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1. INTRODUCTION

This document serves as an architectural design manual for use when executing architectural designs and green building compliance.

2. SUPPORTING CLAUSES

2.1 SCOPE

The document covers architectural design and green building compliance of structures by making reference to various standard codes of practice, manuals and Eskom specifications that shall be complied with when executing such designs. Architectural design and green building compliance are multidisciplinary activities and thus require equal involvement from all interfacing disciplines throughout the various stages of the Project Life Cycle Model.

2.1.1 Purpose

The purpose of this manual is to ensure that architectural designs and green building compliance are executed in accordance with the relevant codes of practice, manuals and Eskom specifications thus ensuring uniformity. The document also serves to provide a starting point for the development of Project specifications and drawings.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 NORMATIVE/INFORMATIVE REFERENCES

The specifications, finishes and requirements presented on relevant project specific drawings and/ or project specifications shall take precedence over the specifications and requirements of this design manual.

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] 240-54937450, Fire Protection & Life Safety Design Standard

[2] 240-54937439, Fire Protection - Detection Assessment Standard

[3] 240-54937454, Inspection, Testing and Maintenance of Fire Protection Systems Standard

[4] 240-55864764, Chemistry Standard for Potable Water

[5] 240-56227443, Requirements for Control and Power Cables for Power Stations Standard

[6] 240-56355541, Control System Computer Equipment Habitat Requirements Guideline

[7] 240-56355808, Ergonomic Design of Power Station Control Suites Guideline

[8] 240-56364545, Structural Design and Engineering Standard

[9] 240-56737448, Fire Detection & Life Safety Design Standard

[10] 240-56737654, Inspection, Testing and Maintenance of Fire Detection Systems Standard

[11] 240-85549846 – Standard for Design of Drainage and Sewerage Infrastructure

[12] 240-8693501 – Engineering Standard for Drawing

[13] 32-245, Eskom Waste Management Standard

[14] AS/NZS 2107, Acoustics: recommended design sound levels and reverberation times for building interiors.

[15] 240-123919938 Legionella Control and Management in Water Systems Standard

[16] ASHRAE 55, Thermal Comfort for Human Occupancy

[17] ASHRAE 62, Ventilation of acceptable indoor air quality

[18] CIBSE AM10, Natural ventilation in non-domestic buildings

[19] EN ISO 3382-3, Acoustics -- Measurement of room acoustic parameters -- Part 3: Open plan offices

[20] ESK AM AAA 1, Corporate Identity Manual

[21] ESK PB AAQ 3, Interior Specifications for Eskom

[22] GBCSA Energy & Water Benchmarking Guideline

[23] GBCSA Existing Building Technical Manual

[24] GBCSA Office Building Technical Manual

[25] Hazardous Substances Act 15 of 1973

[26] ISBN 06425 52878- Water efficiency guide: office and public buildings

[27] ISO 14040:2006 Life Cycle Assessment – Principles and framework

[28] ISO 14044:2006 Life Cycle Assessment – Requirements and guidelines

[29] ISO 14064- 2, Greenhouse gases -- Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements

[30] ISO 14064- 3, Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions

[31] ISO 14064-1, Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

[32] ISO 14065- 4, Greenhouse gases -- Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition

[33] ISO 7730, Ergonomics of the Thermal Environment (PMV Levels)

[34] N.PSZ 45-698, Engineering Drawing Office and Engineering Documentation Standard.

[35] National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977)

[36] National Environmental Management Act, 1998 (Act No. 107 of 1998)

[37] National Environmental Management Waste Act, 2008 (Act No. 59 of 2008)

[38] National Key Points Act, 1980 (Act No. 102 of 1980)

[39] Occupational Health and Safety Act, 1993 (Act 85 of 1993)

[40] SANS 10400-A (SABS 0400-A), The application of the National Building Regulations – Part A: *General principles and requirements*

[41] SANS 10400-D (SABS 0400-D), The application of the National Building Regulations – Part D: *Public safety.*

[42] SANS 10400-G (SABS 0400-G), The application of the National Building Regulations – Part G: *Excavations.*

[43] SANS 10400-K (SABS 0400-K), The application of the National Building Regulations – Part K: *Walls.*

[44] SANS 10400-L (SABS 0400-L), The application of the National Building Regulations – Part L: *Roofs.*

[45] SANS 10400-M (SABS 0400-M), The application of the National Building Regulations – Part M: *Stairways.*

[46] SANS 10400-O (SABS 0400-O), The application of the National Building Regulations – Part O: *Lighting and ventilation.*

[47] SANS 10400-R (SABS 0400-R), The application of the National Building Regulations – Part R: *Stormwater disposal.*

[48] SANS 10400-S, (SABS 0400-S), The application of the National Building Regulations – Part S: *Facilities for persons with disabilities.*

[49] SANS 10400-W (SABS 0400-W), The application of the National Building Regulations – Part W: *Fire installation.*

[50] SANS 10400-XA, The application of the National Building Regulations – Part X: *Environmental sustainability;* Part XA: *Energy usage in buildings*

[51] SANS 10083, The measurement and assessment of occupational noise for hearing conservation purposes

[52] SANS 10103, *The measurement and rating of environmental noise with respect to annoyance and to speech communication*

[53] SANS 10114-1:2005 Interior lighting Part 1: Artificial lighting of interiors

[54] SANS 10142-1, The wiring of premises, Part 1: Low Voltage installations

[55] SANS 10160-1, Basis of structural design and actions for buildings and industrial structures Part 1: Basis of structural design

[56] SANS 10160-2, Basis of structural design and actions for buildings and industrial structures Part 2: Self-weight and imposed loads

[57] SANS 10161, The design of foundations for buildings

[58] SANS 10162-1, The structural use of steel, Part 1: Limit-states design of hot-rolled steelwork

[59] SANS 10162-2, The structural use of steel Part 2: Cold-formed steel structures

[60] SANS 10164-1, The structural use of masonry Part 1: Unreinforced masonry walling

[61] SANS 10164-2, The structural use of masonry Part 2: Structural design and requirements for reinforced and pre-stressed masonry

[62] SANS 10218, Acoustical properties of buildings. Grading criteria for the airborne sound insulation properties of buildings

[63] SANS 10400-C, The application of the National Building Regulations – Part C: *Dimensions.*

[64] SANS 10400-J, The application of the National Building Regulations – Part J: *Floors.*

[65] SANS 10400-N, The application of the National Building Regulations – Part N: *Glazing.*

[66] SANS 10400-P, The application of the National Building Regulations – Part P: *Drainage.*

[67] SANS 10400-T (SABS 0400-T), The application of the National Building Regulations – Part T: *Fire protection.*

[68] SANS 11690-2, Acoustics – Recommended practice for the design of low noise workplaces containing machinery.

[69] SANS 204, *Energy efficiency in buildings*

[70] SANS 50001, Energy Management Systems requirements with guidance for use

[71] SANS 50010, Measurement and Verification of energy savings

[72] SANS 656, Sound level meters.

[73] SANS 658, Integrating-averaging sound level meters

[74] SANS 1200 HC-1988

2.2.2 Informative

[75] 240-56737654, Inspection Testing and Maintenance of Fire Detection Systems Standard

[76] 331-383 Construction Buildings Concept Report (Nuclear Engineering)

[77] 331-388 ESKOM IPD(F) NUCLEAR-1 Complex 4 Admin Building Basic Design Report

[78] ASHRAE 129, *Measuring Air-Change Effectiveness*

[79] CIBSE TM23, *Air Leakage Pressure Testing*

[80] GBCSA Energy & Water Benchmarking Tool

[81] GBCSA Existing Building Rating Tool

[82] GBCSA Office Building Rating Tool

[83] GBCSA Products & Materials Sheet

[84] ISO 14001, Environmental Management Standard

2.3 DEFINITIONS

Definition	Description
Accredited Professional (Green Building)	Qualified individual who can assist with the green building certification processes. Green Star SA Accredited Professionals have a comprehensive knowledge and understanding of the Green Star SA rating system, both in content and practical application during the building design and construction process
Architect	Suitably qualified and experienced individual registered with SACAP (South African Council for the Architectural Profession)
Architecture	The practice of the architect, where architecture means offering or rendering professional services in connection with the design and construction of buildings, or built environments
Base Building	The **base building** normally includes the **building's** primary structure; the **building** envelope in whole or part; public circulation and fire egress; and primary mechanical and supply systems up to the point of contact with individual occupant spaces
Competent Person	Person who is qualified by virtue of his education, training, experience and contextual knowledge to make a determination regarding the performance of a building or part thereof in relation to a functional regulation or to undertake such duties as may be assigned to him in terms of the National Building

Definition	Description
	Regulations
Design	For this standard: refers to architectural design and/or green building compliance only
Independent Commissioning Agent	External facilitator of green building commissioning activities
Management (Green Building)	Internal management of the building during operation
National Key Point	Any place or area which has under section 2 of the National Key Point Act 102 of 1980 been declared a National Key Point
Notional Building	The notional building has a fixed servicing strategy regardless of the strategy adopted in the actual building

2.3.1 Disclosure Classification

Controlled Disclosure: Controlled Disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
AS	Australian Standards
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
CIBSE	Chartered Institute of Building Service Engineers
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COC	Certificate of Compliance (Electrical)
CoE	Centre of Excellence
Du/ha	Dwelling units per hectare
EDWL	Engineering Design Work Lead
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EN	European Standards
GBCSA	Green Building Council of South Africa
GFA	Gross Floor Area
GHGe	Green House Gas emissions
GLA	Gross Lettable Area
HVAC	Heating Ventilation and Air Conditioning
IAQ	Indoor Air Quality
IEQ	Indoor Environment Quality
ISBN	International Standards Book Number
ISO	International Organisation for Standardisation
ISO	International Standards Office
LDE	Lead Discipline Engineer
LPS	Low Pressure Services

Abbreviation	Description
N/a	Not applicable
NFPA	National Fire Protection Association
NKP	National Key Point
NZS	New Zealand Standards
OHS Act	Occupational Health and Safety Act
PLCM	Project Life Cycle Model
PMV	Predicted Mean Vote
PVC	Poly Vinyl Chloride
SANS	South African National Standards
TVOC	Total Volatile Organic Compounds
UA	Usable Area
VOC	Volatile Organic Compounds
W/m^2	Watts per square meter
WMP	Waste Management Plan

2.5 ROLES AND RESPONSIBILITIES

The Civil and Structural Design department's LDE or EDWL on a Project shall ensure that architectural design and green building compliance are executed in accordance with this design manual. The LDE shall ensure that all relevant interfacing disciplines are consulted when required and designs are accordingly approved by such disciplines.

2.6 PROCESS FOR MONITORING

N/A

2.7 RELATED/SUPPORTING DOCUMENTS

As per section 2.2.

3. ARCHITECTURAL DESIGN REQUIREMENTS

3.1 GENERAL

All relevant SANS for architectural designs must be complied with. SANS 10400 and SANS10400-XA Energy usage in buildings, *The application of the National Building Regulations* comprises of various Parts that are to be adhered to when executing architectural designs. Designs should be practical, functional, feasible and aesthetically pleasing.

3.1.1 Roofs

All roofs shall comply with SANS 10400, Part L and be reviewed by a structural engineer for acceptance.

3.1.2 Floors

All floors and associated elements shall comply with SANS 10400, Part J and be reviewed by a structural engineer for acceptance.

3.1.3 Walls

All walls shall comply with SANS 10400, Part K and be reviewed by a structural engineer for acceptance.

3.1.4 Stairways

All stairways shall comply with SANS 10400: Part M, Eskom *Standard Stair and Handrail details: 0.00/ 2901* and be reviewed by a structural engineer for acceptance.

3.1.5 Room and building sizing

The dimensions of rooms and buildings shall comply with SANS 10400, Part A and C where applicable.

3.1.6 Glazing

Glazing and fenestration also to conform to SANS 10400 XA and SANS 204

3.1.7 Lighting and Ventilation

Lighting and ventilation shall comply with SANS 10400, Part O. It should be stressed that although natural lighting and ventilation can be allowed for by the Architect, it is the responsibility of the *Electrical* and *Low Pressure Services* disciplines to ensure that lighting and ventilation is adequately designed for, considering natural and artificial type lighting and ventilation. It is thus recommended that the *Electrical* and *Low Pressure Services* disciplines work in conjunction with the Architect for natural lighting and ventilation considerations.

3.1.8 Drainage

All sewage and drainage shall comply with SANS 10400, Part P. Such shall be reviewed by a civil engineer for acceptance.

3.1.9 Stormwater disposal

Stormwater management around structures shall comply with SANS 10400; Part R to ensure that stormwater is conveyed away from a structure preventing any damages to the structure or inconvenience to the occupants. Such shall be reviewed by a civil engineer for acceptance.

3.1.10 Public Safety and Safety

Considerations for public safety and safety in general shall comply with SANS 10400, Part D and the Occupational Health and Safety Act, 1993 (Act 6 of 1993).

3.1.11 Facilities for persons with disabilities

Provision must be made for persons with disabilities, including lifts according to SANS 10400, Part S.

3.1.12 Fire Protection & Detection

Fire protection shall comply to:

- 240-54937454, Inspection, Testing and Maintenance of Fire Protection Systems Standard;
- 240-56737654, Inspection, Testing and Maintenance of Fire Detection Systems Standard;
- 240-54937450, Fire Protection & Life Safety Design Standard; and
- 240-56737448, Fire Detection & Life Safety Design Standard
- 240-54937439, Fire Protection - Detection Assessment Standard

It should be stressed that although the Architect considers fire protection in his design of architectural components (emergency escape routes, quantity and width of staircases, panic ironmongery, fire water tap off to building, fire sealing of openings, fire doors, fire water drainage, hydrant & hose reel positions),

it is the responsibility of the relevant discipline i.e. *Low Pressure Services* to ensure that a structure is adequately designed for fire safety. The fire rating and building occupancy for all buildings shall be advised by *Low Pressure Services* to ensure that the architectural design is compliant for the buildings purpose. Fire detection specification and emergency lighting is the responsibility of the *Controls and Instrumentation* and *Electrical* disciplines respectively.

3.1.13 Provision for wire-ways

Provision for wire-ways shall be in accordance with 240-56227443, *Requirements for Control and Power Cables for Power Stations Standard* and SANS 10142-1, *The wiring of premises, Part 1: Low Voltage installations* for Power Station production buildings and rooms. For Commercial buildings, SANS 10142-1, *The wiring of premises, Part 1: Low Voltage installations* applies.

3.2 ARCHITECTURAL DESIGN FOR POWER STATION BUILDINGS AND ROOMS

3.2.1 Power Station Battery Rooms

Certain power station buildings and rooms have specific requirements to ensure that the building or room is functional for its intended purpose.

Battery rooms house stationary vented battery cells and valve regulated battery cells. These rooms have specific architectural requirements that are stated in the Eskom standards: 240-56177186, *Design Guide for Power Station Battery Rooms* and 240-56364501, *Battery Rooms Standard*. The Architect shall ensure that all power station battery rooms are designed according to these Eskom standards.

3.2.2 Power Station Control Suites

All power station control suites shall be designed for ergonomic requirements based on 240-56355808, *Ergonomic Design of Power Station Control Suites*.

3.2.3 Power Station equipment rooms housing computer control equipment

All power station equipment rooms housing computer control equipment shall be designed according to 240-56355541, *Control System Computer Equipment Habitat Requirements Guideline*.

3.2.4 Commercial buildings

Designs of commercial buildings such as canteen, kitchen, documentation centre, fire/ medical etc. shall be compliant to the applicable SANS standards.

3.3 CORPORATE IDENTITY REQUIREMENTS

Eskom's Corporate Identity specifications: ESK AM AAA 1, *Corporate Identity Manual* and ESK PB AAQ 3, *Interior Specifications for Eskom* must be complied with for all designs to ensure that all architectural components are compliant to Eskom's corporate requirements.

3.4 SECURITY DESIGN

Security designs are project specific and as such, Eskom Group Security must be engaged at Project inception to ensure that the applicable designed architectural components adequately cater for Eskom Group Security requirements. Security fencing shall be compliant to Eskom Group Security requirements.

3.5 LANDSCAPING

Landscaping should be designed around buildings to create an aesthetically pleasing environment whilst not affecting the designed stormwater management for the area. Landscaping should preserve and

enhance desirable natural features e.g. topography, architectural features of surrounding buildings whilst also providing natural shade.

The selection of plants, flowers, trees and shrubs to support the landscaping design must be approved by the relevant stakeholders and Eskom Environmental department.

3.6 REFURBISHMENT OF EXISTING BUILDINGS

The upgrading and or refurbishment of existing buildings should be considered if the basic structure is still sound and safe i.e. its structural integrity is not compromised. The existing architecture of the power station should be taken into account when a building is refurbished and all new work should conform to the current SANS and OHS regulations and standards. Every effort should be made to preserve the natural heritage of the site and surrounding environment.

3.7 DRAWING STANDARDS

All drawings shall comply with the N.PSZ 45-698, *Engineering Drawing Office and Engineering Documentation Standard.*

3.8 ROOM DATA SHEET

A room data sheet is an efficient tool that is used to capture and define comprehensive multidisciplinary requirements, finishes and fittings for a room or building and is thus a central source for all input information required to execute architectural designs.

The room data sheet shall be completed in the conceptual design phase of the PLCM to ensure that all requirements are defined up front and prevent any cost and time delays associated with late identification of interface requirements. The LDE/ EDWL/ Architect shall manage the development and facilitate multidisciplinary input into the room data sheet.

An example of a room data sheet can be found in Appendix A for modification to a specific Project.

3.9 DESIGN DURATION AND REVIEW

The design durations for any architectural design including green building compliance or not, depends on the magnitude of the Project at hand. Before each significant stage of the PLCM (concept, basic, detailed designs) a multidisciplinary schedule should be created and everyone agree on the deliverable dates to support the timelines and milestones set by the Project Manager.

All designs shall be subjected to Eskom's 240-53113685, *Design Review Procedure* which "*defines the essential steps that are required to ensure that a structured, systematic and consistent approach is followed when design reviews (end-of-phase and interim) are conducted. The execution of these steps shall ensure that designs conform to requirements (user, technical, legislative, etc.), designs are correct (calculations, philosophy, etc.) and designs are integrated."*

All design modifications and changes to approved design baselines shall be conducted according to Eskom's applicable standards: 240-53114026, *Project Engineering Change Management Procedure* and 240-53114002, *Engineering Change Management Procedure.*

3.10 SUBMISSION OF DRAWINGS TO THE LOCAL AUTHORITY

According to section 4 of the *National Building Regulations and Building Standards Act 103 of 1977*, drawings for the erection of a building must be submitted to the local authority for approval.

Buildings exempted from these regulations in section 2, subsection 5 of the mentioned standard are the following:

"(a) any place as defined in section 1 of the National Key Points Act, 1980 (Act No.102 of 1980) -

(i) that has been declared a National Key Point in terms of section 2 of the said Act; or
(ii) in respect of which the Minister of Defence has certified that it will be declared a National Key Point under the said section 2 of that Act;"

Proof of the facility having a National Key Point status must be submitted to the local authority.

However, it should be clearly noted that for NKP facilities, there is still a legal requirement to submit drawing plans to the local authority to the level of depicting building floor space such that the local authority can calculate the rates and taxes bill. Further, regardless of the facility being declared a National Key Point, fire rationale and plans are required by the local authority (for approval by the Fire Chief) from a safety perspective.

3.11 CERTIFICATES OF OCCUPANCY

According to section 14 of the *National Building Regulations and Building Standards Act 103 of 1977,* a representative of the local authority referred to as *"The building control officer",* shall issue a certificate of occupancy as per the following:

"(1) A local authority shall within 14 days after the owner of a building of which the erection has been completed, or any person having an interest therein, has requested it in writing to issue a certificate of occupancy in respect of such building -

(a) issue such certificate of occupancy if it is of the opinion that such building has been erected in accordance with the provisions of this Act and the conditions on which approval was granted in terms of section 7, and if certificates issued in terms of the provisions of subsection (2) and, where applicable, subsection (2A), in respect of such building have been submitted to it;
(b) in writing notify such owner or person that it refuses to issue such certificate of occupancy if it is not so satisfied or if a certificate has not been so issued and submitted to it.

(1A) The local authority may, at the request of the owner of the building or any other person having an interest therein, grant permission in writing to use the building before the issue of the certificate of occupancy referred to in subsection (1), for such period and on such conditions as may be specified in such permission, which period and conditions may be extended or altered, as the case may be, by such local authority."

The said Act indicates that for the building control officer to issue a certificate of occupancy, he requires the following at minimum:

a) A certificate from the Structural Engineering detailed designer confirming that the building has been built as per design;
b) A certificate from the Fire Engineering detailed designer confirming that the fire systems and installations (protection/detection/escape routes etc.) have been built as per design; and
c) A COC certificate from Electrical

"(2) Any person licensed or authorized by a local authority to carry out the installation, alteration or repair of any electrical wiring connected or of which connection is desired with the electrical supply or distribution works of such local authority or any statutory body, shall, at the request of the owner of a building of which the erection has been completed or of any person having an interest therein or of the local authority, issue a certificate if he is satisfied that the electrical wiring and other electrical installations in such building are in accordance with the provisions of all applicable laws.

(2A) Upon completion of the erection or installation of -

(a) the structural system; or

(b) the fire protection system; or

(c) the fire installation system,

of any building the person appointed to design such system and to inspect the erection or installation, shall submit a certificate to the local authority indicating that such system has been designed and erected or installed in accordance with the application in respect of which approval was granted in terms of section 7."

An appointed competent person shall ensure that all documents and drawings required by the local authority are submitted timeously as per the *National Building Regulations and Building Standards Act 103 of 1977* and SANS 10400, *The Application of the National Building Regulations*.

4. GREEN BUILDING COMPLIANCE REQUIREMENTS

Eskom's Corporate Plan addresses sustainability and the environment as key issues going forward. This shift from conventional design will add a far greater value to the objectives of the business. Hence for this design manual, where and when necessary, this Green section shall serve as a guideline for designers who are able to include such initiatives to their inputs and the **Green Building Accredited Professional** will facilitate and manage the certification of projects where Green Building compliance is specifically required as a deliverable.

This section is divided into 2 parts:

a) Section 4.1 which focuses on green building compliance for existing structures; and

b) Section 4.2 which focuses on green building compliance for new structures.

It should be stressed that green building compliance is not mandatory and if specific project requirements call for such on an existing or new structure then the following sections are applicable. However, it should be emphasized that compliance to SANS 204 and SANS 10400, Part XA will be prioritised as these are regulatory requirements and are thus mandatory.

Different green star ratings can be achieved depending on the target required. The GBCSA tools may serve as a guideline where ratings are not being pursued. Credits can be achieved in 9 categories:

- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use and Ecology;
- Emissions; and
- Innovation

These categories are applicable to both existing and new structures. The following sections cover the categories and associated credits in detail.

For each of the sections, the points available will be elaborated on under each of the above categories and accompanying rating outcomes are provided.

4.1 EXISTING BUILDINGS

The GBCSA Existing Building Technical Manual will provide all required information relating to obtaining points for credits under the various categories. It focuses on the performance of the existing buildings during the operation and maintenance cycles, not only for refurbishments or retro-fitting green building features.

Buildings can be rated from 1 Star to 6 Star based on the performance, policies and plans for existing buildings unlike the Office Tool for new buildings which only allows for certification rating from 4 star to 6 star.

Overall Score	Rating	Outcome
10-19	One Star	Eligible for 'Committed to Performance'* Acknowledgement
20-29	Two Star	Eligible for 'Committed to Performance'* Acknowledgement
30-44	Three Star	Eligible for 'Committed to Performance'* Acknowledgement
45-59	Four Star	Eligible for Four Star Certified Rating that recognises/rewards 'Best Practice'
60-74	Five Star	Eligible for Five Star Certified Rating that recognises/rewards 'South Africa Excellence'
75+	Six Star	Eligible for Six Star Certified Rating that recognises/rewards 'World Leadership'

Figure 1: Various Green star ratings and associated outcomes for existing buildings (GBCSA)

4.1.1 General Considerations

Site planning - This includes sustainable site planning, for example during the end of life or removal of one building or multiple buildings, other buildings can still be built or assembled at the same location.

Energy - This includes aspects which would reduce power consumption through the use of natural light, ventilation, thermal insulation and correct orientation of the building. Appropriate selection of HVAC equipment and building system controls are critical to the efficiency of any building.

Material - Green building compliance can minimize the environmental impact by correctly selecting low carbon footprint materials, salvaged materials, renewable materials, recycled materials and materials sourced close to the site.

Water - This includes aspects of reduction of water consumption and/or potable water consumption. The Energy and Water Benchmarking tool plays a significant role in identifying the eligibility for pursuing these credits.

Energy and Water Benchmarking Tool

This tool will be used to quantify the energy and water savings so as to ensure that the credits are achievable prior to certification.

Table 1: Credit summary for existing buildings (GBCSA)

Category	Credit	Description	Points
Management	Man-01	Certified Buildings	1
	Man-02	Accredited Professional	1
	Man-03	Building Management	5
	Man-04	Green Cleaning Performance	3.5
	Man-05	Green Leasing	6
	Man-06	On-going Metering and Monitoring	2
	Man-07	Learning Resources	2
Indoor Environment Quality	IEQ-01	Indoor Environmental Quality	5
	IEQ-02	Lighting Comfort	2
	IEQ-03	Thermal Comfort	2
	IEQ-04	Occupant Comfort Survey	2
	IEQ-05	Acoustic Quality	3
	IEQ-06	Daylight and Views	2
Energy	Ene-01	Energy Consumption (GHGe)	25
	Ene-02	Peak Electricity Demand	2
Transport	TRA-01	Alternative Transportation	4
Water	Wat-01	Potable Water	12
Materials	Mat-01	Procurement & Purchasing	4
	Mat-02	Solid Waste Management	7
Land-use and Ecology	Eco-01	Grounds keeping Practices	4
	Eco-02	Community Facilities	1
Emissions	Emi-01	Refrigerants	2
	Emi-02	Legionella	1
	Emi-03	Storm Water	1.5

Category	Credit	Description	Points
		Watercourse Pollution	
Innovation	Inn-01	Innovative Strategies and Technologies	10
	Inn-02	Exceeding GBCSA benchmarks	
	Inn-03	Environmental Initiatives	
Total			100

4.1.2 Existing Building Categories

4.1.2.1 Management

For this tool the management section deals with the management throughout the life-span of the building, as buildings can under-go refurbishments, retro-fits and tenant changes. Consideration is given to the policies and procedures as well as targets and strategies for operating and maintaining the building. This includes educating the occupants on the features of the building. This is an on-going process which is managed over time.

Certified Buildings

This credit aims to reward the buildings that have shown environmental achievement through other GBCSA tools.

Accredited Professional

This credit aims to recognise the involvement of qualified individuals who can assist the certification processes.

Building Management

The aim of this credit is to recognise management and operating processes and procedures used to optimise building environmental performance, such as:

a) Building Operations Manual;
b) Building User's Guide;
c) Maintenance Management; and
d) Life Cycle Maintenance Programme.

Green Cleaning Performance

Green cleaning practices reduce the exposure of building occupants to potentially hazardous chemical and biological contaminants that can compromise the indoor environmental quality, human health and the environment.

Points can be achieved for showing the following:

a) The Green cleaning products have lower impacts on air, water and the ecosystem;
b) Green cleaning equipment must be energy efficient; and

c) Building audits and cleanliness audits associated with health related incidents that can or may occur.

Green Leasing

This credit aims to recognize and encourage collaboration between Owner & Tenant to manage and operate the building in an environmentally sustainable manner.

Points can be achieved where mutual agreements can be signed outlining:

a) Building Owner/Tenant fit-out and alterations;
b) Type of signed agreement and size of GLA;
c) Management & operations; and
d) Type of agreements and GLA.

Fit-out requirements include:

a) Target Energy Efficiency;
b) Lighting & Appliances;
c) Water Fixtures and Fittings;
d) Waste Reduction/Recycling; and
e) Sustainable Materials.

Management & operational requirements include:

a) Monitoring and reporting for:
    - Electrical Energy;
    - Water; and
    - Waste.
b) Procurement strategy to include environmentally friendly consumables.

On-going Metering and Monitoring

The aim of the credit is to recognise practices that are put in place to facilitate effective on-going metering and monitoring of water and energy consumption.

This includes:

Basic monitoring strategy:

a) Metering is provided for major energy consumption;
b) Metering is provided for major water consumption; and
c) Effective mechanism for monitoring consumption data,

And

Advanced monitoring strategy:

d) As above and to include online and live monitoring; and
e) Trending, Logging etc.

4.1.2.2 Indoor Environmental Quality

This section addresses a healthy and comfortable environment for the working spaces; this translates into increased productivity and reduced health related time-off.

Indoor Environmental Quality

Points are awarded for fresh air or mechanically ventilated system attributes that:

a) Consider fresh air volumes;
b) Contain greater volumes of air than SANS 10400-O provides/ allows for; and
c) Provide mechanical or natural ventilation.

The system attributes should also include:

a) Avoidance of dust infiltration;
b) Avoidance of intake of outdoor pollutants; and
c) Sufficient outdoor air circulation.

Lighting Comfort

This credit recognises operational practices that provide occupants with a high degree of lighting comfort.

Considerations include:

a) Luminaire ballasts;
b) Lighting comfort (work stations);
c) Colour rendering index;
d) Colour temperature;
e) Glare;
f) OHS Act; and
g) SANS 10114-1.

Thermal Comfort

This credit aims to recognise operational practices that monitors and maintains a high level of thermal comfort for building occupants. This refers to mechanical and naturally ventilated areas where points can be awarded for:

a) Periodical measurement of humidity;
b) Assessment of problems prevalent due to high air speed and radiant heat (Audit); and
c) Occupant feedback (survey).

Occupant Comfort Survey

This credit encourages the assessment of the buildings occupants related to the levels of satisfaction and comfort.

A template is provided by the GBCSA for the survey.

Points are awarded for the following:

a) Occupant survey; and
b) Occupant satisfaction level.

Acoustic Quality

This credit aims to encourage operational practices that monitor and maintain indoor ambient noise levels from building services and all outside sources at an appropriate and comfortable level, to mitigate problems created by transference of sound to adjacent spaces, and to control the noise impact from the operations of the existing building on the immediate surrounding environment.

Daylight and Views

This relates to naturally lit spaces where occupants of the regularly occupied space are provided with appropriate daylight to conduct activities.

Points can be achieved for the following:

a) Daylight access and glare control; and
b) Views and lines of sight.

Indoor Pollutant Management

This credit aims to prevent the build-up of indoor pollutants such as Volatile Organic Compounds, CO and $CO_{2.}$ Points are achievable as per the following:

a) Indoor air quality manager: Appointment of IAQ manager; and
b) Regular IAQ Testing: Measurement of CO and CO_2 levels.

4.1.2.3 Energy

The focus is to reduce the energy consumption in turn reducing the greenhouse gas emissions while looking at alternate forms of energy. This also involves metering and monitoring to focus on the more energy intensive areas.

Energy Consumption (GHGe)

This credit assesses the GHGe related to the buildings operations during a stipulated performance period, normally 12 months. The GHGe is calculated against a benchmark i.e. Energy and Water Benchmarking tool. Points are awarded for percentage improvements based on the benchmark.

There are 4 compliance paths that one can follow:

a) GBCSA Energy and Water Tool;
b) SANS 204;
c) Comparable building data; and
d) Historical building data.

Peak Electricity Demand

Points can be achieved through initiatives that reduce the peak demand from electricity supply.

There are 2 compliance paths that can be followed to determine benchmarks and improvements:

a) SANS 10400-XA; and
b) Own historical data.

4.1.2.4 Transportation

This credit aims to measure and assess transportation modes of regular building occupants and promote/encourage green travel plans for commuting and as a result reduce pollution and land development impacts from automobile use.

Alternative Transportation

Points in this credit can be achieved through;

a) Transportation modes survey;
b) Green Travel Plan (GTP) for regular occupants and visitors; and
c) Follow-up on surveys.

A comprehensive template is provided in the GBCSA Existing Building Technical Manual (Informative references).

4.1.2.5 Water

The Water category assesses and rewards reductions in potable water use through efficient building services, water reuse and substitution with non-potable water sources, such as rainwater or greywater.

Potable Water

The aim of the credit is to recognise efficient potable water use associated with building operations, thus reducing the burden on potable water supply and wastewater systems.

2 compliance paths are suggested for determining benchmarks and improvements:

a) GBCSA Water Benchmarking Tool; or
b) Establish historic baseline for efficiency comparison.

In making use of non-potable water sources or using impacted potable water due consideration must be given to the elements contained in the water source to ensure that it has no impact on any equipment or infrastructure of pipework. In the case of were impacted water (reused water, rainwater, greywater) is treated for potable purposes then the water produced and distributed by such a treatment system shall comply with the requirements of 240-55864764, *Chemistry Standard for Potable water*. The design of the water treatment system and the provision of advice on the use of non-potable or impacted water in systems will be informed by the Chemical CoE.

4.1.2.6 Materials

The Materials category focuses on the materials that go into – or come out of – a building during the operational phase of its lifecycle. These are the materials that are required for building operations, not the materials from which the building is constructed. The Materials credits assess issues such as sustainable procurement and purchasing (materials in) and the management of waste (materials out).

Procurement & Purchasing

This credit aims to recognise procurement and purchasing practices which encourage use of products that are environmentally preferable.

Points are available for:

a) Sustainable procurement policy;
b) Sustainable procurement of operational consumables;
c) Sustainable procurement of construction materials, building refurbishment, alterations and extensions;
d) Sustainable procurement of furniture and movable equipment; and
e) Life cycle assessment.

Solid Waste Management

The aim of this credit is to reward operational practices that reduce the amount of solid waste going to landfill. Such waste may be from typical building operations, including on-going and durable goods, and from refurbishments, construction or demolition works.

Points are available for:

a) Solid waste and materials management policy;

b) Waste stream audit of ongoing consumables and development of an operational waste and materials management plan;
c) Waste to landfill diversion: Operational waste and materials;
d) Waste to landfill diversion: Movable and/or electronic goods; and
e) Waste to landfill diversion: Construction waste – churn and alterations.

4.1.2.7 Land Use and Ecology

The credits allocated within the Land Use and Ecology Category of the Green Star SA rating tools promotes initiatives to improve or reduce impacts on ecological systems and biodiversity. The term 'biodiversity' is used to describe the variety of life in an area, including the number of different species, the genetic wealth within each species, the interrelationships between them, and the natural areas where they occur.

Ecological and Site Management

The aim of this credit is to recognise and encourage practices that maintain the ecological value, reduce negative environmental impact and enhance the provision of ecological services of the site.

Points are achievable as follows:

a) Minimum requirement: Ecological assessment must be undertaken to be eligible; and
b) Ecological policy and management plan is created and implemented.

Grounds-Keeping Practices

The aim of this credit is to encourage environmentally sensitive landscape, hard surfaces and building exterior maintenance practices that reduce the environmental impact and improve ecological value.

Points are awarded for creating and implementing the following:

a) Landscape management plan;
b) Hard surfaces and building exterior management plan;
c) Integrated pest management plan; and
d) Site maintenance plans.

4.1.2.8 Emissions

The Emissions category focuses on reducing pollutants from buildings and building services (excluding greenhouse gas emissions which are dealt with in the Energy category) both to the atmosphere and local waterways, on site and beyond site boundaries.

Refrigerants

The aim of this credit is to encourage operational practices that minimise the environmental impacts of refrigeration equipment.

Points can be achieved by identifying;

a) Ozone depleting potential; and
b) Global warming potential.

Legionella

The aim of this credit is to recognise and encourage implementation and utilisation of a water management process with the intention to minimise risks associated with Legionnaires' disease.

Points can be achieved by implementing:

a) Risk management process; and
b) Control of Legionella in water systems.

The implementation method for the risk management process and for control of legionella in water systems can be found in 240-123919938 Legionella Control and Management in Water Systems.

Storm Water Watercourse Pollution

This credit recognises site-related practices that limit the disruption of natural hydrology, pollution and site deterioration.

Points available for the following:

a) Storm water management plan;
b) Storm water run-off reduction; and
c) Storm water quality.

4.1.2.9 Innovation

This credit recognises the building for exceeding GBCSA practices. There are 3 categories for reward:

a) Innovative strategies and technologies;
b) Exceeding GBCSA benchmarks; and
c) Environmental initiatives.

4.2 NEW BUILDINGS

4.2.1 General Considerations

The GBCSA Office Technical Manual will provide all required information relating to obtaining points for credits described in this section.

Site planning - This includes sustainable site planning, for example during the end of life or removal of one building or multiple buildings, other buildings can still be built or assembled at the same location.

Energy - This includes aspects which would reduce power consumption through the use of natural light, ventilation, thermal insulation and correct orientation of the building. Appropriate selection of HVAC equipment and building systems controls are critical to the efficiency of any buildings.

Material - Green building compliance can minimize the environmental impact by correctly selecting low carbon footprint materials, salvaged materials, renewable materials, recycled materials and materials sourced close to site. Attempts will be made to minimise the use of materials such as concrete in the basic design phase.

Indoor Environment - Quality sustainability includes short and long-term health of occupants. Thus green building compliance typically incorporates measures to improve the air quality inside the building by selecting materials that do not release hazardous chemicals or compounds and providing adequate ventilation, temperature, humidity and lighting.

The green building categories are the same as for existing buildings, but with varying scores:

Overall Score	Rating	Outcome
10-19	One Star	Not eligible for formal certification
20-29	Two Star	Not eligible for formal certification
30-44	Three Star	Not eligible for formal certification
45-59	Four Star	Eligible for Four Star Certified Rating that recognises/rewards 'Best Practice'
60-74	Five Star	Eligible for Five Star Certified Rating that recognises/rewards 'South Africa Excellence'
75+	Six Star	Eligible for Six Star Certified Rating that recognises/rewards 'World Leadership'

Figure 2: Various Green star ratings and associated outcomes for new buildings (GBCSA)

CATEGORY	TITLE	CREDIT NO.	POINTS AVAILABLE
Management			
	Green Star SA Accredited Professional	Man-1	2
	Commissioning Clauses	Man-2	2
	Building Tuning	Man-3	2
	Independent Commissioning Agent	Man-4	1
	Building Users' Guide	Man-5	1
	Environmental Management	Man-6	2
	Waste Management	Man-7	3
	Airtightness Testing	Man-8	1
		TOTAL	**14**
Indoor Environment Quality			
	Ventilation Rates	IEQ - 1	3
	Air Change Effectiveness	IEQ - 2	2
	Carbon Dioxide Monitoring and Control	IEQ - 3	1
	Daylight	IEQ - 4	3
	Daylight Glare Control	IEQ - 5	1
	High Frequency Ballasts	IEQ - 6	1
	Electric Lighting Levels	IEQ - 7	1
	External Views	IEQ - 8	2
	Thermal Comfort	IEQ - 9	2
	Individual Comfort Control	IEQ - 10	2
	Hazardous Materials	IEQ - 11	1
	Internal Noise Levels	IEQ - 12	2
	Volatile Organic Compounds	IEQ - 13	3
	Formaldehyde Minimisation	IEQ - 14	1
	Mould Prevention	IEQ - 15	1
	Tenant Exhaust Riser	IEQ - 16	1
	Environmental Tobacco Smoke (ETS) Avoidance	IEQ - 17	1
		TOTAL	**28**
Energy			
	Conditional Requirement	Ene -	0
	Greenhouse Gas Emissions	Ene - 1	20
	Energy Sub-metering	Ene - 2	2
	Lighting Power Density	Ene - 3	4
	Lighting Zoning	Ene - 4	2
	Peak Energy Demand Reduction	Ene - 5	2
		TOTAL	**30**
Transport			
	Provision of Car Parking	Tra - 1	2
	Fuel-Efficient Transport	Tra - 2	2
	Cyclist Facilities	Tra - 3	3
	Commuting Mass Transport	Tra - 4	5
	Local Connectivity	Tra - 5	2
		TOTAL	**14**

Water			
	Occupant Amenity Water	Wat - 1	5
	Water Meters	Wat - 2	2
	Landscape Irrigation	Wat - 3	3
	Heat Rejection Water	Wat - 4	4
	Fire System Water Consumption	Wat - 5	1
		TOTAL	15
Materials			
	Recycling Waste Storage	Mat - 1	2
	Building Reuse	Mat - 2	5
	Reused Materials	Mat - 3	1
	Shell and Core or Integrated Fit-out	Mat - 4	1
	Concrete	Mat - 5	3
	Steel	Mat - 6	3
	PVC Minimisation	Mat - 7	1
	Sustainable Timber	Mat - 8	2
	Design for Disassembly	Mat - 9	1
	Dematerialisation	Mat - 10	1
	Local sourcing	Mat - 11	2
		TOTAL	22
Land Use & Ecology			
	Conditional Requirement	Eco -	0
	Topsoil	Eco - 1	1
	Reuse of Land	Eco - 2	2
	Reclaimed Contaminated Land	Eco - 3	2
	Change of Ecological Value	Eco - 4	4
		TOTAL	9
Emissions			
	Refrigerant / Gaseous ODP	Emi - 1	1
	Refrigerant GWP	Emi - 2	2
	Refrigerant Leaks	Emi - 3	2
	Insulant ODP	Emi - 4	1
	Watercourse Pollution	Emi - 5	3
	Discharge to Sewer	Emi - 6	5
	Light Pollution	Emi - 7	1
	Legionella	Emi - 8	1
	Boiler and Generator Emissions	Emi - 9	1
		TOTAL	17
Innovation			
	Innovative Strategies & Technologies	Inn-1	2
	Exceeding Green Star SA Benchmarks	Inn-2	2
	Environmental Design Initiatives	Inn-3	1
		TOTAL	5

Figure 3: Credit summary for new buildings (GBCSA)

4.2.2 New Building Categories

4.2.2.1 Management

The management category ensures that the planning and operation of a building is carried out by trained professionals and that each green measure implemented is done so according to the standards set.

Green Star SA Accredited Professional

Professional designation follows the completion of the Green Star SA Accredited Professional courses and passing of an examination. Green Star SA Accredited Professionals have a comprehensive knowledge and understanding of the Green Star SA rating system, both in content and practical application during the building design and construction process. Project teams that include an Accredited Professional from the beginning of the project are awarded additional points toward their Green Star SA certification score.

Commissioning Clauses

Management must be informed on the green design goals for the building, including energy and environmental strategy, details on monitoring of targets, and building services. Management must be able to operate and maintain the green features and systems.

Building Tuning

Management should be involved with the verification that systems perform optimally, the optimisation of time schedules and alignment of operation of systems. Management is involved in putting together a Building Tuning Report. Management should be part of the building tuning team.

Independent Commissioning Agent

The commissioning agent should communicate with management during the fine-tuning process and final commissioning of the building.

Building Users' Guide

The Building Users' Guide addresses the current use of building facilities and management must have control over this.

Environmental Management

The contractor must implement a comprehensive, project-specific Environmental Management Plan (EMP) for the construction works in accordance with those requirements which form part of the Environmental Impact Assessment (EIA). The Contractor should also have a valid ISO 14001[84] Environmental Management System (EMS) accreditation prior to and throughout the duration of the project.

Waste Management

Construction management practices should incorporate the minimisation of the amount of construction waste earmarked for disposal. The contractor should implement a Waste Management Plan (WMP) and retain waste records and issues which form part of quarterly reports to the building owner. A percentage greater than 30 % of all demolition and construction waste should be of such a nature that it may be reused or recycled.

Airtightness Testing

Measures to reduce air leakage in buildings, verified through relevant test methods, and should be implemented to achieve an adequate level of airtightness. An air test will be carried out on the completed building in accordance with CIBSE TM23:2000 [79] to assess leakage rates. A leakage rate of less than 15 m^3/ hour/m^2 should be achieved at a relative pressure of 50 Pa. The testing process should allow for corrective sealing procedures and re-testing if required. This credit shall be the responsibility of the *Low Pressure Services* discipline.

4.2.2.2 Indoor Environment Quality

The IEQ category takes into account the quality of the internal well-being of the occupants and the methods taken to achieve these levels should utilise the most efficient “greenest” approach.

Ventilation Rates

Ventilation designs will provide for sufficient amounts of suitable quality outside air to counteract build-up of indoor pollutants. Where buildings are to be mechanically ventilated:

Outside air is provided at rates greater than the requirements of SANS 10400-O [46] and the position of intakes must be within the prescribed minimum distances from exhaust outlets for 95% of the occupied space.

Air Change Effectiveness

This parameter encourages and recognises the provision of response monitoring of CO_2 levels to ensure delivery of optimum quantities of outside air. For mechanically air-conditioned buildings, the ventilation system will be designed such that 95% of the occupied space achieves an air change effectiveness (ACE) greater than 0.95, the measurement thereof will be taken in the breathing zone in accordance with ASHRAE 129-1997 [78]. This credit shall be the responsibility of the *Low Pressure Services* discipline.

Carbon Dioxide Monitoring and Control

Response monitoring of CO_2 levels is required to ensure the delivery of optimum quantities of outside air. Mechanically air-conditioned spaces require carbon dioxide (CO_2) monitoring and control systems with a minimum of one CO_2 sensor per zone or a maximum of 100 m^2 in 95 % of the nominated area. The other alternative is that the HVAC systems provide 100% outside air with no recirculating component. This credit shall be the responsibility of the *Low Pressure Services* discipline.

Daylight

This section encourages building designs to provide good levels of daylight for building users. Points are awarded depending on the nominated area that has a daylight factor of at least 2% or daylight illumination of at least 250 lux as measured at the floor level under a uniform design sky.

Daylight Glare Control

This category encourages and recognises buildings that are designed to reduce the discomfort of glare from natural light. Points are awarded where it is demonstrated that glare from daylight is reduced through any combination of the following:

a) Each typical glazing configuration or atrium or fixed shading device that shades the working plane 1.5m in from the centre of the glazing from direct sun at desk height 720 mm for 80 % of standard working hours;

b) Where blinds or screens are fitted on all glazing and atria as a base building provision, and meet the following criteria:
   - Eliminates 95% of direct sun penetration;
   - Have a visual light transmittance (VLT) of <10 %; and
   - Can be controlled by all affected occupants within each floor or area.

High Frequency Ballasts

An increase in workplace amenity will be achieved by avoiding low frequency flicker that may be associated with fluorescent lighting. This is achieved when high frequency ballasts are installed in a minimum of 95% of the fluorescent luminaires for the nominated area.

Electric Lighting Levels

To ensure that lighting is not over designed, the electric lighting levels are assessed and points awarded where the office lighting design achieves a maximum maintained illumination. This credit shall be the responsibility of the *Electrical* discipline.

External Views

Designs that provide occupants with a visual connection to the external environment can be awarded points if a significant portion of the nominated area has a direct line of sight to the outdoors or into an adequately sized and day-lit atrium.

Thermal Comfort

This section will reward buildings that achieve a high level of thermal comfort. Points are awarded where a high level of thermal comfort is achieved for 95% of the nominated area which is naturally and mechanically ventilated. Points are also awarded if the Predicted Mean Vote (PMV) levels are calculated in accordance with ISO: 7730[33].

Individual Thermal Comfort Control

Identify that buildings are designed to have individual user controls for building heating, cooling and ventilation systems. Points are awarded where user controls are provided every 15 m^2 to 30 m^2 of usable area.

Hazardous Materials

This credit aims to recognise actions taken to reduce health risks to the buildings occupants from the presence of hazardous material through comprehensive hazardous materials survey.

Internal Noise Levels

This credit looks at identifying buildings that are designed to maintain internal noise levels at an appropriate level and provide indoor acoustics for occupants to effectively communicate. Points are awarded where 95% of the project's nominated area does not exceed the maximum internal noise levels, recommended in SANS 10103-2008 [52].

For spaces that are not provided in SANS 10103-2008 [52], a sound level of 45 dB shall not be exceeded.

Volatile Organic Compounds

Specification of interior finishes that minimise the contribution and levels of Volatile Organic Compounds (VOC) in buildings are awarded points. The various finishes used in the project must meet the benchmarks as follows:

a) With Paints, at least 95% of all painted surfaces must meet the Total Volatile Organic Compounds (TVOC) Content limits and must not contain any added lead in the form of driers or pigments; or where no paint is used in the project.
b) With adhesives and sealants, at least 95% of all adhesives and sealants must meet the TVOC Content limits; or where no adhesives or sealants are used.
c) For meeting carpet requirements where:
   - All carpets meet the TVOC emissions limits; or
   - Where no carpet has been installed in the project and projects wish to use low-VOC flooring.

Formaldehyde Minimisation

Formaldehyde is a colourless gas with a pungent odour having the systematic name methanol. This category encourages and recognises the specification of products with low formaldehyde emission levels. Points are awarded where all composite wood products (including exposed and concealed applications) and any other formaldehyde containing products either have low formaldehyde emissions or contain no formaldehyde.

Mould Prevention

Designs of services that eliminate the risk of mould growth and its associated detrimental impact on occupant health are required. Points are awarded where it is demonstrated that for 95% of the nominated area the mechanically air-conditioned ventilation system maintains humidity levels at no more than 60% relative humidity in the occupied space and no more than 80% relative humidity in the supply ductwork. This credit shall be the responsibility of the *Low Pressure Services* discipline.

Exhaust Riser

Dedicated exhaust riser that is used to remove indoor pollutants from printing and photocopy rooms are awarded points, where a reserved room for print/ photocopy is provided and all print/ photocopy room(s) are exhausted to a dedicated exhaust riser. The exhaust riser must have the following characteristics:

a) Provide at least 3 air changes per hour for 100% of the print / photocopy room(s); and
b) The exhaust system is not recycled and is discharged outside of the building.

This credit shall be the responsibility of the *Low Pressure Services* discipline.

Environmental Tobacco Smoke (ETS) Avoidance Energy

Points are awarded where the air quality in the building benefits the occupants by prohibiting smoking inside the building. In this case, smoking is not allowed inside the building and no provision should be made for smoking areas inside the building. There must be clear signage indicating that smoking indoors is prohibited and outside smoking areas clearly identifiable if provided.

4.2.2.3 Energy

In order to achieve green efficiency it is required to minimise the quantity of energy used and emission given off during the on-going operation of the buildings. The sections below define the measures to be taken in order to be energy efficient.

Greenhouse Gas Emissions

Designs that minimise the greenhouse gas emissions associated with operational energy consumption will also maximise potential operational energy efficiency of the base building. The design must comply with all of the SANS 204-2008 [69] 'deemed to comply' clauses regarding building fabric and building services.

Energy Sub-metering

Electrical energy sub-metering will be able to facilitate on-going management of electrical energy consumption and should be considered for installation for this credit. Points are awarded where it is demonstrated that sub-metering is provided for substantive energy uses within the building, (all energy uses of 100 kVa or greater), including separate meters for all tenancies. There must also be an effective automated mechanism for monitoring energy consumption data. Additionally points are awarded where it is demonstrated that sub-metering is provided separately for lighting and separately for power for each floor. For the additional point to be awarded there must also be an effective automated mechanism for monitoring energy consumption data from all energy sub-meters.

This credit shall be the responsibility of the *Electrical* discipline.

Lighting Power Density

Lighting power density is the total amount of energy which will be consumed by the lighting systems in a space and it includes the lamps, ballast, current regulators and control devices. The total is arrived at by adding the energy used and then dividing it by the floor area of the room.

This credit shall be the responsibility of the *Electrical* discipline.

Lighting Zoning

This refers to lighting practices that offer greater flexibility for light switching which makes it easier to light only occupied areas where required. Points are awarded for the following:

a) All individual or enclosed spaces can be switched on/ off individually;
b) The size of individually switched lighting zones does not exceed 100m² for 95% of the unoccupied area; and
c) Switching is clearly labelled and easily accessible by building occupants.

An additional point is awarded where the above is ensured and it is demonstrated that an individually addressable lighting system is provided for 90% of the unoccupied area.

This credit shall be the responsibility of the *Electrical* discipline.

Peak Energy Demand Reduction

Points are awarded if the design will reduce the maximum demand on electrical supply infrastructure and where it is demonstrated that the building has reduced its peak electrical demand on the utility's electricity infrastructure.

This credit shall be the responsibility of the *Electrical* discipline.

4.2.2.4 Transport

The transport category encourages the careful planning of traffic flow and the use of different modes of transport which minimise emissions that negatively impact the environment.

Fuel Efficient Transport

This credit aims to encourage and recognise developments that facilitate the use of more efficient vehicles for staff and visitors/ students travelling to the site. Points are awarded when the following criteria are met:

a) A minimum of 5% of all parking spaces are designed and labelled for mopeds, scooters and/ or motorbikes, and all of these must be located in preferred parking locations; and
b) A minimum of 5 % of all parking spaces solely for use of hybrid or other alternative fuel vehicles, and all of these must be in preferred parking locations and be designed and labelled for the intended vehicles.

Where the share of staff parking is greater than 30% of all parking spaces, a minimum of 3% of staff parking spaces should be dedicated solely for the use by car-pool and car-share vehicles, and all of these must be in preferred parking locations. Signage and labelling must be provided for the intended users.

Cyclist Facilities

The use of bicycles by staff and visitors is encouraged.

Points are available if it can be demonstrated that safe, convenient cycling routes are provided between on-site buildings and the adjacent street network. Points are achievable as follows:

a) where cyclist facilities are provided for 3% of the building staff and bicycle storage is provided for 3 % of daily visitors; and
b) where cyclist facilities are provided for 6% of the building staff and bicycle storage is provided for 6 % of daily visitors.

Commuting Mass Transport

This credit considers the use of mass transport for staff and visitors travelling to the site and which is incorporated in the transport planning.

Points are awarded for the quality of mass transport options available to building staff and visitors. The points are awarded based on the Green Star Mass Transport calculator which depends on the following inputs:

a) The type of mass transport services are available within 1000m of facilities;
b) The number of routes served; and
c) The average interval between services during weekday peak hours.

Further, a transport information point having a dedicated area provides information about local public transport, cycling and walking facilities. The dedicated area must:

d) Be in a location that is accessible to all building users, ideally in a main reception or lobby area; and
e) Be signposted at its location and throughout appropriate areas of the site indicating its existence, purpose and location.

The data at the information point is presented using a lockable noticeboard or electronically.

Local Connectivity

Points can be awarded for identifying and demonstrating that safe, well-lit, dedicated pedestrian facilities are provided between the development and the adjacent street network. Points are achievable as follows:

a) for facilities such as banks, supermarkets and restaurants being located less than 400m from the development;
b) for a minimum gross density of 35 du/ha, for the entire area within 400m of the development.

Electric Vehicles

The electric vehicle is slowly becoming accessible to the public, as the National Utility, it will be imperative to include facilities that promote the use of electric vehicles. This can be executed through the adoption of Electric Vehicle Charging Stations, ultimately increasing electricity revenue as more charging stations will increase adoption as the economics and environmental factors of EVs are fast becoming greatly attractive.

4.2.2.5 Water

Water is a resource which must be used sparingly. To achieve the objective of minimising the quantity of water consumed during the operation of the buildings, various measures mentioned below are required to be applied.

Occupant Amenity Water

This credit looks at the building reticulation design reducing the potable water consumption by building occupants. Points are awarded where the predicted potable water consumption for sanitary use within the building has been reduced against a 'best practice' benchmark. The points can be determined by the Green Star SA Potable Water Calculator.

Water Meters

This credit looks at the building reticulation system monitoring and managing water consumption throughout building. Points are awarded where:

a) it is demonstrated that water meters are installed for all major water uses in the development;
b) there is an effective automated mechanism for monitoring water consumption data, which performs leak detection on the reticulation system; as well as the development of a metering and verification strategy for the project; and
c) it is demonstrated that solenoid valves are installed on the water supply to each ablution area in the building. The flow of water through the water supply is controlled by a link to either:
    - Infra-red movement detectors within each toilet facility, or
    - Sensors or switches placed at or on entry doors to each facility.

Landscape Irrigation

Points are awarded

a) where, potable water consumption for landscape irrigation has been reduced by 50%; and
b) where, potable water consumption for landscape irrigation has been reduced by 90% or plants chosen require no additional watering once established (i.e. xeriscaping).

If there is no landscaping, or the total landscaping represents less than 1% of the site area, these points are 'Not Applicable' and are excluded from the Points Available used to calculate the Water Category Score.

Heat Rejection Water

Points are awarded for the reduction of potable water consumption from the heat rejection systems.

Fire System Water Consumption

A reduction in the consumption of potable water for the building's fire protection and essential water storage systems is catered for. Points are awarded where there is sufficient temporary storage for a minimum of 80% of the routine fire protection system test water and maintenance drain-downs. The water is reused on-site; and each floor fitted with a sprinkler system has isolation valves or shut-off points for floor-by-floor testing.

4.2.2.6 Materials

The materials required for the construction of the structure are sourced such that there is a minimal long term impact on the environment. This is achieved by ensuring that where possible recycled material could potentially be used and that virgin material used is manufactured, transported and stored using the "greenest" approach achievable.

Recycling Waste Storage

This credit looks at storage space that facilitates the recycling of resources used within buildings and that such is incorporated in the building design thus reducing waste going to disposal. Points are awarded for the following:

Waste and Recycling Management Plan: where a comprehensive Waste and Recycling Management Plan is developed for the reduction of the building's overall operational waste.

Recycling Storage Space: where a dedicated storage area for the separation and collection of recyclables is provided and sufficiently sized. The area is able to handle the collection and sorting of all waste streams for the following recyclables as a minimum:

a) Cardboard;
b) Paper products;
c) Glass;
d) Plastics;
e) Metals; and
f) Where kitchens are present: grease, used cooking oil, and organic compost material.

Building Re-use

Points are awarded where a proportion of the total existing façade of the building, by vertical area, is reused and where a proportion of the existing major structure, by gross building volume, is reused.

Where the site contained no buildings at the time of purchase or the total GFA of the original building(s) is less than 20% of the GFA of the new building that replaces it, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Materials Category Score.

Re-used Materials

Points are awarded where at least 1% of the project's total contract value is represented by reused products/materials and where 90% of the UA (Usable Area) of the project is delivered as any combination of shell and core or integrated fit-out.

This credit excludes materials specifically addressed by other credits (i.e. steel, concrete, PVC and timber); neither does it address the reuse of the original building(s) on the site (addressed in Mat-2 'Building Reuse').

Concrete

This credit looks at the reduction of embodied energy and resource depletion occurring through the use of concrete in designs. Points are awarded where the project has reduced the absolute quantity of Portland cement, as an average across all concrete mixes, by substituting it with industrial waste product(s) and/ or oversized aggregate as follows:

a) 30% for in-situ concrete, 20% for precast concrete and 15% for stressed concrete; or
b) 60% for in-situ concrete, 40% for precast concrete and 30% for stressed concrete and
c) 10% of all aggregate used for structural purposes is recycled (Class 1 recycled concrete aggregate in accordance with Australian standard HB155-2002 [10] or slag aggregate); and
d) No virgin aggregates are used in non-structural concrete uses (e.g. building base course, sub-grade to any car parks and footpaths, backfilling to service trenches, kerb and gutter).

Steel

The use of virgin steel is kept to a minimum so as to reduce the embodied energy and resource lessening associated with its use. Points are awarded if in a predominantly structural steel building, the average post-consumer recycled content of the structural steel, by mass, is at least 24% (60% of the structural steel has a recycled content of 40%).

If the building is predominantly a reinforced concrete building, the average post-consumer recycled content of the steel reinforcing, by mass, must be at least 54% for the point to be achieved (60% of the steel reinforcing by mass has a recycled content of 90%).

Additional points are awarded where the average post-consumer recycled content of all major steel applications, (total of structural steel, steel reinforcing, and building envelope), by mass is at least 54% (60% of the total steel has a recycled content of 90%).

PVC Minimisation

This refers to the use of Poly Vinyl Chloride (PVC) products in buildings, considering points awarded where 30% of the total cost of PVC content is reduced through replacement with alternative materials.

Sustainable Timber

This credit aims to encourage and recognise the specification of reused timber products or timber that has certified environmentally-responsible forest management practices.

Design for Disassembly

This credit looks at the designs of the buildings being completed by minimising the embodied energy and resources associated with demolition. Points are awarded where 50% (by area) of the structural framing, roofing and façade cladding systems are designed for disassembly or 95% of the total façade is designed for disassembly.

If the material cost of the structural framing, roofing, and façade cladding systems represent less than 1% of the project's total contract value, this credit is 'Not Applicable'.

Dematerialisation

This credit considers the design process such that the structural systems of the buildings produce a net reduction in the total amount of material used. Points are awarded where it is demonstrated that when compared to a structure with conventional steel, concrete or timber framing:

The building's structural requirements and integrity have been achieved using 20% less structural steel (by mass), or

a) 20% less concrete and reinforcing/ stressing steel (by mass), or
b) 20% less timber (by volume).

The above is achieved without changing the load path to other structural components.

Local Sourcing

Environmental advantages are gained, in the form of reduced transportation emissions, by using materials and products that are sourced within close proximity to the site. Points are awarded as follows:

a) where 20% of the total contract value is represented by materials or products (used in the construction of the project) that have been sourced from within 400 km of the site; or
b) where 10% of the total contract value is represented by materials or products (used in the construction of the project) that have been sourced from within 50 km of the site.

Only materials or products that are permanently installed in the building are eligible and must have been extracted, harvested, recovered, as well as manufactured within the above noted radii of the site in order to qualify for the credit.

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment are to be excluded from the calculations of both local materials and total contract value.

4.2.2.7 Land use and ecology

The land use and ecology category relates to the ecosystem of the site, and is concerned with how the various components of the ecosystem, human and environmental, interact with one another. The green star measures listed below will ensure the minimisation of any negative effects on the ecosystem of the site by the design, construction and operation of the buildings.

Topsoil

Points are awarded where all topsoil impacted by the construction works is separated and protected from degradation, erosion or mixing with fill or waste. The following criteria must be met:

a) Protected topsoil is spread over the relevant impacted areas to a minimum depth of 200 mm and a maximum depth of 600 mm;
b) At least 75% of all protected topsoil ('free air' volume) remains on site. Any remaining protected topsoil is transported to the nearest land holding of the same soil classification that requires rehabilitation and is deposited under the supervision of an ecologist; and
c) Where protected topsoil remaining on site is used productively.

Re-Use of Land

Points are awarded as follows:

a) If the project is a refurbishment or a building extension; or
b) If at the time of the site purchase, 75% of the site had been previously built on.

An additional point is awarded if the site is located within a municipally approved urban edge.

Reclaimed Contaminated Land

Points are awarded as follows:

a) The site was contaminated at the time of purchase; and
b) The developer has undertaken full remedial steps to decontaminate the site prior to construction.

This credit is 'Not Applicable' for projects that are refurbishments or building extensions, and is excluded from the Points Available, used to calculate the Land Use & Ecology Category Score.

Change of Ecological Value

This credit aims to encourage and recognise developments which maintain or enhance the ecological value of their sites. Points are awarded where for the Greenfield site:

a) No threatened or vulnerable species or sensitive ecological units are negatively affected;
b) There is no net reduction of native vegetation;
c) There is no change in sensitivity class through transformation of, or reduction in extent of, threatened vegetation types; and
d) The ecological value of the site is either not diminished, or is enhanced beyond its previously existing state.

4.2.2.8 Innovation

This credit recognises the building for exceeding GBCSA practices. Points are available in the following 3 categories:

d) Innovative strategies and technologies;
e) Exceeding GBCSA benchmarks; and
f) Environmental initiatives.

5. AUTHORISATION

This document has been seen and accepted by:

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Justin Padiachy	Engineering Structural Design CoE

6. REVISIONS

Date	Rev.	Compiler	Remarks
November 2012	0	CS Pretorius	Draft Document for review created from 200-26680
June 2013	1	CS Pretorius	Final document for Publication
August 2014	1.1	D Govender & K Lala	Revision of document by the assigned Work Group: Conversion of standard into design manual and addition of green building compliance requirements
October 2014	1.2	D Govender & K Lala	Draft Document for Comments Review (Rev 1.2)
October 2014	1.2	D Govender	Comments incorporated
October 2014	2	D Govender	Final Document for Authorisation and Publication (Rev 2)
March 2018	2.1	K Lala	Draft Document for Comments Review process in SC
March 2018	2.2	K Lala	Final Draft for Business Review Process
March 2018	2.3	K Lala	Final Draft after Business Review Comments concluded
April 2018	3	K Lala	Final Rev 3 Document for Authorisation and Publication

7. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- Kamir Lala

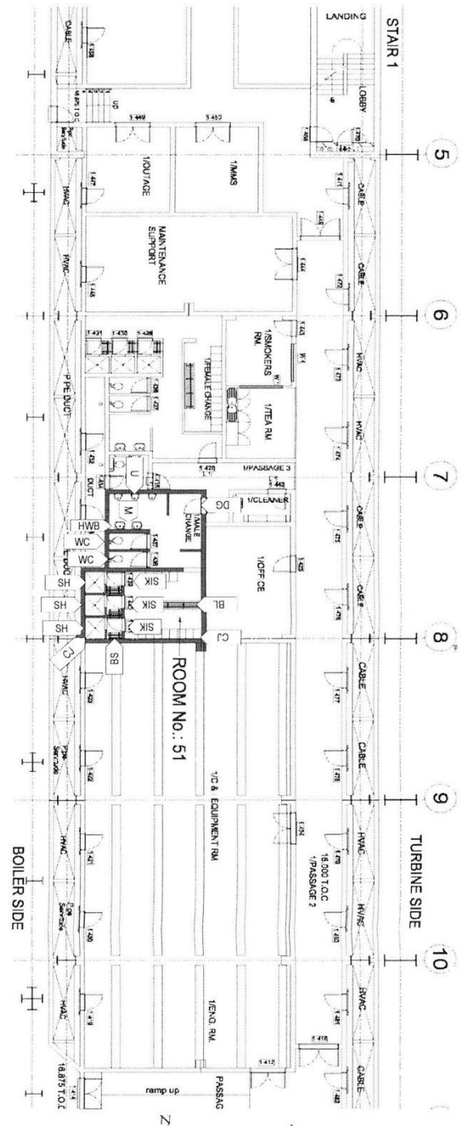
8. ACKNOWLEDGEMENTS

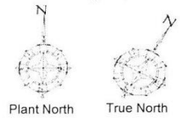
None

APPENDIX A

ESKOM MEDUPI AUX BAY
UNIT 1- LEVEL 16.00
MALE CHANGE ROOM
ROOM No.: 51

		FLOOR	SERVICE DUCTS	WALLS N	WALLS S	WALLS E	WALLS W	CEILINGS	SANITARY WARE	DOORS TO SHOWERS	DOORS TO WC's	METAL WORK	FURTNITURE	SECURITY	BMS	DRAWING REFERENCE
FLOORS:																
Seal construction joints	CJ															
Floor drain	FD															
Floor sleeves	SL			For all sleeves in this area see room 53												
Floor slots	FS															See Eng. Dwg
Computer floor																
Power float concrete		■														
Power float concrete & hardener																
Wood float concrete																
Concrete bunding wall & FD	BW															
SIKA cemflex on screed (showers)	SIK	■														
SIKA floor 381 to sloping screed																
SIKA floor 261 to concrete																
Floor tiles		■														See note
Norament rubber																
Vinyl floor tiles																
Stair nosing FRP	SN															
Anodised AL strip / PVC edge strip	AES PES															See dwg 23.106
Skirting / Power skirting	SK PS			A	A	A	A									See note
WALLS:																
Stock brickwork	1															
Face brickwork	2															
Off shutter concrete	3															
Drywall & PVA to specification	4															
Wall tiles on plaster	5			■	■	■	■									See note
Splash back tiles on plaster	6															
Paint on plaster	7															See note
Seal construction joint	CJ				■											
SIKA cemflex on plaster (shower)	SIK			■	■		■									
Window	W															
Louvre sub-frame	LSF															See dwg 31.101
Doors & door furniture						1				3	2					See door schedule
Handrails paraplegic																
CEILING:																
Off shutter concrete																
Skimmed gypsum & PVA																
Skimmed gypsum & enamel paint								■								
Vermiculite plaster coating on steel																
Suspended acoustic ceiling & insulation (?)																
Sisalation insulation under roof																
Cornice (see note)								B								
SANITARY WARE:																
WC pan & cistern (paraplegic)	WCP															
WC pan & flushmaster	WC	2														
Urinal & flushmaster	U			3												
Handwash basin to wall	HWB				2											
Shower & bench	SH	3														See dwg 29.101
Drop on sink	S															See dwg 29.101
Drop on wash trough	WT															
Drip sink	DS															
Glazed F/C lab sink	LS															
Glazed F/C lab block channels	BC															
Mirror above basin	M				2											
FURNITURE:																
Slatted bench at showers	BS												3			See dwg 29.101
Slatted bench at lockers	BL												1			See dwg 29.101
Adjustable shelves varnished	ASH															
Fixed shelves varnished	FSH															
Kitchen cupboard & sink	KC+S															See dwg 29.101
METALWORK:																
Wire mesh screen with gates	WMS															See dwg 29.101
Guard rails to duct door																See dwg 29.101
Staircase handrails																See dwg 29.102
Lifting shaft cover (eng)	LSC															Eng
EQUIPMENT:																
Crawl beam & winch	CB															See Eng. dwg's
MECHANICAL:																
Louvre in fanlight of door frame	DG					1										See dwg 31.101
Supply air grill type as xxxxxx	SG															See Mech. Eng's dwg
Extract air grill type as DV 02	EG							6								
MCC panel	MCC															
Wall fan / Ceiling fan	WF CF															
Wall penetrations																
Concrete slab for HVAC equipment																
Roof insulation																
Bricking up existing windows																
Glazing of windows																
ELECTRICAL:																
Plugs	P															
Power skirting	PS															
Telephone & data	T+D															
DB	DB															
Light fittings (see note); Quantity								5E 4D								
Geyser power point	G															
Cable slotted openings and fire sealing																
BMS (BUILDING MANAGEMENT SYSTEM):																
Installation in door frame																
Control pad(s) in wall																
SECURITY & FIRE:																
MCP (Manual Control Panel)	MCP															
Main fire panel	MFP															
Evacuation panel	EP															
Sprinklers																
Smoke detection																
Extinguisher	EX															
Fire hydrant	FH															
Fire hose reel	FHR															
Emergency shower & eye wash	ES															





NOTES

Cornice type:	A.	Neat junction sealed with paintable polyurethane
	B.	Perimeter trim LM 651 X
	C.	Neat junction between ceiling & wall
Skirting type:	A.	Tile skirting
	B.	Power skirting
	C.	Neat junction between floor & wall

Paint colours:

Walls:	Plascon inspired Y3-B2-3 Cuttle Fish
Door frames:	Plascon inspired Y2-D1-4 Old Cobblestone
Doors:	Plascon inspired Y3-D2-2 Ivory Ridge
Steelwork:	Plascon inspired Bovine Grey (SABS extra dark Sea Grey G08)

MCP: Security: Manual call point

BMS: Building Management System

Door types: Refer to Door Schedule

Paint on plaster:	A.	Enamel paint
	B.	PVA
Light fitting:	A.	Surface mounted to bulkhead
	B.	Drop in with suspended acoustic ceiling
	C.	Recessed with suspened acoustic ceiling
	D.	Surface mounted to suspended gypsum ceiling
	E.	Recessed into suspended gypsum ceiling
	F.	Fixed to suspended P2000
	G.	Emergency fitting Type T above door | T

Floor tiles: Note that the whole floor area in change rooms to be tiled

Wall tiles: Note that in change rooms wall tiles from floor to ceiling

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