

# An Investigation into Existing Tools That Could Inform Quality Assurance In Low Income Housing – November 2010

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#### **EXECUTIVE SUMMARY**

Ongoing quality concerns in low income housing have allegedly not been addressed adequately, as has been expressed in numerous speeches and at the Provincial Housing Summit of 2005.

This study is an investigation into mechanisms that could inform quality assurance in low income housing projects in KwaZulu-Natal. It is informed by total quality management literature.

It is motivated by aspects including: (1) government's accountability for public funds; (2) serving as base research for improved resource allocation; (3) and for quality improvement and sustainability strategies; (4) creating an opportunity for introspection by other members in the supply chain; and (5) a responsibility of all stakeholders to realise the ultimate goal of customer satisfaction.

The following question was investigated:

What systems, norms and standards are in place to ensure sustained quality assurance in the context of housing delivery in KwaZulu-Natal?

The objectives were to:

- (1) explore quality management literature;
- (2) and identify existing quality assurance mechanisms from various sources of literature that may be applicable to low income housing.

The document presents a summary of literature on quality management theory. Various theoretical frameworks acknowledge that quality of outputs is directly related to quality assurance throughout the value chain. The term quality is defined differently by various authors but the most common trends identify aspects of customer satisfaction and fitness for use and conformance to standard or specification.

*Total Quality* has been defined by Juran (1988:2.5) as a function comprising "an entire collection of activities through which we achieve fitness for use, no matter where these activities are performed". It covers every process, job and person. It is an approach that involves the entire organisation and its value chain. Its integration in such a manner enables more effective utilisation of resources, thus enabling the most economic level at which full customer satisfaction can be delivered.

It is driven by the principle of continuous improvement, in every activity, including decision making and behaviour by employees. This requires the optimization of systems with all stakeholders, including suppliers, subcontractors, employees, markets, communities, regulators and investors - , thus the entire supply chain.

Quality issues in construction have existed for centuries. Quality management evolved from a basic inspection process ensuring the well being of others, progressing to ensuring corrective action, through to more integrative preventative modern approaches involving the entire system from customers to suppliers.

In 2000BC the Code of Hammurabi referred to quality in the contexts of poor house construction that causes death of occupants as punishable by death. (Gitlow, et al, 1999:15). Phoenician civilizations ensured compliance to government enforced quality standards and specifications by amputating the hand of the maker of defective products (Gitlow, et al, 1999:15).

In modern terms, various international examples are sited. In the South African context, the following has been found :

- (a) SANS 10400 building regulations
- (b) CIDB Code of conduct for all parties engaged in construction procurement
- (c) CIDB Standard for Uniformity in Construction and Procurement
- (d) CIDB Practice Note
- (e) CSIR Guidelines for Human Settlement Planning and Design
- (f) CSIR Products : Building, Construction and Engineering
- (g) NHBRC Manual
- (h) Department of Housing National Housing Code: Norms and standards; various procurement documents and specifications (engineering design, town planning

layout, environmental management, geotechnical specifications, etc, inspection checklists, etc (2003)

- (i) National Department of Housing Norms and standards
- (j) Provincial inspection guidelines
- (k) Department of Housing new norms and standards (40sqm)
- (1) House design for environmental efficiency
- (m)NHBRC building standards for low income housing

From the above it is clear that there are already a vast number of norms and standards within the industry.

**<u>Recommendations</u>** : These have been summarised as follows:

- 1. The adoption of a quality management policy that incorporates all stakeholders;
- 2. The inclusion of quality management in strategic plans with a phased implementation programme;
- 3. Partnership development and joint planning with all role players;
- 4. Use of larger contracts, over a longer period of time through a programmatic systems approach;
- 5. Identification of benchmarking partners;
- 6. The adoption of an audit and assurance mechanism, based on ISO 9000;
- 7. Development of a learning organisation and change management culture, led from the top;
- 8. The inclusion of quality performance targets in managers' performance reviews;
- 9. Clearly defined inspections procedures and documents (including roles and responsibilities), and availability of these on site;
- 10. Information management systems upgrading;
- 11. Revision to National Building Regulations in the context of low-income housing;
- 12. Improved municipal strategies on water connection;
- 13. On site training regarding topping of slabs, fitting windows and door frames and block work; and
- 14. Training of all managers and staff on all aspects of quality management theory, tools and techniques, and specifically in relation to low-income housing.

# **CHAPTER 1 : INTRODUCTION AND BACKGROUND**

# 1.1 INTRODUCTION

This study is an investigation into mechanisms that could inform quality assurance in low income housing projects in KwaZulu-Natal. It is informed by total quality management literature. An overview of quality management theory and tools is appended hereto *(Appendix 1 and 2, respectively)*. Chapter 1 aims to explain the background of and motivation for the study, and to identify the research questions and objectives of the study. Chapter 2 places total quality management in the context of low income housing. Chapter 3 makes recommendations based on findings and conclusions.

# 1.2 BACKGROUND AND MOTIVATION

# 1.2.1 <u>Statement of the problem</u>

Ongoing quality concerns in low income housing have allegedly not been addressed adequately.

# 1.2.2 <u>Background</u>

Quality concerns in housing have been ongoing. This matter has been raised in numerous political speeches at National and Provincial level (Makhaye, 2000: 4, and Mabandla, 2003: 4). These concerns were also raised at the KwaZulu-Natal Housing Summit held on 23 and 24 March 2005. The report on the summit highlights the Department of Housing's role in ensuring quality that is acceptable to the beneficiaries (Department of Housing, 2005a:9). Commissions at the summit recorded the need for the quality of housing to be reviewed, the need for improved value of this type of asset, review of the house design, and quantity *vis-à-vis* quality aspects (Department of Housing, 2005a:32). A resolution was taken to "beef up the inspectorate component" of the Department of Housing (herein referred to as the Department), to assist in addressing the quality concerns (Department of Housing, 2005b:4 and 2005a:38). Resolutions were also made that required the Department to develop performance indicators, standardize reporting and monitoring

templates, and quality specifications for various housing options (Department of Housing, 2005a:37).

The South African Government's policy on housing for the poor (1994) was originally based on maximizing the volume of delivery. Many stakeholders have raised concerns on the resultant quality of units that were delivered. (Department of Housing, undated(*a*):1, and Sisulu, 2005b:5). In 1999 the National Department of Housing introduced norms and standards aimed at ensuring a minimum top structure size (30m<sup>2</sup>) and service levels (Department of Housing, 2000:181). In 2002 the National Minister of Housing responsible for housing (herein referred to as "National Minister") announced that the involvement of the National Home Builder's Registration Council (NHBRC) would be extended to low income housing green field projects from 1 April 2002 (Department of Housing, 2002:4). A further agreement had been reached that extended the NHBRC involvement to in-situ developments and units built by people themselves (Department of Housing, 2005c:6).

In 2005, the National Minister reiterated the need to focus on quality. She announced that houses built between 1994 and 2002 would be audited and action would be taken regarding poorly built houses (Sisulu, 2005a:2). She quoted unpublished research which indicates that shoddy construction has been found in the form of poor roofing, cracks, weak doors, damp, poor foundations, and no floors (Sisulu, 2005c:4). A media article quoted her stating the need not to push for quantity only, but to look at quality and correct past errors. This would result in spending funds on corrective work, thus reducing the budget available for new houses (Anonymous, 2005).

In November 2009 the new National Minister, Mr Tokoyo Sexwale (Sexwale, 2009 and 2010) again criticised the vast amount required by the KZN Department of Human Settlements for reconstruction work required to houses as a result of poor quality. Various articles have been sited in the media since then, illustrating major quality concerns in housing delivery and in KwaZulu-Natal, (Govender, 2009 and 2010).

#### 1.2.3 Motivation for research

Quality problems in housing construction have been an ongoing concern in all spheres of government. The Department is answerable to the public for its expenditure on housing initiatives. South African legislation compels all spheres of government to ensure proper spending of public funds, in a cost effective, transparent and equitable manner (Republic of South Africa, 1999- Municipal Finance Management Act sections 2 and 38; Municipal Finance Management Act No. 56 of 2003, section 2).

The housing backlog is still very large and resources are extremely limited. Proper planning and efficient use of resources is, thus, critical if housing goals are to be achieved (Department of Housing, 2005d:2). Rework on poor quality construction depletes scarce resources even further, as indicated by Minister Sexwale and Mrs M Govnder, MEC For Human Settlements (2009-2010). This research could facilitate more efficient resource utilisation.

#### 1.2.4 Theoretical Framework and Context

The research is based on quality management theory as a framework to analyse issues regarding quality in low income housing projects, with a view to suggesting recommendations that may enhance house construction in the market. The relationship between world class supply chain management, total quality management (TQM) and the role of norms, standards and specifications is also explored, and contextualised to low income housing.

It highlights prominent standards and specifications applicable to low income housing, supply chain management, and quality control, in South Africa. Findings on international trends are appended for information purposes (*see Appendix 1*).

### 1.3 RESEARCH QUESTIONS AND OBJECTIVES

#### **1.3.1** <u>The purpose of this study</u>

The purpose of this study was to identify current instruments that could assist in the achieving quality assurance in the housing delivery cycle in KwaZulu-Natal.

## 1.3.2 <u>Research questions</u>

The following question was investigated:

What systems, norms and standards are in place to ensure sustained quality assurance in the context of housing delivery in KwaZulu-Natal?

## 1.4 CHAPTER PLAN

Table 1, below provides a summary of the structure of the document.

Chapter	Content	Purpose	Section
1	Introduction	Overview of the chapter, what is covered and motivation for research.	1.1
		Brief overview of low income housing policy and quality improvement initiatives in government low income housing.	1.2
		Research questions and objectives.	1.3
		Outline of this document.	1.4
2	Quality Management in	Introduction	2.1
	the context of low income	Quality concerns in South African low income housing.	2.2
	housing	National and Provincial initiatives and institutions involved in quality management and assurance in the context of low income housing.	2.3
		Standards and Specifications in the South African Government Subsidized Low Income Housing Initiatives (Overview of norms, standards and specifications in low income housing, as defined in terms of legislation and government policies)	2.4
		Conclusion	2.5
3	Recommendations		
Appendices	Related literature		

Table 1 : Structure of the research report

#### 1.5 SUMMARY

This Chapter provides a brief overview of the content of the report. It presents the problem statement, background and motivation for the research. It also identifies the research questions and objectives and provides a summary of the structure of the report.

### **CHAPTER 2 : QUALITY MANAGEMENT IN HOUSING**

## 2.1 INTRODUCTION

The previous chapter provided a brief introduction and described the intention of the research. This chapter will provide an overview of recent research on quality management in the context of housing, and attempt to identifying how it has been applied to low income housing.

Quality management in housing is not new. The Code of Hammurabi, 2000BC stated that "if a builder has built a house for a man, and his work is not strong, and the house falls in and kills the householder, that builder shall be slain" (Gitlow, et al, 1999:15). Around 1450 BC quality control of component parts was undertaken by Egyptians and Aztecs (central America) by inspecting and measuring the squareness of blocks (Gitlow, et al, 1999:15).

Examples of other historic and modern international trends are appended (Appenix 1).

# 2.2 QUALITY CONCERNS IN LOW INCOME HOUSING IN SOUTH AFRICA

The South African government's policy on housing for the poor (1994) was originally based on maximizing the volume of delivery. Many stakeholders have raised concerns regarding the resultant quality of units that have been delivered (Department of Housing, undated(a):1, and Sisulu, 2005a:5).

The CSIR (Council for Scientific and Industrial Research) is a statutory body which undertakes research in a number of fields, including infrastructure, materials, engineering and technology (CSIR, 2005a). Its research focus is more on the technical aspects, product innovation and suitability of alternative construction materials and building practice (CSIR, 2005b, and Department of Housing, 2005e).

The Construction Industry Development Board (CIDB) has suggested best practice for labour intensive technology for earthworks and pre cast concrete products, bricks and block making. Both guides include best practice suggestions to ensure proper tools and inspections are undertaken (CIDB, 2005:15). It also incorporates building standard requirements of the South African Standards (SABS/SANS), and provides a template for inspections and recommended quality control checks. This includes items; (materials, production and other operations), properties; tests and its sources; and frequency (CIDB, 2005:19). The CIDB has also developed supplier improvement programmes, screening and registration, to improve quality in the construction industry (Hodgson and Milford, 2005:7).

A policy review commissioned by the National Department of Housing for the period 1994 to 2003 confirms perceptions of poor quality houses (Charlton, et al, 2003:10). The report highlights that slightly better quality is achieved where people built their own homes through the "People's Housing Process", but the roll out of such a programme at a large scale may be limited. The report also identifies the need for more environmentally and energy efficient housing (Charlton, et al, 2003:10), to improve asset value (Charlton, et al, 2003:53). It identifies the need for long term usage of houses with improved designs, positioning and construction that enables a range of uses (Charlton, et al, 2003:10), through innovative design (Charlton, et al, 2003:53). It acknowledges that construction quality improvement research is required but that this should not detract from deeper concerns of location and integrated development (Charlton, et al, 2003:17). The report also identifies inadequate aftercare from provincial and municipal levels.

The National Home Builder's Registration Council (NHBRC) is a statutory body that aspires to achieve quality to protect home owners (Department of Housing, 2005e). It has identified the following quality concerns in house construction in general, supported with photographic evidence, but the extent in the context of low income housing is not provided:

- (1) Poor quality bricks.
- (2) Insufficient cement in mortar mix.
- (3) Poor plaster applications to exterior walls.
- (4) Poor storm-water management.
- (5) Structural failure due to poor founding conditions.
- (6) Incorrect use of brick force.

- (7) Incorrect or no brick bonding.
- (8) Vertical cracks in plaster poor quality sand and mix.
- (9) Not built to plan.
- (10) Poor workmanship.
- (11) Structural defects.
- (12) Use of substandard building material.
- (13) Lack of general maintenance.
- (14) Storm-water management control non-existent.
- (15) No on-site quality control and supervision.
- (16) Sagging and leaking roofs.

#### (NHBRC, 2002a).

The NHBRC on its website (NHBRC, 2002a) identifies the shortage of project management skills, construction and financial management skills and construction execution skills as major challenges. It has identified the building of high quality houses in the government subsidized houses as a major challenge that needs to be assessed (Department of Housing, 2005e).

The Provincial Eastern Cape Government has responded to this challenge by developing "A Basic Guide to Quality Housing Development Norms and Standards", aimed at residential structures delivered through government subsidized low income houses, built by the people themselves. The document reflects standards, materials, quantities, sample plans and graphic representation of mixing methods, and general construction requirements to deliver a completed 40m<sup>2</sup> unit. It also incorporates a checklist for inspections, from site preparation, through to completion and handover to the occupant (Province of the Eastern Cape, 2005:3).

# 2.3 NATIONAL AND PROVINCIAL INITIATIVES AND INSTITUTIONS INVOLVED IN QUALITY MANAGEMENT AND ASSURANCE IN THE CONTEXT OF LOW INCOME HOUSING

#### 2.3.1 International Standards

*International Organization for Standardization* (ISO) is a network of technical committees with representatives from 156 national standard organizations. The coordinating committee is situated in Switzerland. Standards are debated between member countries. Democratic votes determine acceptance of the standard. The ISO standards are voluntary and are aimed at improving quality (ISO, undated).

#### 2.3.2 National and Industry Standards

#### (a) <u>Standards South Africa</u>

The Standards Division of the South African Bureau of Standards (SABS) changed its name to "Standards South Africa". The National standards formerly designated "SABS" are now "SANS" (ASOSH, undated). It is mandated by the Standards Act, 1993 (Act 29 of 1993), to develop and publish standards for products and services, developed in conjunction with interest groups such as the CIDB. It works closely with the International Standards Organization to protect interests, whilst adopting international standards where appropriate (STANSA, 2005a). It is also involved in certification schemes, quality system certification and consignment inspection services (ASOHS, undated). It also provides: technical advice; arbitrates disputes lodged by builders against approval authorities; compiles technical reports of building defects for legal purposes; improves legislation; workshops stakeholders on legislation; and evaluates qualifications of building control officers, in relation to construction matters (SABS, undated).

#### (b) <u>Construction Industry Development Board (CIDB).</u>

This Board was established by the Construction Industry Board Act, 2000 (Act 38 of 2000). It is responsible for developing standards relating to good practice, procedures, and procurement and delivery management within the construction industry. It has developed a code of conduct for procurement practice in the industry (CIBB, 2002a, undated). These have been regulated (Republic of South Africa, 2004a and b). It is also

involved in developing methods for monitoring and regulating performance and registration of projects and contractors (CIDB, 2002b).

#### (c) <u>National Home Builders Registration Council (NHBRC)</u>

The Council is a statutory body established in terms of the Housing Consumer Protection Measures Act 1995, (Act 95 of 1995), to protect the interest of housing consumers and to regulate the home building industry (Department of Housing, 2005e). Its *Home Building Manual* provides guidelines from practical experience in implementing the National Building Regulations, and is applicable to low income urban developments. The manual deals with general requirements, design-, and construction standards which have been incorporated into the Department of Housing's Procurement Documents (Department of Housing, 2002(b):1.1).

#### 2.3.3 "Company" Standards

#### (a) Department of Housing

The Department is responsible for housing and delivery of low income housing through the housing subsidies. The Minister must determine national housing policy, including national norms and standards (Act 107 of 1997, section 3(2)(a)). The Department's *"National Housing Code"*, which contains national norms and standards for low income housing, is binding on the provincial and local spheres of government (Act 4 of 2001, section 3(b)). It addresses basic product types and fixes the amount to be spent in respect of municipal services and dwelling, respectively. The amount is revised annually when the subsidy quantum is revised (Department of Housing, 2000:178-180).

#### (b) Municipalities

Municipalities have by-laws that govern town planning and engineering design and construction issues (including land use controls, minimum lot sizes, omnibus servitudes, building line distances, etc). These vary between municipalities. The Department of Housing acknowledges this need and allows for some flexibility, provided the standards are not less than that prescribed by the Department (Department of Housing, 2002b:1.1).

# 2.4 STANDARDS AND SPECIFICATIONS IN THE SOUTH AFRICAN GOVERNMENT SUBSIDIZED LOW INCOME HOUSING INITIATIVES

The specifications and standards applicable to government subsidized housing are briefly summarized below. These include simple specifications (function and fit-, market grade- and qualified product specifications); and complex specifications (commercial standards, design specifications, engineering drawings and material- and-method of manufacture).

#### 2.4.1 Simple specifications

These are very basic types that require few resources and description. It is used to define simple products or services, e.g. "a 30 cm standard stationery ruler" (Burt, et al, 2003:239).

*"Function and fit"* specifications are used to describe what a product/service is required to do. The desired performance is described in detail, including functions to be performed, its relationship to other components, and design outcomes required (Burt, et al, 2003:240), e.g., the "deemed to satisfy" standards in the application of national building regulations (SABS, 1990:4).

*Market grade* is used to describe and determine the quality and or standard ranges of commodity type products. Trade associations, standard setting authorities and government agencies determine grades for specific commodities (Burt, et al, 2003:243).

*Qualified product* specifications are used where it is critical to know up front whether a product or service would be able to comply with expectations, e.g. research equipment. The product and/or service is pre-qualified through a review and qualification testing process, and registered on an approved list of suppliers (Burt, et al, 2003:243-244), such as the use of building contractors registered with the National Home Builder's Registration Council (NHBRC), in low income housing (Department of Housing, 2005f).

#### 2.4.2 Complex specifications

Complex specifications are far more detailed and describe exactly what the buyer wants. They include commercial standards, design specifications, engineering drawings and material and method-of-manufacture (Burt, et al, 2003:244).

*Commercial standards* are developed by industry and government where there is a high frequency of recurring needs for certain materials and or/performance requirements. They entail a complete description of the materials, quality, finishing, testing methods and standards, dimensions, composition, etc. They form part of most mass production systems, and provides a measurement for quality standards (Burt, et al, 2003:244-245), e.g. Standards South Africa.

*Design specifications* set detailed specifications for non-standardized materials, to meet specific design requirements (Burt, et al, 2003:245). In the South African context, these require Agrément Certification (Agrément South Africa, 2002: undated, and SABS, 1990:44).

*Engineering drawings* form part of design specifications and to specify shapes, dimensions, spatial relationships of technical details of a product. These require explicit descriptive instructions and details. It is an accurate and precise form of specification commonly used in construction projects or where high mechanical outputs are required (Burt, et al, 2003:245-246).

*Material-and-Method of Manufacture* is very prescriptive. Prospective suppliers are given precise instructions in the use and processing of materials. It is costly as it requires very detailed preparation of documents and detailed inspections to ensure compliance with requirements (Burt, et al, 2003:246). This may apply to areas such as specific foundations designed by an engineer or sanitation systems.

#### 2.4.3 <u>Standards and Specifications Applicable Through the Project Life Cycle</u>

A number of specifications and standards are applicable throughout the life cycle of a low income housing project, i.e. procurement, preparation, planning and design of township and engineering services, and house construction (NHBRC, 2002b). These will be discussed briefly in the section, below.

#### (1) Procurement

Legislation governs the manner in which funds are spent by organs of state, and the manner in which service providers are procured (a schedule of such legislation, is attached (*Appendix 3*).

**The Department of Housing** has developed standard procurement documents that include CIDB and South African Standards requirements. The specifications came into effect on 1 April 2003 (Department of Housing, 2002b:1.1), and include essential features of standardized documents for a particular contract option (Department of Housing, 2002a:2.1). A summary is attached (*Appendix 4*).

**The Construction Industry Development Board** (CIDB) has published regulations (Notice 63 of 2004, Government Gazette No 26427), to ensure transparent and uniform procurement procedures and practices relevant to construction. These became applicable to all organs of state undertaking procurement for construction, from 14 November 2005 STANSA, 2005b). It is noted that the Department of Housing documents have not been updated to reflect this standard.

**Standards South Africa** has developed standard procurement specifications in response to the CIDB regulations aimed at ensuring uniformity, transparency and predictability of the procurement of construction services (CIDB, 2002b). Different suites have been developed to describe key characteristics and to ensure maximum order in the procurement of each type of service relating to civil engineering construction (STANSA, 2005b), (see *Appendix 5*).

#### (2) **Project Preparation**

The Department of Housing's standard procurement documents include all requirements relating to preparatory work, including procedures and documents required for land identification and purchasing, project motivations and technical reports such as geotechnical site investigations and environmental impact assessments where required (Department of Housing, 2002b:1.1 and 2002e:1.1). Refer to *Appendix 6 and 7*, for a summary of geotechnical investigation and environmental impact assessment requirements and contents of specifications.

ISO has revised its versions of its ISO 14001 and ISO 14004 standards, aimed at setting standards for efficient environmental management systems. ISO 14001 addresses the control and continuous improvement of companies' activities, products and services of its impact on the environment. ISO 14004 focuses on the implementation of environmental management systems (STANSA, 2005c). The auditing standards of environmental systems have been revised by ISO 19011, and provide a single set of guidelines for all aspects relating to quality and/or environmental management system audits. The standards can be extended to other audit types, such as production and regulatory compliance (STANSA, 2005d). ISO 14001 and 14004 have been adopted as South African National Standards, published under SANS 14001, *Environmental Management Systems*, and SANS 14004, *Environmental management systems-general guidelines on principles, systems and support techniques* (STANSA, 2005c).

#### (3) Planning and Design for Township Establishment, and Service construction

The Department of Housing has standardized documents and specifications for procurement of services for town planning and engineering. The town planning specifications outline the qualification criteria for a town planner, and key outputs required. The planning activities; minimum information and aspects to be addressed in the motivation and commentary; relevant sources to be consulted; mapping; and reporting requirements are specified (Department of Housing, 2002c:Introduction).

The Department's specification for the design and construction of services are performance based. It provides the minimum requirements for engineering infrastructure (roads, storm water, drainage, sanitation and water and high mast security), based on the Departments norms and standards, National Home Builder's Registration Council (NHBRC) requirements, and SANS requirements that prevailed at the time (Department of Housing, 2002c:Introduction).

The minimum level of service in terms of the National Housing Code (Department of Housing, 2000:180) is summarized in Table 2.1, below.

TYPE OF SERVICE	DESCRIPTION
Water	Single standpipe per stand (metred)
Sanitation	Ventilated Pit Latrine (VIP)
Roads	Access to each stand with graded or gravel paved road
Storm-water	Lined open channels
Street lighting	Highmast security lighting for residential purposes where feasible and
	practical

Table 2.1: Department of Housing minimum norms and standards for services

(Department of Housing, 2000:180)

The NHBRC has specific requirements for drainage capabilities to also ease maintenance; and storm-water disposal systems to prevent soil erosion or flooding that may adversely affect housing structures (Department of Housing, 2002c:Introduction).

SANS specifications cover all aspects pertaining to engineering design and construction activity, including earth works, erosion control, storm- water drainage, sanitation systems, etc (SABS, 1990:5). The headings of the different standards are self explanatory, as reflected in *Appendix 8*.

The specifications provide a breakdown of civil engineering components and define the needs and performance requirements for each. These include pipe dimensions, -diameters, -gradients and -velocities for storm-water drainage and water supply, slopes and gradients for roads (Department of Housing, 2002c:Introduction).

# (4) House construction

House construction is the final part in the project delivery cycle. A number of standards impact on house construction. The Department has specified a minimum house size of 30m<sup>2</sup> gross floor area, (Department of Housing, 2000:181). It developed performance based standard specifications for the design and construction of houses that incorporates the mandatory requirements of the National Building Regulations, SABS, NHBRC (Department of Housing, 2002g:1.1). The content of the specifications is summarized in *Appendix 9*.

(SABS0400-1990) Code of Practice for the application of the National Building Regulations was developed to ensure a proper interpretation of the National Building Regulations and Standards Act, 1977 (Act 103 of 1977), (SABS, undated). It was approved by the former Council of the South African Bureau of Standards on 23 August 1993. "The Code sets out prescriptive provisions that are deemed to satisfy the technical aspects of the National Building Regulations" (SABS, 1990:4). It deals with all the technical aspects relating to building construction and sets out the minimum requirements to ensure that buildings are designed and built in a manner that ensures people could live and work in a safe and healthy environment. It was intended to minimize regulations and to focus primarily on health and safety aspects. It was also intended at informing innovation - not to impede it (SABS, 1990:3). See Appendix 10 for a summary of the content of the document in the context of low income housing. It should be noted that these are being amended to accommodate environmental and energy efficiency. The draft guidelines are attached to appendix 10. Standards applicable to house construction in the government subsidized housing scheme are listed in *Appendix 11*. The regulations are currently under review and a copy of the draft, and other standards are obtainable from the SANS website.

# 2.4.4 <u>Standards and Specifications in Low Income Housing : Benefits and</u> <u>Challenges</u>

#### (1) Benefits

#### (a) Enables mass production

Standardization increases the potential to use interchangeable parts (Burt, et al, 2003:254), e.g. use of standard different window frames across projects. It stabilizes production processes and encourages continuous improvement (Burt, et al, 2003:254). The experience and learning curve effect is expedited as a standard product is built within a particular project.

#### (b) Enables customization

Standards facilitate the production of a wide variety of finished products from a relatively small number of parts (Burt, et al, 2003:255), e.g., a range of different house designs are possible, using the same quantities, but this is limited to the placement of windows, doors,

internal wall and plumbing, and roofs. Houses built by people themselves may allow more flexibility as the cost of labour is replaced by the builder's own sweat equity. Additions and materials purchased by owner builders from other sources may be used to achieve customization.

#### (c) Improves supplier coordination

Standardized parts and specifications facilitate a clear understanding of dimensions, characteristics and performance standards (Burt, et al, 2003:255). It enables proper quantification and need estimates that inform negotiations for bulk supplier/customer discounts. This is very relevant to housing projects as it is critical to ensure that the right quantity of sand, water and cement is available to ensure the correct mixture of concrete for the desired purpose (e.g. slabs versus plastering), and to ensure that the cement is not delivered prematurely, to guard against the theft and/or expiry of the material.

#### (d) Improves quality

The standard products and design facilitate the experience and learning curve effect, which lowers defects (Burt, et al, 2003:255) as the same process and product are delivered throughout a particular project.

#### (e) Enables simplification

Standards facilitate the identification of bare minimum quantities and qualities of materials required to deliver the desired performance standard, thus resulting in the simplification of the product (Burt, et al, 2003:255). Standards guard against exploitation to ensure that the absolute minimum still complies with health and safety requirements, as determined by the relevant standards and regulations (SABS, 1990:40).

#### (f) Lowers inventories

Where the product is standardized, quantities and delivery needs can be more accurately projected, thus reducing waste with regard to disposable items, and keeping inventory levels low, thus improving inventory and quality control (Burt, et al, 2003:255). Items such as cement have a limited shelf life. Steel products also are at risk of rusting and would require special storage (and security against theft). Low inventory levels reduce this risk.

#### (g) Other Potential Benefits

Standard products and processes reduce risk perceptions, compared to those that are unknown or untested. Budgets are easier to compile as quantities, features and quality costs are more predictable as prices are easier to compare.

It creates a comparable base for tender evaluation as the minimum requirements are transparently defined in standardized procurement specifications. Financial controls are enhanced as payment and performance can be measured against standard specifications.

Mass production is enabled through standardization, which increases the speed of delivery, and reducing costs through economies of scale. Uniform product reduces perception of discrimination amongst same income profile housing beneficiaries in different regions. Expected product features and performance is also easy to communicate, and to inspect.

#### (2) Challenges

- (a) The referencing system used for SABS (now SANS) standards, is complicated, and in some cases a vast number of references need to be explored before the appropriate standards are found. This is also applicable to the organization's electronic referencing system. The standards are not readily available unless they are ordered through the organization, and can only then be obtained at a cost. This could be a limiting factor, as one could search for specifications in the Department of Housing's documents, only to find that additional sources need to be obtained, at additional costs, which may be limiting to owner builders and emerging concerns.
- (b) Product innovation, customization and competition based on product differentiation and low cost is extremely limited. The subsidy is set at a fixed amount with which a product is to be delivered to meet the Departments minimum norms and standards.
- (c) The housing process and documents required for the procurement of services and approval of projects are complicated, especially for emerging contractors who may be less familiar with the specified procedures.

(d) Building Regulations are "deemed to satisfy rules", the interpretation of which is manipulated by unscrupulous developers who still abuse subsidy funds through fraud and poor substandard or very borderline materials.

#### 2.5 CONCLUSION

Quality management in housing is not new. Most recent international research relating to low income housing has focused on slums clearance, upgrading of human settlement and integrated development.

In the international arena, the National Association of Home Builders (United States of America) has developed extensive literature on quality management in relation to housing. This is based on total quality management philosophies. Research indicates that mixed income development also appears to facilitate quality in housing, as higher income earners demand better quality, thus also benefiting low income earners. In Hong Kong, quality efforts are aimed at creating environmentally friendly and sustainable housing. These are facilitated through the HK-BEAM system (Hong Kong Built Environment Assessment Method. Singapore is focusing its efforts on urban renewal and views quality as ensuring a life time asset.

Quality improvement is not only important from an economic perspective. Poor quality house construction may have adverse health implications to its occupants.

The National Home Builder's Registration Council has identified a number of generic quality defects in housing in South Africa, but these have not been quantified. There are a number of standards and specifications that guide house construction in the low income market, relating to houses subsidized by government. These have benefits such as enabling mass production, customization, simplification, improving quality and inventory management, costing and financial programming and speed of delivery. It also has several challenges, such as complicated coding of norms and standards, duplication between several organizations, limiting differentiation, accessibility to information, and manipulation of interpretation of "deemed to satisfy" rules.

#### **CHAPTER 3 : RECOMMENDATIONS**

#### 3.1 INTRODUCTION

This study is an investigation into mechanisms that could inform quality assurance in low income housing projects in KwaZulu-Natal. It is informed by total quality management literature. This chapter presents recommendations in terms of the findings and conclusions, as well as areas for further research.

#### 3.2 STRATEGIC QUALITY MANAGEMENT

- **3.2.1** The Department of Human Settlements needs to take the lead in the drive for quality, through its vision, policies and strategies (Evans and Lindsay, 2002:120 and 130). It needs to work together with all stakeholders to form quality partnerships (Evans and Lindsay, 2002:182). This should be part of its strategic plans, which should include all staff so that they can take ownership and responsibility, and provide inputs to quality improvement initiatives (Kanji and Asher, 1996:2). This should be applicable to all activities as such an approach would enhance service delivery perceptions both internally and externally.
- **3.2.2** A phased approach coupled with suitable change management systems will be required. All managers should be accountable across activities, including support functions, and quality improvement targets should be incorporated in their performance agreements. In the case of new quality improvement initiatives, a facilitator may be appointed for guidance (Gryna, et al, 1999:199. The initial crafting of quality improvement strategies within the Department may require the appointment of a facilitator to guide initial implementation. Such appointment needs to be coupled with a clear brief.
- **3.2.3** A proper planned change management system needs to be in place for quality improvement initiatives to succeed (Pike and Barnes, 1996:77). This must be led and supported by top management (Develin and Hand, 1995:8). It requires sound people based management (Kanji and Asher, 1996:2). A change in management culture is required within the Department to facilitate a learning organization,

failing which a quality management system will not be successful. Progress on these aspects needs to be monitored carefully through staff satisfaction surveys incorporating specific elements such as the extent to which staff are encouraged to share ideas, learn from mistakes, etc. Such surveys would also need to address the various management levels to determine more accurately where problems are, but this would need specialist assistance and should be dealt with sensitively to avoid victimization of both workers, and managers. This would require very specific elements of improvement to be identified, with carefully identified monitoring and evaluation systems.

- **3.2.4** Some quality management initiatives need to be identified that would produce tangible results quickly to facilitate commitment and faith in quality improvement efforts (Pike and Barnes, 1996:43).
- **3.2.5** The crafting of a quality policy should be prioritized by all stakeholders, as this should inform standards and measurements for all activities, and inform key aspects of product and service specifications (Evans and Lindsay, 2002:645). It is also a guide used to consider the financial impact on the organization and its customers (Gryna, 2001:185). In the context of low income housing, such a policy should take into consideration the differences between communities, external environmental impacts and associated matters that impact on the viability of the projects, and inform the general housing subsidy policies. It should also consider the minimum levels of finishes and component parts used in house construction, (such as doors, window frames and floor area/size), and guide decisions on size versus durability type improvement. This would inform beneficiaries of what they can expect and guide suppliers in conforming to acceptable quality standards.
- **3.2.6** It is noted that the Cuban staff had prepared a document regarding policy assurance and, read in conjunction with their guidelines for environmental house designs; basic parameters to improve the housing product; design criteria for reducing the effects of wind on building in KZN; and Costing schedule (2009/10); the National Home Builders Registration Building Manuals; the application of National Norms and standards (including the revisions for environmental friendly design) could be used as the basis for quality assurance guidelines.

#### 3.3 ISO 9000

Whereas ISO 9000 is an internationally recognized quality management system, its application would benefit all role players (Evans and Lindsay, 2002:137). Developers are likely to benefit the most as it can provide them with a competitive advantage in the market. It could also inform departmental and municipal procurement processes as ISO certification could provide quality assurance in procurement processes. Whereas it appears that the Department does not have a formalized quality management system, the ISO 9000 standards should be used to guide the development of such a system. The quality assurance document prepared by the Cuban Officials in 2009/10 use ISO 9000 to inform quality assurance checks.

#### 3.4 BENCHMARKING

- **3.4.1** Benchmarking is a means of improving quality based on best practice, and as such it is an essential tool in comparing performance in the market (Spendoli, 1992:8). It may be difficult for the Department to identify a benchmarking partner locally, but it could explore alternatives such as non-governmental organizations (NGO's), the eThekwini Municipality (Durban) and/or other government departments, or housing departments in other provinces. The department should endeavor to identify a suitable benchmarking partner to facilitate quality improvement.
- **3.4.2** This should include accepted defect rates in low income housing projects and/or standards. Targets need to be set to improve the number of defects. A Pareto analysis indicates how a significant impact can be made by prioritizing those aspects that cause 80% of the problems (Kanji and Asher, 1996:56). The prioritization of areas needing improvement, in accordance with the findings of the Pareto analysis, will greatly reduce the defect rate. This will require a detailed quality improvement plan including actions, task allocation, resource requirements and timeframes. Many challenges are being experienced in determining defect rates. It is suggested that sample projects be identified in which defects are recorded on standardised document to assist in setting a benchmark.

- **3.4.3** Whereas a project management approach is typically used to coordinate and implement quality improvement initiatives, (Gryna, 2001:199), quality improvement in the Province needs to be led by an experienced project manager, supported by an appropriate multi-disciplinary team.
- **3.4.4** Statistical methods are critical in informing improvement measures and for evaluation purposes (Oberlender, 2000:232). This should be informed by more quantitative measures being explored in recording the occurrence of problems through well defined, and mutually agreed check sheets, and or control charts that should be kept and maintained on site. The content, measurements and analysis techniques must be agreed between all stakeholders to facilitate a mutual understanding of uniform data recording, processing and analysis systems and to ensure effective implementation.

#### 3.5 INFORMATION MANAGEMENT

- **3.5.1** Inadequate information systems impair quality management (Beckford, 1998:26). Both the Department and the municipality need to urgently address their information management systems to include these activities to enhance quality management in terms of supplier management, project management, delivery and defect rates, and variations to contract. The system needs to include organizational goals; key performance indicators; actions plan for improvement; progress measurement; evaluation and feedback mechanisms; customer requirements and satisfaction data; product design, specification and standards; and material, equipment and supplier test results; delivery cycle timeframe projections, actual delivery timeframe and timeframe variation; and other variation data and problem solving process management data (Gryna, 2001: 656). These factors are required for effective project management.
- **3.5.2** All role players need to ensure proper records of inspections, supported by a database. These should include the project visited, site numbers, stage of the inspection, results on pre-agreed aspects and standards for inspection, as informed by the inspection guide to be developed. This will reduce duplications as well as serving as a record for statistical analysis and future research.

- **3.5.3** The developer's system should also be improved to include action plans and progress to enable proper evaluation and feedback in performance reviews.
- 3.6 QUALITY CONTROL
- **3.6.1** All role players should adopt a suitable audit and quality assurance system. ISO 9000 standards could be used to guide the development of an efficient system (NAHB:2005a).
- **3.6.2** Inspection procedures and checklists need to be standardized. Clear guidelines need to be developed by the Department of Human Settlements, in consultation with all stakeholders regarding inspection criteria, and quality expectations, including a description of what customers can expect in terms of level of quality. The tolerances, conditions, frequency of inspections and sample size criteria also need to be defined. Documents drafted by the Eastern Cape Provincial Government, the National Association of Home Builders (NAHB), and the Construction Industry Development Board (CIDB), as listed in the references attached to this document, could facilitate this process.
- **3.6.3** Elements identified as critical in the proposed inspection guide should be part of a well defined inspection score card. On site control charts should be available to inform decision makers on quality improvement initiatives, and this would also clarify whether pre-inspections were done, and action taken to resolve issues.
- **3.6.4** Burke (2003:105) indicates that a formal scope change control system should be in place, based on sound project management principles. The change management system should provide for variations to be informed by the implications of changes to the project scope (time, cost and quality trade-off), acceptance by the customer/client and appropriate approval processes (Burke, 2003:106). Variations need to be properly recorded and communicated to all stakeholders, including inspection staff to ensure a common understanding of revised requirements and its implications on subsequent processes (Burke, 2003:106).

- **3.6.5** Control charts and score cards should be maintained on all sites to assist in performance management and problem solving abilities, whilst also serving as a quality audit. The format of this should be agreed by all parties so as to understand the interpretation of results.
- **3.6.6** Poor materials generally increase the cost of quality (Gryna, 2001:403). Sample tests should, therefore, be undertaken regularly on critical materials (Gryna, 2001:419). Although very few defects in critical materials were found in this sample, sample tests should be undertaken on critical materials such as cement mixtures, block strength and roofing material, as guided by the best practice guide for construction, SABS0400, to ensure the continued use of sound quality materials. This should be the responsibility of staff on site, supported by a proper system for recording data.
- **3.6.7** The application of the National Building Regulations needs to be done in the context of low income housing. The National Home Builders Manual attempts to simplify the requirements and could to facilitate a common understanding, even by emerging contractors. Such revisions should be informed by sound building practice and consumer needs, and need to be incorporated into inspection sheets and guidelines of the Department of Human Settlements.

#### 3.7 CUSTOMER FOCUS AND MARKET INTELLIGENCE

- **3.7.1** Leadership needs to create a customer focused vision with clear quality goals which should be incorporated in strategies (Evans and Lindsay, 2002:223). The lack of shared views on customer needs awareness may point to a need to ensure a common understanding of quality in terms of the customer. This should be incorporated in strategic reviews and involve all staff, as quality is defined by both internal and external customers (Gitlow, et al, 1999:3).
- **3.7.2** Market surveys and customer satisfaction surveys would contribute towards a sustained competitive advantage for developers, whilst improving perceptions of service delivery by organs of state (Evans and Linday, 2002:184, read with Beckford, 1998:10).

**3.7.3** Market surveys and customer satisfaction surveys could assist the government in planning future policies regarding housing, and should be explored in the interest of effective service delivery. Organs of state need to ensure a proper customer orientation and recognition of a range of quality needs to be incorporated in a quality policy. This should incorporate housing allocation. It should also consider matters such as how additional funding should be applied to units (bigger size versus durability). This needs to be based on research and local needs, through customer satisfaction surveys (Evans and Lindsay, 2002:184), as it is the customer that defines the extent to which quality is achieved (McLaughlin, 1995:32).

#### 3.8 PERFORMANCE MANAGEMENT PLANS

Performance management systems within all institutions should include measures on quality performance initiatives, as defined by the organization, and including all staff. Measures to monitor adherence to ethical standards should be explored, and this may also be an area for further research.

#### 3.9 PROCESS MANAGEMENT

- **3.9.1** Delivery rates (at each stage of the inspection) also need to be programmed and monitored, and communicated to all stakeholders to enhance supply chain management activities, including "just in time" principles (Evans and Lindsay, 2002:367). This should also apply to the Department.
- **3.9.2** Joint planning and cross functional teams optimize the knowledge base for quality improvement systems and facilitate the incorporation of quality into all processes (Evans and Lindsay, 2002:365). The Department should develop and communicate the expected timeframes for its internal processes to assist stakeholders in their planning activities and ensure that such stakeholders are involved in the process, e.g. standard operating procedure manuals. The nature of housing projects involve different professional services, thus there is a source for the development of cross-functional teams.

**3.9.3** The developer needs to correct tardiness on site to ensure site clearance has been done. This needs to be addressed through the site supervisor, but should also be enforced as a standard practice as the responsibility of all site staff.

#### 3.10 TRAINING

- **3.10.1** Change management training in the context of quality management, and training on quality improvement through human resources (including performance appraisal systems) needs to be developed and implemented. This could be measured by the extent to which improvement targets are achieved by the Department of Human Settlements.
- **3.10.2** Human resource management training is required in the context of "the learning organization and quality management approach" to encourage an environment where staff are able to learn from mistakes.
- **3.10.3** Employee and team appraisal need to be pursued to facilitate a conducive environment for quality improvement. Quality circles tend to focus on problems related to personal well being of staff and their frustrations (Gryna, 2001:202), thus this tool may assist in communicating concerns based on punitive approaches to management, where these are perceived to exist. Likewise, quality teams could assist in identifying quality related problems in project implementation and find solutions to address these.
- **3.10.4** Exposure to a variety of statistical tools could assist in improving quality management approaches, such as the use of Pareto analysis to prioritize quality concerns.
- **3.10.5** Quality management should involve the entire organization, thus training needs to be customized to the needs of each level within the organization, and across functions (Oberlender, 2000:319). Departmental and municipal staff need to undergo quality management training at all levels which should include training on problem solving techniques in the context of low income housing. It should include the basics of quality management philosophy, cause and effect analysis

and basic statistical techniques, as well as interpersonal relations, basic supply chain management and quality management in the context of projects in general.

- **3.10.6** Reference is often made to the costs associated to quality control on site. Literature, however, has indicated that "quality does not cost, it pays" (NAHB, 2005d, and Evans and Lindsay, 2002:107, to quote a few). The "perceived" costs could also be reduced by adopting a "100%, zero defects" approach (NAHB, 2997a), as doing things right the first time will always be cheaper (Crosby in Evans and Lindsay, 2002:106). The optimum level of quality management must be determined through proper cost benefit analysis, taking cognisance of failure costs, inspection costs and prevention costs (Gitlow, et al, 1999:178).
- **3.10.7** Practical hands on training on how to undertake housing projects in all aspects, especially relating to the municipality and the community needs to be pursued by the department. This should also include modules on controls required to ensure compliance with specifications. Training on the latter should only be done once the Department has completed its guide on inspections, which ideally, should involve all stake holders.
- **3.10.8** Inspection staff and monitors within the department can facilitate hands on training by assisting with corrective action on site during inspections and/or site visits. This could be further enhanced through the use of the control charts, as recommended, as these could guide areas of concerns, and with analysis on a Pareto, could highlight where training impetus is required. Based on the findings of this study, the correct mixing of cement and application of screeding techniques (topping of the slab) should be the first priority within this particular municipal area, followed by the fitting of window and door frames and block work on walls.

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#### QUALITY MANAGEMENT THEORETICAL FRAMEWORK

#### 1. INTRODUCTION

Quality has emerged as a dominant theme in management since 1940 (Beckford, 1998: 3). It affects all levels of the organization, i.e. operational, administrative and strategic (Beckford, 1998:11). The need for quality is equally applicable to the public sector as it is required to deliver services at the same or lower cost to meet public expectations (Beckford, 1998:10).

In investigating issues affecting quality in low income housing, this chapter will explore literature to identify how quality is defined, and to obtain a brief overview of the historic evolution of quality philosophies in total quality management (TQM). The importance of quality management will be explored from both an internal and external perspective. The quality control process and the tools and techniques commonly referred to in literature will be briefly outlined. This will include an overview of process analysis, statistical methods, "six-sigma" and benchmarking. The qualitative methods of quality circles, job design, organizational structure and supply chain management will be discussed briefly. An overview will also be given of standards, specifications, and supply chain management.

## 2. DEFINITION OF QUALITY

*Quality* has been defined as the degree of conformance to standards or fitness of use (McLaughlin, 1995:32). Deming defined it as "a predictable degree of uniformity and dependability, at low cost and suited to the market" (Deming in Gitlow, et al, 1999:1).

Juran and Gryna (1988:2.2) defined it as "fitness of use"... and "those product features which meet the needs of customers and thereby provide product satisfaction, (and also) freedom of deficiencies". Fitness of use is achieved through a collection of activities that make up the quality function, and these are critical in achieving some degree of predictability (Gitlow, et al, 1999:168). A product or service is less fit for use when: (1) Product features (quality of design) do not match customer needs; (2) there is a lack of consistency and reliability due to high process variability which reduces customer confidence; and (3) there are high degrees of variation (Gitlow, et al, 1999:9). Quality of conformance is lost with variations to the specification (quality of design), where these variations are above or below the specification limits (Gitlow, et al, 1999:6). Variation may occur in processes related to things such as poor lighting, training, poor design. This is known as common process variation (Gitlow, et al, 1999:9). Special variation may also occur when elements such as material, employees or equipment are introduced (Gitlow, et al., 1999:9).

Crosby defines it as "conformance to requirements, not elegance" (Evans and Lindsay, 2002:106).

Gitlow, et al (1999:3) explores the definition: "Quality is customer satisfaction". They define customers as external (purchasers, intermediaries and all those who come into contact with the product, including governments and regulators), and internal customers

which cover the entire organization (Gitlow, et al, 1999:3). They explore customer satisfaction in terms of "product features" (i.e. quality of design) and "freedom from deficiencies" (i.e. quality of conformance), (Gitlow, et al, 1999:5).

Quality of design defines the quality characteristics of a product or service required to meet the needs of the market (Gitlow, et al, 1999:5). This requires a strong customer focus, consumer research and involvement of all stakeholders in the design (Gitlow, et al, 1999:5).

Quality of conformance is the extent to which the specification (quality of design) can be achieved within cost (Gitlow, et al, 1999:6). Quality of performance relates to how quality of design and conformance perform in the market (Gitlow, et al, 1999:8). This includes after sales, maintenance, logistical support, reliability and purchase rates (Gitlow, et al, 1999:8).

The description that quality comprises customer satisfaction and fitness of use correlates with Juran and Feigenbaum's description of "total quality". *Total Quality* has been defined by Juran (1988:2.5) as a function comprising "an entire collection of activities through which we achieve fitness for use, no matter where these activities are performed". It covers every process, job and person (McLaughlin, 1995:31) and can be applied to any organization (Pike and Barnes 1996:24). It is "a system of behaviour which embraces everyone within an organization and determines their relationship with the outside world – customers, suppliers, competitors, society and the environment" (Develin and Hand, 1995:3). Feigenbaum, who in literature is best known for coining the phrase "total quality maintenance and quality improvement efforts of various groups in an organization to enable production and service at the most economical levels which allow full customer satisfaction" (Evans and Lindsay, 2002:108).

It is driven by the principle of continuous improvement (Develin and Hand, 1995:3), in every activity, including decision making and employee behaviour (Develin and Hand, 1995:5). This requires the optimization of systems with all stakeholders, including suppliers, subcontractors, employees, markets, communities, regulators and investors (Gitlow, et al, 1999:3), thus the entire supply chain.

The common thread in most definitions is that quality means to meet customer requirements (Develin and Hand, 1995:3), thus achieving "customer satisfaction... and fitness for use" (Gitlow, et al, 1999:165). The customer, therefore, determines the extent to which quality is achieved in its totality (McLaughlin, 1995:32).

# 3. HISTORIC OVERVIEW AND CONTRIBUTIONS TOWARDS MODERN PHILOSOPHIES AND TECHNIQUES

## 3.1 Early approaches

Quality issues have existed for centuries (Gitlow, et al, 1999:15). Quality management evolved from basic inspection to ensure the well being of others, progressing to corrective action, through to more integrative preventative modern approaches involving the entire system from customers to suppliers (Gitlow, et al, 1999:3).

In 2000BC the Code of Hammurabi referred to quality in the context of poor house construction that causes death of occupants as punishable by death (Gitlow, et al, 1999:15). Phoenician civilizations ensured compliance to government enforced quality standards and specifications by amputating the hand of the maker of defective products (Gitlow, et al, 1999:15).

From the thirteenth century quality became an inherent part of craftsmanship pride and training through apprenticeships to ensure quality skilled craftsmen in the interest of the trade. Government imposed quality standards (weights and measures) also applied (Gitlow, et al, 1999:15).

In the nineteenth century Frederick W. Taylor introduced the scientific management system to find ways of increasing production quantities (Gryna, 2001:228). This was based on assigning planning activities to educated and professional people, and execution to workers and supervisors (Gryna, 2001:228). The assignment of planning activities based on higher education has been diluted due to increased levels of education, cross functional teams and skills development in the workplace (Gryna, 2001:229).

The increased production focus was accelerated by industrialization. Attention to volume compromised quality but resulted in renewed quality efforts, including the creation of specialized chief inspection positions (Gitlow, et al, 1999: 15). This evolved into an explosion of quality philosophies and techniques throughout the twentieth century (Gitlow, et al, 1999:15). The most commonly quoted examples in the literature are briefly discussed in the section below:

#### 3.2 **Twentieth century trends**

Early in the twentieth century **George Edwards** coined the term "quality assurance" as an approach that results from planned and interrelated activities of all the organizational units in the production chain (Gitlow, et al, 1999:16), thus introducing a more holistic and integrative approach to production.

In 1924 **Walter Shewart** introduced statistical quality control to manage variations and these tools are still in use (Gitlow, et al, 1999:16).

After World War II, quality initiatives were used to rebuild business and economies in America, and Japan (Gitlow, et al, 1999:17). From 1950, **Dr Edwards Deming** worked closely with Japanese industrialists to improve perceptions of poor quality products, by practicing continuous improvement processes (Gitlow, et al, 1999:17). His philosophy focuses on improvements by reducing uncertainty and variability in product design and manufacturing processes by applying statistical tools (Evans and Lindsay, 2002:91). Variability is viewed as the main cause of poor quality which could be reduced through a continuous cycle of design, manufacturing, testing, sales, survey and redesign (Evans and Lindsay, 2002:91). This is articulated also in the "Deming wheel", a continuous cycle of plan; do; check; action (Gryna, 2001:127). He advocates quality improvement as a catalyst for sustainability of a business, as follows: Quality improvement results in cost reduction. This increases productivity, thus performance in the market place, which ensures a viable organization, thus enabling increased job creation (Evans and Lindsay, 2002:91).

**Joseph Juran** also worked extensively with the Japanese and has contributed largely to the *Quality Control Handbook*, published in 1951 (Evans and Lindsay, 2002:104). His philosophy motivates quality management through cost accounting and analysis (Juran and Gryna, 1988:4.4), and focuses on increasing conformance to specifications by eliminating defects through statistical analysis (Juran and Gryna, 1998:23.2). He viewed quality management as a process comprising three generic processes: quality planning, quality control and quality improvement (Juran and Gryna, 1988:2.6).

*Quality planning* involves establishing quality goals, identifying customers and their needs, developing product- and process features, and establishing process controls (Juran and Gryna, 1988:2.6).

*Quality control* is the regulatory process which measures actual quality performance against quality goals, and acts on the difference (Juran and Gryna, 1988:6.31). This entails choosing control subjects and units of measure, setting goals, creating sensors to assist with monitoring, performance measurements, interpretation of variations, and taking action on causes of variation (Gitlow, et al, 1999:171).

*Quality improvement* includes confirming the need for quality improvement, identifying quality projects, organizing project teams, problem solving, and change management (Gitlow, et al, 1999:171). These should include detailed improvement programmes for effective implementation (Evans and Lindsay, 2002:105).

**Phillip B Crosby** offers a behavioural approach to quality management that focuses on managerial thinking (Evans and Lindsay, 2002:107). He emphasizes conformance to clearly defined and understood requirements and getting things right first time to save costs, through a "Zero Defects" performance standard (Evans and Lindsay, 2002:106). He explained that variation was caused by a lack of attention from psychological preconditioning in which defects are perceived to be inevitable, thus mindsets need to be reconditioned to getting it right first time (Evans and Lindsay, 2002:106).

In 1951 **Armand Feigenbaum** expanded on the application of continuous quality improvement from production to all aspects in business, shifting efforts to preventative measures (Gitlow, et al, 1999:17). He emphasizes the role of leadership by management and planning to prevent quality loss (Evans and Lindsay, 2003:108). This requires the integration of quality management into business planning across all disciplines, and involvement of all (Evans and Lindsay, 2002:108). Success of implementation depends on organizational commitment, continuous training and motivation of the entire workforce, and involvement of all role players (Evans and Lindsay, 2002:108).

**Kaoru Ishikawa** was a pioneer in the Japanese quality revolution. He promoted the bottom up and participative approaches to quality management, through team work and the application of statistical tools in all business analyses (Evans and Lindsay, 2002:109). His philosophy expands on Feigenbaum's integrative approach, as quality should be practiced by all, thus reducing reliance on quality professionals and departments (Evans and Lindsay, 2002:109). He advocates that customer requirements and ongoing education are paramount to quality processes. Quality must be the first priority and should address the root cause, not the symptoms, and the difference between goals and actions to achieve them must be understood (Evans and Lindsay, 2002:109). This can be analyzed through

fishbone diagrams, named after him as "Ishikawa Diagrams" and flow charts (Develin and Hand, 1995:137).

**Genichi Taguchi** also contributed and influenced Deming's work (Evans and Lindsay, 2002:109). He grades quality as the extent to which variation occurs about the nominal specification: smaller variation resembles better quality (Evans and Lindsay, 2002:110). He promoted test designs to identify variables, aimed at minimizing the adverse affects of uncontrollable issues on production (Evans and Lindsay, 2002:111 and Gryna, 2001:301).

## 4. IMPORTANCE OF QUALITY MANAGEMENT

Quality is important to the organization itself (i.e. an internal perspective) and to the broader external environment in which it operates (Gitlow, et al, 1999:173).

#### 4.1 <u>The internal perspective</u>

Quality improvement can reduce costs by lowering waste (Gitlow, et al, 1999:172). Inappropriate or misguided quality improvement initiatives such as inappropriate design adjustments can, on the other hand, increase cost to an organization (Gitlow, et al, 1999:172). Quality may prolong completion, or reduced time frames may detract from the intended quality, thus quality, costs and schedules must be compatible (Gitlow, et al, 1999:172). Assessments must be undertaken regularly to ensure optimum quality management systems (Gitlow, et al, 1999:178).

A hundred percent confidence level in quality rates requires a hundred percent inspection rate, but this is rarely successful, is expensive and impractical in many industries (Beckford, 1998:33). The optimum cost of quality must be determined (Juran and Gryna, 1988:4.20). Where failure costs are high, relative to total costs, and prevention costs are low, quality improvement projects should be undertaken. Where appraisal costs exceed failure costs, the appropriateness of standards may be reviewed, inspections may be reduced and sample audits can be introduced (Gitlow, et al, 1999:188), where quality is inherent to the process and the product (Beckford, 1998:33).

Industry norms on quality costs are seldom available. Quality costs should be assessed against the nature of the industry, client and the company's policy on cost reduction to consumers (Gitlow, et al, 1999: 186, 189 and 190). Some industries (e.g. pharmaceutical) may require quality at all costs. Affluent clients may be willing to pay a premium for outstanding quality, whilst some companies strive to optimize the user's cost (Gitlow, et al, 1999:190). The company's culture (opinions beliefs, traditions and practices), also play a role in addressing quality costs (Gitlow, et al, 1999:192).

Quality management increases productivity, price flexibility, competitive position, demand, profit, customer satisfaction, healthy supply chain relationships, jobs and job security (Gitlow, et al, 1999:14). It reduces rework and customer dissatisfaction and associated costs in losing customers, thus the total cost per unit (Gitlow, et al, 1999:4 and 182).

Poor quality adds costs to firms, their suppliers and customers which result from internal failure-, external failure-, appraisal- and prevention costs. (Gitlow, et al, 1999:178).

Some of these costs may be more obvious than others (such as over-time, inventory costs, space, inappropriate buffers to accommodate standard variations and potential loss of sales) (Gitlow, et al, 1999:184).

*Internal failure costs* are those found prior to delivery to the customer (e.g. scrap; rework; analysis costs; inspections, re-inspections and retesting; negligence and price reductions resulting from poor quality) (Gitlow, et al, 1999:178). It includes costs related to defective inputs such as having to stop production and unfulfilled orders, resulting in dissatisfied customers (Beckford 1998:32).

*External failure costs* occur after delivery to the customer and include warranty charges upon replacing or repairing products under warranty; complaints handling processes and discounts for accepting a substandard product (Gitlow, et al, 1999:179).

*Appraisal costs* result from activities to assess the degree of conformance to quality requirements (e.g. inspections; quality audits; testing equipment maintenance; and testing quality of stock) (Gitlow, et al, 1999:179). These cannot be completely eradicated as inspections are necessary to provide information for decision making and strategic direction (Beckford, 1998:3).

*Prevention costs* relate to attempts to minimize failure and appraisal costs, including quality planning; product reviews; quality audits; supplier quality evaluation and training (Gitlow, et al, 1999:180).

The evaluation of quality concerns, assists in (i) quantifying resultant and subsequent problems if quality is not addressed; (ii) identifying other problem areas; (iii) identifying the exact cause of quality problems; and (iv) creates opportunities to identify cost saving and customer dissatisfaction reduction initiatives (Gitlow, et al, 1999:182).

## 4.2 <u>The external perspective</u>

Quality management is important for economic, social and environmental reasons (Beckford, 1998:3).

#### 4.2.1 Economic reasons

Enablers of global trade such as improved information and transport systems have increased markets, competition and customers' choices, making quality a necessity (Beckford, 1998:5).

Increased competition through global trade has increased low cost strategies, encouraging greater emphasis on differentiation on the basis of quality service (Beckford, 1998:7). Addressing quality problems reduces lost opportunities from an inability to meet requirements, or from imports with perceived better quality (Beckford, 1998:6). Increased quality facilitates international trade investment, which benefits the greater economy (Beckford, 1998:8).

## 4.2.2 Social reasons

Poor quality wastes human capital and talent, which demoralizes individuals and contributes to destructive anti-social behaviour (Beckford 1998:7). Such waste must be minimized to maximize employee satisfaction, thus enhancing productivity (Beckford, 1998:10).

The need for quality is equally applicable to the public sector, as observations have been made of governments and society expressing dissatisfaction with public sector cost and effectiveness (Beckford, 1998:5). The public sector is required to deliver services at the same or lower cost to meet public expectations (Beckford, 1998:10).

## 4.2.3 Environmental reasons

Increased global awareness of the finite availability of natural resources has resulted in greater awareness of environmental considerations, requiring the minimization of waste and damage to protect limited natural resources (Beckford, 1998:8). Environmental management requirements are standardized through the International Standards Organization (ISO 14000) (Burt, et al, 2003:254).

## 5. TOTAL QUALITY MANAGEMENT THEORY

## 5.1 <u>The Philosophy</u>

The quality function has grown from basic manufacturing, to the entire supply chain (Gitlow, et al. 1999:168). Customers, processors and suppliers form an integrated system in which each of these are responsible for quality and commit to engage with each other to ensure continuous improvement (Gitlow, et al, 1999:170). This requires an internal and external perspective on quality (Gitlow, et al, 1999:173), with contributions from all disciplines within an organization (finance operations, marketing, and strategic planning) (Gitlow, et al, 1999:173).

Quality affects all levels of the organization (Beckford, 1998:11). Although quality targets are achieved at operational level, this needs to be done against limits imposed by the organization's strategies, which define the scope of the organization's activities. (Beckford, 1998:12 and 14). Quality cannot be achieved unless it is an inherent part of strategy (Beckford, 1998:13).

Total Quality Management (TQM) philosophy has evolved from the involvement of all stakeholders and processes (Gitlow, et al, 1999:174). TQM is a system of activities to achieve customer satisfaction, empower employees and increase revenue, all at lower costs (Gitlow, et al, 1999:174). It is based on the following principles:

a. Customer satisfaction determines quality, thus requiring proper needs identification from the perspective of the customer (Kanji, and Asher, 1996:1), and a proper understanding of these requirements (Pike and Barnes, 1996:24). All business aspects are aligned to meet customer needs as business goals and customer needs are inseparable (Pike and Barnes, 1996:24).

- b. It is based on a sound understanding of current and required performance measurement, and decisions, problem solving and strategies based on factual information (Kanji and Asher, 1996:2).
- c. The focus is on prevention to reduce costs (Develin and Hand, 1995:6) and facilitate continuous improvement (Kanji and Asher, 1996:5).
- d. Continuous improvement is inherent. Employees must have a behavioural orientation that there is always room for improvement (Develin and Hand, 1995:8). Work processes contain elements of variation that must be reduced through continuous improvement, to achieve quality (Kanji and Asher, 1996:3).
- e. Change is inherent to continuous improvement, thus requiring strong leadership and change management (Pike and Barnes, 1996:77).
- f. People are inherent to continuous improvement processes (Kanji and Asher, 1996:3). People based management is essential to ensure they understand what is required, what needs to be done, how to do it, and be provided with feedback and encouragement to take responsibility (Kanji and Asher, 1996:2). "People work in a system. The job of the manager is to work on the system to improve it continuously with their help" (Deming, in McLaughlin, 1995:35).
- g. The process is managed by interdependent relationships of cross-functional teams (Develin and Hand, 1995:8), with members who are committed to quality, and involves every person, process, function and department (Pike and Barnes, 1996:24).
- h. There is a common view and commitment from top management to make quality the ultimate goal (Develin and Hand, 1995:8). This is promoted in all human activities through measurement and rewards (Pike and Barnes, 1996:24).
- i. Leadership by example requires the removal of employees' fear of management in general by actively removing barriers to cooperation and trust and to encourage teamwork and reward (Develin, and Hand, 1995:10).
- j. Getting it right first time, every time, but taking cognisance of human nature where errors result due to: inadequate time to do things properly; training and incompetence; inappropriate tools; inadequate information and material; human error; and poor motivation (Develin and Hand 1995:10 and 11).
- k. A realization that the benefits of quality management, outweigh the costs (Develin and Hand,1995:12 and Juran, 1988:4.4), thus, from this perspective "quality is free ... as doing things right the first time is always cheaper" (Crosby in Evans and Lindsay, 2002:106).

## 5.2 Enablers

Total Quality Management requires an environment, in which:

a. There is commitment and continued active involvement by top management and their continued active involvement is critical (Juran and Gryna, 1988:22.4).

- b.There is a desire to: Exceed customer requirements; improve the organization's image, employee morale, communication, and documentation; improve the design and manufacturing of products, services and the physical environment; create a common mission, adopt best practice and standardized processes; and produce uniform products at low cost, suited to the needs of the market (Gitlow, 1994:32).
- c.Mission and purpose statements, responsibilities and accountability, and policies on customer-, supplier- and employee involvement are clear (Pike and Barnes, 1996:43).
- d.An appropriate culture with sound change management systems (Pike and Barnes, 1996:43).
- e. Quality management processes are carefully planned and involve middle managers from the outset (Pike and Barnes, 1996:43). Quality improvement programmes require a comprehensive and organized approach (Juran and Gryna, 1988:22.5).
- f. Proper coordination of quality functions (Juran and Gryna, 1988:7.21). In large and unique projects this would be done by a project manager (Juran and Gryna, 1988:7.23).

g.Producing tangible results are fast tracked (Pike and Barnes 1996:43).

## 5.3 <u>Barriers</u>

In spite of the benefits of quality management, many challenges need to be overcome. These include:

- a. Fixation on existing systems and procedures increase resistance to change from current systems (Beckford, 1998:22), and/or reliance on specific techniques that focus only on specific aspects (Gitlow, et al, 1999:224). Values and beliefs are reflected in performance systems and procedures that signal performance priorities to staff. It is difficult to change such entrenched beliefs (Beckford, 1998:22). Set mindsets and inability to change the organizational culture impede change management (Gitlow, 1994:33). Resistance to change limits innovation, thus is a threat to continuous improvement (Beckford, 1998:23).
- b. Organizational politics and influential subgroups within an organization impact on the successes of change management. Factions and/or followers may pursue negative views expressed by such groups (Beckford, 1998:22).
- c. Management perceptions that productivity related measurements indicate superior performance cause them to focus on production rather than quality (Beckford, 1998:22), thus focusing on conformance only and neglecting customer needs (Juran and Gryna, 1988:7.21). Performance and selection criteria need to be redesigned to take customer expectations into account (Beckford, 1998:22).
- d. Penal attitudes towards errors detected, as opposed to learning and improvement opportunity recognition, result in employees not owning up to errors and not wanting

to take responsibility (Beckford, 1998:25) which result in fear of being scrutinized (Gitlow, 1994:33).

- e. Lack of commitment and discipline to change, result in an inability to maintain and sustain momentum (Gitlow, 1994:33).
- f. Resistance to standardization and fear of rigidity result in non-adoption of quality management initiatives (Gitlow, 1994:33).
- g. Resistance to concerns of increased workload (Juran and Gryna, 1988:22.5).
- h. Lack of organization and preparation for change (Juran and Gryna, 1988:22.5) including infrastructure, goals, plans, organization implementation mechanisms, time resources and budgets (Gitlow, et al, 1999:223).
- i. Conflicting targets between quality assurance and production, where these are within the same business unit, may result in quality assurance being sacrificed for the sake of production. Quality assurance components should be independent from production units (Beckford, 1998:26).
- j. Inadequate information systems (from report generation through to executive reporting, and general communications) inhibit effective quality management (Beckford, 1998:26). Systems need to generate the right information, in the right format, at the right time and to the correct users (Beckford, 1998:26).
- k. Understanding and articulation of roles may result in inefficiencies (e.g. decision making too far removed from operations and inability of senior management to focus on higher level strategies) (Beckford, 1998:28).
- 1. Lack of required resources results in implementation difficulties (Gitlow, 1994:33).
- m. Skeptic views on new programs within the organization due to previously failed and/or abandoned attempts (Juran and Gryna, 1988:22.4).
- n. Different management styles create confusion. (Gitlow, 1994:33). Management must set the example and create a culture that quality is a cause for concern (Beckford, 1998:29).
- o. Focusing on short term results, results in the use of existing performance parameters, thus losing sight of the need for continuous improvement (Beckford, 1998:29).
- p. Failure to start small and learn from pilot projects (Gitlow, et al, 1999:223).

## 5.4 **Quality Control Process**

Quality control is a process comprising of a universal sequence of steps used to meet quality standards (Gryna, 2001:141). Deming and Juran (in Evans and Lindsay, 2002:105) define the process as follows: Define what to control; establish measurement units to evaluate data objectively; establish performance standards; conduct a gap analysis

and target specific actions to address the gap. Juran also advocates the use of a detailed programme for improvement, which identifies the need and specific quality improvement projects; ensures support activities and resources are planned; diagnoses causes and remedies to address them; tests effectiveness of solutions; and includes a proper control and maintenance system (Evans and Lindsay, 2002:105).

Self-control is the ultimate form of quality control and requires people to know the job content and technique, know their performance and have a system to regulate this (Gryna, 2001:141). Measurement and establishment of standards are central to this process (Gryna, 2001:133). These should be based on the organization's mission and be informed by the results of benchmarking, balanced scorecards and quality assessments. This information is obtained through employee participation, performance planning and evaluation systems (Gryna, 2001:124). This enables a holistic approach resulting in best practice standards that informs business processes, (including operational quality planning and improvement) and the broader strategic planning within the organization (Gryna, 2001:124).

## 6. AN INTERNATIONAL PERSPECTIVE

Most recent international research relating to low income housing has focused on slums clearance, upgrading of human settlement, and integrated development (International Housing Research Network website). The following international research and applications illustrate quality management in the context of housing:

## 6.1 <u>United States of America</u>

The NAHB Resource Centre (National Association of Homebuilders) has developed a quality assurance programme to assist industry leaders to deliver quality houses. It is the leading resource in America for quality related information in residential construction (NAHB Resource Centre, undated). NAHB Resource Centre, American Department of Housing and Urban Development and other industry stakeholders, have developed quality certification programs. These include independent audits and reviews to verify compliance with quality assurance programs (NAHB Resource Centre, 2005a). The NAHB Resource Centre literature covers a wide range of quality assurance matters, including general information, inspections and partnerships (NAHB Resource Centre, 2005b). These will be discussed briefly in the section below.

## 6.1.1 NAHB Resource Centre Quality Assurance Systems

NAHB Resource Centre advocates that the ISO 9000 quality assurance standard be implemented through the "Deming wheel" system of Plan, Do, Check and Act, (NAHB Resource Centre, 2005a, and Gryna, 2001:127) as indicated in Figure 1, below:



NAHB Resource Centre (2005c) notes that customer expectations in the building industry are increasing. Some builders address this by additional inspections which increase construction costs. The Resource Centre suggests that this can be reduced drastically by "building it right first time" (NAHB Resource Centre, 2005c) (as advocated by Crosby in Lindsay and Evans, 2002:106).

Proper quality plans are needed for this. These should address: Clearly defined specifications and required results; quality craftsmen with training, demonstrated skills, experience and abilities that have been certified and verified; approved materials with performance certification; proper tools and equipment; and a documented process (NAHB Resource Centre, 2005c).

The Resource Centre (2005d) advises that "quality doesn't cost – it pays" (thus supporting Crosby's notion of "quality is free")(Evans and Lindsay, 2002:107). The Resource Centre (2005e) advised that findings from a survey indicated that quality assurance programmes reduced "callbacks" for some contractors by 50%, reduced operating costs, and improved builder satisfaction ratings (NAHB Resource Centre, 2005(e). This involves the inclusion of continuous improvement into work plans (NAHB Resource Centre, 2005d).

A formal quality assurance programme is critical in demonstrating that, in the event of a lawsuit, every reasonable effort has been made to ensure quality construction (NAHB Resource Centre, 2005a). ISO 9000 is often used by lawyers to determine quality negligence. The following are often called into evidence, and are elements of a sound quality assurance system (NAHB Resource Centre, 2005a):

- (1) Well defined specifications (drawings/designs, construction details and materials, tolerances, etc).
- (2) Detailed work procedures.
- (3) Recruitment and qualification criteria of labour.
- (4) Pre-work-, compliance- and completion inspection systems.

- (5) Corrective and evaluation systems.
- (6) Documented proof that the system is applied consistently, e.g. inspection records.

The Resource Centre suggests a, "100%, Zero defects" approach to housing delivery (NAHB Resource Centre, 1997a). Buyers assess quality at the time of delivery. Faith in the builder is lost once customers detect defects before they are fixed. The hundred percent, zero defect approach (by Crosby Evans and Lindsay, 2002:106), in the context of house construction, suggests houses be inspected for defects, documented (snagged) and fixed before final inspection by the customer. This increases customer satisfaction, referral rates and trust, that problems would be addressed, if any, whilst also reducing warranty items to resolve (NAHB Resource Centre, 1997a).

It also recommends the following be maintained on site to ensure high performance:

- (1) Detailed installation instructions (including step-by-step illustrations and work procedures, tolerances, environmental conditions, specialized tools, storage requirements and limitations on use);
- (2) Approved materials lists described in detail (by brand, type, dimensions, etc);
- (3) Craftsmen qualification requirements defined in detail;
- (4) Standard contracts, clearly defining expectations, roles and responsibilities;
- (5) Jobsite inspection forms to be completed at specified inspection points, and to include critical job conditions, materials used and state of satisfaction of work completed; and
- (6) Quality manual, consistent with the requirements of ISO 9000.

(NAHB Resource Centre, 2005f).

The above forms part of ISO 9000 recommended quality assurance programmes, and should address the following:

Quality controls should ensure qualified materials and clear installation procedures are followed, and qualified installers are used. A list should be on site specifying tasks to be performed and person/s responsible. Quantities and qualities of products must be specified and usage monitored and documented. Sales and other contracts must clearly describe work requirements, roles and responsibilities. Competent staff should be available to read the contract and ensure that obligations are fulfilled correctly. Construction specification and specific instructions must be available. Jobsite inspections must be conducted while findings and corrective measures must be documented on checklists. Quality systems and work in progress must be audited periodically to ensure adherence, and to effect improvements.

(NAHB Resource Centre, 1997b and c).

#### 6.1.2 NAHB Resource Centre on Inspections

Continuous improvement should form part of "work in progress" inspections thereby greatly reducing problems on snag lists (punch lists) (NAHB Resource Centre, 2005g). This can be achieved by:

- (1) Inspecting work of all trades against specifications, as work progresses.
- (2) Attending to repairs as work progresses.
- (3) Walking the house often as it nears the completion stage.
- (4) Testing appliances, tubs and fixtures.
- (5) Ensure finer details and clean ups are attended to at defined stages.

(6) Record and review findings to improve systems.

Quality inspection checklists are useful to ensure critical items are addressed. Inspections should be a verification process that work has been completed correctly against designs and specifications and in terms of the scope of work, by qualified personnel, with the correct type, quantity and quality of materials, and that any quality problems have been addressed (NAHB Resource Centre, 1997b). The aforementioned should be included in standardized check lists that should provide information on the site establishment, start date, product description, and state of readiness for work to commence (including suitability of building and environmental conditions that may affect quality) (NAHB Resource Centre, 2005h).

Current non-routine problems may be addressed through "hot spot" checklists that need specific interventions. "Hot spot" check lists and inspections are tailored to address extraordinary situations that could impact on quality performance. Once the problem is resolved, the item is removed from the checklist. (NAHB Resource Centre, 2005i).

Inspection efforts should not be duplicated unnecessarily as these add unnecessary costs. ISO 9000 provides some guidance with regard to inspection frequency, which could reduce dependency on inspections, and "by doing the job right the first time" (NAHB Resource Centre, 1997b).

The Resource Centre (NAHB Resource Centre, 2005j) cautions against the use of building practice that is considered normal, but incorrect (such as incorrect roof ties and truss attachments and framing techniques). Building techniques can vary widely. "Self"-inspection could ensure that a contractor's own practices adhere to recommended building codes (NAHB Resource Centre, 2005j).

The role of inspection staff and supervisors must not be underestimated as they can provide valuable inputs in quality improvement efforts, problem and solution analysis, change management systems and feedback on quality management effectiveness. The responsibility for improving production systems and leading quality improvement should remain with management, but inspection staff and supervisors should be engaged in these efforts (NAHB Resource Centre, 2005k).

Quality inspectors at production level should be transformed to quality managers that take ownership of construction processes and quality improvement initiatives, through reliable processes aimed at delivering defect free units. This involves developing process thinking, problem solving and quality control system skills (NAHB Resource Centre, 20051).

## 6.1.3 NAHB on Partnerships

Leadership is essential to setting consistently high performance standards and achieving quality and performance excellence (NAHB Resource Centre, 2005m). This can be facilitated through partnerships. These should include product manufacturers, as quality products and proper installation are a foundation for quality in the end product (NAHB Resource Centre, 2005f).

Collaborative efforts that focus on skills development also contribute towards quality efforts. This should include joint efforts to secure quality craftsman training, both from

trade schools and product manufacturers; collaborative quality and safety plans that details all resources, qualifications and specifications and inspection requirements; and define inspection and control systems and interaction (NAHB Resource Centre, 1999b).

The Resource Centre supports the PATH initiative (Partnership for Advancing Technology in Housing), that aims to improve housing durability and reduce maintenance cost by 50% by 2010. This includes "reducing the cost of home ownership, improving energy efficiency and environmental performance of new and existing homes and reducing failures due to natural disasters (NAHB, 1999:2). Durability in this sense relates to the expected service life of a house or component parts under standard conditions of use with standard maintenance (NAHB, 1999:3).

Baselines for durability performance must be set, and strategies need to be adopted in partnership with manufacturers and users of building materials. These should include improving the performance of existing products and materials; ensuring selection and use of more durable products; minimizing premature failure due to manufacturing and installation problems; and encouraging preventative maintenance and early detection of maintenance areas needing attention (NAHB Resource Centre, 1999:5-7). The Resource Centre recognizes that home owners and occupants have varied levels of skills in attending to maintenance issues and recommends that businesses consider this as an additional service that could assist owners in extending the durability of their homes (NAHB Resource Centre, 1999:7).

The above illustrates that total quality management is applicable to housing construction and provides many benefits. In spite of this, quality issues still prevail in low income housing, especially rental schemes where landlords refuse to repair and maintain buildings, even though inspections are done (Clampet-Lundquist, 2003:135).

## 6.1.4 Mixed Income Developments and Quality

Smith (2002:2) suggests that mixed income housing developments can de-concentrate poverty and contribute to delivering affordable units of high quality. He states that low income housing in America is stigmatized as poor quality high density developments with standardized designs, providing little private space, for the lowest income groups (2002:10). He suggests that mixed income developments may contribute to high quality units and subsequent maintenance of these developments to a higher standard (2002:11). This is postulated on the theory that such developments need to attract a variety of income groups, thus having to raise the standard to attract higher income earners that seek market rated designs. Likewise maintenance is likely to improve as landlords need to ensure that the expectation of higher income earners are satisfied (2002:11).

This approach requires careful consideration of environmental factors such as the condition of the housing market, nature of the target market, population dynamics, financing, size of project, community dynamics and feasibility of income mixes (Smith, 2002:2).

## 6.1.5 Housing Quality and Health

Krieger and Higgins (2002:758) identify substandard housing as a major public health issue as scientific evidence has demonstrated a relationship between housing and health,

and substandard housing and increased risk of chronic diseases. Substandard housing is associated with the lack of safe drinking water, absence of hot water for washing, ineffective waste and food disposal and carriers of disease (Krieger and Higgins, 2002:758). Crowding and lack of housing in temporary shelters are found to contribute to respiratory diseases and the spread of tuberculosis (Krieger and Higgins, 2002:758).

Conditions resulting in damp, such as overcrowding in units and water penetration, nurture an environment for mites and cockroaches, viruses and molds, which increase respiratory diseases such as asthma, as well as recurrent headaches, nausea, vomiting and sore throats. Children with asthma exposed to these conditions have an increased risk to hospitalization, whilst mouse allergens increase morbidity (Krieger and Higgens, 2002:758), whilst such poor living conditions and health impact on mental health (Krieger and Higgins, 2002:759). Injuries occur more commonly in low income housing due to exposed heating sources, unprotected upper-storey windows and low sills, slippery surfaces, poorly designed stairs and poor lighting; coupled with a lack of resources to repair them (Krieger and Higgins, 2002:759-760).

The above factors result from structural defects that permit entry of cockroaches and rodents; leaking pipes; inadequate food storage and disposal facilities; inefficient thermal qualities; toxic substances such as lead in paint and other volatile particle substances (e.g. particle board and floor coverings); asbestos exposure; and poor ventilation (Krieger and Higgins, 2002:759).

Krieger and Higgins (2002:763) suggest that this calls for enhanced housing codes, to include health factors to new and existing stock, and greater involvement of public health departments. The article however, also demonstrates the need for quality management to be implemented in low income housing and to include health aspects in standards and specifications, thus for public health departments to become partners in housing quality management.

## 6.2. Hong Kong

Environmental management and sustainability has received growing attention in Hong Kong and has been incorporated into government policies. Programmes have been developed to replace old housing stock with more environmentally and financially sustainable housing (Keung and Edmunds, 2004:2), thus improving quality.

The Hong Kong Building Environment Assessment Method (HK-BEAM), has played an important part in achieving these objectives. HK-BEAM was established in 1996 as an independent certification programme aimed at stimulating sustainable and environmental friendly developments and meeting its requirements through "best environmental practice" (Keung and Edmunds, 2004:11 and 2).

HK-BEAM has developed standards for both new and existing developments. (Keung and Edmunds, 2004:3). The most significant environmental issues are assessed at each stage of the building's life cycle, from planning through to construction (Keung and Edmunds, 2004:5). It includes site and locational aspects; material selection (including usage and waste management); energy use; water consumption (including quality and conservation); indoor environmental quality (such as thermal comfort, air, lighting, and

noise); and innovation (Keung and Edmunds, 2004:6). The process of evaluation is summarized in Figure 2 below.

Figure 2 : The HK-BEAM Assessment Process (Adapted from Keung and Edmunds, 2004:4)



HK-BEAM has assisted in increasing the sustainability and efficient use of resources in housing in Hong Kong, through partnerships with all stakeholders in the building industry (Keung and Edmunds, 2004:11). This sustainability is seen as a key to becoming a world class city (Keung and Edmunds, 2004:10).

## 6.3 <u>Singapore</u>

The Singapore government provides low cost housing to low income groups through its Housing Development Board. Its policy (including aspects of design, construction and renewal programmes) is driven by community dynamics and sustainability (Meng and Yin, 2004, paragraphs 1 and 2). It aims to promote community bonding and building by meeting the needs of the community. Developments are aimed at ensuring lifetime homes, which are facilitated through ongoing research into new housing forms to ensure community needs are met (Meng and Yin, 2004, paragraph 3), thus ensuring quality.

Programmes are in place to replace old units, aimed at improving quality and amenities on par with new ones. This is facilitated by pre-cast technology which reduces disturbance of the family, reduces cost and other inconvenience factors, thus increasing the speed of delivery (Meng and Yin, 2004, paragraph 4).

Designs are aimed at improved convenience, accessibility and design efficiency (Meng and Yin, 2004, paragraph 3). Family units are self contained flats with ample living space, a kitchen and bathroom. There are different size options and the needs of the elderly are accommodated in elderly friendly features such as barrier free entry and non-slip tiles (Meng and Yin, 2004, paragraph 3). This is similar to aspects of the Department of Housing's urban renewal programme of renewing old buildings, but this is not as "generous" as the Singapore policy.

#### 6.4 <u>Namibia</u>

Namibia is focusing its low income housing policy on informal settlement upgrades (The World Bank, 2002:7). Quality is controlled in terms of National policy which requires:

(1) minimum sanitation of a communal toilet within 30 meters;

- (2) access to communal potable water within 200 meters;
- (3) roofed structure of durable materials of not less than 6m<sup>2</sup>;
- (4) minimum plot size of 300m<sup>2</sup> unless consented to by the Minister where justified by design, implementation or marketing concepts.

(The World Bank, 2002:8).

In addition to this, the Windhoek City Council has set the following principles and guidelines:

- (1) Services in all development options should be based on reasonable health standards.
- (2) Appropriate technical development levels to be used.
- (3) Reasonable social acceptance and understanding of development concepts and options.
- (4) Promotion of community initiative and responsibility to gradually improve developments, in order to manage and optimize financial and institutional resources.
- (5) Permanent ownership forms to be promoted.
- (6) Minimization of financial risk to the Council and its clients.
- (7) Standardized, yet flexible costing, pricing and administrative systems for land sales and leases to be applied.
- (8) Optimization of all natural, human and financial resources.
- (9) Environmental, social and financial sustainability to be ensured.
- (10) Full cost recovery and "the user pays" should be the underlying principle of low income programmes.
- (The World Bank, 2002:14).

Six different levels of development packages have been formulated, with different levels of services, for different target groups to ensure affordability (The World Bank, 2002:14). The top-down setting of standards/service levels may lead to inappropriate service levels which are not affordable to the greater majority, and waste occurs in the provision of infrastructure and services that people don't need. This highlights the need to involve communities in the planning and implementation of housing schemes that affect them (The World Bank, 2002:18).

#### QUALITY MANAGEMENT TOOLS AND TECHNIQUES

#### **APPENDIX 2**

Quality management should be informed by statistical methods, as it provides a quantitative means for analysing problems, rather than depending on opinions and subjective preferences of individuals (Oberlender, 2000:323). Various authors discuss a range of different tools and techniques, those most commonly referred to in the literature are briefly outlined in the section below.

#### 1 <u>Process analysis</u>

Process analysis outlines systems and helps to identify process and quality problems (Beckford, 1998:227). It can be used to identify standards and measures for critical parts of the process, identify gaps, and unnecessary activities and duplications in processes (Pike and Barnes, 1996:204). Flow charts provide a visual representation of all the steps in a process, links between them, source of inputs and resultant outputs (Develin and Hand, 1995:141). Such a system should factually record and cover the entire process and related activities, and allow for these to be questioned and verified. New processes should not be adopted until all quality problems and causes have been exposed (Beckford, 1998:232).



#### 2 **Quality management systems**

A quality management system is a systematic approach that yields a formal record of an organization's quality management method and provides a basis for measuring and monitoring quality performance (Beckford, 1998:243). The system is certified by a third party as conforming to an acceptable standard, such as the International Standards Organization (Beckford, 1998:243). The system should be accurate, robust and generate meaningful data, thus employees at the "coal face" should be involved in its development, and be committed to the system for success (Beckford, 1998:238). It should contain the organization's quality policy, procedures for implementation and procedures, described in terms of the process, rather than broad functions (Beckford, 1998:240). A record system should be included to monitor adherence to the system (Beckford, 1998:240).

## 3 <u>Statistical method</u>

Data collection and analysis form the basis of quality assurance initiatives (Gitlow, et al, 1999:685). The collection of data may be done on a continuous measurement scale (variable data) or as a result of counting the occurrences of variations to attributes (attribute data). Various tools are available to collect and analyse data (Gitlow, et al, 1999:685). A number of computerized software programmes are available and are able to generate run charts, control charts, histograms, Pareto charts, scatter diagrams and other statistical analyses (Evans and Lindsay, 2002:729).

Statistical process control methods record and monitor the outputs of a system to identify aspects needing improvement (Beckford, 1998:255). It requires a predefined process; established measurement system and predetermined quality characteristics definitions that are understood and agreed to by all (Beckford, 1998:244). The system must indicate what is to be measured, where, recording and reporting method and timeframes (Beckford, 1998:245). It is based on performance limits against which performance is measured, taking cognizance of any input specifications (Beckford, 1998:245). Performance between limits indicates common (normal) variation where the process is deemed to be under control. Points outside the upper and lower limit indicate areas that may need intervention (Beckford, 1998:245). Causes may be common (random/chance types inherent in the process), or special (chronic cases) that need special intervention through quality improvement (Gryna, 2001:499). Gryna (2001:96) advocates that only chronic cases should be addressed through quality improvement projects.

**3.1 Run charts** (Figure 2 below) provide graphic representation of occurrences over time to indicate trends, cycles and other changes over time (Develin and Hand, 1995).



Figure 2 Run chart

**3.2** Control charts (Figure 3, below) are used to indicate variation that exceed set limits (Beckford, 1998:247), and to identify "special causes" needing intervention to reduce variation (Gryna, 2001:499). Upper and lower limits are normally set within 3 standard deviations from the mean (Beckford, 1998:247).

<sup>(</sup>Adapted from Gryna,2001:248)





(Adapted from Evans and Lindsay, 2002:607)

Different types of charts and calculations should be used to indicate defective items or failures of components with reference to attributes, and whether constant samples or varied sample sizes can be taken (Beckford, 1998:247, Gryna, 2001:503). These charts indicate when the number of defective items or components are changing over time and differentiate between common/random variation from real variation caused by changes in a process (Kanji and Asher, 1996:194), as indicated in Table 1 below.

Table 1 : Attribute Control Chart types

	Sample Size	Chart type
Defective	Varied	P chart
units	Constant	NP chart
Component	Varied (by more than 25% of the average sample size)	U chart
Failure	(Kanji and Asher, 1996: 225)	
	Constant (or does not vary more than 25% of the	C chart
	average sample size (Kanji and Asher, 1996:161).	

**3.2.1.1** A Pareto analysis is used to identify the most critical problems to be addressed for maximum impact (Kanji and Asher, 1996:56). The resultant charts (Figure 4), provide a graphic representation of factors in descending order of the frequency of occurrences (Develin and Hand, 1995:137), identify the starting point for problem solving, monitor progress and identify basic causes (Gitlow, et al, 1999:686). It is useful in six sigma approaches to identify critical processes (Gryna, 2001: 57, see also 7.4 below) and in supplier analysis during supplier selection (Gryna, 2001:426).



(Adapted from Develin and Hand, 1995:137)

**3.2.1.2 Histograms** (bar charts) are used to display the frequency distribution of an occurrence through the use of bar charts. It highlights the centre and amount of variation in a sample. It is simple to construct, thus effective in elementary data analysis (Beckford, 1998:251, and Gryna, 2001:244)





(Adapted from Beckford, 1998:252)

**3.2.1.3 Cause and effect diagrams** (Figure 6.1) are used to identify root causes of problems and indicate resultant effects. It allows for a holistic approach to problem identification and points to possible areas for investigation and data collection (Kanji and Asher, 1996:79).With adaptation the model can be used to indicate the potential consequences of proposed actions (Beckford, 1998:248), see Figure 6.2.





(Adapted from Beckford, 1998:250)

#### Figure 6.2 : Solution-effect diagram



(Adapted from Beckford, 1998:250)

**3.2.1.4** Stratification data is presented in stratification charts (Figure 7). Bands of information are presented as cumulative totals of each type of occurrence to indicate which element is incurring the greatest costs, or greatest number of faults (Beckford, 1998:250). These can be used to indicate the relative importance of contributing factors to a process or problem and are typically easier to construct than Pareto charts (Beckford, 1998:250).



- **3.2.1.5** Check sheets provide a simple method for collecting data on the occurrence of defects or values, in a wide range of areas (Kanji and Asher, 1996:164). It is used to collect numerical values of non-conforming aspects for Pareto analysis and/or histograms (Gitlow, et al, 1999:685).
- **3.2.1.6** Scatter diagrams are used in combination with statistical methods to determine whether there is a relationship between two variables (Develin and Hand, 1995:139). Points are plotted on a graph to ascertain whether there is a pattern in the distribution that would allow a line of best fit to be drawn with the same number of points on each side (Beckford, 1998:252).

Figure 8 : Scatter diagrams



(Adapted from Develin and Hand, 1995:139)

## 3.3 <u>Six Sigma, a combined approach</u>

Six sigma combines managerial and statistical techniques to reduce process variation (Gryna, 2001:57). Six sigma status means that a small amount of variation (denoted by a sigma) exceeds specification limits. Six standard deviations are recorded between the process mean and upper and lower limits. The closer the number of variations to six, the better (Gryna, 2001:57). The approach aims to identify, remedy and prevent future defects (Gryna, 2001:58), as does total quality management discussed earlier, thus from this perspective it is a means through which total quality can be achieved.

It comprises five phases which with reference to Gryna (2001:57-96) can be summarized as follows:

Phase 1- Definition phase: Identify and define projects and -teams (Gryna, 2001:58).

*Phase 2-* Measurement phase: Identify key parameters and process characteristics; data collection needs and measures current process capabilities (Gryna, 2001:63).

*Phase 3-* Analysis phase: Collect and analyze past and current performance data to identify causes for variation, including the development and testing of theories (hypothesis) on cause and effect relationships of variations identified (Gryna, 2001:70).

*Phase 4-* Improvement phase: Design a remedy to address causes of variation; test and prove effectiveness; develop and implement change management plan (Gryna, 2001:86).

*Phase 5-* Control phase: Ensure design and implementation of activities for maintenance and improvement of processes (Gryna, 2001:94).

Six sigma requires intensive coordination across organizational units and project improvement teams (Gryna, 2001:200).

## 3.4 <u>Deming wheel</u>

This is a management concept advocated by Deming (a quality management theorist) to satisfy customer requirements by using a continuous cycle of **plan**, **do**, **check** and **action** (see Figure 10, below).

## **Figure 10 : Deming Wheel**



## 3.5 Gannt charts

Commonly used in project management or to illustrate steps and timeframes for activities, as illustrated in Figure 11, below.

Task		Time	frame	e		
No.	Description	1	2	3	4	5
1	Activity 1		•			
2	Activity 2	-				
3	Activity 3					
4	Activity 4					
5	Activity 5					

## Figure 11 : Example of a Gannt Chart

## 3.6 Benchmarking

A benchmark is a reference point against which performance is measured. Such points may include the specification, customer desires, competition, best in the industry, and best in *any* industry (Gryna, 2001:105). Benchmarking is "a continuous, systematic process for evaluating the products, services and work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement" (Spendoli, 1992:8 and Finnigan, 1996:5). It is the measurement of an organization's performance against best practices, determining how these are achieved and using this information for superior

performance (Evans and Lindsay, 2002:413). It involves identifying characteristics to be benchmarked, choosing organizations or components against which to benchmark, collecting and analyzing data, determining who is considered to be the best in class, and then identifying the organization's own performance gap, relative to the benchmark partner (Gryna, 2001:105).

It is a total quality management tool for continuous improvement throughout an organization to achieve higher levels of customer satisfaction and productivity. It provides information for improving almost any business activity (Spendoli, 1992:33), and the key processes involved for competitive advantage (Finnigan, 1996:4). It forces organizations to look outside themselves and compare their business thinking, ideas and inspiration with their external environment, thus learning from the business-, industrial- and competitive environments for self-improvement (Spendoli, 1992:16).

# 3.7 **<u>Qualitative methods</u>**

# 3.7.1 Quality circles

Quality circles (workforce teams) comprise groups of people within each department who meet regularly to address quality problems within their particular components (Gryna, 2001:202). Such teams tend to focus on problems related to the personal well being of workers and their frustrations (Gryna, 2001:202). They have potential behavioural and motivational benefits that can contribute toward increased performance (Gryna, 2001:203).

## 3.7.2 Job design

People need to know the job requirements and how they should be executed, they should be suitable to the job, be trained and skilled thus also indicating the importance of proper selection and recruitment, and should be authorized to make decisions (Gryna, 2001:230). Delegation empowers people and is a motivational tool that could stimulate innovation (which is critical to continuous improvement), and illustrates management's trust in its employees (Gryna, 2001:230).

Continuous feedback on performance through effective appraisal and reward is a key element in improving work quality (Gryna, 2001:232).

## **3.7.3** Organizational structure

Recent trends indicate a shift from function based to processed based organization (Gryna, 2001:405), where quality management is assigned to all functional departments, focusing on internal and external customers. Decisions are delegated to lower levels and suppliers and customers are partners in quality improvement (Gryna, 2001:188). Upper management leads quality and is responsible for quality strategy development and implementation support (Gryna, 2001:190-192). Middle management is responsible for strategy execution; and the workforce for implementation and providing knowledge and experience type inputs (Gryna, 2001:196-7).

These trends increase coordination of quality activities (Gryna, 2001:189). Project teams could facilitate coordination and implementation of quality improvement projects (Gryna, 2001:199). Teams should comprise a project champion from upper management; team leader

responsible for execution; project recorder for administrative functions; and cross functional team members (Gryna, 2001:199-200). Expertise may supplement the team to guide initial processes (Gryna:2001:201).

#### 3.7.4 Supplier development and supply chain management

Poor quality component goods and services impact on the cost of quality (Gryna, 2001:403). Cost- and quality improvement in supply chain inventory management, (such as just-in-time), increase the need for quality inputs, as goods and services are provided only in the quantity and at the time they are required for production (Gryna, 2001:403). This also applies to the service sector (Gryna, 2001:403).

Gryna (2001:404) describes traditional and strategic approaches to purchasing process relationship. **Traditionally** supplier relationships are adversarial, short term, competitive and distrusting. Quality assurance is achieved through inspection on receipt. Many suppliers are used and managed, based on the norm. Purchasing plans are developed in isolation from end-users, and purchasing decisions are based on price. **Strategic** approaches use purchasing to build partnerships based on mutual trust to achieve long term symbiotic relationships that negates the need for incoming inspection. There are few, carefully selected suppliers who are managed individually. Purchasing plans are integrated with end-user requirements. The focus on purchasing decisions is on the total cost of ownership.

Burt, et al (2003:80-87) describe a continuum of three different types of supplier relationships, i.e. transactional, collaborative, and strategic alliances. The characteristics of each are briefly summarized in Figure 12, below.

Continuum of Buyer-Seller Relationships				
	$\overline{\mathbf{v}}$			
Type of Relationship	Transactional C	ollaborative	Allian	ce
		$\rightarrow$		>
Characteristic	Little or no concern about the other party's well-being. win- lose orientation (Burt, et al, 2003:81)	An awareness of interder necessity of coop recognition of the ber provides (Burt, et al, 200	ependence and peration and pefits that this (3:83).	Institutional trust (shared information on strategic plans, relevant cost information and forecasts; risks and rewards addressed openly and informal agreements are viewed as good as formal ones (Burt, et al 2003:84))
Communication	High potential for problems		Systematic a	oproach to enhance communication
Competitive Advantage	Low		High	
Connectedness	Independence		Interdepende	nce
Continuous Improvement	Little		A focus	
Contributions to New Product Development	Few		Many early su	upplier involvement
Difficulty of Exit	Low		Difficult, high	impact
Duration	Short		Long	
Expediting	Reactive		Proactive	
Focus	Price		Total cost	
Level of Integration	Little or none		High or total	
Level of Trust	Low		High	
Number of Suppliers	Many		One or few	
Open Books	No, secrecy		Yes, mutual v	visits, disclosures and assistance
Quality	Incoming inspection, conforman	ce to specification	Designed into	o system, fitness for use, continuous improvement.
Relations	Inward looking, arms length		Concern with	each other's well being
Resources	Few, low skill level		Professional	
Service	Minimal		Greatly impro	ved
Shared Forecasts (Plans)	No		Yes	
Supply Disruptions	Possible		Unlikely	
Technology Inflows	No		Yes	
Type of Interaction	Tactical		Strategic syne	ergy

Figure 12 Characteristics of Three types of Relationships

(Adapted from Burt, et al, 2003:80, and Evans and Lindsay, 2002:405)

 $\wedge$ 

None of these relationships are good or bad (Burt, et al, 2003:81), and few are true to the type (2003:87) (hence a continuum). Collaboration and alliance relationships complement continuous improvement (Gryna, 2001:418). Burt, et al (2003:86-87) indicate several factors to be considered in determining the appropriate type of relationship, summarized in Table 2, below:

Table 2	Criteria in Selecting	an Appr	opriate Relatio	nship
			*	

	Delegation of the
Characteristic	Relationship
Many relatively undifferentiated suppliers providing interchangeable commodities.	Transactional.
Supplier has economic power and is willing to exert this over its customers.	Transactional or very carefully developed and
	managed collaborative.
Both parties recognize potential benefit of alliance but lack human resources.	Collaborative.
Desire to progress to strategic alliance.	Collaborative is the appropriate first step.
Supplier is superior in providing value (including price, innovation, adaptability, capacity,	Alliance.
etc.).	
Supplier is strategic to the organization's performance as it has a major impact on, and	Alliance may be vital.
is a critical element in performance.	
There are potentially great benefits to integrating supplier with the organization (e.g.	Alliance.
shared ideas, resources, product development initiatives).	
Require high degrees of flexibility and speed of performance, due to customer	Alliance.
requirements.	

This indicates that there are areas where strategic alliances may be less appropriate, hence some companies segment their suppliers into categories based on their importance to the business, and manage them accordingly (Evans and Lindsay, 2002: 405).

Supply and purchasing management also involves specification of requirements; selection of suppliers; and management of the supply chain (Gryna, 2001:406). These are discussed briefly in the section below. The relevant specifications in the context of low income housing in South Africa are discussed in the next chapter.

#### (a) <u>Specifications and Standardization</u>

"Specifications and standardizations are related topics in supply chain management" (Burt, et al, 2003:237).

"*Specifications* are targets and tolerances determined by designers of products and services. Targets are ideal values for which production is to strive; tolerances are specified because designers recognize the impossibility of continuously meeting targets in manufacturing (Evans and Lindsay, 2002:13). The degree of conformance to specifications, within the prescribed tolerance of deviation, is a means of defining quality (Evans and Lindsay, 2002:13).

Specifications are broadly categorized as simple or complex. Most firms use a combination. Specifications must be clear for the correct procurement of goods and services. They should concentrate on minimum requirements for cost effectiveness, as unnecessary precision adds risk and costs to suppliers, which in turn increases costs to the purchasing firm. This can be countered through standardized products (Burt, et al, 2003:251).

*Standardization* is related to specification and can reduce cost and enhance quality. (Burt, et al, 2003:253). It is performance goals for product and process features that are

legitimate, customer focused, measurable, understandable, aligned and equitable (Gryna, 2001:132). ISO defines it as "documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products and services are fit for their purposes (Evans, et al, 2002:132). It is "a uniform identification that is agreed on" (Burt, et al. 2003:252).

Two broad types are found : (i) Industrial standardization establishes agreed uniform specifications for "define characteristics of quality, design, performance, quantity, service and so on", and (ii) Managerial standardization focuses on operating practices, procedures and systems" (Burt, et al, 2003:152). It is a means of reducing the number of variations in materials and components to reduce costs (Heizer, et al, 2004:424). Three sources exist: international; national and industry; and company standards (Burt, et al, 2003:253).

#### (1) International standards

The International Standards Organization (ISO) develops standards through its technical committees that are usually accepted world wide. These are developed through consultation with other national standards authorities such as the American National Standards institute (ANSI), German Institute for Standards; and British Standards Institute (Burt, et al, 2003:253). These standards have facilitated international trade as it provides a benchmark for acceptable quality process (ISO 9000) and environmental (ISO 14000) standards world wide (Burt, et al, 2003:254). The content of the ISO 9000 series is summarized in Table 3, below.

ISO	Reference	Content
Code		
9000		Quality Management Systems - Fundamentals and Vocabulary.
9001		Quality Management Systems - Requirements.
9004		Quality Management Systems – Guidance for Performance Improvement.
19011		Environmental Management.

Table 3 : ISO: 9000 Standards

(Adapted from Evans and Lindsay, 2002:133 read with Burt et al, 2003:254)

#### (2) National and industry standards

Many countries develop their own standards with industry stake holders, and taking cognisance of international standards (Burt, et al, 2003:254). In the South African context, this includes the South African National Standards (formerly SABS).

#### (3) Company standards

Companies may develop their own standards (Burt, et al, 2003:254). The National "*Norms and Standards for Low Income Housing*" of the National Department of Housing is such a standard.

#### (b) <u>Selection of suppliers</u>

The selection of suppliers involves "make or buy", and "in-source or outsource" decisions (Gryna, 2001:409). Outsourcing could facilitate superior quality and lower costs where an organization cannot easily develop or maintain elements. Core competencies should not be outsourced as this could expose the organization to exploitation (Gryna, 2001:410). Supplier selection (in addition the relationships issues outlined in Figure 2.8 and Table

2.2, above), should be based on: reputation of the supplier; qualification testing/screening (e.g. samples) facilities survey and supplier databases (Gryna, 2001:411).

Selection processes should consider the supplier's quality survey and evaluation processes (e.g. quality certification, warranties and inspection results of the product) (Gryna, 2001:412). Assessment criteria will depend on the product or service to be procured (Gryna, 2001:412). It may include management philosophy, commitment to quality, design aspects, manufacturing facilities and management, purchasing policies, quality management and coordination, inspection and tests, data and information management, and personnel performance results (Gryna, 2001:413). ISO9000 could assist such surveys (Gryna, 2001:414).

#### (c) <u>Management of the supply chain</u>

Management of the supply chain is affected by the quality of the relationship with suppliers and selection criteria (Gryna, 2001:428). Trends are moving towards partnerships in supply chain management and quality (Gryna, 2001:415). These partnerships can be facilitated through joint economic and technological planning (Gryna, 2001:416) and cooperation in execution of contracts (Gryna, 2001:418).

Joint economic planning should identify value adding activities rather than focusing on conformance to specification, to improve or maintain quality at lower costs. It should reduce ownership costs by identifying costs over the life cycle of the product to identify opportunities in order to reduce these in the interest of both partners (Gryna, 2001:416).

Joint technological planning should strive for a shared understanding of all requirements, (specifications and interpretations, processes, quality control and inspection requirements) and systems that are required to provide continuous and timely feedback, and responses (Gryna, 2001:417).

Effective supply chain management requires proper supply, demand and logistics management (Burt, et al, 2003:622). *Supply management* includes the effective management of suppliers, supplier networks and relationships with them (Burt, et al, 2003:623). *Demand management* seeks to ensure effective planning and management of information for procurement, deliveries and processes, between buyers and suppliers, to ensure a continuous flow of goods and services at the time, place and quantities in which they are needed (Burt, et al, 2003: 627). *Logistics management* focuses on the effective flow of goods from the point of origin, through the supply chain, to consumption (Burt, et al, 2003:634). Organizations achieve different levels of mastering world class supply chain management (Burt, et al, 2003:7), as summarized in Figure 13, below:

			World Class	
			Strategic sourcing	
			<ul> <li>Monitoring supply environment</li> </ul>	
		<u>Proactive</u>	<ul> <li>Understand key supply industries</li> </ul>	
		Coordinate procurement system	<ul> <li>Develop and implement commodity strategies</li> <li>Commodity teams</li> </ul>	
		Involved in development of requirements	<ul> <li>Supply base by design</li> </ul>	
	Mechanical     Transactional focus	<ul> <li>Fulfil social responsibilities</li> <li>Plan for recurring requirements</li> </ul>	<ul> <li>Time-based competition</li> <li>Manage risk</li> </ul>	
Clerical		<ul> <li>Develop Suppliers</li> </ul>	<ul> <li>Leverage supplier technology</li> </ul>	
<ul> <li>Process paperwork</li> </ul>		<ul> <li>Near defect free materials and</li> </ul>	<ul> <li>Virtually defect free materials</li> </ul>	
		services	and services	
	<ul> <li>Not involved in key source selections</li> </ul>	Active in source selection	<ul> <li>Integrated supply strategy</li> </ul>	
Confirm actions of others	<ul> <li>React to requisitions</li> </ul>	Long term contracts	<ul> <li>Develop and manage alliances and networks</li> </ul>	
Emphasis : Convenience	Emphasis : Purchase price	<ul> <li>Emphasis : cost, quality, timeliness</li> </ul>	Emphasis : total cost	
Relationships : Personal	<ul> <li>Relationships</li> <li>Transactional/adversarial</li> </ul>	<ul> <li>Relationships : Transactional and collaborative</li> </ul>	<ul> <li>Relationships: Transactional, collaborative, and alliance</li> </ul>	
Bottom-line impact :	<ul> <li>Bottom-line impact:</li> </ul>	<ul> <li>Bottom-line impact : Profit</li> </ul>	<ul> <li>Bottom-line impact : Increase</li> </ul>	
- Reporting : yony low lovel	- Revenue neutral	- Poporting : Upper management	- Reporting: Mombor executive	
- Reporting . very low level		- Reporting . Opper management	aroun	
Data: Not available	Data: Used to expedite	<ul> <li>Data Facilitates sourcing and pricing</li> </ul>	<ul> <li>Data: Facilitates strategic</li> </ul>	
	Computers process     paperwork	e-Commerce	e-Commerce II	
1 2	3 4 5	6 7 8	9 10	
World Class Supply Chain Scale				

## Figure 13. The Progression to World Class Supply Chain Management

(Adapted from Burt, et al, 2003:8).

Supply chain quality control is an integral part of the process and focuses on ensuring cooperation in the execution of contracts, supplier certification and rating, and quality measurement for supplier relationships (Gryna, 2001):418. Supplier product delivery is typically evaluated through different levels of inspection, as summarized in Table 4, below:

 Table 4
 Methods of evaluating supplier product

Method	Approach	Application
100% inspection	Every item is evaluated against some or all elements in the specification.	<ul> <li>(1) Critical items where costs is justified by cost of risk of defects.</li> <li>(2) To establish quality level of new suppliers.</li> </ul>
Sampling	Sample selection based on predefined sampling plan, and decision made to accept or reject, based on sample.	Important items where supplier has good quality track record.
Identifying inspection	Product examination to ensure correct delivery, only.	Less important item where quality record and supplier laboratory reliability has been established
No inspection	Self explanatory.	Standard, non-critical items, not used in the product.
Supplier data (certification)	Supplier data or certification is used, thus no inspection based on certification from supplier.	Items where supplier has strong quality control record.

(Adapted from Gryna, 2001:419)
The choice of evaluation method will depend on factors such as (Gryna, 2001:420):

- (1) Supplier's track record;
- (2) Importance of the component part in overall performance and/or later operations;
- (3) Warranty or use history;
- (4) Supplier process capability and overall capacity;
- (5) Nature of the process;
- (6) Product homogeneity (e.g. greater homogeny requires smaller sample sizes); and
- (7) Availability of required inspection skills, equipment and resources.

Proper measurement of the supplier, coupled with communication, feedback and awards, is critical (Evans and Lindsay, 2002:405). This requires ongoing surveillance and rating of supplier quality with appropriate measures (Gryna, 2001:419). These measures may include percentage of product not conforming; overall product quality; delivery against schedule; cost of defective products (including hidden cost) against purchase price), and other quantitative means that reflect critical supplier elements in relation to business outputs (Gryna, 2001:423).

#### SUMMARY

Recent trends view quality management as an integrative process that involves the entire supply chain. It is applicable to both products and services, and both public and private enterprises. Evidence of its applicability to housing is found in the code of Hammurabi, circa 2000BC.

There are a number of tools and techniques available to assess quality and to set procedures in place to ensure continuous improvement. These should not be used in isolation, but should be combined to ensure proper analysis and appropriate application. The quality management process, however, cannot succeed unless there is sufficient and continued support from top management to the extent that quality management must be part of the organization's strategy, implementation and measurement systems.

There appears to be a progressive move towards partnerships with suppliers, but the nature of the task at hand, complexity, and capacity issues need to be evaluated first to assess the appropriate relationship type. Ideally, quality must be planned throughout the supply chain and integrated between buyers and suppliers at the point of interface. Standards and specifications have a role to play in ensuring performance, both from the perspective of the customer, and evaluation of suppliers, to ensure customer requirements are met.

### SUMMARY OF PROCUREMENT LEGISLATION

(Adapted from the Department of Housing, User's Guide to standardized procurement documentation, 2002.)

#### Table 1: An overview of procurement legislation in South Africa

Specification	Reference to Procurement	Applicability	Comment
State Tender Boa	rd Act (Act 86 of 1968)		
	This Act provides for the regulation of the procurement of supplies and services for the disposal of moveable property of, and the hiring or letting of anything or the acquisition or granting of any right for or on behalf of, the state and to that end establishes a State Tender Board and provides for the establishment of a regional tender board.	National and provincial departments	Provincial procurement is governed by provincial legislation, which in the main, are modelled on the State Tender Board Act. The cabinet of the government of South Africa resolved in November 2000, to repeal the national and provincial tender board acts.
Local Governme	nt Transitional Act (Act 209 of 1993)		
10G (5)(a)	A municipality is required to award contracts for goods and services in accordance with Section 217 of Act 108 of 1996. The Act requires that the granting of preferences be	Local sphere of government	
To (c)	made public and permits municipalities to dispense with the calling for tenders in the case of an emergency or of a sole supplier or within such limits as may be prescribed by national law. Sets out restrictions placed on councillors and officials		
10H	with respect to any interests which they may have or benefits derived through contracts which are awarded.		
Constitution of th	ne Republic of South Africa (Act 108 of 1996)		
217	Procurement must be conducted in accordance with a "system which is fair, equitable, transparent, competitive and cost effective." An organ of state must implement a procurement policy providing for categories of preference in the allocation of contracts and the protection or advancement of persons, or categories of persons disadvantaged by unfair discrimination in accordance with a framework contained in national legislation	All organs of state	

Public Finance M	lanagement Act (Act 1 of 1999)		
38(a) and 51(a) 76(4)	Accounting officers (head of departments / CEOs) and Accounting Authorities (boards / CEOs) are required to ensure that their organisations have in place an appropriate procurement and provisioning system which is fair, equitable, transparent, competitive and cost effective; effective, efficient and transparent systems of financial and risk management and internal control and a system for properly evaluating major capital projects prior to a final decision on a project. The National Treasury may make regulations or issue instruction concerning the determination of a framework for an appropriate procurement and provisioning system.	All organs of state, except in the local sphere of government.	A Municipal Finance Management Bill (MFMB), which mirrors the PFMA, is currently before parliament.
Preferential Procu	rement Policy Framework Act (Act 5 of 2000)		
All	This Act gives effect to Section 217 of the Construction by providing a framework for the implementation of the procurement policy embedded in the Constitution	All organs of state (SOEs at discretion of Minister)	
*Construction Indu	ustry Development Board Act (Act 38 of 2000)		
5(1)(a) and 5(3)	The CIDB is empowered within the construction industry to promote and implement policies, programmes and projects aimed at procurement reform, standardisation and uniformity in procurement documentation, practices and procedures within the	All organs of state which engage in construction industry related procurement.	The Construction Industry Development Board (CIDB) has only recently been established and must within three years of their establishment establish the
5(2)	framework of the procurement policy of government; and best practices. The CIDB is charged with the establishment and maintenance of a national register of contractors which		registers of contractors and projects and, within a reasonable period thereafter, establish a best practice contractor recognition
5(4)	facilitates public sector procurement and a register of projects. It may also establish a register of suppliers, manufactures or service providers in the construction		scheme.
16 and 18	industry. The CIDB must publish a code of conduct for all construction-related procurement and all participants in the procurement process and may implement		
18 and 22	programmes aimed at standardisation of procurement documentation, practices and procedures. The Minister of Public Works must prescribe the manner in which public sector contracts may be invited, awarded or managed within the framework of the register and policy on procurement. Only contractors who are registered with the CIDB are permitted to undertake, carry out or complete construction works or a portion thereof. All construction contracts above a prescribed value must be recorded in the register and be subjected to a best practice project assessment.		

(\*Note : The Construction Industry Development Board Regulations have not been included in the Department's Documents. The Regulations are published under Notice 63 of 2004, government Gazette 26427. These are aimed at ensuring uniformity, transparency and predictability of procurement in construction processes.

## LIST OF STANDARDIZED PROCUREMENT DOCUMENTS : DEPARTMENT OF HOUSING

#### **1. SUMMARY OF MINIMUM STANDARDS FOR PROCUREMENT LOW INCOME HOUSING** (Adapted from Department of Housing User's Guide to Standardised Procurement Documents)

These include the minimum standards for:

- (1) issuing, receiving and evaluating tenders, including preferencing requirements;
- (2) provides standard conditions of tender that are suitable for all methods of evaluation and preferencing i.r.o housing;
- (3) identifies professional services, engineering and construction works and standards of key outputs, and desired minimum performance standards in respect of each output;
- (4) returnable documents and format of submission;
- (5) drafting contracts;
- (6) performance requirements and measurement;
- (7) pricing instructions and schedules

#### 2. SPECIFICATION AND TENDER DOCUMENTATION

#### Table 1: Documents that relate to the Tender

Number	Document	
Part 1:Tendering procedures:		
T1.1	Tender Notice and Invitation to Tender	
T1.2	Tender Data	
Part 2: Returnable documents:		
T2.1	List of Returnable Documents	
T2.2	Tender Schedules	

#### Table 2: Documents that relate to the Contract

Number	Document
Part 1: Agree	ement / Contract Data
C1.1	Form of Offer and Acceptance
C1.2	Contract Data
C1.3	Forms for Adjudicators Appointment
C1.4	Forms of Securities
Part 2: Pricir	ng data
C2.1	Pricing Instructions
C2.2	Activity Schedule / Bill of Quantities
Part 3: Scope	e of Work
C3	Scope of Work
Part 4: Site in	nformation
C4	Site Information

	tenuers				
, T	olumes		Contents		
Number	Description	Number	Heading		
Volume I	Tendering	Part 1: Tenderi	ng procedures		
	procedures	T1.1	Tender Notice and Invitation to Tender		
		T1.2	Tender Data		
Volume 2	Tender	Part 2: Returna	ble documents		
	Returnables	T2.1	List of Returnable Documents		
		C1.1	Form of Offer and Acceptance		
		C1.2	Contract Data (if relevant)		
		C2.1	Pricing Instructions		
		C2.2	Activity Schedule / Bill of Quantities		
		T2.2	Tender Schedules		
Volume 3	Contract	Part 1: Agreem	ent and		
		<b>Contract Data</b>			
		C1.2	Contract Data (if not included in the above)		
		C1.3	Forms of Securities		
		C1.4	Forms for Adjudicators Appointment		
		Part 2: Pricing	data		
		Part 3: Scope of	f Work		
		C3	Scope of Work		
		Part 4: Site info	rmation		
		C4	Site Information		

# Table 3:Standard Headings and Sequencing of Documents when calling for<br/>tenders

## Table 4: Descriptions of component documents

Contents		Function and broad outline of contents				
Number	Heading					
	·	TENDER				
Part1: Tender	ing procedures					
T1.1	Tender Notice and Invitation to Tender	Alerts prospective contractors to the nature of the supplies, services or engineering and construction works required by the employer and should contain sufficient information to enable them to respond appropriately.				
T1.2	Tender Data	Provides information to tenderers about the procedures that are to be observed during the tendering stage and what documentation they need to submit with their tenders, failing which their tenders may be rejected.				
Part 2: Return	able documents					
T2.1	List of Returnable Documents	Ensures that everything the employer requires a tenderer to submit with his tender is included in, or returned with, his tender submission.				
T2.2	Tender Schedules	Contains documents that are required for the purpose of evaluating tenders, some of which will be included in the subsequent contract.				
		CONTRACT				
Part 1: Agreen	nents and contract data					
C1.1	Agreement, Tender and Acceptance	Establishes the offer and acceptance				
C1.2	Contract Data	Establishes the terms that collectively describe the risks, liabilities and obligations of the contracting parties and the agreed procedures for the administration of the contract.				
C1.3	Forms for Adjudicators Appointment	Establishes the appointment and terms of reference for adjudicators.				
C1.4	Forms of Securities	Provides the securities required by the employer				
Part 2: Pricing	g data					
C2.1	Pricing Instructions	Sets out the way in which items are to be measured and priced.				
C2.2	Activity Schedule / Bill of Quantities	Records the contractor's prices for providing supplies / services / engineering and construction works in terms of the contract.				
Part 3: Scope	of Work					
C3	Scope of Work	Identifies the supplies, services, or engineering and construction works which are to be provided during the execution of the contract and establishes any requirements and constraints relating to the manner in which the contract is to be executed. (Management, resource, construction and material specifications are included under the Scope of Work)				
Part 4: Site i	information (engineering and construction					
works contrac	ts only)					
C4	Site Information	Describes the site as at the time of tender to enable the tenderer to price his tender and to decide upon his method of working and programming				

Contents		Engine	ering an	<u>nd</u> Varles C				Land ac	quisition
Number	Heading The sector of the sect				contract				
Nulliber	ireading	-	T P	radition replann Contrac	al ed t		ti		
		Turnkey Contrac	Short contract	ECC2	Development	Services contrac	Project agreeme	Land purchase	Land availability
STANDAR	D HEADINGS OF DOCUMENTS THAT RI	ELATE	TO TH	E TENL	DER				
T1 1	Tenden Neties and Institution to tenden						v		
11.1 T1.2	Tender Notice and invitation to tender	N	N	N	N	N	A V	N .	N
T1.2		Ň	N,	N	Ň	Ň		Ň	N
11.3 Dant 2. Data	Standardised conditions of tender	Ŷ	Ň	Ŷ	N N	Ň	Λ	٦	Ŷ
T2 1	List of Returnable Documents	2	1	1		1	v	1	1
T2.1	Tender Schedules	<u> </u>	N 1	N N	Y	V	1	V	V
12.2	Certificate for authority of signatory	1	1	1	1	1	x	x	x
	Certificate of attendance at clarification meeting	*	x	x	x	J	X	X	X
	Record of addenda to tender documents	1			x	x	X	X	X
	Form of intent to provide a performance bond	Ĵ	?	1	x	X	x	X	X
	Proposed subcontractors	,	X	Ĵ	X	X	X	X	X
	Quality plan	Ĵ	X	x	X	X	X	X	X
	Provision of samples	?	?	?	X	X	X	X	X
	Certificate of attendance at site meeting	٠ ا	Ň	٠ ا	1	X	X	X	X
	Basis of Design (Design / build and turnkey contracts)		X	x	X	X	X	X	X
	First programme method ands method statement	1	?	√	X	X	X	Х	Х
	Management plan	Ń	?	Ń	X	X	X	Х	Х
	Health and safety plan	Ń	?	?	X	X	X	X	X
	Record of addenda to tender documents	Î	1	√	√	X	X	X	X
	Preference schedule (direct preference)	?	?	?	1	X	X	Х	Х
	Preference schedule (direct preference (generic)	X	x	X	X	1	X	X	X
	Preference schedule (direct participation) (generic)	X	X	x	X	V	X	Х	Х
	Preference schedule (direct participation using the SABS 1914-4 specification)	?	?	?	X	X	X	X	X
	Preference schedule (direct participation using the SABS 1914-5 specification)	?	?	?	X	X	Х	X	X
	Targeted Enterprise Declaration Affidavit (S&ME)	?	?	?	X	X	X	X	X
	Targeted Enterprise Declaration Affidavit (SBE/ WBE/ EE)	?	?	?	√	X	X	X	X

#### Table 5: Standardised procurement documents associated with the Project Linked **Subsidy Housing Developments**

Notes:

√ X ?

Standardised document in suite to be used No document required Standardised document in suite may be used if appropriate / necessary

Contents		Engine	eering a	nd				Land ac	quisition
		Const	Construction Works Contract				contract		
Number	neading		T P	radition replann Contrac	al ed t		ti		
		Turnkey Contrac	Short contract	ECC2	Development	Services contrac	Project agreeme	Land purchase	Land availability
STANDAL	RD HEADINGS OF DOCUMENTS THAT RI	ELATE	TO THI	E CONT	RACT				
Part 1: Agr	eement and Contract Data	, ,				,			
C1.1	Form of offer and acceptance	V	٦	٦	٦	٦	٦	1	√
C1.2	Contract Data	ECC2	ECSC1	ECC2	ECSC1	PSC2	ECC2	Purpose written	Purpose written
C1.3	Forms for Adjudicators Appointment	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	√	Х	Х
C1.4	1.4 Form of securities		?	1	Х	X	X	X	X
Part 2: Pric	ing Data								•
C2.1	Pricing instructions	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
C3.2	2 Pricing schedules		√	$\checkmark$	$\checkmark$	√	_ √		
Part 3: Sco	pe of work	, , ,						-	1
C3	Scope of work	√ √	٦	٦	V	٦	V	Х	Х
	Subsidy Administration	X	X	X	X	X	V	X	X
	Specification for Construction and management requirements pertaining to the NHBRC Warranty Scheme	?	?	?	X	X	√	X	X
	Schedule of Actual Cost	X	Х	Х	Х	X	1	X	Х
	Programme for Housing Development	X	X	Х	Х	Х	$\checkmark$	Х	Х
	Draw Down Forecast	X	Х	X	X	X	$\checkmark$	X	Х
Part 4: Site	Information	, , ,						-	1
C4	Site Information	√ √	٦	٦	٦	٦	V	Х	Х
	Annexure for Land acquisition agreement	?	X	X	X	X	V	Х	Х
	Annexure for Municipality's undertakings to supply and install bulk connector services and take over installed services.	?	X	X	X	X	1	X	X
	Annexure for NHBRC Project Enrolment Certificate	?	X	X	X	X	1	X	X
	Annexure for Phase 1 geotechnical investigation report.	?	X	X	X	X	1	X	X
	Annexure for Environmental impact assessment report	?	X	X	X	X	1	X	X
	Annexure for Social Compact Agreement	?	Х	Х	X	Х	1	Х	Х

Notes:

√ X ?

Standardised document in suite to be used

Standardised document in suite to be used
 no document required
 Standardised document in suite may be used if appropriate / necessary
 ECC2 = NEC Engineering and Construction Contract 2<sup>nd</sup> Edn 1995
 ECSC1= NEC Engineering and Construction Short Contract 1<sup>st</sup> Edn 1999
 PSC2= NEC Professional Services Contract 2<sup>nd</sup> Edition June 1998

# SUMMARY OF STANDARDS SOUTH AFRICA (SANS) PROCUREMENT SPECIFICATIONS

### Table 1 : SANS Procurement Specifications

SANS	Description
Number	
*294	Construction procurement processes, methods and systems
*10403	Formatting and compiling of construction procurement documents
*10306	Implementing preferential procurement policies using targeting
	procurement procedures
*1914	Family of standards for targeted procurement
*10120	Code of practice for use with standard specifications for civil engineering
	construction and contract documents

\*Note : The National Housing documents have not been updated to reflect this standard.

#### SUMMARY OF GEOTECHNICAL REQUIREMENTS INVESTIGATION

Adapted from the Department of Housing Standard Procurement Specifications, also obtainable from the NHBRC website at

http://nhbrc.org.za/SubsidySector/TechnicalDocuments.htm, as accessed on 20 September 2005 and 28 August 2006).

#### 1. GEOTECHNICAL INVESTIGATION ACTIVITIES FOR GOVERNMENT FUNDED LOW INCOME HOUSING PROJECTS

The specifications outline the following activities:

- (1) Evaluation of the geology and hydrogeology of the site.
- (2) Examination of existing geotechnical information pertaining to the site.
- (3) Excavating or boring in soil or rock.
- (4) In-situ assessment of geotechnical properties of materials.
- (5) Recovery of samples of soil or rock for examination, identification, recording, testing or display.
- (6) Testing of soil or rock samples to quantify properties relevant to the purpose of the investigation.
- (7) Evaluation of geotechnical properties of tested soils
- (8) Reporting of the results

#### 2. SUMMARY OF CONTENT OF GEOTECHNICAL SPECIFICATION FOR GOVERNMENT FUNDED LOW INCOME HOUSING PROJECTS

(Adopted from the Department of Housing's Standard Procurement Documents)

The specifications contain:

- (1) minimum qualification and experience of the professional conducting the reports in the various types of geotechnical investigations
- (2) objectives and key outputs for each stage of the investigations;
- (3) classification of risks of doline and specified size sink hole forming
- (4) classification of risk characterization and anticipated number of ground-movement;
- (5) minimum requirements for the entire process (objectives, inputs, processes and outputs) of the geotechnical investigations, including the following:
- (6) consultation with relevant organizations
- (7) data input, collection and analysis requirements
- (8) geotechnical classification and scale of favourability of the site;
- (9) field work and testing; and
- (10) very detailed reporting requirements, including standard headings, content, presentation, special precautionary measures, and attachments (such as maps), specifically aimed at obtaining risks and precautionary measures for excavation, sanitation and founding conditions and soil suitability.

#### SUMMARY ENVIRONMENTAL ASSESSMENT SPECIFICATIONS

(Adapted from the Department of Housing Standard Procurement Specifications, also obtainable from the NHBRC website at

http://nhbrc.org.za/SubsidySector/TechnicalDocuments.htm, as accessed on 20 September 2005 and 28 August 2006).

The specification contains :

- (1) objectives for each stage of the environmental impact assessment;
- (2) key outputs;
- (3) qualification criteria of professionals engaging in the process;
- (4) Minimum requirements for each stage of the process (pre feasibility scan, scoping, impact report and management plan phases);
- (5) Reporting requirements in respect of inputs, processes and outputs; and
- (6) Application requirements, including investigations, motivation, consultation, recommendation and feedback.

SUMMARY OF STANDARDS AND SPECIFICATIONS FOR ENGINEERING SERVICES

#### 1. Department of Housing norms and standards

Table 1 : Department of Housing minimum norms and standard i.r.o engineering services

Type of service	Minimum Level
Water	Single standpipe per erf (metered)
Sanitation	Ventilated Pit Latrine per erf
Roads	Access to each erf with graded or gravel paved roads
Strom Water	Lined open channels
Street lighting	High mast security lighting for residential purposes where this is
	feasible and practicable, on condition that such lighting is not
	funded by CMIP or funding available form other sources

#### 2. SANS specifications

Table 2 : SANS Civil Engineering Design and Construction Specification
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SANS	Description
Number	
1200	Civil engineering construction standards
	Design of buried pipelines
*0102	Pipe materials
*010252 <sup>2</sup>	Water supply and drainage for buildings
*102993	Development, maintenance and management of ground water resources

\*<u>Note</u>: 1 These standards have not been updated in the Department of Housing Documents.

- 2 SANS 010252 *Water supply and drainage for buildings*, has legal status as it was proclaimed in the Government Gazette No. 22355, 8 June 2001 Regulation Notice R509. (www.stansa.co.za/watersuply.aspx)
- 3 SANS 10299 Development, maintenance and management of ground water resources, was developed specifically to address South African needs to establish a framework in which ground water should be managed, specifically with regard to the location, siting, design, construction, drilling, rehabilitation and decommissioning of boreholes and associated pumps. (www.stansa.co.za/TOWARDSBETTERGRONDWATERUSE.aspx

#### 3. **CSIR**

CSIR "Guidelines for human settlement planning and design - The Red Book"

These are not standards in the true sense as it is not designed to be enforceable absolute limits, but have informed the Department of Housing's specification for engineering design and construction. The guidelines are performance based suggestions for professionals involved in human settlement planning and design. It is aimed at ensuring quality town planning layouts and engineering designs, taking cognizance of planning and transport nodes, land use planning, minimum property sizes, distances, open space types, quantities, transport matters (including access), sanitation and water designs, etc.(CSIR, 2000:2-5).

#### HOUSE CONSTRUCTON SPECIFICATION : DEPARTMENT OF HOUSING

(Adapted from the Department of Housing Standard Procurement Specifications, also obtainable from the NHBRC website at

http://nhbrc.org.za/SubsidySector/TechnicalDocuments.htm, as accessed on 20 September 2005 and 28 August 2006).

- (1) Acoustics (privacy, reduce noise penetration and annoying emission);
- (2) Condensation (applicable to the Southern Cape Condensation Area);
- (3) Construction accuracy (dimensions and limits);
- (4) Energy efficiency;
- (5) Fire safety (ease of escape, mitigation of spread, suppression and rescue elements);
- (6) Functionality (in terms of spaces, uses, ease of access, indoor visual environment, natural ventilation and accident safety);
- (7) Internal wall finishing;
- (8) Minimum measurements/dimensions/distances;
- (9) Permissible deviations (i.r.o concrete work; masonry and reinforcement in masonry; drainage; structural timber members; pre-cast concrete elements before and after erection);
- (10) Sanitation;
- (11) Solar radiation;
- (12) Storm water disposal;
- (13) Structural durability;
- (14) Structural safety;
- (15) Structural serviceability performance (e.g. design life minimum of 50 years for structural system and non-accessible components, 25 years for repairable/replaceable components such as roofing material);
- (16) Tests (general; performance; structural safety; serviceability and durability; and rain penetration test for roofs and walls respectively;
- (17) Thermal Performance;
- (18) Water penetration (rain and other moisture elements); and
- (19) Water saving measures.

#### SUMMARY OF CONTENT : CODE OF APPLICATION OF THE NATIONAL BUILDING REGULATIONS (SABS 0400:1990) – NOW SANS 10400 (currently under review. Amendments anticipated to be implemented by 2011)

- (a) Administration
- (b) Structural Design
- (c) Dimensions (Plans, room heights, floor area)Public Safety
- (d) Demolition work
- (e) Site operations
- (f) Excavations
- (g) Foundations
- (h) Floors
- (i) Walls
- (j) Roofs
- (k) Stairways
- (l) Glazing
- (m)Lighting and ventilation
- (n) Drainage
- (o) Non-water borne means of sanitary disposal
- (p) Storm water disposal
- (q) Facilities for disable persons
- (r) Fire protection
- (s) Refuse disposal
- (t) Space heating
- (u) Fire installation

SUMMARY OF SANS BUILDING CONSTRUCTION SPECIFICATIONS APPLICABLE TO LOW INCOME HOUSING (SABS 0400:1990) – NOW SANS 10400 (currently under review. Amendments anticipated to be implemented by 2011)

SANS Number	Description		
0400	Code of Practice for the application of the National Building		
	Regulations		
542	Specification for concrete roofing tiles		
0155	Code of practice for accuracy in buildings (Method of measurement		
	and accuracy of dimensions for setting out and completing structur		
	with permissible deviations, as prescribed)		
0160	Code of Practice for general procedures and loadings to be adopted in		
	the design of buildings (stability of structures when exposed to wind)		
0177	Fire proofing		
1263	Glazing (including areas requiring safety glazing, but this is less likely		
	in low income housing projects)		
*11600:1993/	Building construction – sealants – classification and requirements		
ISO11600:1993			
10409:2000	Design, selection and installation of geomembranes facilitates the		
	correct use and installation of plastics to act as a barrier for		
	waterproofing (e.g foundation slabs and roofs)		
	www.stansa.co.za/SANS10409.aspx		
*10145:2000	Concrete masonry construction (Covers construction of walls with		
	precast concrete masonry units)		
*1783-2:2005	Sawn softwood timber Part 2:Stress graded structural timber and		
	timber for frame wall construction		

Table 1 : SANS Building Construction Related Specifications

\*<u>Note</u>: These standards have not been updated in the National Department of Housing Documents.

### LIST OF PREFESSIONAL BODIES

**APPENDIX 12** 

SERVICE		PROFESSIONAL BOARD
1.	Architects	South African institute of Architects (SAIA)
		Registration with regulating board, the SAC for Architect profession (SACAP)
2.	Quantity Surveyors	South African Council of Quantity Surveyors
		Member of South African Surveyors Association (Act QS of 1970)
3.	Structural Engineers / Civil Engineers	South African Association of consulting Engineers (SAACE)
4.	Electrical Engineers	South African Engineers Council (SAEC)
5.	Mechanical Engineers	South African Engineers Council (SAEC)
6	Project Managers	South African Council for Project and Construction Profession in terms of the Project and construction management Act 2000 (Act 48 of 2000) (SACPCMP)
		Council for Built Environment (CBE)
7.	Land Surveyors	South African Council for Professional and Technical
	-	Surveyors
8.	Home Builders	National Home Builders Registration Council (NHBRC) in terms of the Housing Consumer Protection Act, 1998 (Act no 95 of 1998)
9.	Construction (Infrastructure)	Construction Industry Development Board (CIDB)
10.	Electrical Services	Electrical Contractors Association (ECA) Electrical Contractors Bodies (ECB) Construction Industry Development Board (CIDB)
11.	Plumbing	South African Institute of Plumbing (IOPSA)
12.	Valuators	South African Institute of Valuators
13.	Environmental Consultants	South African Engineering Council (SAEC)
14.	Geo technical Engineering	Council of Geo-Science
15.	Security Services	Private Security Industry Regulatory Authority (PSIRA) Security Officers Board (SOB)
16.	Legal Services	Membership of any Provincial Law Society
17.	Chattered Accountants	South African Institute for Chattered Accountants
18.	Auditors	Independent Regulatory Board for Auditors
19.	Education and Training	South African Qualification Association (SAQA)

## EXAMPLES OF POOR QUALITY IN LOW INCOME HOUSING

#### **APPENDIX 13**



Figure 1 : Poor mortar mix, inadequate cement.



Figure 2 : Poor block work resulting in re-work.



Figure 3 : Poor founding conditions resulting in cracks.



Figure 4 : Severe cracking, with daylight shining through.



Figure 5 : Structural cracks from window to roof. internal door.



Figure 6 : Structural cracks from roof beam to Window.



Figure 7 : Structural crack starting from roof.



Figure 8 : Foundations being underpinned as a result of poor founding. Also note block-work had to be redone.



Figure 9: Roof screw not done properly.



Figure 10: Poor sealing of holes, as is evident from reflection of light on the beam.



Figure 11 : Poor quality timber used.



Figure 12: Poor material (knotty timber), nailing roof crews, poor and holes not sealed.



Figure 13 : Roof ties fitted retrospectively



Figure 14 : Poor beam filling, roof ties fitted retrospectively, and holes not sealed.



Figure 15 : Poor service maintenance.



Figure 16 : Poor service maintenance.



Figure 17 : Poor service maintenance.



Figure 18 : Poor service maintenance.



Figure 1: An informal wattle and daub structure.



Figure 2 : Platform excavation for foundation.



Figure 3 : Platform preparation.



Figure 4 : Preparation for constructing foundation.



Figure 5 : Preparation for foundation continued.



Figure 6: Damp proofing and steel reinforcement of foundation.



Figure 7 : Pouring cement for foundation and slab.



Figure 8 : Slab completed, ant poison applied and clearance commencing.



Figure 9 : Setting profiles to construct walls.



Figure 10 : Mixing mortar for wall construction.



Figure 11 : Joints being filled and internal wall construction.



Figure 12 : Unit completed to plate level.



Figure 13 : Roofing of structure commencing.



Figure 14 : Completed unit ready for occupation.



Figure 15 : Unit handed over to occupant.