
Standard for the Delivery and Maintenance of Infrastructure using a Gateway System



November 2012

Construction Industry Development Board
Pretoria
Tel: 012 482 7200
Fax: 086 688 5715
E-mail: cidb@cidb.org.za

Standard for Delivery and Maintenance of Infrastructure using a Gateway System

Contents

Introduction

1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Gates, stages and associated key deliverables	6
5	Activities	8
5.1	Planning activities	8
5.1.1	Stage 1: Infrastructure planning	8
5.1.2	Stage 2: Procurement planning	10
5.1.3	Stage 3: Package preparation	10
5.1.4	Stage 4: Package definition	12
5.2	Detailed design activities	14
5.2.1	Stage 5: Design development	14
5.2.2	Stage 6: Design documentation	15
5.2.2.1	Stage 6A: Production information	15
5.2.2.2	Stage 6B: Manufacture, fabrication and construction information	18
5.3	Site activities	18
5.3.1	Stage 7: Works stage	18
5.3.2	Stage 8: Handover stage	18
5.4	Close out stage	20
5.4.1	Stage 9A: Asset Data	20
5.4.2	Stage 9B: Package completion	20
6	Professional services	20
6.1	General	20
6.2	Drawings	24
6.3	Scope of professional services	24
6.3.1	Stage 1 (Infrastructure planning) services	24
6.3.1.1	General services	24
6.3.1.2	Preliminary assessment	26
6.3.2	Stage 2 (Procurement planning) services	27
6.3.3	Stage 3 (Package preparation) services	27
6.3.4	Stage 4 (Package definition) services	27
6.3.5	Stage 5 (Design development) services	27
6.3.6	Stage 6 (Design documentation) services	28
6.3.7	Stage 7 (Works), Stage 8 (Handover) and Stage 9 (Close out) services	28
6.3.8	Procurement services	28
6.3.9	Project management services	28

Annexure A.....	37
Incorporating the provisions of this standard in the scope of work of contracts.....	37

Introduction

This standard establishes the work flow (sequence of connected activities) associated with the delivery and maintenance of infrastructure. It groups logically related activities in the infrastructure cycle together into discrete stages in such a manner that the end of the stage culminates in a major milestone in the form of documented information which requires approval or acceptance before a stage can be regarded as being complete. These stages create decision gates (control points) at the end of each stage which can be used to provide assurance that the proposed works:

- remains within agreed mandates,
- aligns with the purpose for which it was conceived, and
- can progress successfully from one stage to the next.

The starting point in the infrastructure gateway system is the development of an infrastructure plan which identifies long term needs and links prioritised needs to a forecasted budget over at least a medium term expenditure framework period. The end point is a completed package.

The standard also establishes performance requirements for those persons providing professional services in the implementation of one or more stages, namely to do whatever is necessary to develop an end of stage deliverable. Such persons are required to:

- use the normal skill and care used by professionals providing similar services in doing so; and
- develop the end of stage deliverable in sufficient detail to enable informed decisions to be made regarding its acceptability by those who are tasked to make such decisions, and, if applicable, to form the basis of the scope of work for taking a package forward in terms of the selected contracting strategy.

Typical tasks are outlined for professional persons performing different roles associated with each stage.

This standard can be referenced in the scope of work of professional service contracts and engineering and construction works contracts where contractors have design responsibilities for the works (see Annexure A).

Standard for the Delivery and Maintenance of Infrastructure using a Gateway System

1 Scope

This standard establishes the work flow and services for the delivery and maintenance of infrastructure using a gateway system. It identifies the location of the gates, key deliverables and principal actions associated with the various stages of this system and establishes the typical tasks associated with the execution of the stages associated with planning, detailed design, site and close out activities.

This standard does not provide procedures or assign responsibilities for approving or accepting end of stage deliverables.

NOTE 1 The infrastructure gateway system described in this standard provides a number of generic control points (gates) in the infrastructure life cycle where a decision is required before proceeding from one stage to another. Such decisions need to be based on information that is provided and is pertinent to the project. If correctly done, a gateway system may provide assurance that a project, remains within agreed mandates, aligns with the purpose for which it was conceived, and can progress successfully from one stage to the next.

NOTE 2 The infrastructure gateway system is generic in its formulation and structure. As such it establishes the minimum gates which are necessary to control the delivery and maintenance of infrastructure. Some clients may wish to add additional gates ("sub-gates") between gates to suite their internal procedures or sector specific requirements.

NOTE 3 This standard is intended for use by those tasked with the delivery and maintenance of infrastructure through a single contract or a series of package orders issued over the term of a framework agreement. It establishes the key end of stage deliverables and the services which employees of the client, professional services providers and contractors typically need to perform to achieve the end deliverables associated with a stage.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IDM Toolkit Delivery Management Guidelines Practice Guide 2 - Construction Procurement Strategy. Construction Industry Development Board and National Treasury. (www.cidb.org.za).

3 Terms and definitions

For the purposes of this part of the standard, the following terms and definitions apply:

asset register

a record of asset information including inventory, historical, financial, condition, technical and financial information.

brief

a working document for an identified package which specifies at any point in time the relevant needs, objectives, acceptance criteria and priorities of the client, provides the context of the package and any appropriate design or maintenance requirements within which all subsequent briefing (when needed) and designing can take place

building

includes

- a) any structure, whether of a temporary or permanent nature, and irrespective of the materials used in the erection thereof, erected or used in connection with
 - 1) the accommodation or convenience of human beings and animals;
 - 2) the manufacture, processing, storage, display or sale of goods;
 - 3) the rendering of a service;
 - 4) the destruction or treatment of refuse or other waste materials; and

- 5) the cultivation or growing of plants or crops;
- b) a wall, swimming bath, swimming pool, reservoir or bridge or any structure connected therewith;
- c) a fuel pump or tank used in connection therewith;
- d) any part of a building, including a building as defined in (a), (b) or (c); and
- e) any facilities or system, or portion thereof, within or outside but incidental to a building, for the provision of a water supply, drainage, sewerage, stormwater disposal, electricity supply or other similar service in respect of the building

NOTE This definition is the same as that contained in the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977)

client

person or organization who

- a) is responsible for initiating, financing and accepting a brief for the delivery or maintenance of infrastructure for its own use as an end user or an agent of the end user; or
- b) procures or commissions works to be constructed, refurbished, rehabilitated, extended, altered, maintained or demolished and pays for it.

commissioning

a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems and assemblies meets defined objectives and criteria

concept report

the document which contains the package information which sets out the integrated concept for the works, any statutory permissions and funding or utility approvals granted, a risk report and, where new infrastructure is created, a logistic support plan

contractor

person contracted to construct, refurbish, rehabilitate, extend, alter, repair, maintain or demolish works or components thereof

cost consultant

person who provides independent and impartial estimation and control of the cost of constructing, rehabilitating and refurbishing infrastructure by means of one or more of the following:

- a) accurate measurement of the works,
- b) comprehensive knowledge of various financing methods, construction systems, forms of contract and the costs of alternative design proposals, construction methods and materials, or
- c) the application of expert knowledge of costs and prices of work, labour, materials, plant and equipment required.

construction procurement strategy

the documented delivery management strategy and contracting and procurement arrangements for the delivery or maintenance of infrastructure

contracting strategy

strategy that governs the nature of the relationship which the employer wishes to foster with the contractor, which in turn determines the risks and responsibilities between the parties to the contract and the methodology by which the contractor is to be paid

control budget

the amount of money which is allocated or made available by the client to deliver or maintain infrastructure associated with a package including site costs, professional fees, all service and planning charges and applicable taxes, which may be adjusted by the client from time to time

cost plan

the document progressively developed by estimating the total cost of the package including any construction, refurbishment, extension and professional service costs, service and planning charges and applicable taxes

definition services

services which develop the deliverable associated with an end stage

delivery management strategy

strategy which is adopted to manage and resource the delivery and maintenance of infrastructure

design development report

the package information at the conclusion of stage 5

designer

person who is responsible for providing design or conditional assessment services relating to the provision or maintenance of infrastructure

gate

a control point in the infrastructure life cycle where a decision is required before proceeding from one stage or sub-stage to another

infrastructure

fixed assets that are constructed or result from construction operations including buildings, structures, facilities and water supply, sanitation, electricity supply, transportation and stormwater drainage systems

infrastructure plan

plan which identifies long term needs and links prioritised needs to a forecasted budget for the next few years

lead designer

person who is responsible for

- a) setting design standards for and co-ordinating and integrating the design of designers; and
- b) co-ordinating advice on design related issues by designers and providing design advice

logistic support plan

a plan which establishes the organisational structure required for the operation and maintenance of the asset resulting from the package over life span, and office, stores, furniture, equipment, information technology and staff training requirements to run operation and maintenance facilities as well as engineering infrastructure

maintenance

combination of all technical and associated administrative actions during the service life to retain works or its parts in a state in which it can perform its required functions

manufacture, fabrication and construction information

information produced by or on behalf of the contractor, based on the production information provided for a package which enables manufacture, fabrication or construction to take place

package

works which have been grouped together for delivery under a single contract or a package order

package information

information at a point in time, following the identification of a package which is contained in one or more of the following documents:

- a) the brief which is progressively developed from time to time;
- b) the design documentation including specifications, data schedules and drawings;
- c) the schedule which identifies key dates and time periods for the performance of the works and services associated with the package; and
- d) cost plan

package order

the instruction to carry out construction works under a framework agreement

packaging strategy

organization of work packages into contracts

person

a natural or juristic person

portfolio

a collection of projects or programmes and other work that are grouped together to facilitate effective management of that work to meet strategic objectives

NOTE The projects or programmes of the portfolio may not necessarily be interdependent or directly related

pricing strategy

strategy which is adopted to secure financial offers and to remunerate contractors in terms of the contract

procurement

process which creates, manages and fulfils contracts relating to the provision of goods, services and engineering and construction works or disposals, or any combination thereof

procurement strategy

selected packaging, contracting, pricing and targeting strategy, and procurement procedure for a particular procurement

procurement procedure

selected procedure for a specific procurement

production information

the detailing, performance definition, specification, sizing and positioning of all systems and components enabling either construction (where the contractor is able to build directly from the information prepared) or the production of manufacturing and installation information for construction

professional service provider

persons whose primary business is to provide impartial and independent knowledge-based services to clients for a fee

programme

a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually.

NOTE Programmes include an element of on-going work and may include elements of related work outside the scope of discrete projects in the programme

project

identified elements of work involving the construction, refurbishment, rehabilitation, extension, alteration, demolition or preventative, corrective, scheduled or routine maintenance of infrastructure, the transfer of infrastructure to another institution or the leasing of infrastructure

project leader

person who has a non-design role to lead and direct the project team and whose basic responsibilities with respect of a stage for which services are required include:

- a) the establishment of the overall strategy for the development and delivery of the deliverable;
- b) the monitoring and integration of the activities of the project team;
- c) the development and maintenance of a schedule and the monitoring of progress towards the attainment of the deliverable; and
- d) the briefing of, the reporting to and the obtaining of decisions and acceptance of a deliverable from the client

record information

information that:

- a) records the condition of the completed works associated with a package;
- b) documents the works as constructed or completed;
- c) contains advice on the care and servicing requirements for the works or a portion thereof;
- d) contains advice on the use of plant and equipment;
- e) confirms the performance requirements of the design development report and production information;
- f) contains certificates confirming compliance with legislation, statutory permissions etc.; or
- g) contains guarantees that extend beyond the defects liability period provided for in the package

NOTE Record information includes drawings, specifications, design and service life parameters and maintenance and operation manuals

review services

services which review the definition service of a stage undertaken by others for general conformity with the scope of work selected for a particular contracting strategy

risk

effect of uncertainty on objectives

risk report

report intended to inform particular internal or external stakeholders by providing information regarding the current state of risks and its management

scope of work

document that specifies and describes the goods, services, or engineering and construction works which are to be provided, and any other requirements and constraints relating to the manner in which the contract work is to be performed

schedule

- a) the planned dates for performing activities and the planned dates for achieving major milestone; or

b) a table of items of information

stage

a collection of logically related activities in the infrastructure delivery cycle that culminates in the completion of a major deliverable

statutory permissions

any relevant approval, consent or permission under any legislation required to implement a package

strategic brief

the document accepted at the end of stage 3 which contains, the package information, the schedule of statutory permissions, funding requirements and utility approvals, as relevant, that are to be obtained as the work proceeds and the procurement strategy

NOTE The strategic brief is the client's specification of requirements for a project. It confirms key requirements and constraints.

targeting strategy

strategy that enables secondary procurement policy objectives to be promoted

user requirements

statement of need to be fulfilled

utility

a company, municipality or municipal entity which provides services such as water or electricity

4 Gates, stages and associated key deliverables

4.1 The stages, key deliverables and principal actions associated with the delivery and maintenance of infrastructure shall be as stated in Table 1 and illustrated in Figure 1. Stages 5 and 6, depending upon the package information that is available at the end of stage 4, may be omitted.

Table 1 – Key deliverables and activities associated with the gateway system

Activities	Stage		Key deliverable
	No	Description	
Planning at a portfolio level	1	Infrastructure planning	Client approved infrastructure plan
	2	Procurement planning	Client accepted construction procurement strategy for implementing the infrastructure plan in the medium term
Planning at a package level	3	Package preparation	Client accepted strategic brief
	4	Package definition	Client accepted concept report including where necessary, a logistic support plan
Detailed design	5	Design development	Client accepted design development report
	6a	Design documentation (Production information)	Completed and client accepted production information
	6b	Design documentation (Manufacture, fabrication and construction information)	Client accepted manufacture, fabrication and construction information
Site	7	Works	Completed works which are capable of being occupied or used and accepted by the client.
	8	Hand over	Works which have been taken over by the user complete with record information
Close out	9a	Asset data	Archived record information and updated asset register
	9b	Package completion	Completed contract or package order

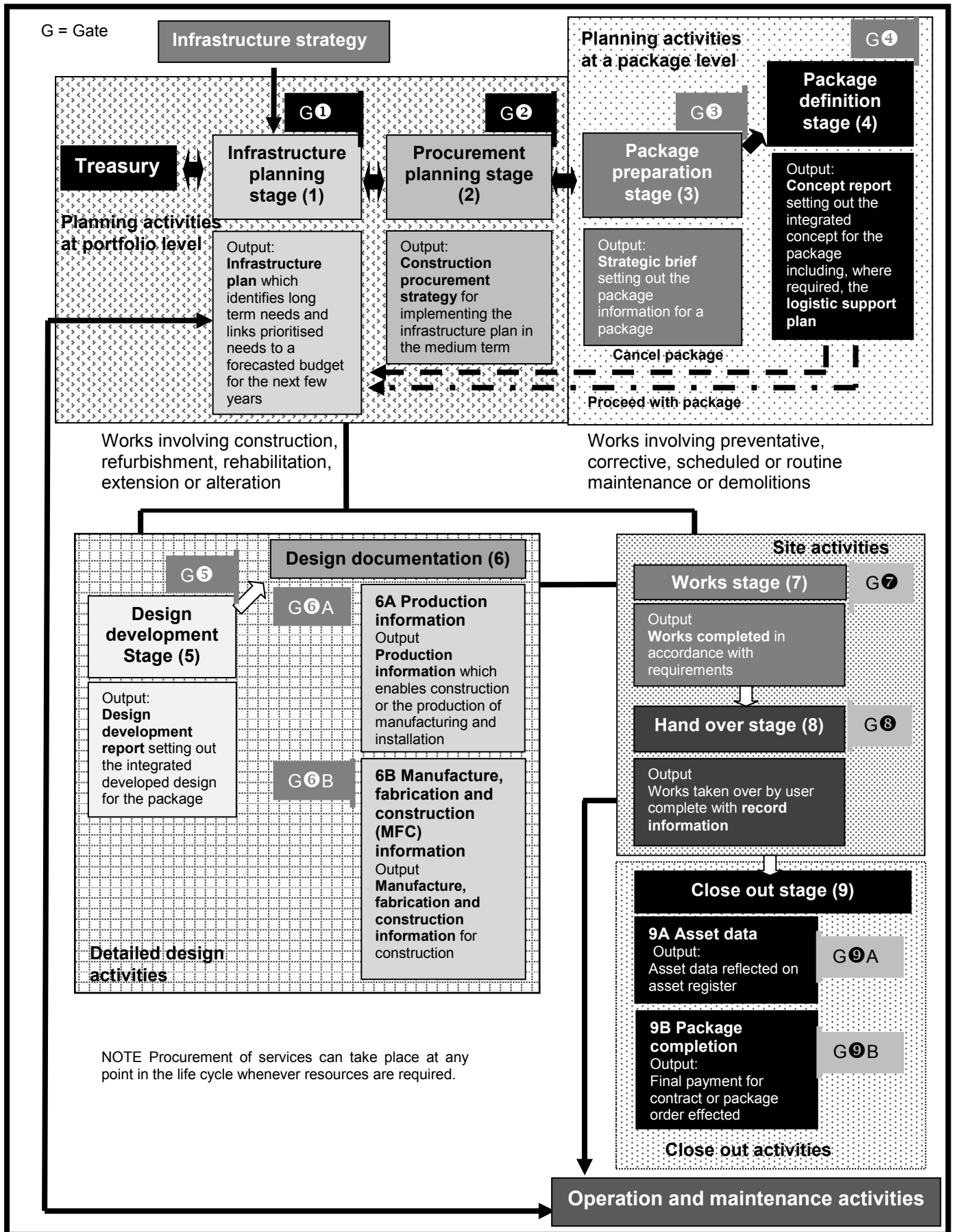


Figure 1 – The stages and gates of the Infrastructure Gateway System

4.2 A gate shall be located at the end of each stage and where appropriate within a stage as indicated in Table 1 and Figure 1. A stage in the gateway process shall only be completed when the deliverable has been approved or accepted by the person or persons designated to do so.

NOTE 1 The planning activities at a portfolio level (stages 1 and 2) and at a package level of the infrastructure gateway system are iterative activities (see Figure 1). Projects may be reprioritised or cancelled following the conclusion of stage 4. Also procurement planning should be undertaken on an annual basis. As a result, packages may change e.g. be grouped together or broken down.

NOTE 2 Infrastructure spending by government departments and municipalities is often characterised by poor expenditure patterns resulting in either under or over-expenditure in a financial year. For example very little expenditure occurs in the first three financial quarters of the year and then a sudden flurry of expenditure in the 4th quarter. This results in what has become known as the “fourth quarter expenditure spike”. Associated with this trend is either under-spending which results in rollovers, or over-spending, which results in departments and municipalities running out of money before the financial year has been completed or rushed expenditure on goods and services that may not be in accordance with long term infrastructure management plans.

Research has found that the infrastructure delivery cycle was running in parallel with the budgeting cycle and therefore work which was expected to contribute towards the expenditure in a particular year was only being identified in the year prior to the anticipated construction/implementation. Furthermore, the package planning activities commenced only in the Medium Term Expenditure Framework (MTEF) period. In order to improve planning and efficiency in the delivery of infrastructure, the Alignment Model was developed (see chapter 7 of CIDB Delivery Management Guidelines Delivery Process 1 – Portfolio Management) to align the time frames and activities of the infrastructure gateway system with the MTEF Budget Cycle. The longer timeframe for the planning activities of the infrastructure gateway system means that the start of the infrastructure planning process leads the start of the budget planning process by at least one year. Allowing for this lead time adds immense value to the budget planning process because projects identified and prioritised during infrastructure planning can also become an input into the budget planning process which will be strengthened with the inclusion of more accurate estimates and packages which can proceed unimpeded to the detailed design stage or works to be procured.

NOTE 3 The infrastructure gateway system deals with the generic work flow associated with the delivery and maintenance of infrastructure and generates information which informs decisions at particular points. It is not aligned to any particular funding or procurement procedures.

4.3 Activities associated with a stage may be undertaken in parallel or series, provided that each stage is completed in sequence.

4.4 The level of detail contained in a deliverable associated with the end of each stage shall be sufficient to enable informed decisions to be made to proceed to the next stage (see Figure 2). The deliverables at the end of stages 3 to 6a shall in addition satisfy the requirements of 6.1.3e.

NOTE The level of information increases with each successive stage. Different types of infrastructure, contracting strategies as well as the scale and location of projects present different risks. As a result, the level of detail at each stage necessary to make an informed decision at a gate is a matter of professional judgement and varies between different types of projects and contracting strategies.

5 Activities

5.1 Planning activities

5.1.1 Stage 1: Infrastructure planning

The following activities shall be undertaken during stage 1 (infrastructure planning) to develop an infrastructure plan:

- a) identify the policy drivers, strategies and long term objectives of national, provincial and local government which impact upon the client’s mandate;
- b) formulate objective decision making criteria relating to the selection and prioritisation of projects;
- c) produce a portfolio infrastructure plan for the forecasted long term acquisition, refurbishment, rehabilitation and maintenance of infrastructure which provides a projected list of projects described by category, location, type, economic classification and function and links prioritised projects to a forecasted budget for the next three to five years; and

- d) undertake specific activities prescribed by law or by any funding requirements including the making of applications for funds;
- e) update the portfolio infrastructure plan at least once a year and include updated information obtained from the concept report produced at the end of stage 4 and the mapping of projects falling within the MTEF period to packages which are identified in the latest construction procurement strategy (see 5.2);
- f) remove projects associated with packages from the portfolio infrastructure plan which are not to be carried forward past stages 3 or stage 4; and
- g) obtain infrastructure plan approval.

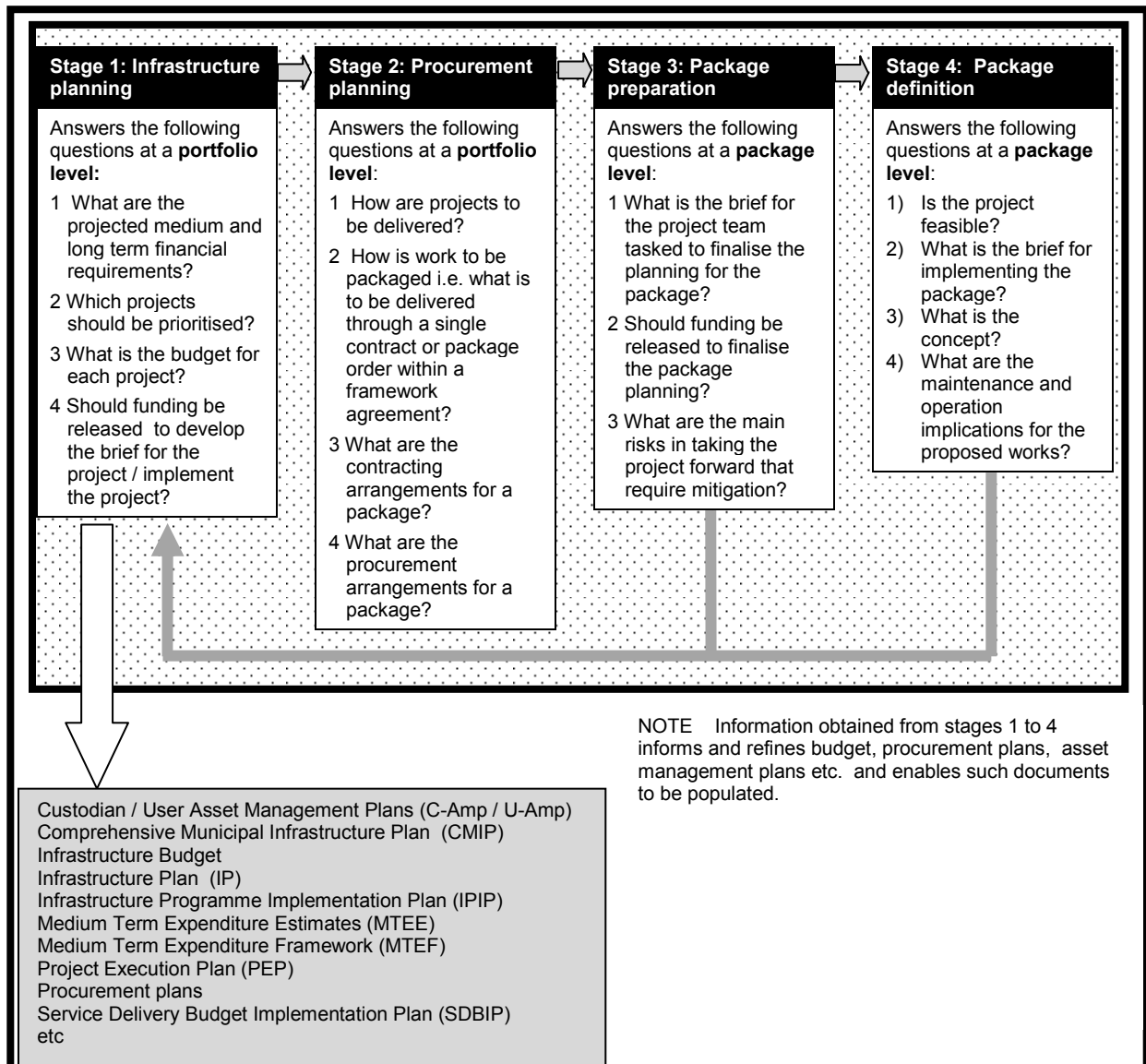


Figure 2: Questions answered in each of the planning stages

NOTE 1 The development of a portfolio infrastructure plan is an iterative process. It answers the questions as to which projects should be prioritised against objective criteria via an implementation time table.

NOTE 2 Detailed guidance on the development of aspects of infrastructure plans may be found in the following publications:

- Association of local Government Engineering NZ and National Asset Management Steering (NAMS) Group. International Infrastructure Management Manual – South African Edition 2006. ISBN No 0-473-10685-X

- IDM Toolkit. Delivery Management Guidelines: Delivery Process 1 - Portfolio Management. <http://www.cidb.org.za/layouts/toolkit/index.html>
- Department Co-operative Government and Traditional Affairs. Municipal Infrastructure - An Industry Guide to Infrastructure Service Delivery Levels and Unit Costs. January 2010
- Department: Provincial and Local Government: The Municipal Infrastructure Grant: Basic Level of Service and Unit Costs: A Guide for Municipalities. June 2010.
- Department: Local and Provincial Government. Guidelines for Infrastructure Asset Management in Local Government 2006 – 2009. www.dplg.gov.za/subwebsites/mig/docs/7.pdf
- National Department of Public Works. Guidelines for Users - User Asset Management Plans (U-AMPs). [www.cidb.org.za/layouts/toolkit/data/ai_docs/DP2-S10%20Guideline%20for%20U-AMP%20\(2008-10-20\)%20Version%201.pdf](http://www.cidb.org.za/layouts/toolkit/data/ai_docs/DP2-S10%20Guideline%20for%20U-AMP%20(2008-10-20)%20Version%201.pdf)
- National Department of Public Works. Guidelines for Custodians - Custodian Asset Management Plans (C-AMPs). [www.cidb.org.za/layouts/toolkit/data/ai_docs/DP2-S09%20Guideline%20for%20C-AMP%20\(2008-10-20\)%20Version%201.pdf](http://www.cidb.org.za/layouts/toolkit/data/ai_docs/DP2-S09%20Guideline%20for%20C-AMP%20(2008-10-20)%20Version%201.pdf)

5.1.2 Stage 2: Procurement planning

The following activities shall be undertaken at a portfolio level, using the step by step procedure contained in the IDM Toolkit Practice Guide 2, during stage 2 (procurement planning) to produce a construction procurement strategy for implementing the infrastructure plan over the MTEF period:

- develop a delivery management strategy;
- decide on contracting arrangements;
- decide on procurement arrangements;
- document the identified construction procurement strategy, preferably using the recommended headings provided in Table 2;
- review and update the construction procurement strategy at least once a year; and
- obtain construction procurement strategy acceptance.

NOTE The headings contained in Table 2 enable the outcomes of each activity in the step by step procedure provided in the IDMS Toolkit Guideline to be documented in a logical and systematic manner. The documenting of the reasons for making each decision under these headings enables the reader to understand the thinking behind the decisions that were taken.

5.1.3 Stage 3: Package preparation

The following activities shall be undertaken during stage 3 (package preparation) to develop a strategic brief:

- define the package objectives, business need, user requirements, acceptance criteria and client priorities and aspirations;
- confirm the scope of the package and identify any constraints;
- establish the project criteria including as, relevant, the performance and reliability requirements, design life, service life of components, function, maintenance and replacement requirements, mix of uses, scale, location, quality, value, time, safety, health, environment and sustainability;
- where necessary, conduct preliminary investigations, stakeholder consultations, site visits or desk top studies to obtain data or to interrogate outstanding risks relating to matters such as the site, bulk services, the environment, heritage, safety, planning;
- identify procedures, organizational structure, key constraints, statutory permissions (e.g. environmental, heritage, social, planning, building control), and utility approvals, policies (e.g. environmental, developmental, social, maintenance or facilities management) and strategies to take the package forward;
- identify risks that need to be mitigated;

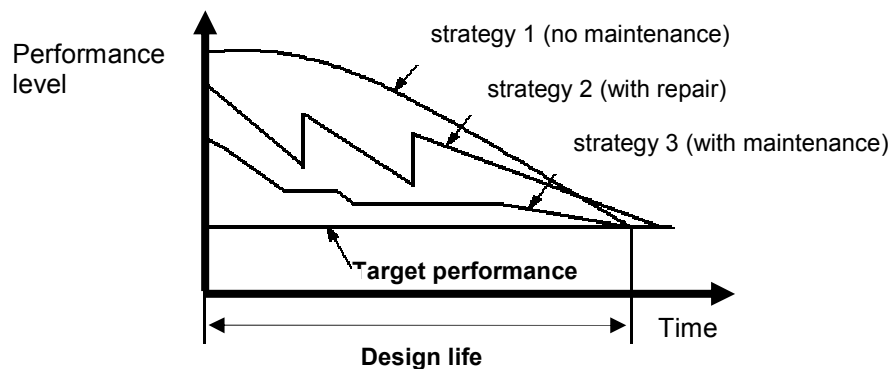
- g) establish the control budget for the package, ownership costs and schedule for the package; and
- h) develop, finalise and obtain acceptance of the strategic brief.

Table 2 – Recommended headings in a construction procurement strategy

#	Heading	Subheadings
1	Background / introduction	
2	Delivery management strategy	2.1 Nature and spatial arrangement of projects and clusters 2.2 Client organisation characteristics 2.3 Market characteristics 2.4 Primary procurement objectives 2.5 Secondary procurement objectives 2.6 Delivery management plan 2.7 Delivery mode 2.8 Packaging strategy
3	Contracting arrangements	3.1 Risk allocations for packages 3.1.1 Contracting and pricing strategies 3.1.2 Forms of contract 3.2 Professional services contracts 3.2.1 Requirements for outsourced services 3.2.2 Packaging for professional service contracts 3.2.3 Allocation of risks for professional service contracts
4	Procurement arrangements	4.1 Quality strategy 4.2 Procurement procedure 4.3 Targeted procurement procedure 4.4 Tender evaluation procedure
5	Satisfying primary and secondary objectives	5.1 Construction procurement strategy 5.2 Issues to be dealt with in contracts which are not addressed elsewhere

NOTE 1 The preliminary investigations, depending upon the nature of the project, are characterised by site visits and assessments including site suitability from a legal, land, bulk service, geotechnical, topographical, environmental, heritage, social etc. perspectives and stakeholder support. The level of detail is usually insufficient for detailed design purposes i.e. it is indicative. More comprehensive investigations are performed in stage 4. The preliminary investigations allow a project to be further probed beyond a preliminary assessment before significant resources are committed to prepare the project for implementation. It also enables a choice of project options to be made at an in principle level.

NOTE 2 ISO 10845-3:2009, *Houses – Description of performance: Part 3: Structural durability*, indicates how three different maintenance strategies can provide acceptable performance over the design working life of a structure as follows:



NOTE 3 ISO 15686-1:2000, *Buildings and constructed assets — Service life planning — Part 1: General principles*, suggests the following minimum design lives of buildings in years based on their accessibility for maintenance:

Design life of building	Inaccessible or structural components	Components where replacement is expensive or difficult (including below ground drainage)	Major replacement components	Building services
Unlimited	Unlimited	100	40	25
150	150	100	40	25
100	100	100	40	25
60	60	60	40	25
25	25	25	25	25
15	15	15	15	15
10	10	10	10	10

Easy to replace components may have design lives of 3 to 6 years
An unlimited design life may rarely be used as it significantly reduces design options

NOTE 4 The consequences of failure also need to be considered when developing a brief for design life. The consequences of failure can be categorised as indicated below (see ISO 15686-1:2000):

Category	Consequence	Example
1	Danger to life	Sudden collapse of structure
2	Risk of injury	Loose stair tread
3	Danger to health	Serious damp penetration
4	Costly repair	Extensive scaffolding required
5	Costly because repeated	Window hardware replacement
6	Interruption of building use	Handling failure
7	Security compromised	Broken door latch
8	No exceptional problems	Replacement of light fixtures

5.1.4 Stage 4: Package definition

5.1.4.1 The following activities shall be undertaken during stage 4 (package definition) to develop a concept report setting out the integrated concept for the package:

- a) obtain site studies and specialist advice, as necessary;
- b) establish the feasibility of satisfying the strategic brief for the package within the control budget with or without modification;
- c) determine the initial design criteria and design options to construct, refurbish, rehabilitate, alter or extend infrastructure or the repair methods and procedures required to maintain the condition of infrastructure for the package;
- d) investigate alternative solutions and recommend the preferred solution;
- e) establish the detailed brief, scope, scale, form and cost plan for the package;
- f) develop an indicative schedule for documentation and construction or maintenance services associated with the package;
- g) produce a site development plan or other suitable schematic layouts of the works and obtain the necessary statutory permissions, funding approvals or utility approvals to proceed with the works associated with the package;
- h) undertake where necessary, studies to determine whole life costs and to forecast revenue over the lifetime of the infrastructure associated with the project to confirm the financial sustainability of the project

- i) produce a risk report which incorporates the need for further surveys, tests, other investigations and consents and approvals, if any, during subsequent stages and identified health, safety and environmental risk;
- j) produce a logistic support plan in accordance with the provisions of 5.1.4.2 if new infrastructure is created; and
- j) develop and finalise and obtain the clients acceptance of the concept report.

NOTE 1 The package preparation stage is the last stage of the planning activities. It brings to a close the information required to make informed decisions concerning the implementation of the project. This stage as such needs to resolve any outstanding project related risks and gather sufficient information to enable such decisions to be made.

NOTE 2 Site studies can include site evaluations, topographical surveys, surveys of existing structures, geotechnical investigations and environmental, social or heritage assessments.

NOTE 3 Resolution of details that do not impact upon the key elements are generally left to stage 5.

NOTE 4 Stage 4 is where sufficient design concepts or solutions are developed for the client to establish the feasibility of the works associated with the package or to select a particular conceptual approach to pursue.

NOTE 5 The design or solution at the end of stage 4 is "frozen". The concept report as such in the case of

- a) construction, refurbishment, rehabilitation, alteration or extensions of infrastructure contains as relevant, the preliminary analysis, key assumptions, the evaluation of alternatives, preliminary sizes of primary or key elements, a description or outline of secondary elements, the preliminary review of the utility supply capacity, indicative specifications or schedules of finishes and preliminary layout drawings.
- b) maintenance contains the specifications for the maintenance and repair procedures.

5.1.4.2 The following activities shall, where required, be undertaken to produce the logistic support plan:

- a) **Client:** identify additional organisational structure required for operation and maintenance over life span, and office, stores, furniture, equipment, information technology and staff training requirements to run operation and maintenance facilities as well as engineering infrastructure
- b) **Professional:**
 - i) establish logistic requirements in respect of facilities and/or engineering infrastructure;
 - ii) specify requirements, if any, for the contractor to provide a servicing and maintenance plan for all facilities and engineering infrastructure

NOTE 1 Logistic requirements typically relate:

- a) in engineering infrastructure to the strategic management of the operation and maintenance of water supply, sanitation, telecommunication, electricity supply, electronic, transportation, and stormwater drainage systems, taking full cognizance of their design or forecasted behaviour under specific operating conditions in a manner that does not compromise their intended functioning or the health and safety of workers and users or harm property or the environment
- b) in buildings and related site works to facilities management i.e., an interdisciplinary field primarily devoted to the day to day operations, maintenance and care of buildings e.g. the care of air conditioning, electric power, plumbing and lighting systems, cleaning, decoration, grounds keeping and security.

NOTE 2 The IDM Toolkit Delivery Management Guidelines Delivery Process 3 - Operations & Maintenance points out that *it is important that facility and engineering infrastructure managers plan the day-to-day as well as longer frequency activities such as inspections, services and replacement of critical spares/components as per operating and maintenance manuals. Some of the planning tasks are:*

- *The tender process to contract service providers*
- *Preventative maintenance and timely replacement of critical spares*
- *Procurement of critical spares, storage and inventory control thereof*
- *Monitoring and controlling performance of service providers*
- *The handling of complaints*
- *Prioritising repairs*
- *Meeting with HSE and users in order to continually monitor health, safety and environmental aspects*
- *Building condition assessment.*

NOTE 3 The IDM Toolkit Delivery Management Guidelines Delivery Process 3 - Operations & Maintenance also stresses that the mobilisation of the user and custodian (entity that is responsible for the efficient and effective management of infrastructure throughout their lifecycle) staff to manage assets needs to start well in advance to ensure that the facility is ready at least one

week before occupation to allow for unforeseen systems failures as well as to ensure that all facilities management staff are acquainted with what they should do. Such mobilisation needs to include not only the identification of user and custodian staff but also the placement and training of staff that can mobilise facilities management contracts and services.

5.2 Detailed design activities

5.2.1 Stage 5: Design development

The following activities shall be undertaken during stage 5 (design development) to develop the design development report:

- a) develop in detail the accepted concept to finalise the design and definition criteria;
- b) establish the detailed form, character, function and cost plan, defining all components in terms of overall size, typical detail, performance and outline specification, as relevant;
- c) confirm or revise the cost plan included in the concept report; and
- d) develop and finalise and obtain the clients acceptance of the design development report.

NOTE 1 Detailed design includes the selection of materials and components. At this stage there will frequently be an iterative process of proposing a component, checking its predicted performance against the brief, and amending selections if required.

NOTE 2 The design development report translates the concept report into a document which paints a picture of what is to be delivered in terms of the package. The report needs as such to describe how structures, services or buildings and related site works, systems, subsystems, assemblies and components are to function, how they are to be safely constructed and how they are to be maintained. The report should as relevant contain the following:

- The purpose of the works
- A general description of the works
- The updated brief for the works
- The location of the works and, where relevant, existing services
- Particulars of the design team (name, area of responsibility and contact particulars)
- The manner in which legislative requirements including National Building Regulations is to be satisfied
- Legal restrictions on the site or works
- Statutory and local authority permissions which have been obtained or still need to be obtained
- A list of reports together with a brief overview of such reports which have informed the design
- Key design features e.g. passive design concepts, fire safety systems
- Design assumptions e.g. infiltration rates, consumption patterns, traffic flows, design populations etc.
- Design parameters e.g. structural loads, recurrence intervals of design events, target energy consumption levels, design life, envelope performance, daylighting etc.
- Design standards employed e.g. international, national or organisational standards
- Outline specifications for selected components, assemblies and subsystems including key test procedures
- Sketches, drawings, diagrams, outline specifications etc.
- Proposals for the cleaning and maintaining of the works
- Proposals for warranties and guarantees
- An outline of the commissioning procedures and dependencies between subsystems etc.
- A completion strategy which sets out what needs to be done, inspected and tested to achieve satisfactory completion / commissioning of each subsystem and the works as a whole
- The schedule for implementation and cost plan

NOTE 3 Outline specifications should be in sufficient detail to enable a view to be taken on the operation and maintenance implications of the design and the compatibility with existing plant and equipment to be established. Reference to applicable specifications and key data associated therewith may be sufficient e.g. reference to applicable SANS 2001 *Construction standards* and critical specification data.

NOTE 4 As part of service life planning, components should be assessed for compliance with performance requirements. Performance will deteriorate at a rate depending on the local environment, including the reactions at interfaces between materials and/or components, the design of the works, the component and installation detailing, the materials, the skill and quality of site work, maintenance, and usage. Responsibility for interface design should be clearly identified as it is critical to performance.

NOTE 5 The design should reflect the constraints of the budget for the overall project. To meet the brief, adjustment of either the budget or the service life requirements may be necessary. Where a specification is adjusted to meet cost constraints, the maintenance implications should also be considered.

NOTE 6 The most obvious way to reduce initial costs (by altering to a lower specification component) may increase maintenance requirements over the life of the building, which may be unacceptable to the client.

NOTE 7 Commissioning is often misinterpreted to focus solely on testing during the end of the construction phase. But commissioning is actually a collaborative process for planning, delivering, and operating works that function as intended. ASHRAE (The American Society of Heating, Refrigeration and Air-Conditioning Engineers) defines commissioning as "...the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent... Commissioning begins with planning and includes design, construction, start-up, acceptance and training, and can be applied throughout the life of the building." This definition accurately depicts commissioning as a holistic process that spans from pre-design planning to post-construction operation and can be thought of as a checks-and-balances system. Accordingly, the goals of commissioning are to:

- Define and document requirements clearly at the outset of each stage and update through the process
- Verify and document compliance at each completion level
- Establish and document commissioning process tasks for subsequent stage delivery team members
- Deliver works that meet the owner's needs, at the time of completion
- Verify that operation and maintenance personnel and occupants are properly trained
- Maintain works performance across its life cycle

Regardless of the extent of commissioning that is determined as appropriate for a project, there are three overarching principles in the commissioning process that begin at project inception and continue through occupancy and operations, namely:

- a) Determine project performance requirements as proposed designs and constructed works can only be evaluated against objective criteria and measures that are embodied in well-documented brief. Plan the Commissioning Process
- b) Commissioning involves the systematic process of planning delivery team member roles and responsibilities and tasks for all project phases and activities, including review and acceptance procedures, documentation requirements, development and approval of commissioning plans, commissioning schedules, and testing and inspection plans. Document Compliance and Acceptance
- c) Commissioning serves as the historical record of an owner's expectations for project performance throughout the project delivery process.

The purpose of commissioning documentation is to record the "Why, How, and What" of key delivery team decisions throughout the planning and delivery process. Commissioning documents the establishment of standards of performance for building systems or works, and verifies that designed and constructed works meets those standards.

5.2.2 Stage 6: Design documentation

5.2.2.1 Stage 6A: Production information

The following activities shall be undertaken during stage 6A (production information) to produce the production information:

- a) produce the final detailing, performance definition, specification, sizing and positioning of all systems and components enabling either construction (where the contractor is able to build directly from the information prepared) or the production of manufacturing and installation information for construction; and
- b) obtain the clients acceptance of the production information.

NOTE 1 "Scope of work" is defined in the CIDB Standard for Uniformity in Construction Procurement as *the document that specifies and describes the goods, services, or engineering and construction works which are to be provided, and any other requirements and constraints relating to the manner in which the contract work is to be performed.* Production information focuses on the "specifying and describing" of the permanent works. It may include certain constraints relating to the temporary works, sequencing of the works and times between operations e.g. concrete stripping and curing periods.

NOTE 2 Quality in contracts is frequently considered to be "conformance to stated requirements." Defects on the other hand are parts of the works which are not in accordance with stated requirements. This necessitates that requirements are objectively and comprehensively expressed in the scope of work in such a manner that compliance is capable of objective assessment i.e. the contractor can verify compliance without reference to the designer or representative of the employer.

NOTE 3 Those responsible for drafting or providing inputs to the scope of work need to:

- a) consider the inclusion of requirements for a quality management system or a quality management plan;
- b) state, as necessary, the nature of the tests and inspections that are to be conducted, the timing of specified tests/inspections, where and when the tests are to be performed, who is responsible for performing the tests, requirements for witnessing of tests, who is responsible for providing materials, facilities and samples for tests/inspections, the objectives of the tests/inspections, the testing procedures to be applied and the standards to be satisfied; and
- c) express quality standards in such a manner that compliance is capable of being objectively assessed.

NOTE 4 The CIDB Standard for Uniformity in Construction Procurement requires that the scope of work, wherever possible be, based on national or international standards, where such exist. It should be noted in this regard that:

- a) The SANS 2001 series of technical standards for construction works specifies and describes permanent works and provides constraints of a technical nature in constructing such works. The SANS 1921 series of standards for construction and management requirements for works contracts, on the other hand, specifies and describes the constraints to the manner in which the contract work is to be performed i.e. the management, control and execution of the works.
The SANS 2001 and SANS 1921 standards are not designed around any particular form of contract or system of measurement. They are suitable for use with any contracting strategy (i.e. design and construct, develop and construct and design by employer) or pricing strategy (i.e. price based (lump sum, activity schedules, price list or bill of quantities) or cost based (cost reimbursable or target cost)).
Some of the parts of SANS 2001 form part of the deemed to satisfy provisions of the National Building Regulations e.g. those covering the construction of masonry, plaster, timber and concrete. Compliance with these regulations cannot be claimed on a deemed to satisfy basis if these standards are not utilized.
- b) The SANS 1200 *Standardized specifications for civil engineering construction* were developed and in the main and last updated in the 1980s. They were specifically developed around the South African Institution of Civil Engineering's General Conditions of Contract (1982) and Civil Engineering Quantities (1973) for a design by employer contracting strategy where use is made of bills of quantities. The structure of SANS 1200 is not consistent with the CIDB's Standard for Uniformity in Construction Procurement and the use of terms such as "*Engineer considers to be unsuitable, consent of the Engineer, authorised by the Engineer, opinion of the Engineer, etc.*" introduces subjectivity and uncertainty into what the requirements are and is difficult to audit. As a result, the use of SANS 1200 should be avoided as far as possible.

NOTE 5 This stage includes selecting appropriate component specifications and installation details, and may extend into selecting the optimum specifications, using techniques such as value engineering or life cycle costing.

NOTE 6 Commissioning procedures need to be scheduled in relation to other services or construction activities. Since the commissioning process is dependent on the progress of systems, structures and building fabric, the scheduling of commissioning activities needs to be carefully planned in relation to those activities. Accordingly, the interdependency problems need to be identified and considered as early in the project as possible as they need to be included in the designer's specification.

The tabulation below can be used to break buildings down into subsystems and thereafter to establish interdependencies between the various subsystems and to map out what needs to be done, inspected and tested to achieve satisfactory completion of each subsystem and the building as a whole (see ISO 6241, *Performance standards in building -- Principles for their preparation and factors to be considered*):

Sub-system		Example of assemblies or components
Structure	Foundation	Shallow (ground beam, raft, etc.) Deep (deep footing, pile, diaphragm wall, etc.)
	Carcass	Column, beam, panel, slab, shell, lattice structure, etc.
External envelope	Envelope below ground	Base, side and top envelope (solid floor, basement wall, underground roof, etc.) Openings (pipe entry, shaft, etc.)
	Envelope above ground	Base, side and top envelope (exposed floor over external space, wall, roof) Openings (door, window, roof-light, etc.)
Spatial dividers outside the envelope	External vertical divider	Partitions (wall, balustrade, etc.) Openings (door, grille, etc.)
	External horizontal divider	Floors (terrace, balcony, porch roof, etc.) Openings (trap-door, etc.)
	External staircase	Stairs, ramp, etc.
Spatial dividers within the envelope	Internal vertical divider	Partitions (wall, balustrade, cupboard, etc.) Openings (door, etc.)
	Internal horizontal divider	Floors Openings (trap-door, etc.)
	Internal staircase	Stairs, ramp, etc.
Services	Water distribution and disposal	Water distribution (pipes, taps, tank, pump, etc.) Sanitary appliance (basin, sink, bath, shower, bidet, WC, etc.) Waste water disposal (pipes, traps, bullies, etc.) Rain water disposal (pipes, tanks, etc.) Sewerage (pipes, inspection chamber, septic tank, cesspool, etc.)
	Heating and ventilation	Gas fuel distribution (pipes, taps, tank, etc.) Liquid fuel distribution (pipes, taps, tank, etc.) Primary heat source (boiler, chimney, etc.) Water circuit (pipes, plant room, etc.) Air circuit (ducts, air vent, ventilator, etc.)
	Gas distribution	Compressed air distribution (pipes, plant, etc.) Gas distribution (pipes, plant room, etc.)

Sub-system		Example of assemblies or components
Services (continued)	Electrical	High voltage grid (lines, etc.) Transformer Low voltage grid (writing, switch, socket, lighting, etc.) Emergency electrical system and equipment
	Telecommunication	Telephone system (writing, telephone, etc.) Intercom system (writing, bells, door opener, intercom, etc.) Radio and television distribution (writing, aerial, etc.)
	Mechanical and electromechanical transport	Lift (plant room, car, cables, etc.) Escalator and moving walkway (plant, stairs, etc.) Facade cleaning equipment (cradle, cables, plant, etc.) Hoist (pulleys, etc.)
	Pneumatic and gravity transport	Refuse disposal (ducts, etc.) Central vacuum cleaning (ducts, plant, etc.) Linen chutes (ducts, etc.) Pneumatic transporter (ducts, plant, etc.)
	Safety	Lightning protection (conductor, cable, earth connection, etc.) Fire protection (pipes, tank, fire alarm, smoke detector, etc.) Intrusion protection (burglar alarm, etc.)
<p>NOTE 1 This table lists the physical parts of the building fabric in terms of sub-systems which exclude furniture and furnishings. This approach is based on the consideration of function only, being independent of any particular method, material or order of constructing the building.</p> <p>NOTE 2 Examples of common components or assemblies which perform the functions of each sub-system are given in brackets.</p>		

NOTE 7 Problems in the commissioning of plant may be inherent with the design of the system itself. Care needs to be taken to ensure that the components and equipment essential to facilitate commissioning are incorporated in the design details of the system, failing which the system may be technically uncommissionable when the time for commissioning arrives.

NOTE 8 A commissioning specification should be developed which includes:

- the scope of works i.e. the details of the systems to be commissioned, their functions and duration of operation, and an explanation of their relationship with other engineering systems
- the technical specification of the commissioning work i.e. the relevant standards to be complied with, the instruments to be used, the tolerances for test results, and the witnessing and reporting procedures
- design data relevant to commissioning such as flow rates, temperatures, operating pressures, plant capacities, illumination levels and glare indices, control logic statements, plant schematics, fault levels, and noise ratings.

NOTE 9 The designer should specify the precise scope and content of the operating and maintenance manuals and record drawings that are required. Requirements for the checking of draft manuals ahead of handover also needs to be stated in the scope of work

NOTE 10 The designer is required in terms of the Construction Regulations issued in terms of the Occupational Health and Safety Act of 1993:

- before the contract is put out to tender, make available to the client all relevant information about the design which may affect the pricing;
- inform the contractor of any known or anticipated dangers or hazards relating to the construction work, and make available all relevant information relating thereto including that relating to geotechnical conditions, the loading the structure is designed to withstand and the methods and sequence of construction;
- not include anything in the design of the structure necessitating the use of dangerous procedures or materials hazardous to the health and safety of persons, which can be avoided;
- take into account the hazards relating to any subsequent maintenance and minimise the risks associated therewith in the design;
- carry out sufficient inspections to ensure compliance with the requirements of the design and keep a record of such inspections on site;
- stop any contractor from executing any construction work which is not in accordance with the relevant design;
- conduct a final inspection upon completion prior to commissioning in order to render the works safe for use and issue a completion certificate to the contractor; and
- ensure that cognizance of ergonomic design principles is taken into account in order to minimise ergonomic related hazards

5.2.2.2 Stage 6B: Manufacture, fabrication and construction information

The following activities shall be undertaken during stage 6B (manufacture, fabrication and construction) to produce the manufacture, fabrication and construction information:

- a) **contractor:** produce the manufacture, fabrication and construction information based on the production information.
- b) **client's representative:** review the manufacture, fabrication and construction information prepared by others, based on the production information for design intent and conformance with scope of work.

NOTE Standard forms of contract contain generic requirements which facilitate the acceptance of manufacture, fabrication and construction information. Contract specific requirements may be included in the scope of work.

5.3 Site activities

5.3.1 Stage 7: Works stage

The following activities shall be undertaken during stage 7 (works) in relation to the works:

- a) provide temporary works
- b) provide permanent works in accordance with the contract
- c) manage risks associated with health, safety and the environment on the site,
- d) confirm that design intent is met; and
- e) correct notified defects which prevented the client or end user from using the works and others from doing their work

NOTE 1 Contract data in a contract identifies the applicable conditions of contract which contain terms that collectively describe the rights and obligations of contracting parties and the agreed procedures for the administration of their contract.

NOTE 2 Most of the standard forms of contract prescribed in the CIDB Standard for Uniformity in Construction Procurement for use by the public sector contain standard provisions for the delegation of employer responsibilities to an employer's representative. The standard arrangements are as follows:

- a) the Principal Agent in the JBCC Series 2000 contracts;
- b) the Project Manager in the NEC3 Engineering and Construction Works Contract;
- c) the Service Manager in the NEC3 Term Service Contract;
- d) the Supply Manager in the NEC3 Supply Contract; and
- e) the Engineer in GCC 2010 and the FIDIC contracts other than the FIDIC Short Form of Contract.

NOTE 3 High level procedures relating to the completion and correction of defects are contained in the conditions of contract. A well formulated contract should contain, where relevant, comprehensive commissioning requirements in the scope of work.

5.3.2 Stage 8: Handover stage

The following activities shall be undertaken during stage 8 (handover):

- a) finalise and assemble record information which accurately reflects the infrastructure that is acquired, rehabilitated, refurbished or maintained
- b) hand over the works and record information to the user and, if necessary, train end user staff in the operation of the works.

NOTE 1 There is a difference between achieving completion of the works in accordance with the provisions of the contract and the handing over of the works to the owner, end user or those responsible for the operation and maintenance of the works. A well formulated contract should contain, where relevant, testing and commissioning requirements ahead of completion to facilitate a smooth hand over.

NOTE 2 A handover needs to be planned. Prior warning of the expected handover dates needs to be given to those who are going to use, operate or maintain works. The successful completion of packages which incorporate plant (machinery and heavy equipment installed for the operation of a servicer) is usually dependent on there being a properly conducted commissioning procedure prior to or integrated with the hand over.

NOTE 3 The primary objective of the record information is to provide those tasked with the operation and maintenance of a building and associated site works with the necessary information to:

- a) understand how the designers intended the works, systems, subsystems, assemblies and components to function;
- b) effectively operate, care for and maintain the works, systems, subsystems, assemblies and components to function
- c) check, test or replace systems, subsystems, assemblies or components to ensure the satisfactory performance of works, systems, subsystems, assemblies and components over time;
- d) develop preventative (scheduled, routine) maintenance plans;
- e) determine stock levels for components and assemblies that need to be regularly replaced; and
- f) budget for the operation and maintenance of the works, systems, subsystems and components over time

The secondary objective of the record information is to provide information pertaining the planning and design of a works to inform refurbishments, alterations, modifications, renovations and additions that may be required from time to time.

NOTE 4 The record information that is handed over should be based on the design development report. They should include the following, as relevant:

Project information

- The purpose of the works
- A general description of the works
- The location of the works and, where relevant, existing services
- Particulars of the design team (name, area of responsibility and contact particulars)
- Particulars of the main and key subcontractors
- The manner in which legislative requirements including National Building Regulations were satisfied
- Legal restrictions on the site or works
- Statutory and local authority permissions which were obtained
- A list of reports together with a brief overview of such reports which informed the design and construction
- Key design features e.g. passive design concepts, fire safety systems
- Summary of testing and commissioning information prior to handover

Operating and maintenance information

- Systems and services descriptions
- Works information (e.g. list of record drawings, schedules, specifications, finishes, lock and key schedule, signage details etc.)
- Operational information (e.g. instructions on how to operate components and assemblies)
- Maintenance information (e.g. expected service life, cleaning and servicing instructions, health and safety procedures, servicing and maintenance plans, etc.)
- Warrantees and guarantees (provide particulars which extend beyond the defects date)
- Compliance certificates including certifications by designers to the effect that design intent was met

NOTE 5 The operation and maintenance manuals should contain information to enable safe and efficient operation and maintenance. The scope of content is likely to include:

- System description
- Mode of operation
- Manufacturer's technical literature
- Health and safety documentation
- Equipment schedules
- Parts identification and recommended spares
- Commissioning data
- Maintenance instructions
- Maintenance schedules
- Fault finding advice
- Emergency procedures/call out
- Lubrication details
- Modification information
- Advice on disposals
- Record drawings which provide a record of all the systems and components installed including pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components as well as position points for operating and maintenance purposes.

NOTE 6 The following terms are commonly used when describing maintenance activities:

- **Preventative maintenance** refers to maintenance undertaken at predetermined intervals for technical, statutory or reliability considerations.
- **Essential maintenance** refers to a process whereby maintenance activities is only undertaken to ensure that statutory requirements are met and that breakdowns that render the works unusable are repaired.
- **Inspections** refer to regular inspections conducted on critical components or elements such as plant and equipment to ensure that they function as intended in the manufacturer's product and guarantee specification or where applicable in terms of the occupational health and safety legislation.
- **Servicing** refers to the regular servicing of components (e.g. air conditioning, elevators, etc.) as per manufacturer's product and guarantee specifications or where applicable in terms of the operational health and safety legislation.
- **Repair** refers to actions required to reinstate a component of an immovable asset to its original state when such a component fails due to ordinary use.

Preventative maintenance is focused at keeping works at the current condition level through regular inspection, servicing and repair.

5.4 Close out stage

5.4.1 Stage 9A: Asset Data

The following activities shall be undertaken during stage 9A (asset data) in relation to the works:

- a) archive record information
- b) update portfolio asset register

NOTE This stage involves the obtaining of the required information for the asset register, the validation of the information and the entering of the information into the asset register.

5.4.2 Stage 9B: Package completion

The following activities shall be undertaken during stage 9B (package completion) in relation to the works:

- a) correct all defects that are detected during the defects liability period;
- b) complete the contract by finalising all outstanding contractual obligations including the finalisation and payment of amounts due after the expiry of the defects correction period
- c) evaluate package outcomes; and
- d) compile a completion report for the package outlining what was achieved in terms of key performance indicators and suggestions for improvements on future packages of a similar nature

NOTE The standard forms of contract that form the basis of the contract between the client and a contractor establish requirements for bringing a contract to conclusion.

6 Professional services

6.1 General

6.1.1 Professional services are required as inputs into most of the activities associated with a stage in order to produce a deliverable. Such services may be provided by suitably qualified employees, contracted individuals or professional service providers appointed by either the client or a contractor.

6.1.2 Professional services, as necessary and provided for in 6.3 shall be provided in support of the activities identified in 5.

6.1.3 Persons providing services shall:

- a) observe all relevant statutes, by-laws and associated regulations, standards of professional conduct and industry norms established in relevant South African national standards published in terms of the Standards Act of 2008 or standards recommended by professional associations;
- b) plan, design and review the works, installation or system, as relevant, taking into account pragmatic elements such as cost, construction limitations and technology and adjust their designs where the cost of the package exceeds the control budget, unless the client agrees to an increase in the control budget;
- c) do so using the skill and care normally used by professionals providing services similar to the required services;

- d) provide the required services for each stage or part thereof for which they are appointed in accordance with the relevant provisions of this standard;
- e) develop the deliverables associated with the end of a stage in sufficient detail so that it can be used to form the basis of the scope of work for taking the package forward in terms of the selected contracting strategy as shown in Table 3 (see Figure 3);
- f) maintain in full force and effect all consents and approvals and implement all actions required in accordance with their respective terms within the period of their validity;
- g) provide advice relating to the works or portions thereof that they are responsible for during the evaluation of tender offers;
- h) provide the necessary inputs into the client's occupational health and safety specification for incorporation into the scope of works associated with a construction works contract; and
- i) provide copies of all certifications associated with the provision of services relating to the project required in terms of legislation.

Table 3 – Key deliverables associated with the scope of work of a contracting strategy

Contracting strategy		Key deliverable which forms the basis of the scope of work associated with a contract	
Strategy	Description	Stage associated with the deliverable	Deliverable
Management contractor*	Contract under which a contractor provides consultation during the design stage and is responsible for planning and managing all post-contract activities and for the performance of the whole of the contract	3 Package preparation	Client accepted strategic brief*
Design and construct	Contract in which a contractor designs a project based on a brief provided by the client and constructs it	4 Package definition	Client accepted concept report
Develop and construct	Contract based on a scheme design prepared by the client under which a contractor produces drawings and constructs it	5 Design development	Client accepted design development report
Design by employer	Contract under which a contractor undertakes only construction on the basis of full designs issued by the employer	6a Design documentation (Production information)	Completed and client accepted production information

* A management contractor can also be appointed after Stage 4, 5 or 6A in which case the client accepted concept report, design development report or production information, respectively, can serve as the basis of the scope of work.

6.1.4 The client may in respect of a package, separately appoint a project leader, a lead designer, designers and a cost consultant. Alternatively, the client may appoint a person to perform more than one role or all the roles.

NOTE Where works involve a single discipline, e.g. civil engineering works, a single person is usually appointed to perform all the roles.

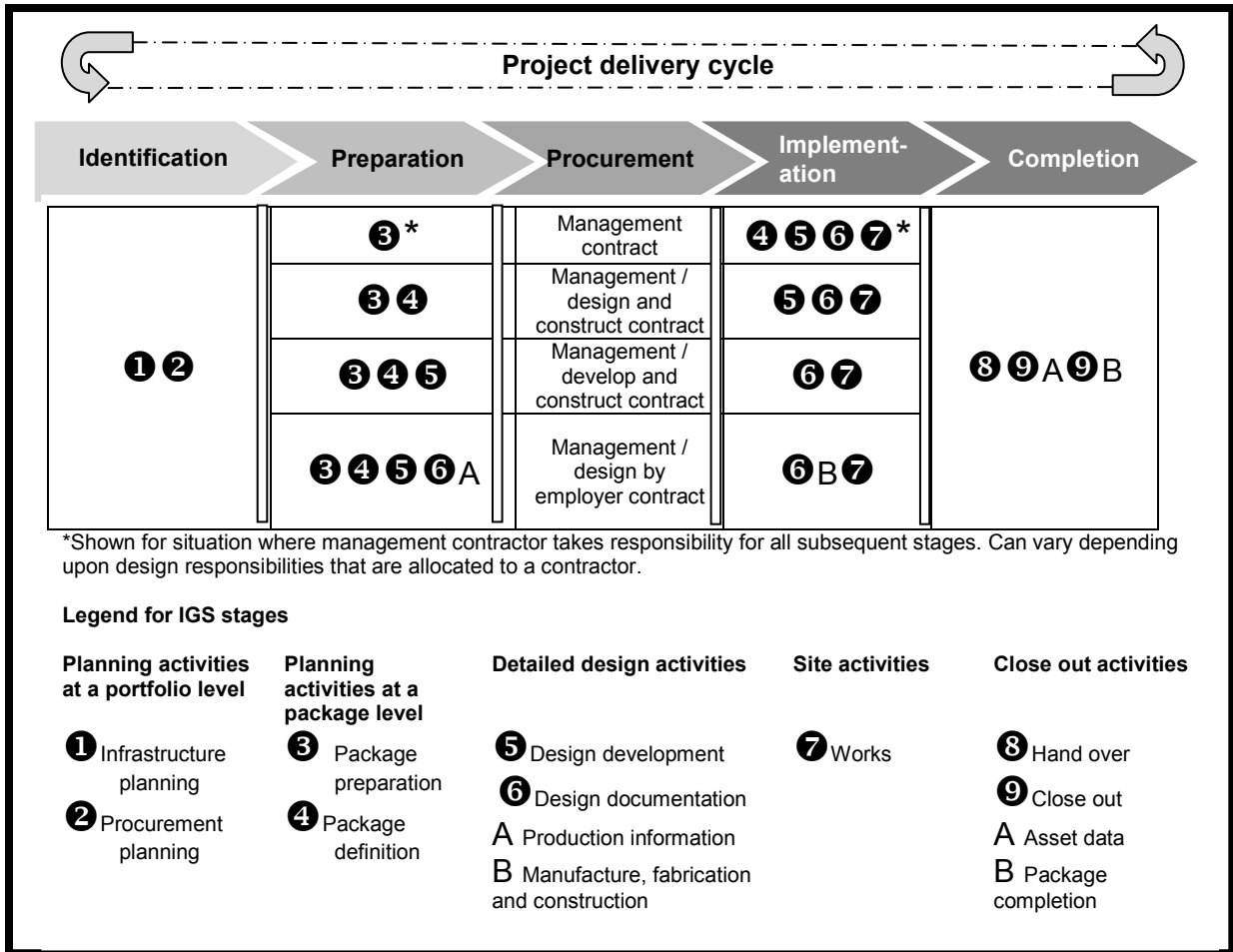


Figure 3: Procurement of contractors within the project delivery cycle

6.1.5 The client may appoint a designer to perform a discipline specific service (e.g. according to those described in Table 4 for building works) in which case, the designer shall provide the service in relation to the identified discipline, subject to the person appointed as the designer for architectural design services relating to a building ensuring that the planning and design of buildings, spaces and structures and associated site works:

- a) is properly co-ordinated between the different design disciplines as relevant; and
- b) satisfies the relevant prescriptive and functional requirements of the National Building Regulations published in terms of the National Building Regulations and Standards Act of 1977 (Act 103 of 1977) in relation to structural design, dimensions, public safety, site operations, excavations, foundations, floors, walls, roofs, stairways, glazing, lighting and ventilation, drainage, non-water-borne means of sanitary disposal, stormwater disposal, facilities for disabled persons, fire protection, space heating and fire installation.

6.1.6 The responsibilities for definition (i.e. develop the deliverable associated with a stage) and review (confirm that the deliverable satisfies the package information) services for each of the services provided for each stage in terms of different contracting strategies are as stated in Table 5 (see Figure 1).

6.1.7 Persons providing services shall establish the need for specialist advice, studies, tests and surveys relevant to design input, including the necessity of appointing a specialist to design a component of the fire protection component of buildings described in Table 6 and advise the client accordingly. They shall thereafter, as necessary, brief the specialist, co-ordinate the advice, studies, tests and surveys, advise the client on payments due, collate outputs of specialist study surveys, advise on implications of findings, report to the client and obtain further instructions

Table 4 – Design services relating to buildings

Service	Principal activities
Architectural design	Plan, design and review the construction, extension or refurbishment of buildings, spaces, structures and associated site works for the use of people by the creative organization of materials and components with consideration to mass, space, form, volume, texture, structure, light, shadow, materials and the project brief.
Acoustic design	Plan, design and review the construction of buildings and building components to achieve acoustical outcomes
Civil engineering	Plan, design and review the construction of site works comprising a structure such as a road, pipeline or sewerage system or the results of operations such as earthworks or geotechnical processes.
Electrical engineering	Plan, design and review the installation of the electrical and electronic systems for and in a building or structure
Facade engineering	Plan, design and review the installation of structures to enclose spaces in buildings and spaces
Fire safety	Plan, design and review the fire protection system to protect people and their environments from the destructive effects of fire and smoke.
Landscape architectural design	Plan, design and review the construction of outdoor and public spaces to achieve environmental, socio-behavioural, or aesthetic outcomes or any combination thereof
Mechanical engineering	Plan, design and review the construction, as relevant, of the gas installation, compressed air installations, thermal and environmental control systems, materials handling systems or mechanical equipment for and in a building
Structural engineering	Plan, design and review the construction of buildings and structures or any component thereof to ensure structural safety and structural serviceability performance during their working life in the environment in which they are located when subject to their intended use in terms of one or more of the following: i) external and internal environmental agents; ii) maintenance schedule and specified component design life; or iii) changes in form or properties
Wet services	Plan, design and review the construction, within buildings or from a point of drainage installations intended for the reception, conveyance, storage or treatment of sewage and water installations or water installation which conveys water for the purpose of fire-fighting or consumption within a building.

Table 5– Allocation of responsibilities for services in the different contracting strategies

Contracting strategy (see Table 3)	Stage (See Figure 1)	Client's responsibilities	Contractor's responsibilities
Management contractor*	4, 5 and 6A	Review services	Definition services
Design and construct	4	Definition services	None
	5 and 6A	Review services	Definition services
Develop and construct	4 and 5	Definition services	None
	6A	Review services	Definition services
Design by employer	4, 5 and 6A	Definition services	None

* A management contractor can also be appointed after Stage 4, 5 or 6A, in which case, the management contractor will assume the responsibilities for the contractor associated with that stage.

Table 6 – Specialist fire design services

Design, install and maintain automatic sprinkler system in accordance with the requirements of SANS 10400-T
Design and install a lightning protection system in accordance with the requirements of SANS 10400-T
Design, install, test and maintain the pressurization of emergency routes and components in accordance with the requirements of SANS 10400-T
Design, install and maintain a fire detection and alarm system in accordance with the requirements of SANS 10400-T
Design, install and maintain a fixed automatic fire-fighting system that is in accordance with the requirements of SANS 10400-T
Perform a rational assessment of building materials and components to determine their fire resistance in accordance with the requirements of SANS 10400-T.

NOTE Some of the specialist fire design services can be undertaken by specialist subcontractors of the contractor

6.2 Drawings

6.2.1 Those providing services shall:

- a) maintain a register of all drawings and other production information issued for construction purposes.
- b) provide record drawings indicating all deviations from the construction drawings.

6.2.2 The drawings shall clearly indicate the following:

- a) the project title;
- b) the drawing title;
- c) the drawing number and date;
- d) the revision number and date; and
- e) the drawing status i.e. for acceptance, for construction or for fabrication/manufacture.

6.2.3 The structural drawings shall contain the following information:

- a) the design standards;
- b) the loads which the structure is designed to withstand;
- c) the key geotechnical parameters used in the design;
- d) the basic engineering properties of the construction materials; and
- e) the construction standards;

6.3 Scope of professional services

6.3.1 Stage 1 (Infrastructure planning) services

6.3.1.1 General services

Provide the following services, as necessary, to develop and update the end of stage deliverable:

- a) identify infrastructure needs (demand) based on:

- 1) the client's service mandate which has been translated into infrastructure norms and standards and service delivery priorities;
 - 2) strategic objectives and policy mandates from the strategy development process including targets for delivery of basic infrastructure and the addressing of backlogs; and
 - 3) assessment reports, if any, (usually based on asset register reports and life cycle plans associated with each asset);
- b) translate needs into preliminary projects which include a brief description of the item so that they may be readily identified;
- c) categorise projects into the following time frames:
- 1) long term – projects which may be initiated after the current Medium Term Expenditure Framework (MTEF) period;
 - 2) medium term – projects which will be initiated in the current Medium Term Expenditure Framework (MTEF) period; or
 - 3) short term – projects which have been initiated or will be initiated in the current or next financial year;
- d) review the status of existing infrastructure (supply) by generating data from the asset register and obtaining confirmation from the:
- 1) user (entity that uses or intends to use infrastructure) regarding considerations such as utilisation, suitability for services delivered, cost effectiveness and availability of the infrastructure as well as the anticipated duration that such assets will be required for; and
 - 2) custodian (entity that is responsible for the efficient and effective management of infrastructure throughout their lifecycle) regarding considerations such as life cycle management information, condition assessments and maintenance requirements to confirm the actions that need to be taken, namely:
 - i) infrastructure is in an acceptable condition to the user in which case normal maintenance is to continue;
 - ii) infrastructure is suitable to the user's requirements, but require technical condition assessment as the asset performance does not meet minimum functional requirements; or
 - iii) infrastructure is unsuitable to the current user's requirements;
- e) conduct a gap analysis by comparing:
- 1) the demand for and supply of infrastructure and
 - i) categorise these gaps into non-infrastructure solutions (leasing, disposal or transfer of infrastructure between users) and infrastructure solutions; and
 - ii) schedule when these solutions are required; or
 - 2) required versus current service levels;
- f) describe the consequences of not addressing the gaps;
- g) develop a range of proposed projects to address the identified gaps or schedule projects to minimise the consequences of not addressing gaps;

- h) conduct preliminary assessments on proposed projects in accordance with the requirements of 6.3.1.2 to screen and to sift through the merits of solutions and competing projects.
- i) where appropriate conduct further assessments and prepare:
 - 1) more detailed cost estimates for the cost of the project;
 - 2) a credible revenue forecast over the lifetime of the infrastructure associated with the project to determine financial sustainability; and
 - 3) reports on aspects of the project based on desk top studies to confirm the viability of the project and to ensure that the cost estimates are realistic;

to increase confidence in budgetary value, the project value proposition or project risk profile and thereby facilitate improved management decision making.

NOTE A further assessment can be appropriate in the case of very large and complex projects (e.g. large water or sewer treatment works) or in projects where there is a high level of cost variability between different projects or the benefits derived from the project are uncertain. It might also be necessary to undertake some of the activities usually associated with stage 3 in such an assessment.

- j) categorise projects under the following broad categories:
 - 1) maintenance (preventative, corrective, scheduled or routine);
 - 2) refurbishment and rehabilitation
 - 3) acquisition (construction, extension, alteration, or leasing); and
 - 4) demolition/transfer of infrastructure between users; and
- k) further categorise projects to facilitate reporting and collate all the estimated costs and schedules of these costs in respect of each category of project and develop a preliminary multiyear cash flow focusing on the MTEF period, taking into account the available funding, priorities based on objective criteria and commitments carried over from the previous financial year and costs to manage the implementation of the infrastructure plan.

6.3.1.2 Preliminary assessment

6.3.1.2.1 Conduct a preliminary assessment on the range of options to resolve the identified gaps in order to arrive at an initial decision as to whether or not:

- a) a proposal is worthy of consideration; and
- b) funding should be committed to take the project forward.

6.3.1.2.2 Provide information, as appropriate on the following:

- a) the problem description or opportunity i.e. the objective of the project;
- b) particulars of the proposal such as location, timeframe and indicative costs;
- c) alternative solutions; and
- d) perceived benefits, potential risks and other considerations, based primarily on professional judgement rather than detailed research and planning

6.3.1.2.3 Establish objective decision making criteria based on factors such as those relating to strategic objectives, the level of stakeholder support, legislative compliance, risk considerations and financial justification.

6.3.1.2.4 Identify risks and categorise in accordance with provisions of Table 7.

Table 7 – Categorisation of risks in preliminary assessments

Risk category	Description
A	Low risk - no apparent material risks detected. Project viable and should proceed rapidly
B	Medium risk - some material risks detected which need to be considered and mitigated against before proceeding. Project potentially viable subject to further assessment.
C	High risk – material risks detected with limited prospects for mitigation or elimination.

6.3.1.2.5 Make a recommendation for the acceptance or rejection of the proposed project and, if relevant, select the preferred solution, based on the merits and impact of the problem and the solutions offered.

6.3.1.2.6 Document findings, assumptions and recommendations in a brief report.

NOTE 1 The preliminary assessment is a “lightweight” upfront pre-screening of a specific project by a suitably qualified professional and answers the question as to whether or not funding should be released to conduct an assessment and what are the main risks that require mitigation.

NOTE 2 The necessary inputs to the service can be obtained from:

- a) telephonic interviews or meetings with officials in organs of state, professionals working on similar projects or aspects thereof in the vicinity or who have previously worked on the infrastructure or related infrastructure that is under consideration, councillors, community leaders and relevant stakeholders;
- b) public documents and records e.g. Integrated Development Plans and asset management data bases;
- c) site visits, aerial photographs and GIS systems, and
- d) technical reports and studies previously produced by public and private bodies and individuals

NOTE 3 A preliminary assessment is characterised by the collection of available information, desk top assessments, initial stakeholder consultation and site visits.

NOTE 4 Issues such as landownership/custodianship, ownership disputes and intra-community conflicts should be considered and highlighted as they can be regarded as fatal flaws.

6.3.2 Stage 2 (Procurement planning) services

Provide services following the step by step procedure contained in IDM Toolkit Delivery Management Guidelines Practice Guide 2 - Construction Procurement Strategy to develop or update the end of stage deliverable.

6.3.3 Stage 3 (Package preparation) services

Provide as necessary, the services set out in Table 8, to develop the end of stage deliverable.

6.3.4 Stage 4 (Package definition) services

6.3.4.1 Provide, as necessary, the services set out in Table 9 to develop the end of stage deliverable.

6.3.4.2 Where others develop the concept report (e.g. in terms of a management contractor contracting strategy), professionals appointed by the client shall review the concept report for general conformity with the scope of work in their respective areas of expertise.

6.3.5 Stage 5 (Design development) services

6.3.5.1 Provide, as necessary, the services set out in Table 10 to develop the end of stage deliverable.

6.3.5.2 Where others develop the concept report (e.g. in terms of a management contractor or design and construct contracting strategy), professionals appointed by the client shall review the concept report for general conformity with the scope of work in their respective areas of expertise.

6.3.6 Stage 6 (Design documentation) services

6.3.6.1 Provide, as necessary, the services set out in Table 11 and 12 to develop the end of stage deliverable.

6.3.6.2 Provide as necessary the services associated with the development of the logistic support plan.

6.3.7 Stage 7 (Works), Stage 8 (Handover) and Stage 9 (Close out) services

6.3.7.2 Provide, as necessary, the services set out in Table 13 to develop the end of stage deliverables.

6.3.7.2 Provide services associated with the performance of one of the roles identified in Table 14 in relation to the contract entered into with the contractor.

6.3.7.3 Provide construction monitoring services as required by the client at the level indicated in Table 15.

6.3.7.4 Record in a book, which shall be kept on site in the same place as the health and safety file required in terms of the client's occupational health and safety specification, all site visits and any notifications or instructions to the contractor regarding defects and the rectification thereof which occur prior to completion of the works.

6.3.8 Procurement services

6.3.8.1 Develop, where required by the client, procurement documents (calls for expressions of interest, tender documents and contracts) in accordance with the provisions of the CIDB Standard for Uniformity in Construction Procurement.

6.3.8.2 Evaluate, where required by the client, calls for expressions of interest and tenders in accordance with the provisions of the CIDB Standard for Uniformity in Construction Procurement and develop evaluation reports taking into account relevant best practices and practice notes issued by the CIDB.

6.3.9 Project management services

Provide where required by the client, the following services, as necessary:

- a) manage the planning and implementation of packages in terms of the infrastructure gateway system stages in a manner that enables the client to achieve its objectives and in such a manner that:
 - 1) all projects are developed and managed in terms of a common procedural and programmatic approach and integrated with the client's administrative processes and are institutionalised;
 - 2) the various elements of the projects are properly co-ordinated;
 - 3) the projects include all the work required, and only the work required, to complete the project successfully;
 - 4) the timely completion of the projects is facilitated;
 - 5) projects are completed as far as is reasonably possible, within the budget that is agreed from time to time with the client;
 - 6) the project satisfies the needs for which it was undertaken;
 - 7) effective use of the people involved with projects is made;

- 8) timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project and package information occurs; and
 - 9) the systematic identification, analysis, and response to project risk occurs.
- b) act as the client's agent in terms of the contracts that the client has with professionals.

Table 8 – Stage 3 (Package preparation) services

Project leader	Lead designer	Designer and cost consultant
<p>1) Establish the need for specialist advice and studies and procure or facilitate the procurement of such advice and studies.</p> <p>2) Obtain outline statement from the client setting out the client's requirements and objectives including cost and schedule for the package.</p> <p>3) Identify and document constraints to the development of design proposals or solutions.</p> <p>4) Identify stakeholders and facilitate the necessary consultations in consultation with the client.</p> <p>5) Facilitate the development and finalization of the strategic brief.</p> <p>6) Document findings, assumptions and recommendations on studies and work undertaken in developing the strategic brief in a brief report.</p> <p>7) Obtain the client's acceptance of the strategic brief.</p>	<p>In addition to providing services as set out for the designer, coordinate the advice and input of designers and cost consultants</p>	<p>1) Provide discipline specific advice, data or input into the need for specialist advice and studies, liaison with stakeholders and the development of the strategic brief.</p> <p>2) Carry out, where instructed by the project leader, discipline specific preliminary studies and information gathering to assist in establishing the strategic brief.</p> <p>3) Advise on the need for surveys, analyses, tests or investigations which will be required in stage 4 to refine the production information and assumptions made during stage 3 and the availability and location of related infrastructure and services.</p> <p>4) Collaborate and assist with the preparation and finalisation of the strategic brief.</p>

Table 9 – Stage 4 (Package definition) services

Project leader	Lead designer	Designer	Cost consultant
<p>1) Assist the client with the procurement of the services of suitable qualified persons to provide discipline specific services.</p> <p>2) Brief the client and the project team on procedures to complete stage 4 and to meet project objectives.</p> <p>3) Initiate, obtain agreement and direct implementation of management and reporting procedures for stage 4.</p> <p>4) Obtain instructions from client on allocation of design responsibilities within project team.</p> <p>5) Receive advice on constraints that may affect the accepted strategic brief, obtain instructions on how the client wishes to proceed and incorporate any agreed amendments and adjustments in the concept report or revised construction procurement strategy.</p> <p>6) Receive and consider inputs from the project team and take any necessary actions.</p> <p>7) Facilitate the development and finalization of the concept report including the obtaining of any approvals or in principle acceptances of elements within the concept report.</p> <p>8) Obtain the client's acceptance of the concept report.</p>	<p>In addition to providing services as set out for the designer:</p> <p>1) Establish the design approach or solution so that the design or solution achieves the required quality, health and safety and other required standards and is co-ordinated within the project team.</p> <p>2) Advise on allocation of responsibilities within the project team and resolve potential ambiguities.</p> <p>3) Co-ordinate:</p> <p>a) the designers' and cost consultant's activities, inputs and outputs.</p> <p>b) the establishment of the primary design, rehabilitation or maintenance criteria including durability, projected maintenance, design or service life and environmental policy.</p> <p>c) the carrying out of specialist studies and surveys relevant to design input or solutions.</p> <p>d) the periodic reviews of the development of the design concept or solution for conformity with the strategic brief and the control budget.</p> <p>e) the scope of consultations with statutory authorities, funders and utilities.</p> <p>4) Give design direction to the preparation of design options or solutions and inputs into the concept report and the establishment of preferred design option or solution.</p>	<p>1) Implement the established management and reporting procedures to complete the concept report in response to the strategic brief.</p> <p>2) Visit the site, carry out initial appraisal and advise on physical restrictions that might affect the package information and the control budget.</p> <p>3) Collaborate with the project team and provide discipline specific advice, data or input into the need for specialist advice and studies, liaison with stakeholders, consultations with and documents required by statutory bodies, funders and utility providers and the development and finalisation of the concept report.</p> <p>4) Advise on further surveys, analyses, tests and investigations which may be required and advise on payments due to specialists for specialist investigations, tests and studies.</p> <p>5) Develop the design or maintenance approach with the project team so that the design achieves the required quality, health and safety and environmental standards, satisfies all regulatory requirements and consents and is integrated within the project team and with the requirements of utility providers and interfaces with related projects of existing infrastructure.</p> <p>6) Advise and comment on matters, regulations or guidelines with which the project must comply and comment on implications on package information.</p> <p>7) Establish design options or solutions and motivate preferred options or solutions.</p> <p>8) Provide information for or establish cost and life cycle cost estimates of components or elements of the package.</p> <p>9) Prepare preliminary design information or repair and maintenance information in the form of sketches, design notes, drawings or any combination thereof and outline performance specifications sufficient to describe the scope, scale, form and character of works for concept report and to develop a realistic cost plan; and</p> <p>10) Assemble concept design information and narrative describing developed brief and evolving design or maintenance intent for inclusion in concept report.</p>	<p>5) Provide cost advice to support the development of design approach or solutions so that the selected design or solution achieves the required quality and health and safety standards within the control budget.</p> <p>6) Receive details of options and preliminary design information or solutions and prepare cost plan for the concept report based on preliminary and elemental or equivalent cost estimates.</p> <p>7) Advise on the effect of market conditions on cost plan.</p> <p>8) Assemble the cost plan and related reports for inclusion in the concept report and motivate or propose cost reduction measures where the cost plan exceeds the control budget.</p>

Table 10 – Stage 5 (Design development) services

Project leader	Lead designer	Designer	Cost consultant
<p>1) Direct</p> <ol style="list-style-type: none"> a) project team considerations and investigations of alternative design solutions that comply with the package information. b) risk management process, allocate to project team risk mitigation actions, and assess impact on package information. c) value management process, allocate to project team proposals for value management, and assess impact on package information. d) receive reports/proposals and obtain instructions from client. <p>2) Monitor</p> <ol style="list-style-type: none"> a) progress of consultations with utility providers. b) finalization of design criteria. c) provision of principal elements to assist in establishing cost plan. <p>3) Refine, obtain agreement and direct implementation of management procedures and reporting procedures.</p> <p>4) Receive inputs from project team, assess impact on package information and, as necessary, submit to client and obtain instructions or agreement.</p> <p>5) Manage and monitor liaison and consultations with statutory authorities to agree submission requirements, report to client and arrange payment of fees.</p> <p>6) Prepare and assemble design development report and submit to client for acceptance.</p> <p>7) Obtain client comments on or amendments to design development report, discuss with project team, advise on impact of any amendments or additional requirements, agree changes and resubmit design development report to the client for acceptance.</p> <p>8) Obtain statutory permissions that are required</p>	<ol style="list-style-type: none"> 1) Refine design approach so that the design achieves the required quality, is co-ordinated within the project team and is in conformity with package information. 2) Co-ordinate work of discipline specific design consultants and cost consultant. 3) Give design direction to consideration of design options. 4) Give design direction and co-ordinate <ol style="list-style-type: none"> a) provision of briefing information to specialists, and suppliers. b) integration of the design and requirements of project team. c) integration of the design and requirements of specialists and suppliers. 5) Lead and co-ordinate liaison and consultations with statutory authorities to agree submission requirements. 	<ol style="list-style-type: none"> 1) Advise on updating design schedule. 2) As the design develops, review compliance with regulations and advise on any implications. 3) Collaborate and assist in preparing design development report. 4) Receive and with project team discuss client comments on or amendments to design development report, advise on impact of any amendments or additional requirements and changes. 5) With project team, develop design approach and periodically review so that the design achieves required quality, is co-ordinated and is in conformity with package information. 6) Prepare design options for elements of works and test options with project team against package information and agree preferred option. 7) Develop strategy for use, cleaning, maintenance and subsequent construction. 8) Advise where elements of works are most appropriately designed (wholly or in part) by specialists/suppliers, provide briefing information. 9) Receive and advise on outputs of specialist studies and surveys and incorporate into the design. 10) Liaise with utility providers as necessary and incorporate into the design their requirements. 11) Prepare calculations in sufficient detail to facilitate and verify design development. 12) Finalise design criteria for works. 13) Develop actions for risk mitigation and assess with project team impact on package information. 14) Contribute to value management process and assess impact on package information. 15) Provide information on principal elements to assist in establishing cost plan. 16) Establish critical construction details, tolerances, performance tolerances and anticipated movements, defining critical co-ordination clearances. 17) Advise on scope of performance and prescriptive specifications, and procurement implications. 18) Liaise with project team and contribute to consultations with statutory authorities to agree submission requirements. 19) Prepare design development drawings defining detailed form, function and character of works with the primary components being defined in terms of overall size and typical detail, including general arrangement plans, sections, elevations and details in sufficient detail to show design intent. 20) Prepare outline specifications for components of works defining performance and quality. 21) Assemble design development drawings, outline specifications and agreed visualizations for inclusion in design development report. 	<ol style="list-style-type: none"> 5) Provide cost advice for development of design approach so that the design achieves required quality, is co-ordinated within project team and in conformity with package information. 6) Contribute to periodic reviews of development of the design for conformity with project team, assess need for changes, advise on impact on package information and incorporate agreed changes. 7) Update cost plan and advise on budget. 8) Prepare cash flow forecasts and monitor expenditure against cost plan and report. 9) Advise on effect of market conditions including forecast of construction cost. 10) Prepare cost studies to assist project team in testing options. 11) Consider cost aspect of strategy for use, cleaning and maintenance and subsequent construction. 12) Receive and advise on outputs of specialist studies and surveys and incorporate into the cost plan. 13) Provide cost information for liaison with utility providers. 14) Support development of actions for risk mitigation and assess impact on package information with project team. 15) Contribute to value management process and assess impact on package information with the project team. 16) Receive information on principal elements to establish approximate quantities. 17) Receive details of design development and prepare cost details for inclusion in the design development report. 18) Assemble cost plan and reports for inclusion in design development report.

Table 11 – Stage 6A (Production information) services

Project leader	Lead designer	Designer	Cost consultant
<p>1) Refine or initiate, obtain agreement and direct implementation of refined management procedures and reporting procedures.</p> <p>2) Receive:</p> <p>a) project team advice on scope, content, assembly, packaging and sequencing of production information, and updating of design schedule and report to client and obtain instructions.</p> <p>b) results of periodic review of the development of the design for conformity with package information and advise on need for change, advise on impact, submit to client and obtain instructions.</p> <p>3) Monitor and manage development of production information in conformity with package information.</p> <p>4) Direct work of project team, allocate actions, assess impact on package information, report to client and obtain instructions.</p> <p>5) Contribute to strategy for construction, use, cleaning and subsequent maintenance, and report to client and obtain agreement.</p> <p>6) Manage and monitor project team liaison and submissions to statutory authorities and report to client.</p> <p>7) Receive production information drawings and schedules of work sufficient for construction and assemble works information and undertake package review.</p> <p>8) Obtain any outstanding statutory permissions</p>	<p>1) Co-ordinate work of discipline specific design consultants and cost consultant.</p> <p>2) Co-ordinate advice on scope, content, assembly, packaging and sequencing of production information and implementation of clients instructions.</p> <p>3) Give direction to development of production information in conformity with package information.</p> <p>4) Give design direction and co-ordinate integration of the design requirements of project team and specialist and suppliers into package information.</p> <p>5) Lead and co-ordinate project team liaison and making of submissions to statutory authorities.</p>	<p>1) Advise on scope, content, assembly, packaging and sequencing of production information and implement instructions.</p> <p>2) Advise on updating design schedule.</p> <p>3) Develop production information in conformity with package information.</p> <p>4) Periodically review development of the design for conformity with package information, assess with project team need for changes and advise on impact on package information.</p> <p>5) Incorporate non-material changes to the design.</p> <p>6) Confirm strategy for construction, use, cleaning and subsequent maintenance.</p> <p>7) Develop actions for risk mitigation and assess with project team impact on package information.</p> <p>8) Contribute to value management process, develop proposals for value management and assess with project team impact on package information.</p> <p>9) Integrate the design and requirements of project team into package information.</p> <p>10) Integrate the design and requirements of specialists and suppliers into package information.</p> <p>11) Prepare drawings and integrate information from specialists and suppliers.</p> <p>12) Liaise with project team and contribute to submissions to statutory authorities.</p> <p>13) Prepare production information drawings and schedules of works sufficient for construction or preparation of manufacturing and installation drawings and production information by other project team members.</p> <p>14) Receive confirmation of setting out information and dimension drawings.</p> <p>15) Prepare detailed specifications for components of works for inclusion in scope of work, defining performance, quality, operating and maintenance requirements.</p> <p>16) Incorporate appropriate facilities for commissioning within the system design.</p>	<p>3) Support development of production information in conformity with the package information.</p> <p>4) Contribute to the periodic review of the development of the design for conformity with package information, advise on conformity with the package information, assess with project team need for changes and advise on impact on package information.</p> <p>5) Contribute to confirmation of strategy for use, cleaning and maintenance and subsequent construction.</p> <p>6) Advise on effect of market conditions including forecast of construction cost.</p> <p>7) Support development of proposals for risk mitigation and assess with project team impact on package information.</p> <p>8) Contribute to value management process, support development of proposals for value management and assess with project team impact on package information.</p> <p>9) Review integration of the design and requirements of specialists and suppliers into package information for conformity with cost plan.</p> <p>10) Receive production information drawings and schedules of work sufficient for construction or preparation of manufacturing and installation drawings and undertake cost check exercise, monitor cost and update cash flow projections.</p>

Table 12 – Stage 6B (Manufacture, fabrication and construction information) services

Design lead	Discipline specific designer
<p>Professionals appointed by client (review service)</p> <p>Coordinate work of discipline specific design consultants:</p>	<ol style="list-style-type: none"> 1) Advise on need for instructions relating to MF&C information. 2) Review schedule for submission of MF&C information to meet needs of procurement pre-installation testing, and construction schedule. 3) Provide information required to clarify production information drawings and specifications. 4) Receive and review MF&C information for general conformity with scope of work and consider need for amendments and resubmissions for further review and issue comments. 5) Advise on need to amend production information or design included in scope of work and assess impact on changes on package information with project team. 6) Advise on contractor's proposals relating to elements of the works to be designed by contractor. 7) Receive and review samples of materials, components and assemblies for general conformity with scope of work and consider the need for amendments and resubmission for further review and issue comments. 8) Comment on contractor's method statements in so far as they reflect on design intent of the works. 9) Monitor progress with completion of MF&C information. 10) Review operation and maintenance manuals for components and systems, record drawings and schedules of design criteria of works as constructed, for general conformity with scope of work information and completeness. 11) Update production information, general arrangement drawings and schedules, incorporating changes instructed during construction.
<p>Professional appointed by the contractor</p> <p>Coordinate work of discipline specific design consultants:</p>	<ol style="list-style-type: none"> 1) Consider production information and advise on issues requiring supplementary information or clarification. 2) Advise on design schedule that meets needs of procurement, pre-installation testing, construction works contract and construction schedule. 3) Regularly review design schedule for receipt and issue of information, submissions for approval, and testing and commissioning during construction. Issue schedule of drawings and other information to be provided. 4) Develop actions for risk mitigation and assess impact with construction contract team/project team. 5) Contribute to value management process. Develop proposals for value management. With Construction Contract team/project team assess impact on construction works contract. 6) Request and obtain information required to clarify production information drawings and specifications. 7) Prepare co-ordinated manufacture and installation drawings of elements and/or components and relevant testing and commissioning information, based on production information. Integrate with construction, manufacture and installation drawings. 8) Periodically review development of the design for conformity with production information. With construction contract team/project team assess need for changes and advise on impact on construction works contract. 9) Obtain reviews and approvals for MF&C information. Provide, for review and approval, technical submissions detailing quality and performance of materials and equipment to demonstrate compliance with production information. 10) Provide clarification of MF&C information as required. 11) Update drawings and schedules to reflect changes in components and installations as construction progresses. 12) Assess impact of variations on production information and advise. 13) Define quality control and testing procedures to demonstrate compliance with construction works contract. Receive results of performance demonstration tests, adjust MF&C information as required and re-test. Obtain reviews for results of tests. 14) Advise on need for special inspections or tests during construction. 15) Assist with preparation of maintenance manuals for components and systems, record drawings and schedules of design criteria of works as constructed.

Table 13 – Stage 7 (Works), Stage 8 (Handover) and Stage 9 (close out) services

Project leader	Lead designer	Designer	Cost consultant
<p>1) Deal with any outstanding issues</p> <p>2) Monitor</p> <ul style="list-style-type: none"> - review of record information and issue to client - liaise with project users in use of systems - respond to queries about use, cleaning, maintenance and subsequent operation - obtain outstanding statutory permissions <p>3) Lead post-Project review</p> <p>4) Assemble records and archive originals and copies as appropriate</p>	<p>In addition to performing discipline specific Design Consultant tasks co-ordinate</p> <ul style="list-style-type: none"> - review of record information - liaison with project users in use of systems - assistance with queries about use, cleaning, maintenance and subsequent operation - the obtaining of any outstanding statutory permissions 	<p>1) Deal with any outstanding issues</p> <p>2) Contribute to post-project review</p> <p>3) Assemble records and archive originals and copies as appropriate</p> <p>4) Complete inputs into record information</p> <p>5) Liaise with Project users in use of systems</p> <p>6) Assist with queries about use, cleaning, maintenance and subsequent construction</p> <p>7) Assist with obtaining of any outstanding statutory permissions</p>	

Table 14 – Roles provided for in different forms of contract (stage 7)

Form of contract		Role as provided for in the contract
FIDIC	Red, Yellow, Silver or Gold Book	Engineer
	Green	Employer's representative
GCC 2010		Engineer
JBCC series 2000 PBA and MWA		Principal agent
		Agent
NEC3	Engineering and construction contract	Project manager
		Supervisor
	Engineering and construction short contract	Employer's representative
	Supply contract	Supply manager
	Term service contract	Service manager
Term service short contract	Employer's representative	

Table 15 – Levels of construction monitoring (stage 7)

Level	Description
1	<ul style="list-style-type: none"> Monitor the outputs from another party's quality assurance schedule against the requirements of the plans and specifications. Visit the works at a suitable frequency to review important materials, critical work procedures and/or completed elements or components.
2	<ul style="list-style-type: none"> Review, preferably at the earliest opportunity, a sample of each important: <ol style="list-style-type: none"> work procedure; and construction material for compliance with the requirements of the works information and review representative samples of important completed work prior to enclosure or completion as appropriate. Visit the works at a suitable frequency to review important materials, critical work procedures and/or completed elements or components.
3	<ul style="list-style-type: none"> Maintain a part-time presence on site to review random samples and review important completed work prior to enclosure, or on completion, as appropriate.
4	<ul style="list-style-type: none"> Maintain a full time presence on site to constantly review: <ol style="list-style-type: none"> work procedures construction materials for compliance with the requirements of the plans and specifications and review completed work prior to enclosure or on completion as appropriate.

NOTE 1 The Contractor is responsible for providing the works in accordance with the provisions of the contract. Construction monitoring provides an independent verification, to the level required by the client, that the works are being completed in accordance with the requirements of the contract, that the designs are being correctly interpreted and that appropriate techniques are being utilised. Construction monitoring creates no contractual relationship between those providing the monitoring services and the contractor.

NOTE 2 The level enables requirements for site staff to be determined.

Annexure A

(informative)

Incorporating the provisions of this standard in the scope of work of contracts

A.1 General

SANS 10403, *Formatting and compilation of procurement documentation*, and ISO 10845-2, *Formatting and compilation of procurement documentation*, provide informative annexes which list a number of items which are recommended for inclusion in the scope of work of engineering and construction works contracts and service contracts. These standards state that “*Some of the topics might not be required where use is made of standards for construction and management requirements, or a generic management specification issued by a particular employer, as these documents might adequately cover these topics. Likewise, the use of certain forms of contract and the adoption of some contracting strategies might obviate the necessity for some of the headings.*”

A.2 Engineering and construction works contracts

A.2.1 SANS 10403 and SANS 10845-2 recommend that the following topics which relate to design are dealt within the scope of work of engineering and construction works contracts:

- “Employer’s Objectives” which describe the employer’s objectives for the delivered end product or the project.
- “Design services and activity matrix” be addressed to identify responsibilities for design and related documentation
- “Employer’s design” which describes the extent of the employer’s design, if any
- “Design brief” which provide the design brief where the contractor is required to provide the works
- “Drawings” which State requirements for drawings to be prepared by the contractor and list all drawings prepared by the employer
- “Design procedures” which establish design procedures where the contractor is responsible for the design

NOTE 1 It is important to clearly state the employer’s objective for the works and for the overall project should such works form part of a project.

NOTE 2 Where the design by employer contracting strategy is used with, or without a management contractor, use should be made of SANS 1921-1, *Construction and management requirements for works contracts Part 1: General engineering and construction works*, and if relevant SANS 1921-3, *Construction and management requirements for works contracts Part 3: Structural Steelwork*, to develop the scope of work. These standards require the contractor to design the temporary works and, in the case of structural steel work, to provide the design of simple connections that are not intended to transfer bending moment, fabrication drawings and erection mark drawings, if so required in terms of the specification data.

NOTE 3 Where the management contractor is responsible for the design of the works, the client’s strategic brief needs to be incorporated in the scope of work

A.2.2 The manner in which the provisions of this standard can be incorporated by reference into the scope of work of an engineering and construction works contract where the contractor is responsible for design activities other than those associated with a specialist subcontractor is illustrated in Examples 1.

EXAMPLE 1 Incorporating the standard in an engineering and construction works contract which allocates design responsibilities to the contractor

Design and planning services

1 *The Contractor shall perform the activities and develop the end of stage deliverables associated with the following stages in the Standard for the Delivery and Maintenance of Infrastructure using a Gateway System published by the CIDB:*

.....*
 *Insert stages, depending upon which contracting strategy is selected

Stage	Contracting strategy		
	Management contractor	Design and construct	Develop and construct
Stage 4: Package definition	contractor	employer	employer
Stage 5: Design development	contractor	contractor	employer
Stage 6A: Production information	contractor	contractor	contractor

2 *The contractor is required to design all temporary works*

Employer’s design

*The employer’s design is contained in annexure**

*Insert one of the following documents in the annexure, depending upon the selected contracting strategy

Contracting strategy	
Design and construct	Develop and construct
Concept report	Design development report

Design procedures

- 1 *The Contractor shall prepare the end of stage deliverable(s) for acceptance by the Employer.*
- 2 *The Contractor shall engage with the Employer’s professional services providers appointed to undertake review services in accordance with the requirements of the Standard for the Delivery and Maintenance of Infrastructure using a Gateway System published by the CIDB in the finalisation of the deliverables. The Contractor shall respond to issues of clarity raised by the Employer’s professionals and provide additional information that they may require to enable the Employer to take a decision on the deliverable.*

A.3 Services contract

A.3.1 SANS 10403 and SANS 10845-2 recommend that topics such as the following are included in services contracts:

- “Client’s or employer’s objectives” which describes the client’s or employer’s overarching objectives for the project, including, if necessary, the time frames for completion and expected outcomes.
- “Background” which contextualizes the project and provides sufficient background information and available data to enable a response to stated and perceived requirements to be made or provides the necessary background to enable a better understanding of the client’s objectives, e.g. the background could include the rationale of the project, the project history (what has been done so far and by whom), a list of relevant studies and basic data, the need for the services and an outline of the issues which needs to be resolved.
- “Description of the services” which provides a short description or outline of the extent of the services and outlines what the key deliverables are.
- “Requirements” which should state that the service shall satisfy the stated objectives of the employer in relation to the services identified in the description of services and establish minimum requirements, i.e. what is expected in relation to specific tasks, or functions in relation to the services that are to be provided to achieve the expected results.
- “Reference data” which states the reports, surveys, agreements, etc. upon which the contractor is to base the service, if any, e.g. past studies, aerial photographs, maps, or records of surveys carried out in the assignment area.
- Particular/generic specifications which should be drafted such that they:

- contain acceptance procedures to enable compliance to be determined;
- specify requirements uniquely and unambiguously;
- preferably state what is to be provided and not how it is to be provided.

NOTE Many of the aforementioned topics or aspects thereof are addressed in this standard.

A.3.2 The manner in which the provisions of this standard can be incorporated by reference into the scope of work of a professional service contract is illustrated in Example 2.

EXAMPLE 2 Incorporating the standard in a professional services contract

Description of the services

1 *The Consultant is required to provide services for**

* Describe the project, the site and particular elements of the construction for which the consultant provides services.

2 *The construction procurement strategy for the packages associated with the service is**

*Describe strategy (i.e. packaging, contracting, pricing and targeting strategy) so that the Consultants understand the level of detail and the precise services that are required.

3 *The Consultant shall provide the services in accordance with the relevant requirements of the Standard for the Delivery and Maintenance of Infrastructure using a Gateway System published by the CIDB in respect of the following stages**

*List the applicable stages or state stages, e.g. 4 to 9

4 *The Consultant shall only provide review services in relation to stagesas the contracting strategy adopted by the Employer for the works is the strategy**

*Delete 4 if not applicable or describe the stages and the adopted contracting strategy – see Table 5.

5 *The Consultant shall provide services and perform the role of in relation to such services.**

*Identify the required services e.g. from Table 4 in the case of services relating to buildings e.g. Fire safety . State the role to be performed i.e. project leader, lead designer, designer or cost consultant or any combination thereof.

6 *The Consultant shall perform the role of in terms of the**

*State the role from Table 14 and the form of contract that is to be used e.g. the principal agent in terms of the JBCC Principal Building Agreement.

7 *The Employer has / has not* appointed a project manager to provide the services identified in clause 6.3.9 of the Standard for the Delivery and Maintenance of Infrastructure using a Gateway System published by the CIDB and to perform the role of project leader as described in 6.3.*

* Delete that which does not apply. (Typically applies to discipline specific appointments)

8 *The required level of construction monitoring is level as described in Table 15*

*State the level i.e. 1, 2, 3 or 4

9 *The following services are not required.....*

*Delete if all design and planning services are required or state what is not required where other perform such services e.g. the Employer obtains certain statutory permissions.

10 *The following additional services are required:*

*Delete if there are none or state what they are.