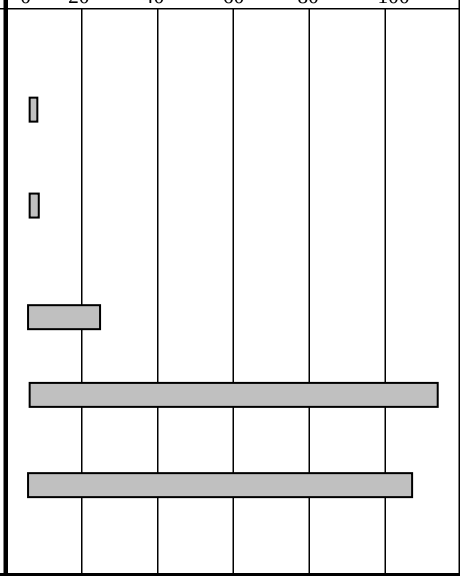
	TOTAL	GRAPHICAL PRESENTATION (0 20 40 60 80 100)	TYPE OF RESPONDENT: ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**259**		158	64	37
Strongly Disagree	**1**		1	0	0
%	**0.4**		*0.6*	*0*	*0*
Moderately Disagree	**7**		5	2	0
%	**2.6**		*3.2*	*3.1*	*0*
Undecided	**24**		11	8	5
%	**9.3**		*7.0*	*12.5*	*13.5*
Moderately Agree	**117**		67	30	20
%	**45.2**		*42.4*	*46.9*	*54.1*
Strongly Agree	**110**		74	24	12
%	**42.5**		*46.8*	*37.5*	*32.4*
Mean	**4.27**		4.32	4.19	4.19
S.D.	**0.77**		0.79	0.77	0.66

Table 23: A comprehensive local specification system, based on recent international classification developments, will assist drafters of specifications and others to apply standard/model documentation more effectively (Statement 2.6)

The vast majority of respondents indicated strong support for the statement (sample mean = 4.27) that a specification conforming to international standards of content and classification would assist in the better and more effective application of standard/model documentation. The three disciplines indicated almost identical support for the statement

It is common knowledge amongst members of the quantity surveying profession in the RSA that the introduction of the *Model Bills of Quantities (1991)* greatly benefited overall standards of procurement documentation, particularly those of bills of quantities in the building industry. It is, however, also common knowledge that this document is in urgent need of revision, and that it should undergo some major structural changes to be become even more useful. The following are some of the changes that should be considered:

- The document should be generic, i.e. there should no mention in the document of any brand or trade names

- The document should be structured in such a way that interfaces between the document and other documents, such as the SSM and a Commentary (see structure of the NATSPEC system in Australia, as described in Chapter 5) can be applied

- Interfacing with manufacturers and suppliers should also be introduced, enabling users to source up-to-date and relevant product related information

- The document should be based on a national standard for classification of construction information

The literature study has revealed (see Chapters 4 and 5) that the abovementioned revision and restructuring would be assisted to a large extent if it can be built on an already established national comprehensive specification system that has gained wide acceptance and application in the industry

	TOTAL	GRAPHICAL PRESENTATION (0 20 40 60 80 100)	TYPE OF RESPONDENT: ARCHITECT	QUANTITY SURVEYOR	ENGINEER
Total Responses	**258**		157	64	37
Strongly Disagree	**10**		1	5	4
%	**3.9**		*0.6*	*7.8*	*10.8*
Moderately Disagree	**25**		16	6	3
%	**9.7**		*10.2*	*9.4*	*8.1*
Undecided	**74**		50	19	5
%	**28.7**		*31.9*	*29.7*	*13.5*
Moderately Agree	**104**		55	28	21
%	**40.3**		*35.0*	*43.7*	*56.8*
Strongly Agree	**45**		35	6	4
%	**17.4**		*22.3*	*9.4*	*10.8*
Mean	**3.58**		3.68	3.38	3.49
S.D.	**1.01**		0.95	1.04	1.14

Table 24: Specifiers and other users would be prepared to pay an annual subscription fee for the use of such a comprehensive specification system (Statement 2.7)

The sample mean (3.58) of the total for all respondents is an indication that the respondents supported the statement. There were, however, quite diverse opinions on the suggestion that users should pay for the use of a comprehensive specification, as is evident from the following “open-ended” responses received:

These specifications should be the norm set by the relevant authorities, which specifiers should adhere to. Thus, the specifier cannot be forced to pay for these services

Users are already paying subscription fees for currently available systems; therefore a subscription fee for an improved and more comprehensive system shouldn’t pose a problem

Such system should be made available through the professional councils where an annual membership is paid (to SAIA, for example) – non-members should apply/pay to use this system. This system should only be used by professionals who can be held accountable for the contents of the specification and application thereof

There should be only ONE specification system for the entire built environment. It MUST be run by the state, or partly by the state – to remain objective – not money driven. It should therefore be a free service to all

8.3.4 Frequency distribution of responses to statements in Questions 3 and 4

Figures 5 and 6 show the frequency and percentage distributions of responses received from the total for all respondents, whilst figures 7 to 13 (inclusive) show the frequency and percentage distributions of responses received from each profession separately

An evaluation, in the form of a brief discussion, of the realisation of the sample's response to each statement under Questions 3 and 4 in the questionnaire is given following each Figure, which is amplified/supported/not supported by "open-ended" comments where applicable

8.3.5 Evaluation of data collected for Question 3: How effective is the management of product information sourcing in the RSA?

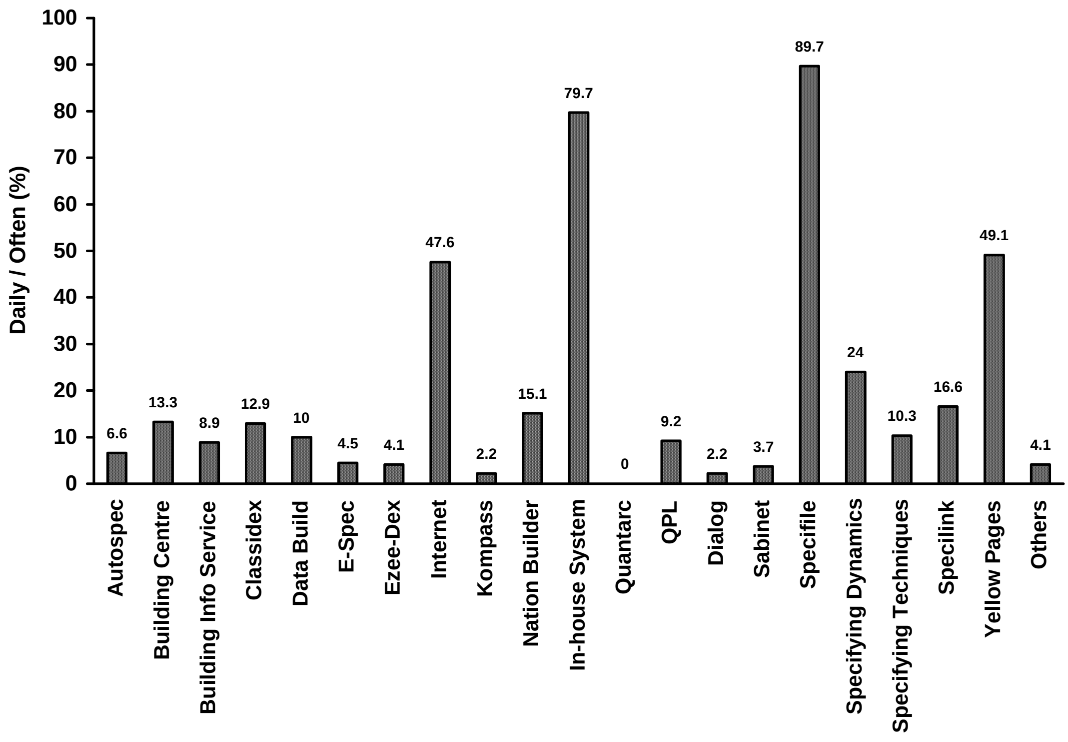


Figure 5: The regularity of use of available product information sources - Daily / Often (Question 3.1)

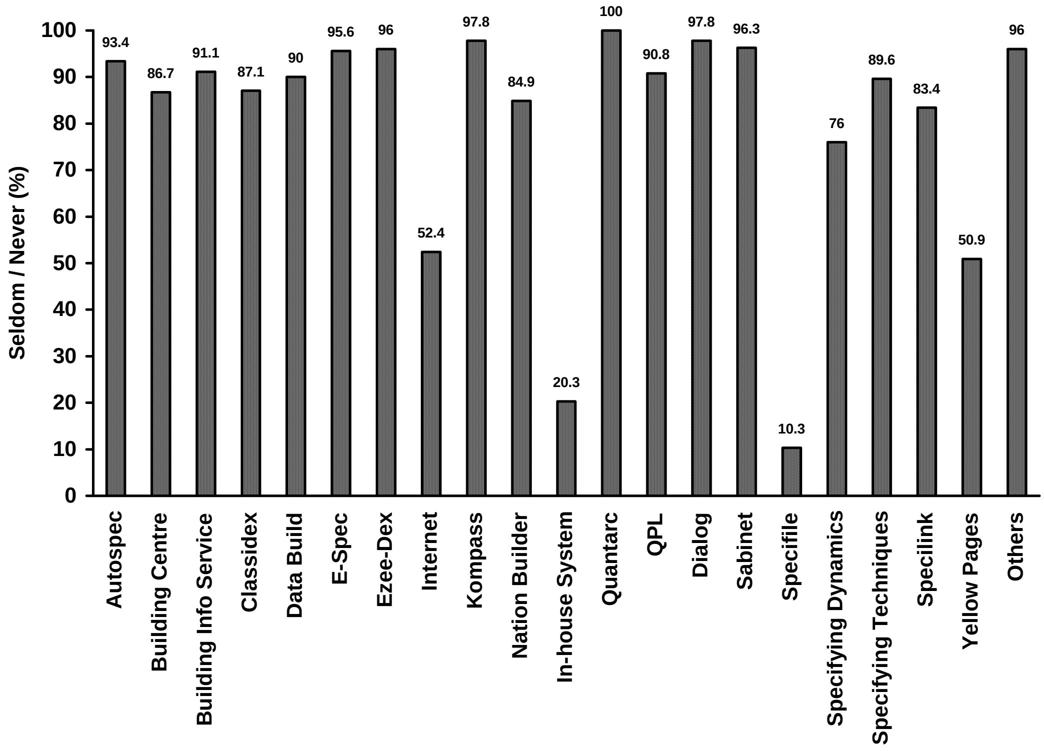


Figure 6: The regularity of use of available product information sources - Seldom / Never (Question 3.1)

Figure 6 gives a graphic illustration of the responses received on the regularity of use of available product information sources, and it is an exact opposite to the responses received as depicted in Figure 5. This graphic comparison has been inserted to make it abundantly clear that little use is made of the greater majority of available product information sources

After the responses received to this question were analysed, it was decided to group the categories of “daily” and “often” into one group, and the categories of “seldom” and “never” into another group. This was done as it was obvious that some respondents did not make a clear distinction between the original finer divisions. The results of the responses for the original finer divisions are, however, indicated in Appendix 9, and a graphic illustration thereof appears in Appendix 12

It was previously reported (see 4.5 hereinbefore) that a survey conducted during 2000 amongst professionals and contractors in the building industry revealed that only 0.08% of respondents rated the Internet useful for product sourcing. Professionals and contractors in the building industry were, until a few years ago, probably aware of the Internet, but chances were that they had never or seldom gone online or ‘surfed’ the Web for product sourcing. The thought of connecting the computer via a telephone line to some obscure network of information was practically unheard of

However, times have changed, as is evident from the results illustrated in Figures 5 and 6. The use of Web-based tools and technologies is gaining significant momentum in the construction community, as an increasing number of professionals and contractors begin to understand the critical role of the Internet in their day-to-day business operations. Figures 5 and 6 show that nearly 50% of the respondents use the Internet daily or often in some form or fashion, and that it is already rated the fourth most important means of obtaining building product information in the RSA. Some obviously rely on the Internet more than others – it all depends on how technologically advanced the company is – but chances are that it will be used to manage at least some of the business processes

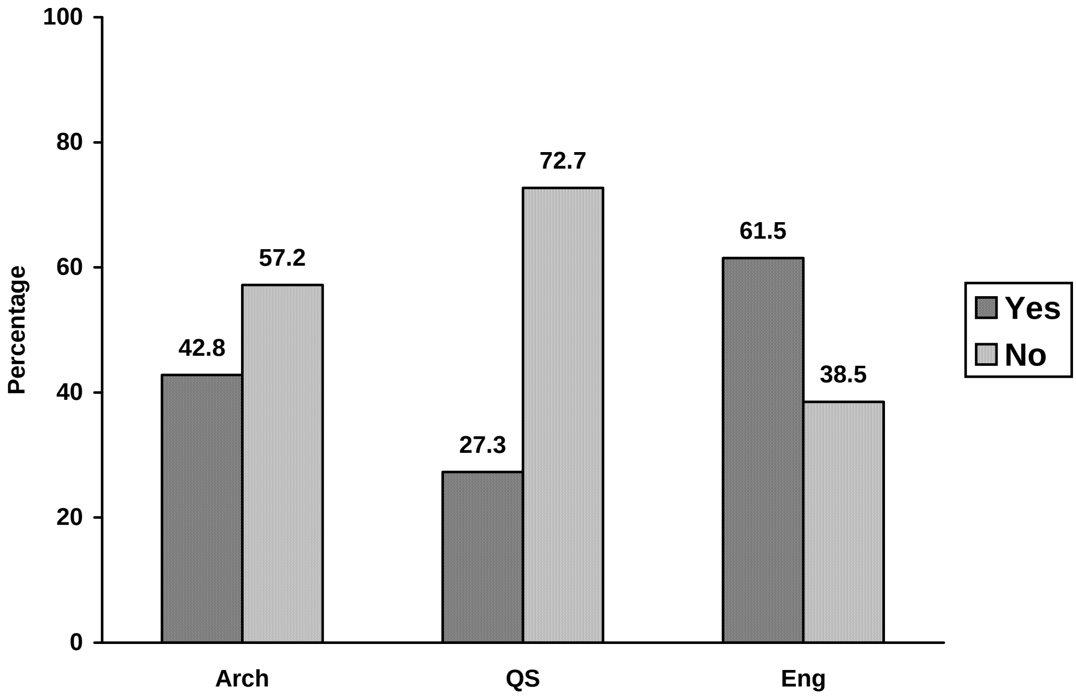


Figure 7: Sufficiency of current available product information services (Question 3.2)

The graphic presentation in Figure 7 of responses received for question 3.2 illustrates clearly that the quantity surveying profession is the least satisfied when their perception of the sufficiency of current product information services is evaluated. The inference that can be drawn from the responses received for this question is that the industry, in general, but more specifically quantity surveyors, does not regard the availability of product information as sufficient

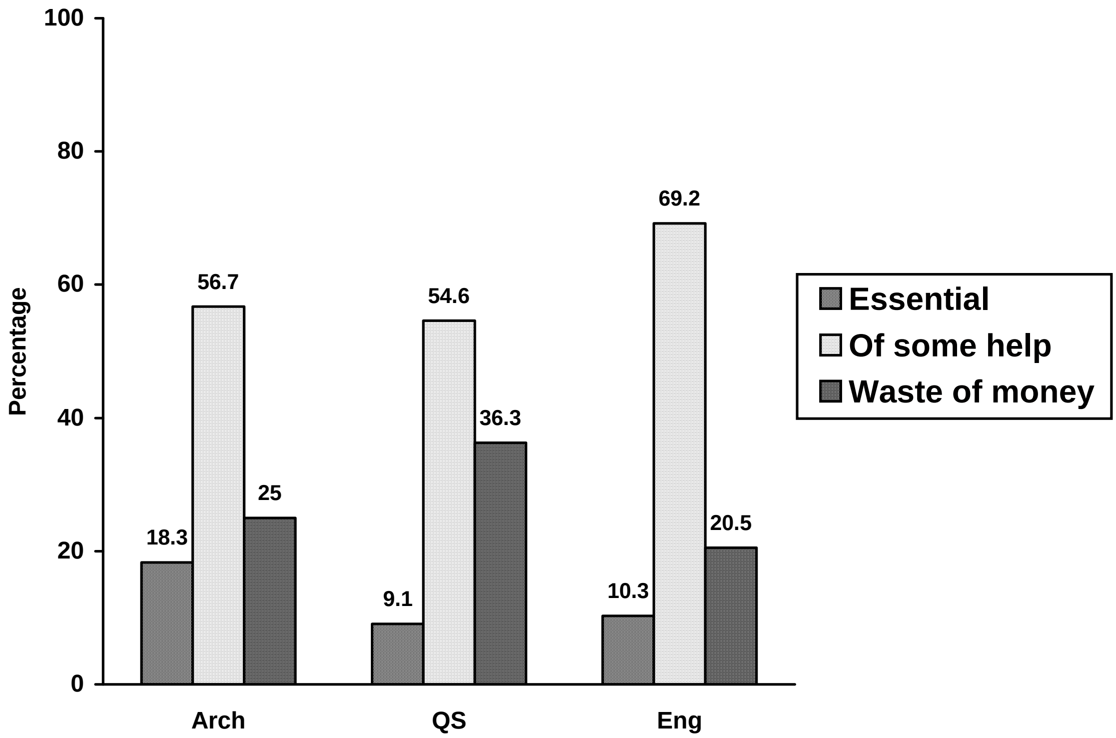


Figure 8: Relevancy of individually customised product information systems (Question 3.3)

Figure 8 is based on the responses received on the question of the relevancy of the several individually-customised product information systems that are currently on offer in the RSA. The inference that can be drawn from the above graphic presentation is that most respondents regarded them as of some help, but that the respondents were not completely convinced of their usefulness, as quite a large percentage of each profession saw them as a 'waste of money'

A selection of some of the more notable responses to "open-ended" questions received on the specific issue of how effective the management is of product information sourcing in the RSA are presented verbatim below:

> *Product information should be updated regularly and old/outdated spec's removed so that the specifier doesn't have to check if the relevant product/company is still being manufactured/still exists*

> *Many companies are withdrawing from the currently available systems, which makes the systems even more inadequate. One unified system would attract all players*

The affordability of such a system is of some concern if it is initiated as a profitable enterprise. [Classidex, as an example, is unaffordable for small to medium size practices (despite its comprehensiveness) which is a pity]

Everyone has something of value, but if it were not for our database that the company has initiated we would be in a predicament. Because no one of the listed companies has a decent variety, not even Specifile – too many manufacturers are withdrawing

Current computer-available information is still very limited

How do you implement such a system in a fragmented industry like ours?

The current product information systems/libraries do not satisfy the measurer's needs

Information systems that encroach on user computer hard disc space are not acceptable to us

There is a need for information to be accessible. "Brochure"-type sheets are not relevant to this age

A comprehensive, integrated system would be very helpful

Most of these database/info systems are laborious and time consuming; hence they need some obvious restructuring

Computer search engines are fast and efficient and do not need a unified classification system. The yellow pages have worked perfectly for many years – and that is an alphabetical classification system (very simple)

Internet-based systems are inefficient, time wasting and very costly (phone bills). If manufacturers/or others want us to use their products, they must pay for getting their information to the specifiers

8.3.6 Evaluation of data collected for Question 4: Is there a need for a classification system for use in procurement documentation in the construction industry in the RSA?

The graphic presentations shown in Figures 9, 10 and 12, which are based on the responses received for questions 3.4 and 4.1, 3.5 and 4.3 respectively, all indicate a frequency distribution for "Yes" of virtually 100%, and are, therefore, completely self-evident of the interpretation of the results. The trend is clearly positive, which makes further comment superfluous. Suffice to say that the responses to these questions all indicated strong support for the development of national classification standards, and that these standards should be developed along similar lines as those in countries that have already done the necessary exploratory work in this field of information management

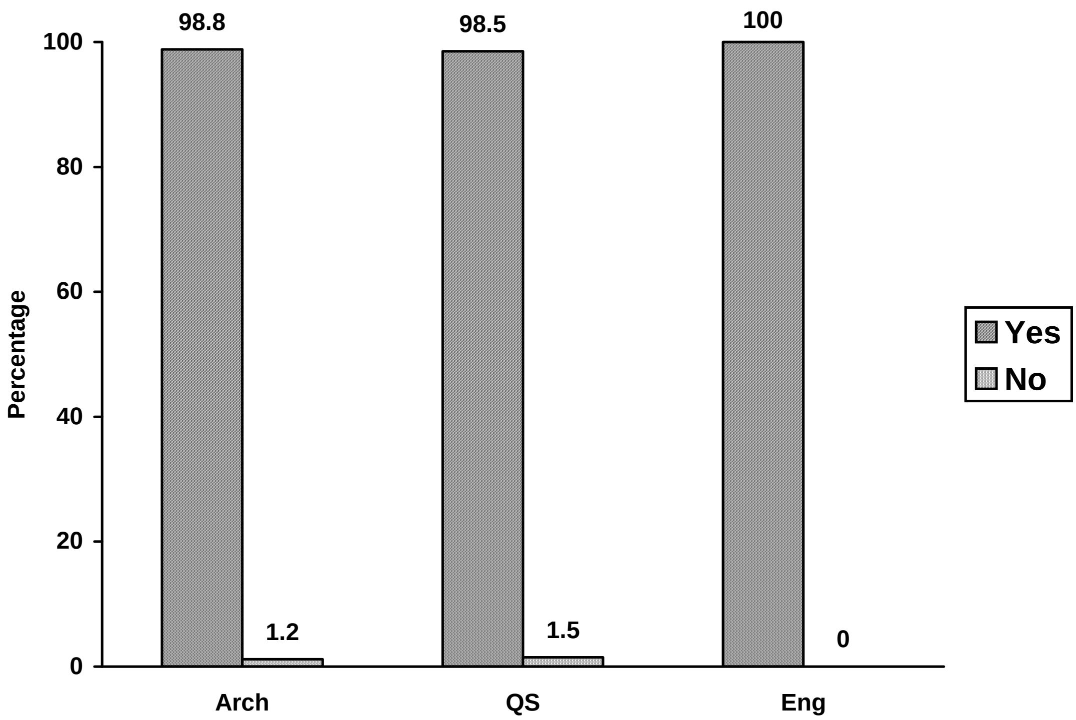


Figure 9: Essentiality of classification systems for the South African construction industry (Questions 3.4 and 4.1)

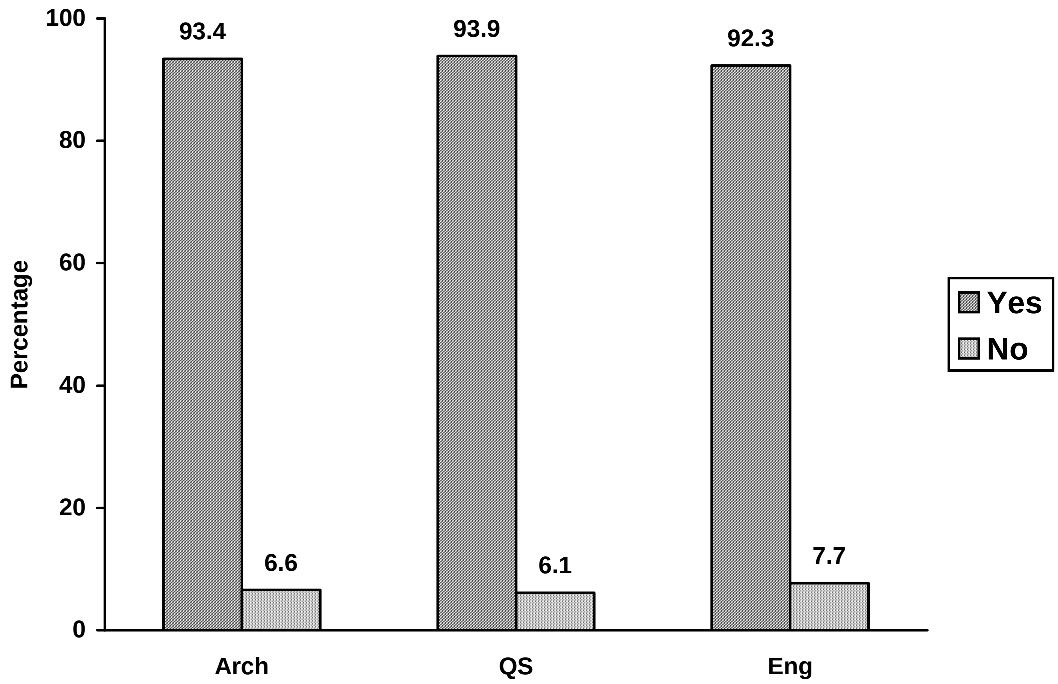


Figure 10: Do the local information structures need to explore new concepts in information analysis as a result of the Internet and computerisation? (Question 3.5)

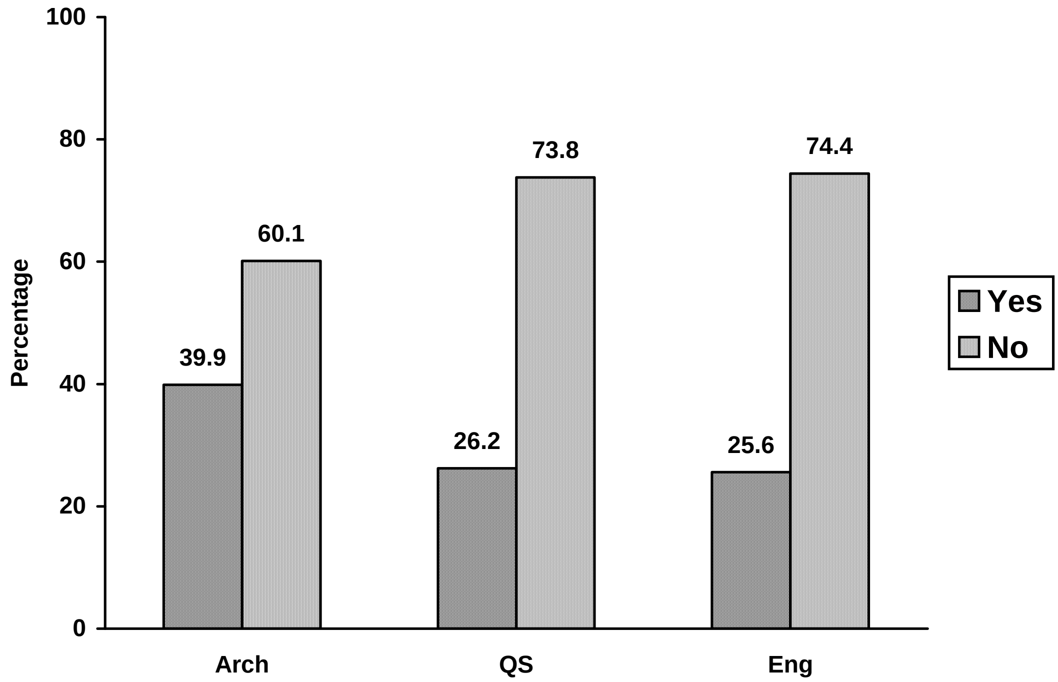


Figure 11: Familiarity with the CI/SfB classification system (Question 4.2)

During the drafting of the questionnaire it was decided to test the respondents on their familiarity with classification systems. For this purpose, the CI/SfB classification system for arranging construction product literature (see Chapter 4) was chosen. From the responses received (graphically illustrated in Figure 11 above) it is evident that most of the respondents, in particular the quantity surveying and engineering professions, were not familiar with the CI/SfB classification system

The inference that can be drawn from this response is that there is a general ignorance amongst building professionals, and presumably also amongst others involved in the construction industry, such as contractors and suppliers, with regard to the theory of classification of construction information. The foregoing statement is based on the presumption that if a respondent is not aware of the CI/SfB classification system, he, in all probability, would not be aware of any of the other international building classification systems (such as Uniclass)

It is therefore suggested that, in order to successfully implement the proposed national standard for classification of cost information and construction resources information in the construction industry, the following actions would have to be considered to promote adherence to the proposed standards:

- Publication of articles in construction journals and in literature distributed by the various constituent bodies, organisations and other controlling bodies
- Presentations of talks and seminars
- Active involvement of governmental institutions such as the CBE and CIDB
- Promotion of electronic transfer of construction information
- Joint involvement of all building professions to actively promote the adoption of the national standards in specifications and other procurement documents
- Clients and client bodies such as SAPOA and DPW to make consultants adopt the standards

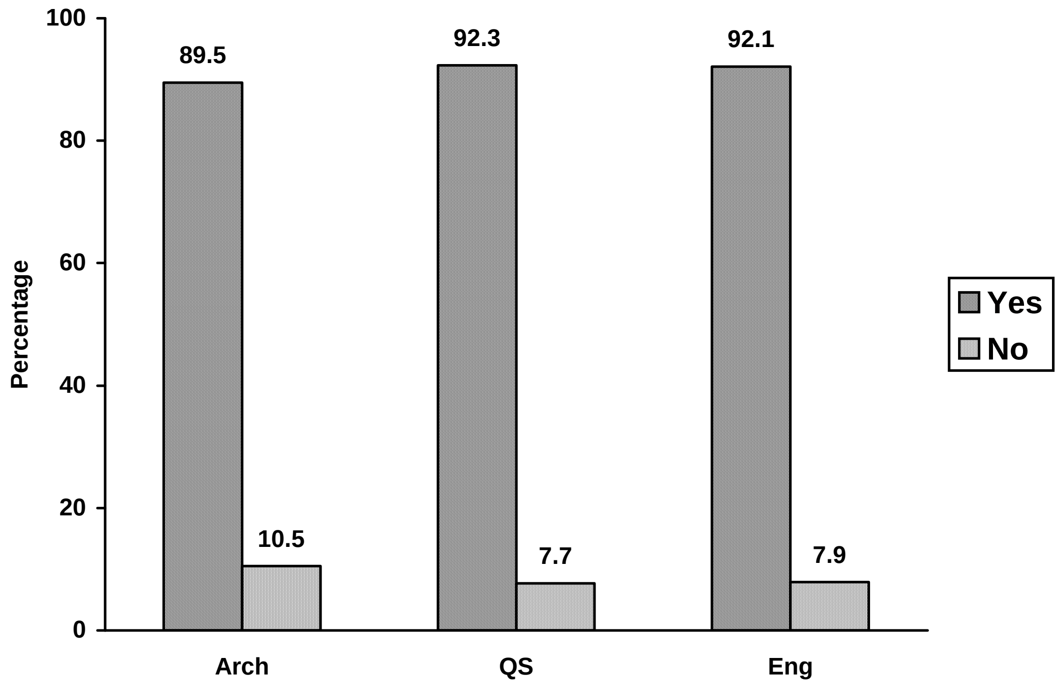


Figure 12: Must the proposed local classification systems be developed along similar lines as those of certain overseas countries? (Question 4.3)

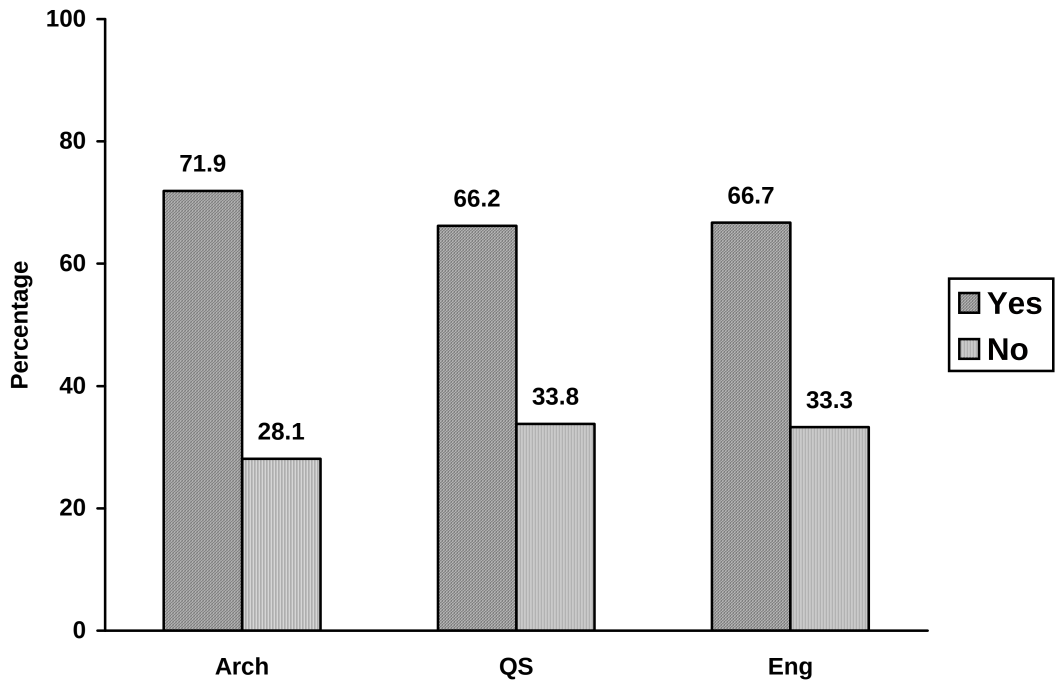


Figure 13: Does the RSA have the resources to develop and maintain its own comprehensive specification and construction information resource systems? (Question 4.4)

The almost identical positive frequency distribution based on the responses received from the three professions, as illustrated by Figure 13 above, is an indication that the respondents supported the statement that the RSA disposes of the necessary resources to develop and maintain its own information systems

In the “open-ended” responses following Question 4 three of the respondents noted the following on this particular issue:

> *Should work if “internationalised” as far as possible and run by private sector – subscriber basis. Viable if used by all sectors*

> *All consultants, suppliers and other role players need the information and would definitely support an improved system; therefore I believe it would be sustainable*

> *Resources are not limited. They can be used in various ways. These ways should be explored and details of the technical data should be published. A new system incorporating this idea will be able to sustain itself*

A selection of some remaining responses to “open-ended” questions that were received on the specific issue of whether a need exists for a classification system for use in procurement documentation in the construction industry in the RSA, are presented verbatim below:

> *Create standard model similar to classification used by libraries. Information worldwide on Internet is useless if system is not universally accepted*

> *Government funding should be made available to develop systems as it is to the advantage of the country as a whole*

> *Short-term expenses – long-term gains*

> *Expensive to start up, but will have advantages when running*

8.4 TRENDS INDICATED BY DATA COLLECTED

The main objectives of the second stage’s survey are recited as headings hereunder for the sake of convenience, and they are followed in each instance by abbreviated inferences and conclusions made based on the frequency distribution generated by the descriptive statistical exercise

Objective 1:

To establish how effective and up-to-date the currently available specification systems are and whether there is a need for change

Grouping of statements 1.1 and 1.4 to 1.8

FREQUENCY AND PERCENTAGE DISTRIBUTION: LINE OF BUSINESS				
SCALE (1 - 5)	ARCHITECT	QUANTITY SURVEYOR	ENGINEER	TOTAL
Disagree (1-2)	39	4	10	53
%	23.49	6.06	25.64	19.56
Neutral (3)	92	44	21	157
%	55.42	66.67	53.85	57.93
Agree (4-5)	35	18	8	61
%	21.08	27.27	20.51	22.51
TOTAL	166	66	39	271
%	61.25	24.35	14.39	100.00

Table 25: Frequency and percentage distribution of statements grouped under Objective 1 categorised, according to line of business

FREQUENCY AND PERCENTAGE DISTRIBUTION: LOCATION			
SCALE (1 – 5)	INLAND	COASTAL	TOTAL
Disagree (1 – 2)	23	29	52
%	14.20	26.85	19.26
Neutral (3)	104	53	157
%	64.20	49.07	58.15
Agree (4 – 5)	35	26	61
%	21.60	24.07	22.59
TOTAL	162	108	270
%	60.00	40.00	100.00
Chi-Squared test	Value = 8.1115 P-Value = 0.0173		

Table 26: Frequency and percentage distribution of statements grouped under Objective 1, categorised according to location

The majority of respondents indicated that they are neutral/undecided on this issue (57.93%). The *Chi-Squared* test for independence (see 8.2 hereinbefore) in Table 26 depicts that a meaningful dependence between the different locations exists that is less than the 5 per cent critical value (1.73%), which is an indication that the frequencies between the two locations are statistically significantly different

Quantity surveyors seem to be more concerned about the current situation than the other two professions. This might be ascribed to the fact that quantity surveyors in the RSA take on most of the responsibility regarding specification matters (see Chapter 5), and would, therefore, be more exposed to the ineffectiveness of the available specification systems

The neutrality/indecision of the three professions as depicted in Table 25 might be ascribed to the fact that people have a strong resistance to the adoption of new methods when they have been using existing methods over a long period in time. Some of the key reasons why certain respondents do not want to change might be a general lack of incentive and benefit to change, and the potential cost to be incurred from such change, especially in the re-classification of historical data

Objective 2:

To determine the preference regarding the task of preparing specifications

Grouping of statements 1.2 and 1.3

FREQUENCY AND PERCENTAGE DISTRIBUTION: LINE OF BUSINESS				
SCALE (1 - 5)	ARCHITECT	QUANTITY SURVEYOR	ENGINEER	TOTAL
Disagree (1-2)	1	0	0	1
%	0.61	0.00	0.00	0.37
Neutral (3)	16	6	3	25
%	9.70	9.09	7.69	9.26
Agree (4-5)	148	60	36	244
%	89.7	90.91	92.31	90.37
TOTAL	165	66	39	270
%	61.11	24.44	14.44	100.00

Table 27: Frequency and percentage distribution of statements grouped under Objective 2 categorised according to line of business

The vast majority of respondents were clearly in support of the statement (90.37%) that consultants responsible for the design should also be responsible for the drafting of the specifications, and that such persons should possess specific expertise and appropriate experience. The inference that can be drawn from this result is that the responsibility ‘to specify’ belongs to the architectural and engineering professions, and that the quantity surveying profession should at most be involved in checking the specification for its correctness and completeness, which is commonly accepted to be one of the quantity surveyor’s basic duties

Over the years the process of building has become more complicated. From inception to completion, through site acquisition, design, contract and construction, each stage has become more time-consuming, and thus more expensive. The need to optimise the process is therefore of paramount importance, and the best base from which to achieve this is proper and efficient team-work. It is therefore vital that all members of the building team are fully conversant, not only with their own role, but also with the roles of others, and with interrelationships at each stage of the project. Each can then play their part fully and effectively, contributing their particular expertise whenever required (Hackett & Robinson, 2003 : 1)

Objective 3:

To ascertain whether a preference exists for a single national building specification system in the RSA and, if so, who should publish, maintain and finance such a system

Grouping of statements 1.9 to 1.11 and 2.7

FREQUENCY AND PERCENTAGE DISTRIBUTION: LINE OF BUSINESS				
SCALE (1 - 5)	ARCHITECT	QUANTITY SURVEYOR	ENGINEER	TOTAL
Disagree (1-2) %	8 4.85	3 4.55	2 5.26	13 4.83
Neutral (3) %	27 16.36	10 15.15	5 13.16	42 15.61
Agree (4-5) %	130 78.79	53 80.30	31 81.58	214 79.55
TOTAL %	165 61.34	66 24.54	38 14.13	269 100.00

Table 28: Frequency and percentage distribution of statements grouped under Objective 3, categorised according to line of business

The respondents strongly supported the statement (79.55%) that there should be only one national specification system in the RSA. They further agreed that such a national system should be published and maintained by a body that should seek the cooperation of both public and private organisations. The respondents were also generally in favour of a subscription fee for the use thereof being levied. However, there was also some support for the fact that the service should be free to all, thereby implying that the state should be responsible for the financing of the system

Objective 4:

To establish what the classification format of such a national specification system should be

Grouping of statements 2.1 to 2.6

FREQUENCY AND PERCENTAGE DISTRIBUTION: LINE OF BUSINESS				
SCALE (1 - 5)	ARCHITECT	QUANTITY SURVEYOR	ENGINEER	TOTAL
Disagree (1-2) %	7 4.24	1 1.52	1 5.26	9 2.56
Neutral (3) %	14 8.48	11 16.67	3 7.69	28 10.37
Agree (4-5) %	144 78.79	54 80.30	35 81.58	233 79.55
TOTAL %	165 61.11	66 24.44	39 14.44	270 100.00

Table 29: Frequency and percentage distribution of statements grouped under Objective 4, categorised according to line of business

The respondents firmly supported (79.55%) a system conforming to international standards of content and classification. However, respondents also supported statement 2.3 that the existing trade format of classification could be an option, and furthermore supported the statement that it is important for such a system to be compatible with other systems, both locally and elsewhere

Objective 5:

To investigate whether the Internet and/or individually customised on-line product information systems will suffice and in fact replace the need for a separate standard specification

Statement 1.12

The respondents indicated that they do not support this statement (see Table 17). The inference can be drawn that, although the Internet is fast becoming an important instrument for information sourcing, electronic systems currently available for construction resources information need further development before they can be effectively applied

Objective 6:

To establish how often, and which of, the current available product information systems are consulted, and whether they in fact satisfy the present needs

Grouping of questions 3.1 to 3.3

Figures 4 and 5 graphically illustrate that, of the 21 product information sources that were known to be operating at the time when the survey questionnaire was drafted, only four were regularly consulted. Two of those four, namely the Internet and the Yellow Pages, are general information sources, i.e. they are not specifically designed for use by the construction industry, and, from the responses received, the regularity of use for both those sources was rated below 50%. Of the remaining two information sources that were regularly consulted (regularity of use was 79.7% and 89.7% respectively) one was the respondents' in-house system, whilst the other was that of a commercial product information distributing company (Specifile)

It is generally accepted that in-house systems have certain shortcomings as an information source, the most important being that they are not comprehensive and not regularly maintained. Even large practices find it difficult to properly resource the maintenance of their in-house systems, with the result that it may be several years since they were last reviewed. Such systems would also be inconsistent across offices with regard to their style, content and structure. It can therefore be argued with a reasonable amount of certainty that the information in any of the in-house systems would be supplementary only to the information provided by commercial companies that practices subscribe to, and that such information would most likely be stored in hard copy format only. The in-house system would also most probably not make use of a recognised bibliographic classification method

Commercial product information distributing companies (only two, i.e. Specifile and Classidex) operate in the RSA on a subscription basis, whilst all the others provide their services free of charge to users. These companies regularly update (at least twice a year) the information in their subscribers' or users' files (hard copy brochures) and also distribute certain information electronically (CD-Rom)

The advantages of using independent product information companies can be identified as:

- More current than in-house systems
- Lower cost than in-house systems. Cost of subscription would be less than doing your own thing to the same level of quality
- More comprehensive than in-house systems
- Help service to locate information would generally be available
- Familiarity with indexing system
- Personal contact with knowledgeable field representatives

The disadvantages of using independent product information companies can be identified as:

- Relevant material often not included
- Must be subscribed to
- Absence of a national standard for classification, as different companies use different methods of arranging product information
- Limited integrating possibilities with consultants' own production systems

The respondents were not requested to rate the effectiveness of individual companies, but were asked to rate in general the sufficiency of the available information sources. These results are illustrated in Figure 7, and show that 57.2% of the respondents from the architectural profession and 72.7% of the respondents from the quantity surveying professions were not satisfied, whilst 61.5% of the respondents from the engineering profession indicated that they were satisfied. A probable explanation for this contradiction might be that information sourced by architects and quantity surveyors is much more varied than that sourced by civil engineers

Although most of the respondents from the three professions indicated that the information distributed by the various companies was 'of some help', a substantial portion rated the proliferation of such companies as 'a waste of money'

The general conclusion that can be drawn from the responses received in the above grouping of questions is that product-information-sourcing in the construction industry is not handled effectively in the RSA, and therefore does not satisfy the needs of consultants, contractors, manufacturers, suppliers, etc. The fact that in-house product libraries were rated the second most important source for product information is further testimony that current product-information-systems do not provide an effective service to the industry

Objective 7:

To determine whether a need and the capacity exist for the development of a unified classification system for structuring product literature and project information similar to trends in other parts of the world

Grouping of questions 3.4, 3.5 and 4.1 to 4.4

The respondents from all three professions gave a clear indication of their support (see Figure 9) for the adoption by the RSA of national standards for classification for structuring product literature and project information, as well as for electronic procurement (see Figure 10). The support was almost equally strong that such standards should conform to international standards (see Figure 12), but the respondents were not fully convinced that the RSA could develop and maintain its own classification systems (see Figure 13)

8.5 SUMMARY

This Chapter presented and analysed the primary data collected from 271 practices in the respective professions of architecture, quantity surveying and civil engineering, mainly with regard to national standards for classification of construction cost information and construction resources information

Some of the more prominent trends indicated by the data collected, and concomitant inferences and conclusions, were presented. A more comprehensive summary of conclusions from the results and recommendations towards the possible solving of problems encountered in this area of organising construction cost information and construction resources information appears in the final chapter (Chapter 10) of this study

The next chapter (Chapter 9) proposes formats of national standards for construction cost information (elements and work sections) and proposes strategies for implementing such national standards for construction resources information

CHAPTER 9

NATIONAL STANDARDS FOR THE CLASSIFICATION OF CONSTRUCTION INFORMATION

9.1 INTRODUCTION

The second-stage survey results have supported the fact that a need exists for a comprehensive, unified classification system for the construction industry, and that new concepts should be introduced in information analysis and retrieval. The literature review that was conducted has indicated that these needs have been brought about mainly by the advancement of computerisation and IT. Appropriate solutions to satisfy these needs should be developed, and attempts should also be made to bring current systems into line with international developments. Based on the literature review conducted, it is clear that the RSA lags far behind countries that have already adopted construction information classification systems. In order to make up the lost ground, it is recommended that a specialised committee(s), similar to such committees as the *Construction Project Information Committee (CPIC)* in the UK, or the *Construction Industry IT Standards Technical Committee (CITC)* in Singapore, be formed to spearhead the development and ultimate establishment of national standards for classification of construction information

It is evident from the respondents' comments to "open-ended" questions posed in the second-stage survey that strong support exists for the involvement of <u>all</u> sectors of the industry in the development of the proposed classification standards. The quantity surveying profession in the RSA has, especially during the last three or more decades, been mainly instrumental in the drafting of standard documents regarding specification and classification matters. The *SSM*, the *Model Preambles* and the *Guide to Elemental Cost Estimating & Analysis for Building Works* are three examples of documents dealing with these issues that have been published and maintained by the ASAQS. According to Table 16 (see Chapter 8) the great majority (more than 75%) of respondents supported the statement that a national body representing all the industry players should control the development process of the proposed standards. In this regard STANSA (formerly SABS Standards Division), in conjunction with the CIDB, would probably be the most suitable organisation to take the lead in the proposed development

The main reason for suggesting that STANSA should be involved in the development of national standards for classification of construction information is that the drafting of standards in the RSA is, in the main, a function STANSA. The SABS, which preceded STANSA as the authorative body responsible for producing national standards, is a legal entity instituted by law (Act 24 of 1945), in its capacity as a statutory organisation. (The act was subsequently amended into the present Standards Act 1993, Act 29 of 1993). The former SABS has been particularly important for the building and construction industry, in that it provides services across a wide spectrum, which include, *inter alia*, the setting up of national standards, and assistance in compiling private specifications (Hauptfleisch & Siglé, 2002 : 79)

As previously mentioned, the Standards Division of the SABS has recently changed its name, and it develops and publishes standards henceforth under the banner of Standards South Africa (STANSA), to distinguish them from the identity of their parent organisation, SABS Holdings, a state enterprise that will control the testing facilities and certification services. Both will answer to the SA National Standards Organisation. This identity change was identified as necessary during the recent review of South Africa's Standards, Quality Assurance, Accreditation and Legal Metrology (SQAM) infrastructure commissioned by the Department of Trade and Industry (Source: Internet: http://www.bdfm.co.za/cgi-bin/pp-print.pl Access 10/14/02)

Because of the abovementioned importance of the SABS for the construction industry, specifically regarding the setting up of national standards, a short outline is given of the general procedural aspects that STANSA have introduced for drafting of national standards

A recommended practice for drafting of standards exists in a trilogy of documents, which were last revised in 1998, entitled:

- *ARP 013: Rules for the structure and drafting of standards*
- *ARP 015: Methodology for the development of standards*
- *ARP 017: Procedures for the technical work in the preparation of South African standards*

Standards are generally developed by representative committees on the principle of consensus, and are in alignment with international standards such as those published by ISO and IEC wherever possible. In order to achieve of consistency within the complete corpus of STANSA standards, *ARP 013* prescribes that the text of every standard shall be in accordance with the relevant provisions of existing basic SABS standards. This relates particularly to:

- *standardised terminology;*

- *principles and methods of terminology;*
- *quantities, units and their symbols;*
- *abbreviated terms;*
- *bibliographic references;*
- *technical drawings; and*
- *graphical symbols*

In addition, for specific technical aspects, *ARP 013* prescribes that the relevant provisions of general SABS standards dealing with the following subjects are to be respected:

- *limits and fits;*
- *tolerancing of dimensions and uncertainty of measurement;*
- *preferred numbers;*
- *statistical methods;*
- *environmental conditions and associated tests;*
- *safety; and*
- *chemistry*

Examples of national standards are:

- Voluntary specifications for products and services (e.g. SANS 542 for concrete roofing tiles)
- Codes of practice (e.g. SANS 10249 for masonry walling)

When a new standard or code of practice has to be produced *ab initio*, it has the advantage that it may be more focused, i.e. addresses the specific needs better, but the disadvantages are the time and cost involved. Should either a regional/international standard/code of practice be adopted, the advantages might be that it is cheap, quick and easy, but the disadvantage exists that it may not be the best standard

In considering the proposal for a national standard for classification of construction information in the RSA, it was decided to build the standard on classification systems already in existence elsewhere in the world. A hybrid standard has, however, certain distinct disadvantages, as it would create a new system unique to the RSA. In the long-term, the purpose of IT standards is to enable users to interoperate with firms, not only locally, but also elsewhere in the world, and a localised or customised standard would only hinder this process. Over time, there should ideally be only one or two universal standards applicable worldwide (Goh, 2002 : 2). The proposal for classification standards in this chapter has taken the foregoing requirements noted by Goh into consideration

9.2 CLASSIFICATION OF CONSTRUCTION INFORMATION

9.2.1 General

The proposal for a national classification standard for the construction industry will be limited to the classification of construction cost information. The Uniclass system previously referred to (see Chapter 4) that was recently introduced in the UK, consists of 15 tables covering a wide spectrum of topics and activities in construction information, such as Management, Facilities, Construction entities, Spaces, Elements for buildings, Work sections for buildings, Construction products, etc. Only two of these topics, namely those of *Elements for buildings* and *Work Sections for buildings,* are included in the proposed standard, and no attempt has been made to present proposals for classification systems for the remaining, and possibly even other, topics. This would entail covering a much wider scope than the delimitations put forward for this study (see Chapter 1). However, attention has been drawn to some of these topics in the foregoing chapters in an attempt to highlight the various needs that exist for an overall classification system. In this regard this study has identified, for instance, the particular need that exists in the industry for construction products information sourcing (see Chapters 3 and 4)

The development process of the proposed national standard for classification of construction information involved two stages. Firstly, a review was conducted of selected foreign national standards that have already been developed, to establish how they compare with the standards currently in use in the RSA. Secondly, adaptations from the foreign standards were made to suit local industry practices where these standards have been incorporated into the local standards. In the first stage, the standards developed in the UK, Australia and Singapore were evaluated. This approach was chosen on the basis that the standards in these countries could readily be adopted, (although not in full), in the local industry for classifying elements and work sections, mainly because of the similarity that exists between the procurement processes of these countries and those of the RSA. Certain other aspects (e.g. system structure) were also evaluated, and for this purpose the systems employed in the USA, Sweden and the Netherlands, in addition to the systems in the aforementioned countries, were considered. Modifications were then made to the ultimate proposal to accommodate local conventions

9.2.2 Scope of the proposed standard

The proposed standard consists of the following parts:

- An ***elemental classification***: These are the elements and sub-elements used for cost planning purposes

- A consequential restructuring of ***work sections classification***: These are the work sections and their subdivisions that may be used as a more detailed framework for documentation of all kinds, such as specifications and bills of quantities

9.2.3 Elemental classification

The primary purpose of the following elemental classification standard is to propose a re-structured system for elemental estimating and cost reporting. The proposed standard follows basically the same structure as that presented in the *Guide to Elemental Cost Estimating & Analysis for Building Works* (published in 1998 by the ASAQS and currently employed by the quantity surveying profession in the RSA), but it is more comprehensive and can readily be adopted for local and international use. It differs only in specific detail from systems currently employed in the UK, Australia, Singapore, etc. As previously mentioned, this compatibility is an important feature of the proposed system, as it has been established in this study that there is a definite need for a common language if IT is to be used as a means to increase interoperability between firms locally and internationally. The elemental classification table that follows hereafter could be particularly useful in conjunction with the ISO standard on CAD layering, when that is fully implemented in the RSA

ELEMENTAL CLASSIFICATION TABLE		
GROUP ELEMENTS	**ELEMENTS**	**SUB-ELEMENTS**
Site preparation	Demolitions Site Clearance Alterations and Renovations Earthworks Soil investigation (Vacant)	
Substructure	Piling Foundations Basement Ground Floor Construction (Vacant)	
Superstructure	Columns and structural walls	Columns Structural walls (Vacant)
	Upper floors	Slabs Beams Steps and ramps (Vacant)
	Roofs	Roof structure Roof coverings Roof drainage Roof lights (Vacant)
	Staircases	Staircase structure Staircase finishes Handrails and balustrades (Vacant)
	External walls and cladding	External walls Cladding Curtain walls External wall finishes* External windows* External doors* Internal finish to external walls* (Vacant)
	Internal walls and partitions	Internal walls Partitions Acoustic walls Internal windows* Internal doors* Internal finish to internal walls* (Vacant)
	Windows	External windows Internal windows (Vacant)
	Doors	External doors Internal doors (Vacant)
	Sun control screens, grilles, etc	
Finishes	Wall finishes	Internal wall finishes External wall finishes (Vacant)

	Floor finishes	Internal floor finishes Raised access floors (Vacant)
	Ceiling finishes	Internal ceiling finishes Suspended ceilings (Vacant)
Fittings, fixtures and furnishing	Sanitary ware and fittings	
	Fixtures and furniture	Fittings Kitchen equipment and stoves Specialised equipment Signage (Vacant)
	Artworks and sculptures	
	Soft furnishing	Curtains Loose carpets Bed linen (Vacant)
Service installations	HVAC	Heating system Air-conditioning system Mechanical ventilation system Smoke extraction system (Vacant)
	Sanitary and plumbing	Sanitary and waste pipe system Plumbing (water supply) system (Vacant)
	Electrical installations	Internal power supply and distribution External power supply and distribution Internal light fittings and accessories External light fittings and accessories Lightning protection system Emergency power supply (Vacant)
	Transportation	Lifts, hoists and cranes Escalators Conveyors (Vacant)
	Communications installations	Intercom system Telephone system Public address system Audio-visual system IT network system (Vacant)
	Security systems	Access control Burglar and security alarms Security cameras and television monitoring (Vacant)
	Fire protection systems	Sprinkler system Smoke extraction/control system Fire/smoke alarms Hose reel system Fire extinguishers (Vacant)
	Gas installations	
	Maintenance equipment	
	Pool and water feature installations	

	Special installations	Compressed air installation Cold room installation Car park equipment Refuse disposal equipment Special power distribution system Sewage treatment system Building management system Document handling system (Vacant)
	Service connections	
	Builder's work in connection with services	
	Builder's profit and attendance on services	
External works	Surface treatments	Boundary walls, fences and gates Landscaping Swimming pools Tennis courts Squash courts Other sports facilities Playgrounds Footpaths Driveways, open car parks and entrances Covered car parks Pergolas, Canopies, etc Covered walkways Retaining walls (Vacant)
	Drainage	Soil drainage Sub-surface water drainage Stormwater drainage (Vacant)
	External services	Water supply mains Fire supply mains Gas supply mains Electrical supply mains Communications cable mains Diversion of existing services (Vacant)
	Miscellaneous items	(Vacant)
Preliminaries		
Contingencies • Price and Detail Development • Building Contract Contingencies		
Escalation • Pre-tender escalation • Contract escalation		
Value Added Tax (VAT)		

* Sub-elements marked with an asterisk in the columns above show sub-elements that may be included with the element in which they occur, or which may be given separately as provided for

9.2.4 Work sections classification and their subdivisions

The proposed work sections classification will serve to organise information in specifications, bills of quantities and for the classification of technical literature on particular construction operations. It is important to note that this proposed classification is not intended to be used for the classification of products and services (see 9.3 hereinafter for discussion on this particular issue). Work sections classification is therefore separate from, and complementary to, the classification of other concepts such as building types, elements, construction products and properties/characteristics (Allot, 1998)

The classification system should be robust enough to embrace the variety of trades employed in the construction process and detailed enough to allow for technical distinctions and commonly understood by all who use it (Packer, 1996 : 3). The proposed classification following hereinafter was established to achieve these goals and has been designed as the envisaged framework within which the rules for measuring building work under the next edition of the SSM would be drafted. The classification system is loosely based on the pattern of trades employed during building operations. The order in which these are presented generally reflects the sequence of events as they are likely to occur on site, and that order closely resembles the trade sequence of the present SSM

The adoption of the proposed classification system should facilitate cross-referencing and coordination between bills of quantities and other documents, such as drawings and specifications, where they have been prepared using the same system of classification. The goal would be that if the system were to be correctly implemented, the contractor would receive a set of site documents that are consistent and mutually interchangeable

The following are some of the additional merits of the proposed re-structuring that were identified:

- It is internationally compatible

- The proposed work sections classification follows a more logical structure for identification of materials and labour than the classification structure in the present standard specification documents, which all use the same traditional trade format structure of the present SSM. It would, therefore, be advantageous if specification and design systems adopted a similar classification structure to the one proposed

- Improved predictability of location of relevant information. Work to be measured or specified can be more readily identified (e.g. demolitions, windows, doors, etc) as such work is at present not separately indicated in the first two grouping levels (see 9.2.5 hereinafter)

- Improved distinction between elements such as structural timber roofs and aluminium work that are presently incorporated in the trades Carpentry & Joinery and Metalwork respectively

- Fewer omissions, duplications and discrepancies between documents

- Borders between the various traditional trades are sometimes vague, especially in the case of surface finishes. Uncertainty often exists as to whether a particular product (such as *cemwash*) should be classified under Masonry work, Plastering or Paintwork. The decision of where to classify such products should become much easier in the proposed re-structuring, as the work section 'Surface finishes' is generic and would accommodate surface finishes of all kinds

The proposed re-structuring of work sections following in 9.2.4.1 below is based on the SSM (RSA), CAWS and SMM7 (UK), and the Singapore Standard Method of Measurement of Building Works (Second edition). Both the general indexes of the proposed re-structuring and the existing work sections (standard trades classification in the SSM) are given to highlight the differences between the proposed and existing classifications.

9.2.4.1 General index

	Proposed restructuring	**Existing (SSM)**
A	General instructions	General instructions
B	Preliminaries	Preliminaries
C	Prefabricated buildings/structures/units	
D	Existing buildings/demolitions/alterations	Alterations
E	Earthworks	Earthworks

F	Lateral support	Lateral support
G	Piling	Piling
H	In situ concrete/Precast concrete	Concrete, formwork & reinforcement Precast concrete
I	Masonry	Masonry
J	Structural steel/timber	Structural steelwork Carpentry & joinery
K	Aluminium work	
L	Roof coverings/cladding, etc	Roof coverings
M	Waterproofing	Waterproofing
N	Ceilings/Partitions/Access flooring	Ceilings, partitions and access flooring
O	Windows/Doors/Solar control	
P	Surface finishes	Floor coverings, wall linings, etc Plastering Tiling Paintwork Paperhanging
Q	Furniture/Equipment/Stairs/ Architectural metalwork	Carpentry & joinery Metalwork
R	Ironmongery	Ironmongery
S	Glazing	Glazing
T	Disposal systems	Plumbing & drainage
U	Piped supply systems	Plumbing & drainage

V	Electrical supply/power/lighting systems	Electrical work
W	Communications/Security/Control systems	Electrical work
X	Mechanical services	Mechanical work
Y	Paving/Planting/Fencing/Site furniture/etc	External work
Z	Roadwork	External work

9.2.4.2 Work sections and their subdivisions

The SSM method of classification has traditionally been followed in the RSA (since the early 1900's), and this method was again chosen on the basis that the version proposed in the general index above would serve as the proposed standards framework, while the SSM would provide the contents. Again, the pervasive use of the SSM for the traditional classification of construction information in the local industry was the key reason for its choice. This circumstance is not unique to the RSA, as Singapore, for instance, has recently adopted similar strategies when drafting their national standard (Goh & Chu, 2002 : 5))

		A	**General instructions**
A1	General instructions	A10	Bills of quantities
		A11	Setting out of bills of quantities
		A12	Order of items
		A13	Order of dimensions
		A14	Net measurements
		A15	Fractional quantities
		A16	Provisional quantities
		A17	Provisional sums
		A18	Contingencies etc
		B	**Preliminaries**
B1	Preliminaries	B10	Preliminaries

		C	**Prefabricated buildings/structures/units**
C1	Prefabricated buildings etc	C10	Prefabricated buildings/structures (new)
		C11	Prefabricated building units (new)
		D	**Demolition/Alterations**
D1	Demolition	D10	Demolition
D2	Site clearance	D11	Site clearance
D3	Alterations	D12	General
		D13	Old materials
		D14	Barricades, screens, etc
		D15	Removals
		D16	Alteration work
		D17	Openings
		D18	Building up openings
		D19	Re-use of existing components
		D20	Work in patches
		D21	Sundries
		E	**Earthworks**
E1	Earthworks: General	E10	Method and procedure
		E11	Bulking
E2	Excavations, filling, etc	E12	Nature of material to be excavated
		E13	Excavations
		E14	Classification of material to be excavated
		E15	Removal of services
		E16	Carting away of excavated material
		E17	Risk of collapse of excavations
		E18	Working space
		E19	Keeping excavations free of water
		E20	Dewatering

		E21	Filling
		E22	Foundation courses
		E23	Compaction of surfaces
		E24	Grassing, pitching, etc
		E25	Gabions and interlocking block retaining structures
		E26	Filter fabric
		E27	Weedkillers, insecticides, etc
		E28	Tests
		F	**Lateral support**
F1	Lateral support: General	F10	Removal of lateral support
		F11	Insurance
		F12	Movement monitoring
F2	Ground anchoring	F13	Descriptions
		F14	Establishment
		F15	Test anchors
		F16	Ground anchors
		F17	Waterproofing of ground anchors
		F18	Testing, re-tensioning and de-stressing of ground anchors
		F19	Rock bolts and rock dowels
		F20	Soldiers, boarding, shotcreting, etc
F3	Planking, strutting and shoring	F21	Planking and strutting
		F22	Shoring units
F4	Lateral support piling	F23	Lateral support piling

		G	**Piling**
G1	Piling: General	G10	Site conditions
		G11	Nature of the work
		G12	Establishment
		G13	Setting up
		G14	Excavations
		G15	Reinforcement
		G16	Exposing piles for inspection
		G17	Cutting off etc
		G18	Testing
G2	Prefabricated piling	G19	Precast concrete piles
		G20	Steel piles
		G21	Sheet piling
G3	Concrete cast in situ piling	G22	Augered piles
		G23	Driven, bored or similar tube piles
		G24	Disposal of excavated material
		H	**In situ concrete/Precast concrete**
H1	Concrete	H10	Classification
		H11	Scope and unit of measurement
		H12	Composite slabs etc
		H13	Shotcrete
		H14	Projections
		H15	Shaped tops and striking off and curing
		H16	Surface treatment
		H17	Grooves, channels, mortices, etc
		H18	Bedding under base plates etc
		H19	Test blocks
H2	Formwork	H20	General
		H21	Scope and unit of measurement
		H22	Propping etc
		H23	Columns

		H24	Slabs
		H25	Edges, risers, etc
		H26	Projections, grooves, etc
		H27	Openings
		H28	Movement joints etc
H3	Reinforcement	H29	General
		H30	Classification
		H31	Bar reinforcement
		H32	Special reinforcement
		H33	Fabric reinforcement
		H34	Pre-tensioned or post-tensioned reinforcement
		H35	Tests
H4	Precast concrete	H36	Classification
		H37	Formwork
		H38	Reinforcement
		H39	Bedding, jointing, etc
		H40	Unit of measurement
		H41	Wall linings
		H42	Copings, sills, etc
		H43	Slab paving
		H44	Joint sealants, jointing strips, etc
		H45	Holes, notches, etc
		H46	Cramps, dowels, brackets, etc
		I	**Masonry**
I1	Masonry: General	I10	Classification
		I11	Descriptions
		I12	Circular work
		I13	Concrete filling
I2	Brickwork	I14	Mass brickwork and piers
		I15	Walls and linings
		I16	Beamfilling

		I17	Vaulting
		I18	Lintels
		I19	Forming toothings and bonding
		I20	Hacking face or raking out joints for key
		I21	Battered and oversailing faces
		I22	Building brickwork to a fair face
		I23	Bagging
		I24	Flues
		I25	Splayed mortar fillets in cavities
		I26	Closing cavities
		I27	Projections and cores
		I29	Rough arches
		I30	Rough niches
		I31	Joint forming material in movement joints
		I32	Reinforcement to brickwork
		I33	Fabricated lintols
		I34	Turning pieces
I3	Face brickwork	I35	Face brickwork
		I36	Walls faced both sides
		I37	Cut face brick linings
		I38	Fair cutting to face brickwork
		I39	Special face bricks at angles
		I40	Face brick bands
		I41	Face brick copings, lintels, sills, etc
		I42	Face brick arches
		I43	Face brick niches
I4	Blockwork	I44	General
		I45	Piers
		I46	Standard complementary blocks at corners, ends, etc
		I47	Special blocks for copings, sills, lintels, etc
I5	Rubble walling	I48	Mass and irregular rubble work
		I49	Walls and linings
		I50	Beamfilling

		I51	Facing and pointing
		I52	Copings, sills, etc
		I53	Pitched angles
		I54	Trimming to receive plaster etc
		I55	Flues
		I56	Niches
		I57	Turning pieces and centers
I6	Stonework	I58	Classification
		I59	Labours
		I60	Ashlar walling, linings and paving
		I61	Margins, skirtings, cornices, etc
		I62	Mouldings
		I63	Columns, piers, etc
		I64	Special features
		I65	Rough rebates, grooves, etc
		I66	Fair edges, angles, etc
		I67	Holes, notches, etc
		I68	Cramps, dowels, etc
		I69	Turning pieces and centers
I7	Masonry: Miscellaneous	I70	Quarry tiles, cement tiles, fibre-cement, etc
		I71	Ornamental blocks, glass blocks, etc
		I72	Hoop iron ties, cramps, etc
		I73	Air bricks etc
		I74	Fireplaces
		I75	Special features
		J	**Structural steel/timber**
J1	Structural steel	J10	Classification
		J11	Unit of measurement
		J12	General
		J13	Tests
J2	Structural timber	J14	General
		J15	Structural timbers

		J16	Plate nailed timber roof truss construction
		J17	Floor and roof boarding
		K	**Aluminium work**
K1	Aluminium work	K10	General (new)
		K11	Windows, doors, etc
		K12	Curtain walls, shopfronts, etc
		K13	Balustrades, etc (new)
		L	**Roof coverings/cladding, etc**
L1	Slates, tiles and shingles	L10	General
		L11	Circular cutting
		L12	Eaves and verges
		L13	Ridges, hips, closed valleys and vertical angles
		L14	Purpose made tiles
L2	Thatch	L15	General
		L16	Ridges and apex caps
		L17	Ornamental bands and runners
L3	Profiled sheeting of metal, fibre-cement, plastic, etc	L18	General
		L19	Circular cutting
		L20	Cranks, bullnoses and curved turn-ups
		L21	Rolled edges at verges
		L22	Accessories
		L23	Special sheets
		L24	Roof ventilators and roof lights
		L25	Insulation
L4	Flat sheet metal	L26	General
		L27	Circular cutting
		L28	End caps, finials, etc
L5	Sheet metal flashings,	L29	General

	linings, copings, etc	L30	Flashings
		L31	Linings, copings, etc
L6	Fascias, barge boards, etc of metal, fibre-cement, etc	L32	General (new)
		M	**Waterproofing**
M1	Damp proof course	M10	General
M2	Sheet or membrane Waterproofing	M11	General
		M12	Preparatory work, underlays, etc
		M13	Protection
		M14	Circular work
		M15	Flashing strips
M3	Trowelled-on waterproofing	M16	General
M4	Liquid waterproofing	M17	General
M5	Waterstops, joint sealants, etc	M18	Waterstops, sealing strips, etc
		M19	Joint sealants
		M20	Waterproofing additives
		N	**Ceilings/Partitions/Access flooring**
N1	Ceilings	N10	General
N2	Partitions	N11	General
N3	Access flooring	N12	General
		O	**Windows/Doors/Solar control**
O1	Windows etc	O10	Windows, sashes, etc
		O11	Frames, rails, etc
O2	Doors etc	O12	Doors, shutters, hatches, etc

		O13	Frames, linings, etc
O3	Solar control (new)	O14	Screens, louvres, etc
		O15	External blinds
		O16	Awnings
		P	**Surface finishes**
P1	Plastering	P10	Classification
		P11	Circular work
		P12	Scope and unit of measurement
		P13	Labours on finishes
		P14	Skirtings
		P15	Finishes to kerbs, sills, etc
		P16	Mouldings
		P17	Ornaments etc
		P18	Dividing strips, metal beads, etc
		P19	Metal lathing
P2	Tiling	P20	Classification
		P21	Circular work
		P22	Beds and backings
		P23	Scope and unit of measurement
		P24	Labours on tiling
		P25	Mitred corners and special edge and corner tiles
		P26	Treads, risers, sills, copings, skirtings, etc
		P27	Channels
		P28	Soap dishes etc
P3	Floor coverings, wall linings, etc	P29	General
		P30	Preparatory work
		P31	Polish, sealers, etc
		P32	Circular work
		P33	Dished flooring
		P34	Circular cutting
		P35	Margins, borders and turn-ups

		P36	Insets
		P37	Edge and cover strips
		P38	Skirtings
		P39	Stairs
		P40	Nosings
		P41	Plastic handrails
P4	Paintwork	P42	Classification
		P43	Colours
		P44	Scope and unit of measurement
		P45	Columns, beams, ribs, hoods and fins
		P46	Trusses and lattice work
		P47	Frames etc
		P48	Windows, sash doors, etc
		P49	Signwriting and gilding
		P50	Polishing
P5	Paperhanging	P51	Classification
		P52	Scope and unit of measurement
		P53	Borders and motifs
		P54	Hessian, canvas, etc
		Q	**Furniture/Equipment/Stairs/Architectural metalwork**
Q1	General purpose fixtures, furnishings/equipment	Q10	General
		Q11	Fixing
		Q12	Frames, rails, skirtings, etc
		Q13	Shelves, fittings, lockers, writing boards, etc
		Q14	Stairs, balustrading, cat ladders, gates, etc
		Q15	Panelling
		Q16	Domestic kitchen fittings
		Q17	Catering equipment
		Q18	Sanitary appliances/fittings
		Q19	Signs/Notices
Q2	Special purpose fixtures,	Q20	Appropriate section titles for each project

	furnishings, equipment	Q21	Ditto
		Q22	Ditto
		R	**Ironmongery**
R1	Ironmongery	R10	Classification
		R11	Fixing
		R12	Unit of measurement
		R13	Door/Window ironmongery
		R14	Sundry ironmongery
		S	**Glazing**
S1	Glazing	S10	Classification
		S11	Glass in shapes other than rectangular
		S12	Glazing
		S14	Labours on glass
		S15	Glass louvre blades
		S16	Glass in tops, shelves, doors, mirrors, etc
		S17	Bent glass
		S18	Leaded and coppered lights
		S19	Patent glazing
		S20	Materials resembling glass
		T	**Disposal systems**
T1	Drainage	T10	General
		T11	Roof gutters, rainwater pipes, etc
		T12	Stormwater channels
		T13	Foul drainage above ground
		T14	Drainage below ground
		T15	Gulleys, grease traps, inspection chambers, catch pits, etc
		T16	Connections
		T17	Testing
T2	Sewerage	T18	Sewage pumping

		T19	Sewage treatment/sterilisation
T3	Refuse disposal	T20	Refuse chutes
		T21	Compactors/Macerators
		T22	Incineration plant
		U	**Piped supply systems**
U1	Water supply	U10	General
		U11	Water supply below ground
		U12	Cold water/Hot water above ground
		U13	Pressurised water
		U14	Irrigation
		U15	Fountains/Water features
U2	Fire fighting	U16	Water supply above ground
		U17	Water supply below ground
		U18	Fire hose reels, fire hydrants, etc
		U19	Fire fighting equipment
		U20	Sprinklers
U3	Gas supply	U21	General
		U22	Compressed air
		U23	Natural gas
		U24	Medical/Laboratory gas
U4	Other supply systems	U25	Vacuum
		U26	Steam
		V	**Electrical work**
V1	Main supply/HV distribution	V10	Electricity generation plant
		V11	HV supply/distribution
		V12	LV supply
		V13	Connections
V2	General LV distribution/	V14	Classification

	lighting/power	V15	Distribution boards etc
		V16	Cables/Cable trenches
		V17	LV distribution
		V18	General lighting
		V19	General LV power
		V20	Fittings, equipment, etc
V3	Special supply/distribution	V20	DC supply
		V21	Uninterruptible power supply
V4	Earthing/Lightning protection	V22	Earthing
		V23	Lightning protection
V5	General	V24	Testing and commissioning
		V25	Drawings, manuals, etc
		W	**Communications/Security/Control systems**
W1	Communications	W10	Telecommunications
		W11	Paging/Emergency call
		W12	Public address/Conference audio facilities
		W13	Audio-visual communications
W2	Security	W14	Access control
		W15	Security detection and alarm
		W16	Fire detection and alarm
		W17	Electromagnetic screening
W3	Central control	W18	Central control/Building management
		X	**Mechanical services**
X1	Heating/Ventilation/ Air conditioning	X10	Classification
		X11	Equipment
X2	Pipework etc	X12	General
		X13	Scope and unit of measurement

		X14	Valves etc
		X15	Pipe trenches
		X16	Pipe insulation and protection
X3	Ductwork etc	X17	Scope and unit of measurement
		X18	Diffusers, grilles, etc
		X19	Ducting insulation and protection
X4	Conveying installations	X20	Lift installations
		X21	Hoist, escalator and conveyor installations
		X22	Material handling installations
X5	General	X23	Testing and commissioning
		X24	Drawings, manuals, etc
		Y	**Paving/Planting/Fencing/Site furniture/etc**
Y1	Pavings	Y10	Pavings
		Y11	Kerbs/Edgings/Channels/Paving accessories
Y2	Planting etc	Y12	Seeding/Turfing
		Y13	External/Internal planting
		Y14	Ponds, water features, etc
		Y15	Landscape maintenance
Y3	Fencing	Y16	Fencing
Y4	Site furniture	Y18	Site/Street furniture/equipment
		Z	**Roadwork**
Z1	Roadwork	Z10	Classification
		Z11	Excavations, filling, base courses, etc
		Z12	Road surfacing, humps, shoulders, etc
		Z13	Channels, kerbing, edging, etc

		Z14	Drainage
		Z15	Road marking
Z2	Road signs etc	Z16	Road signs etc
Z3	Barriers/Guardrails	Z17	Barriers
		Z18	Guardrails

9.2.5 Levels of groupings

An arrangement of levels similar to that of the CAWS system is proposed. The CAWS arrangement is in three levels, the third and lowest of these being the 'work sections'. Levels 1 and 2 are not work sections as such, but rather as headings under which the actual work sections are grouped. To reinforce the distinction between the work sections and the higher-level groupings, the three levels have been given the following titles:

Level 1	Group	e.g.	E	Earthworks
Level 2	Sub-group	e.g.	E1	Earthworks: General
Level 3	Work section	e.g.	E10	Method and procedure

An overriding consideration adopted by the CAWS arrangement, and also followed in the foregoing proposal, was the need for simplicity, and particularly that the section numbers should be short and easy to remember

9.2.6 Application

The main objectives of the first stage survey and the inferences drawn were summarised in 7.5 hereinbefore, which summary is reiterated below because of its relatedness to the application of the proposed national standard for the classification of construction information

> *… the investigation into what influence recent developments in procurement procedures, especially the introduction of the tabulated format of the standard method of measuring (SMM7) and the classification system (CAWS), have had on the quantity surveying profession in the UK, and how these developments benefit the local construction industry. It appears from the data gathered that the quantity surveying profession in the UK regards these developments as a natural evolutionary progression in the*

procurement process and that they generally are in favour of, and have also widely adopted, these latest developments

Should the proposed re-structuring of work sections be accepted, the Standard System Joint Committee would then also have to seriously consider presenting the contents of the SSM in a tabular, as opposed to the current prose, format. It is suggested that the tabular format should be similar to that of the SMM7 that was, by all accounts, successfully introduced in the UK (and also in other parts of the world)

The Model Preambles (specification) should follow the identical overall work sections classification, as set out above, for integration and reference purposes. The purposes and content of a specification document are, however, completely different to that of a standard method of measurement, and far greater input would be needed to introduce a comprehensive specification system, as the current Model Preambles, unlike the SSM, would not be suitable for adoption (see results of the second stage survey in the previous chapter, and particularly the discussion following Table 11). In this regard it is recommended in Chapter 10 that a committee that should be sufficiently representative of all the relevant sectors be appointed to develop such a comprehensive specification system for the South African construction industry. It is further suggested that such a committee should take cognisance of developments regarding specification issues in other parts of the world, and in this regard close cooperation with ICIS (see Chapter 5) is recommended

Specification systems of selected other countries were reviewed in Chapter 5, specifically with regard to their structures and bibliographic systems employed (Appendices 4 to 8 provide additional details of the systems that were reviewed)

9.3 CLASSIFICATION OF CONSTRUCTION RESOURCES INFORMATION

9.3.1 Introduction

In previous chapters, and more specifically in Chapters 3 and 4, references have been made to the need to develop a standardised format for the classification of construction resources information, in order to facilitate procurement activities in the construction industry. Intensive research in this area is an ongoing process, and vast amounts of money have already been invested by governments or private commercial enterprises in developed first world countries such as Denmark, Sweden, Finland, the UK, the USA, the Netherlands, Singapore, etc to find practical solutions. Some of these countries have recently introduced classification systems into their respective markets, but the application of these systems is, in each case, in the initial stages. The *Standard Code of Practice for Classification of Construction Resources Information* (Singapore) and *Building Catalogue* (Australia) are two examples of such systems recently introduced

These innovations all have one thing in common, i.e. they are based on a bibliographic classification system (e.g. the UDC for Uniclass and the DDC for OCCS). An example will be provided to illustrate this point. The system chosen for this purpose is the Singaporean system that is based on MasterFormat (see 4.3.5 hereinbefore), that in turn is based on the DDC (see 3.3.5 hereinbefore)

According to Goh (2002: 1) the development of the Singaporean standard involved the following three main stages:

- A review of international standards;
- A selection of international standards for detailed evaluation; and
- A localisation of terminology

The committee that was responsible for the development of the Singaporean standard reviewed the following international standards:

- Uniclass
- CI/SfB
- United Nations – Central Product Classification
- United Nations – UN/SPSC
- CSI/CSC MasterFormat

In their view the MasterFormat surfaced as the most suitable standard because of its generic terminology that would be familiar to most construction practitioners, and even to suppliers. A 6-

digit numbering system instead of the 5-digit system in the CSI publication was, however, adopted for the hierarchical organisation of titles-by-level within the 16 divisions of the standard. This numbering system is illustrated in Figure 14 below

6 DIGIT NUMBERING SYSTEM					
DIVISION		**LEVEL Two**	**LEVEL Three**	**LEVEL Four**	
0	**1**	**5**	**1**	**0**	**1**

Temporary Electricity (015101)

Temporary Utilities (015100)

Temporary Facilities And Controls (015000)

GENERAL REQUIREMENTS (010000)

Figure 14: The 6-digit numbering system of the proposed Singaporean Classification of Construction Resources Information (Source: Dr. B H Goh, National University of Singapore)

The technical differences between the different national systems, and the influence of new IT systems on construction resources information, will require further study, and falls outside the scope of this study. It is suggested that the next phase of the research must be devised by groups of experts, who would advise the local construction industry on what system to adopt. The chosen system should then be tested on representative groups from all parts of the industry. This method should, if properly managed, provide the best possible view of future developments, and will not be dominated by the enthusiasm of experts, since the real test of whether, or when, these developments are likely to be widely used will be in the hands of the people who will have to be persuaded to use them. The proposed classification system should be capable of lasting for many years (the SfB system has been in existence for more than fifty years), but it should also be flexible and suitable for firms of all types, some of which may never adopt leading technology

9.4 SUMMARY

Some of the biggest challenges facing the construction industry in the world today, and in the RSA in particular, have been identified in this study. These are ineffective procurement of construction information and the integration of disparate software systems. Technology tools such as design, estimating and procurement systems all offer value to architects, quantity surveyors, engineers and contractors, but, if they are not integrated, significant problems will remain, including the inability to access and share real-time project information. Many professional and contracting firms have burnt their fingers by buying inappropriate products or services for short-term solutions, but which cost them dearly in the long-term to adapt or replace. The ever-increasing rate of improvement in global communications continues to change the way that people communicate and source information

Professionals, such as architects and engineers, have moved from drawing boards to desktop computers and, more recently, to notebook computers to do their design work. In the past, these professionals used libraries to source information on products, but for many today their notebook computers have become their libraries. These professionals, as in the past, must be provided with the information on products and other related construction information that is suitably classified and immediately available at the press of a button. Some of the others may, for many years to come, not be part of this leading-edge technology, and must, likewise, have easy access to construction information. Classification systems should therefore be flexible and developed in a way that would accommodate the needs of different applications

In this chapter a proposal is made for a national standard for the classification of construction information that suggests a new structure for classifying building elements and their associated sub-elements. This is followed by a proposal for the restructuring of work sections and their associated subdivisions. These classification standards should assist the quantity surveying profession, in particular, in the preparation of cost estimates, cost reports/plans, bills of quantities, valuations and financial statements, in a manner consistent with local and international requirements. However, the proposed classification standards should also be of benefit to the design professions, by providing easy access to specification matters, and, in addition, by eliminating the task of having to structure construction information according to the specific needs or practices of clients or contractors, as a ‘common language’ would have been established that is not conceptually new, but certainly more comprehensively structured than what is currently on offer in the RSA

Should the proposed restructuring be adopted, it would inevitably have an impact on the format of model/standard documentation currently in use in the RSA, and documents such as the SSM and Model Preambles would have to undergo major re-drafting

Attention has also been drawn, once again, to the need that exists for developing a standardised format for classifying construction resources to facilitate procurement activities in the construction industry. The fact was emphasised that the development of classification standards in the RSA should be based on a comprehensive master specification, and should have, as the initial objective, the replacement of the current under-utilised libraries of catalogues with complete product on-line information that should be accessible to designers, estimators, measurers, contractors, subcontractors, etc. It has also previously been illustrated that such development has to progressively incorporate, where practicable, the latest international research on information modelling standards such as bcXML, the IAI Industry Foundation Classes, STEP and other ISO standards

CHAPTER 10

SUMMARY AND RECOMMENDATIONS

10.1 INTRODUCTION

The study was primarily conducted to investigate the question of South Africa's ability to effectively organise construction information. For the best part of 50 years, systems for the classification of construction information have been used with the aim of the rational organisation, storage and retrieval of a wide variety of material – about product information, specifications, cost information, drawings, and library contents, for example. Various classification systems, most notably the CI/SfB, have been used across the world, and recently the emphasis has been on efforts to arrive at internationally agreed tables for classification of construction information

Judging from the literature reviewed and data generated in the survey processes, it is clear that the building and civil industries in the RSA lack effectiveness in certain areas of the procurement process. This study has identified that the ineffective exchange of information is one such area, and focuses on strategies to be implemented so that construction data can be effectively sourced and utilised, which would ultimately lead to improved procurement management. The background to this statement is more fully discussed in Chapter 1

The main reason why the organisation of construction information is not handled effectively has been identified as the absence of national classification standards. The absence of such standards has previously been formulated as the main problem of this research report, which is reiterated hereunder in question format:

> *Does the absence of national classification standards for use in procurement documents in the construction industry such as specifications, bills of quantities, etc with a level of sophistication which could accommodate contemporary and future trends such as the adoption of new construction techniques, the increase in specialisation in specific work areas, computerisation, etc as well as the dynamic nature of the industry contribute to the lack of effectiveness in the procurement process?*

This study also gave rise to information exchange related topics that appear to merit further investigation. Sub-problems covering such topics were formulated consequent upon the foregoing main problem (see Chapter 1)

A comprehensive literature review was done (Part 2) to gather more information on the problem areas identified, as well as on related matters. This was supplemented by personal observations and comments. On completion of the collection of secondary data, the process of refining the research objectives commenced, as it was then possible to define the identified problem areas in more detail. In addition, hypothetical statements, conclusions and recommendations that came to the fore during the process of collecting the secondary information were summarised and tested in the primary data collection process. The primary data were collected through a two-staged descriptive survey process that was followed by detailed analyses of the results collected

On completion of the aforementioned processes it has now become possible to formulate the hypotheses (deductive inferences) that follow on the sub-problem statements, in order to draw conclusions from the stated premises. These hypotheses are given in the same chronological order as the sub-problem statements (objectives) in Chapters 1, 6 and 8

10.2 HYPOTHESES

- The currently available specification systems are neither effective nor up-to-date but some people do not necessarily want change, as they have a natural resistance to the adoption of new methods

- Consultants responsible for the design should also be responsible for the drafting of the specifications, and such persons should possess specific expertise and appropriate experience
- A single national building specification would assist the drafters of procurement documentation in the production of better quality documentation and speed-up the documentation process. All building professions should be involved in the drafting process, with the architectural profession in the leading role. The financing of such a specification system should be the joint responsibility of the state and of the private sector, as both would benefit from the use thereof

- The format of standard/model documentation currently in use in the RSA, such as the SSM, the Model Preambles and the SABS 1200 Standard Specifications, is somewhat outdated and in need of revision. The format of these currently-used prescriptive documents will necessarily be affected by the introduction of a new classification approach, and should follow closely, if not exactly, the same classification structure as that of the proposed new national standard for classification

- Although the Internet is fast becoming an important instrument for information sourcing, electronic systems currently available for construction resources information need further development before they can be applied effectively

- Product information sourcing in the construction industry is not handled effectively in the RSA because the available product information systems do not provide an effective service to the industry. The advancement made in information technology has exposed deficiencies and gaps in currently-used information systems, which make it essential for the local building industry to review its applications, and to derive mutual benefit for all concerned from cooperative efforts with several overseas countries that have adopted new concepts in information analysis

- The RSA should adopt national standards for classification for structuring construction information and product literature, and such standards should conform to international standards. It is, however, doubtful whether the RSA could develop and maintain the required classification standards and accompanying specification systems

10.3 CONSEQUENCES OF AND OPPORTUNITIES FOR INTRODUCING NATIONAL STANDARDS FOR CLASSIFICATION

10.3.1 General

A competency-based review of professional quantity surveying was recently conducted and reported on by Nkado and Meyer (2001). Using a two-stage descriptive survey (a similar methodology to the one employed in this study) they generated the data from a respondent sample of 114 professional quantity surveyors that were ultimately required to rank 23 competencies listed alphabetically in the second-stage survey. The result of the competency ratings is provided in Table 30 hereinafter. The table indicates that the two most important competencies required of quantity surveyors for current and future successful delivery of services are, firstly, expertise in computer literacy and information technology, and secondly, procurement and financial management

This research report has also placed great emphasis on the importance of these two competencies as contributory factors to a more effective procurement process. The introduction of national standards for classification will have consequences and provide opportunities to improve the current proficiency levels among practitioners in the construction industry in these important competencies, and which ultimately should add value to the financial and contractual management of construction projects at the pre-contract, construction and post-contract stages, if implemented successfully

NUMBER	COMPETENCY HEADING	IMPORTANCE	
		Current (%)	Future (%)
1.	Computer literacy and information technology	90,0	96,2
2.	Procurement and financial management	89,8	93,8
3.	Economics of construction	88.9	93.3
4.	Construction contract practice	88.1	88.4
5.	Measurement	85.6	81.6
6.	Professional practice	85.4	87.0
7.	Marketing	81.8	90.4
8.	Personal and interpersonal skills	81.5	90.1
9.	Development appraisal	79.6	87.0
10.	Advanced financial management	77.9	89.7
11.	Leadership and general management skills	77.9	85.3
12.	Project management	77.3	90.8
13.	Skills to work with emerging contractors	77.2	84.5
14.	Skills in managing a business unit	77.1	86.9
15.	Construction technology and environmental services	74.2	80.5
16.	Arbitration and other dispute resolution pr5ocedures	74.0	80.8
17.	Law	73.5	81.4
18.	Property investment funding	72.8	88.9
19.	Management of joint quantity surveying appointments	71.0	78.8
20.	Mapping	68.1	75.8
21.	Macro-economic perspectives	67.7	79.8
22.	Facilities management	62.3	79.7
23.	Research methodologies and techniques	57.5	74.0

Table 30: Competency ratings of professional quantity surveyors in the RSA (Source: Nkado and Meyer, 2001)

In introducing new standards into the Singaporean construction industry recently, some key pointers were identified by Goh & Chu (2002 : 10) for intended standard developers to follow. These are:

- *make a conscious effort to involve industry players in the development of the standards in order to help bring down barriers to change;*

- *keep the standards as simple and concise as possible;*

- *adopt a two-stage approach so as to achieve a win-win result;*

- *identify leaders in the industry (in both private and public sectors) who can drive the developed standard/technology in order to convince other players to follow suit; and*

- *develop assistance schemes to help small and medium firms embrace standardisation and IT*

The pointers quoted above are very relevant to the local circumstances, as the decline in demand for construction goods and services (as experienced in the construction industry during recent times), has resulted in increased competitive pressure for work and a decline in fees earned by professionals. This competitive pressure has caused professional practices to curtail professional development activities such as knowledge transfer and mentoring of young professionals. A few of the larger professional practices have responded by moving into the international market, thereby creating some opportunities to benefit from international trends. The small local practices are, however, often subject to volatilities due to the geographic distribution of construction and the peak workloads that characterise construction projects. This further reduces their ability to build capacity to, *inter alia,* embrace standardisation and IT

The results of this study have indicated conclusively that a need exists for the introduction of national standards for classification of construction cost information and construction resources information for the mutual benefit of all stakeholders. The following proposals are suggested for local producers of model/standard documentation to follow when introducing future editions of such standards:

10.3.2 Proposals for the formatting of specifications etc

The model/standard documents currently in use in the RSA that relate to specification matters are:

- The Model Preambles for Trades (1999)
- Specification of Materials and Methods to be used - PW 371 (1993)
- Various other standard specifications used by public authorities and private architect firms
- SABS 1200 Standard Specifications (various publication dates)
- Contract Price Adjustment Provisions - CPAP (1998)

The comparison between national specification systems in the overseas countries selected (see Chapter 5) has led to the conclusion that the systems are generally very similar in their basic contents and structures. They all cover more or less the same basic construction works, with descriptions arranged by work sections. Their main users are consultants, and their structure reflects the chronology of a construction project. The use of the specification systems varies in the individual countries mainly due to the different working methods employed. The specification systems also provide interfacing facilities that vary from other construction information systems, the extent of variation depending mainly on the form of computerisation of the specific system. Systems that are more advanced in this respect (such as the system in the Netherlands), provide wide interfacing facilities to other construction information systems

The potential for continued work by the local construction industry in this area is of such a scale that one or more working groups would have to spend a vast amount of time on it Therefore, decisions by the industry role players will be needed on the most important priorities, such as the status of the proposed working groups; the extent and status of the information to be provided; the possible use of the information; and the financing of the work. In this regard the following salient aspects will have to be considered:

- Due to the rapid progress of computer technology and its widening range of application areas, the demands of the various construction parties for interfacing possibilities between different programmes will increase. The following three technologies will be of particular significance for the exchange of information:

- Integrated knowledge-bases and data-bases for CAD, enabling all construction parties to work simultaneously on a proposed building model
- Computer-based communication networks
- Electronic data interchange

- The increasing development of international standards, and their integration into national systems, will automatically lead to a assimilation of the technical contents of the various systems into local applications

- International projects are increasingly being carried out by individual professional firms or contractors or as joint ventures with overseas partners, and local systems have to be readily adaptable for international use. Harmonisation of the different systems will be necessitated, due to growing international competition and globalisation, and to the growing use of construction IT. As more and more specifiers and other users discover the advantages of data-based information systems, compared to computerised typewriters or the “cut and paste” method, they would prefer to use these systems in order to rationalise and increase the efficiency of their work

- A comprehensive national specification system would provide standardised specifications in all construction areas. Especially on small or medium-sized projects contractors often earn additional money from variations requested by the employer during the construction period due to specifications only covering the basic necessities and therefore being incomplete. With a comprehensive national specification system covering all construction works in a standardised way, this problem can to a large extent be obviated

- There should be only one comprehensive and up-to-date national building specification system in the RSA. The system should be linked to:

    - National (SABS/STANSA) standards, codes of practice and other technical approval documents
    - Cost information systems

- o Product information systems (proprietary product specification by manufacturers)
- o Design systems
- o Measurement systems

- It is further suggested that the proposed national standard for classification (see Chapter 9) be followed for the classification of work sections and their subdivisions

10.3.3 Proposals for the formatting of standard methods of measurement

The model/standard documents currently in use in the RSA for prescribing measurement rules for estimating and bills of quantities are:

- The Guide to Elemental Cost Estimating & Analysis for Building Works (1998)
- The SSM (1999: 6th Edition - Revised)
- The Standard System for Measuring Building Work for Small or Simple Buildings (1999)
- Guide to Measuring Builder's Quantities (1998)

In the foreword of the Guide to Elemental Cost Estimating & Analysis for Building Works (1998) the chairman remarked as follows: *The elemental list contained in the 1982 second edition has been revised, categories of elements amended and the format changed. This Guide is more comprehensive than the previous one and has been expanded to include taking-off and pricing notes and a column for analysis purposes.* To this he added the following: *Hopefully this document will be supplemented in future by further guides to the various other methods and stages of estimating, ultimately providing a comprehensive estimating manual*

It is evident from the foregoing citations that the Guide will continue to be expanded on and further developed. It has been advocated in this study that this should happen in a manner consistent with developments elsewhere in the world. It is therefore suggested that the proposed national standard for classification (see Chapter 9) be considered in future revisions for the classification of elements and their sub-elements, as cognisance is taken of the format of systems developed elsewhere during the drafting of the proposed standard

The fourth edition of the SSM was published in June 1971 and differed appreciably from previous editions. The application clause under the section *General Instructions* of this fourth edition describes the main difference as follows: *This Standard System of Measuring Builders' Work, while aiming at uniformity in bills of quantities, is designed to lay down principles rather than to tabulate lists of items, with the object of making it comprehensive and adaptable.* This prose format was continued in all future editions and is still the current format of the latest edition published in 1999 (6th Edition - Revised)

When considering what the format of the SSM should be, one of the essential points to take into account is the amount of detail that has to be provided in bills of quantities. In the Preface of the latest edition of the SSM the then Chairman (Professor H M Siglé) of the Standard System Joint Committee stated: *A comparison between the 1906 and the fifth editions reveals an enormous development and much more fragmentation – from a system prescribing only how to measure the principal materials and labour to a system prescribing the measurement of almost all material and labour in the finest detail*

'Measurement in detail' can be explained by the amount of detail that the taker-off, in order to achieve realistic estimating, has to take cognisance of. This may include any or all of the following:

- Total quantity of work
- Number of components within the total quantity
- The size of each individual member
- The precise shape of each individual member
- The relationship of members to each other and their arrangement within the component
- Accurate specification of the material required
- Extent of waste
- Relationship of particular subcontract work to the contract as a whole
- Production and delivery schedules

To endeavour to include all of the above will result in bills of quantities of unmanageable proportions, and the Standard System Joint Committee responsible for drafting the sixth edition had, according to the then Chairman (M J Maritz) *… the dual task of attempting to simplify the standard system on the one hand and to satisfy the demands of the building industry on the other hand*

The quantity surveying profession in the UK was confronted with exactly the same problem of builders wanting more detail and quantity surveyors wanting to provide less. It reached a point where there was widespread criticism, as bills of quantities became too expensive to produce as a result of the amount of detail that had to be provided. The SMM6 was published in 1979 as an interim measure to stop this ever-increasing proliferation of items – typical bills of quantities consisted of approximately 2500 items (measured in accordance with SMM5) - and should another 100 items be added it would not necessarily give a more accurate result

Shortly after the publication of the SMM6, a new committee began with work on the SMM7, which was supposed to be a final, long-term document. The committee looked at all the evidence that existed up to that point in time and, in addition, held workshops across the UK on what the SMM should look like. The committee also drew upon what the engineers had done with their latest revision of CESMM3 that for the first time used a tabular format. The SMM7 when published in 1988 was in a completely different format to its predecessors, using as a base a common arrangement order (CAWS), rather than the traditional trade or work sections. The SMM7 was revised in 1998 after the publication of the Uniclass classification. (see Chapter 4 for a detailed description of the Uniclass classification). The other major change from previous editions is that the measurement rules have been translated from prose into classification tables

It is suggested that consideration be given to the adoption of a similar strategy to the one followed by the UK as described above. The comments gathered from the interviews conducted in the UK (see Chapter 7) were generally very much in favour of the new format of the SMM7. It is further suggested that the proposed national standard for classification (see Chapter 9) be considered for the classification of work sections and their subdivisions

10.3.4 Classification of construction products and services

The ultimate objective is to provide a source of comprehensive information about all construction products and services, covering the complete life cycle of a development. To achieve this would require a comprehensive system for the classification and storage of data

It was previously reported in this study that various initiatives in this field are being undertaken to promote interaction in the AEC/FM industries by, for instance, international organisations such as IAI, and national organisations such as CSI in the USA, with their recently introduced OCCS System. The main sources of guidance, which could help to coordinate national systems, are ISO 12006 – 2 and the ISO PASS 12006 – 3. There is also the work of EPIC on product classification and relevant developments in IT that include the Industry Foundation Classes (IFCs), ISO 10303 STEP, and various developments in the Internet mark-up language, XML

It was further pointed out in this study (see Chapter 3) that although the Internet (plus Intranet and Extranet) potentially forms the ideal open, low-cost communication platform for the building and construction industry, in practice the Internet is currently only used in a limited way. The most important reason for this has been identified as 'insufficient structuring of information', and because the current Internet language HTML only supports freeform data exchange. International research organisations such as eConstruct are currently developing the Internet XML-based building/construction extensible Mark-up Language (bcXML) that will hopefully address the main problem mentioned above by providing the right information infrastructure for this industry. The semantics included in bcXML will support electronic business communication about construction products, resources, work methods, regulations, and much more

Though developed as part of bcXML, the semantics will be developed in a separate part that acts as a 'neutral' classification system, providing classification-neutral object identifications. This component will help to solve one of the biggest obstacles the industry is facing, i.e. the fact that the information systems of different countries are all unique. These differences stem from language differences and from differences in the national classification systems that define the building and construction semantics. If the research in developing a tool that supports both language and classification conversion is successful, and this tool can be applied effectively, cooperation and electronic business communications between individual participants in local and international projects will be greatly stimulated

10.4 RECOMMENDATIONS

This research report clearly indicated that there is a strong need for utilising information systems more effectively. The following recommendations are provided that might assist decision-makers in future planning:

- A specialised committee(s), similar to such committees as the *Construction Project Information Committee (CPIC)* in the UK, or the *Construction Industry IT Standards Technical Committee (CITC)* in Singapore, should be initiated to spearhead development in construction IT. Such a committee should represent all stakeholders at all levels in the South African building and construction industries. In this regard it is suggested that Boutek of the CSIR should take the leading role, as much research work has already been carried out by their experts in certain areas of construction IT (notably in Web-enabled knowledge based approaches to life cycle development, CAD design technologies, e-Commerce product information sourcing, e-Tendering, etc)

- Work groups should be set up to develop national standards for construction classifications, including the drafting of a comprehensive national specification system for the building and construction industries. These work groups should involve all stakeholders, and in this regard it is the author's opinion that STANSA, in conjunction with the CIDB, is the organisation best suited to control the development, publication and maintenance of the classification standards and specification systems

  The development of such standards and specifications should take into account international trends and the latest developments. Therefore, it is recommended that the proposed work groups should seek active participation and cooperation with international organisations such as ICIS and IAI

- It is recommended that an annual subscription fee be charged for the use of the national specification system to provide for the continuing development and maintenance thereof. The continuing updating of the system is of great importance and an essential aspect for effective utilisation. It was previously mentioned in this study that specification writers, researchers and editors of the MasterSpec specification system in the USA spend in excess of 18 000 hours a year updating it. In addition, the system undergoes regular and extensive peer reviews to ensure continuous adherence to required standards

- It is recommended that the Standard System Joint Committee of the ASAQS and BIFSA should immediately embark on the development of the seventh edition of the SSM. For this new edition the committee should consider adopting the classification for work sections and subdivisions proposed in this study, and should consider changing the format from prose to tabular to accommodate for international trends and the advancement in computerisation

- It is recommended that the Construction Economics Committee of the ASAQS should consider the adoption of the more comprehensive classification for elements and sub-elements proposed in this study for the structuring of elemental cost estimating

- Continuous development is taking place in the organisation of building product literature of which the recently introduced Uniclass (UK) and OCCS (USA) systems (see Chapter 4) are two of the most notable. In the general field of bibliographic control the rest of the world, including the RSA, has followed the developments in a few leading countries of which the USA is probably the most important. Of the main bibliographic systems (see Chapter 3) three, namely DDC, LCC and Bliss, were developed in the USA. It is, therefore, recommended that the OCCS classification system recently published in the USA (see Chapter 4) be considered for possible adoption by the RSA, as this system has drawn on the best of existing formats that are available that could serve as legacy systems and starting points (e.g. Uniclass)

10.5 CONCLUDING REMARKS

The DPW commissioned Boutek of the CSIR to draw up a *Construction Industry Status Report.* This Status Report was published in March 2002. The objective of this Status Report was to report on the status, capacity and performance of the construction industry against development criteria. The Status Report focused on a number of issues, two of which were:

- **Standardisation of contract information;** to determine the percentage of contracts awarded on criteria other than price, and to determine how many contracts meet the principles of modern forms of contract

- **Customer satisfaction;** with construction products, delivery time, and quality of service and product

The summary of the findings for **Standardisation of contract information** revealed the following:

> *The survey clearly revealed little uniformity in procurement practices, and the CIDB will not only have to develop best practices to promote uniformity, but will also need to ensure that ongoing training programmes for both clients and professionals are available*

> *to keep people abreast of the latest best practices, and in general ensure the value of uniformity in procurement processes*

On the issue that dealt with **Customer satisfaction** it was reported, *inter alia*, that:

> *Traditional methods of preparing design specifications seem to pose a large problem in both the architectural and engineering domains, and neither clients nor contractors are satisfied with design specifications. Professionals are of the opinion that the quality of specifications is still good, but that it is becoming increasingly difficult to produce quality specifications within the time and budget constraints. This confirms the general opinion that work processes are not up to international standards amongst a large contingent of professionals* (My emphasis)

> The above shortcomings were further emphasised by the following concluding remark:

> *Clients and contractors perceive that consultants have lost a significant amount of expertise and capacity in developing specifications and documentation in the building sector. This leads to inaccurate specifications that result in a high level of design variations which, in turn, lead to an adversarial and time-consuming approach in dealing with variation orders*

The above citations that emanated from the aforementioned Status Report sum up the problems currently being experienced in the procurement processes in the RSA. The citations also confirm, and are supported by the findings of this study, that there are areas where the building and civil engineering industries lack effectiveness. This study has attempted to highlight these problem areas in the foregoing chapters, and it can be argued that if the recommendations in this study should be implemented, significant progress can be made to achieve 'best practices' in the relevant industries that will eventually lead to improved delivery in the procurement processes

10.6 POSSIBLE AREAS FOR FUTURE RESEARCH

Finally, suggestions are made for possible areas for future research that may expand on some of the guidelines and recommendations towards the proposed implementation of national standards for classification of construction information. These are:

- Investigation into the effectiveness of building products and services information distribution, as perceived by the contracting fraternity (contractors, subcontractors, manufacturers, suppliers, etc)

- SMM format. It was proposed in this study that a tabular format, similar to the SMM7 be followed for the next edition (seventh) of the SSM. This format might not completely satisfy the local quantity surveying profession and might, therefore, need further investigation

- Development of a national standard for classification of construction resources (products and services). It was stated on several occasions in this study that international research on this matter is an ongoing process, but the full implementation of the ultimate results of such research might not be practicable for local circumstances and might, therefore, need further investigation

- Development of a mapping dictionary for CAD layers and elements based on the elemental classification proposed in this study

- Development of a mapping dictionary for elements and work sections based on the elemental and work sections classifications proposed in this study